RECORD OF DECISION

Lower 8.3 Miles of the Lower Passaic River
Part of the Diamond Alkali Superfund Site
Essex and Hudson Counties, New Jersey

U.S. Environmental Protection Agency
Region II
New York, New York
March 3, 2016

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Diamond Alkali Superfund Site
Essex and Hudson Counties, New Jersey
Operable Unit Two (OU2): Lower 8.3 Miles of the Lower Passaic River
Superfund Site Identification Number: NJD980528996

STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the selected remedy to address contaminated sediments found in the lower 8.3 miles of the Lower Passaic River, a part of the Diamond Alkali Superfund Site. This action addresses the Lower Passaic River in Essex and Hudson Counties, from the river's confluence with Newark Bay to River Mile (RM) 8.3 near the border between the City of Newark and Belleville Township, New Jersey. The lower 8.3 miles of the Lower Passaic River comprise OU2 of the Site, also referred to in the Proposed Plan as the Focused Feasibility Study Area (FFS Study Area). The selected remedy was chosen by the U.S. Environmental Protection Agency (EPA) in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, 42 U.S.C. §§9601-9675, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record file for this Site (see Appendix III).

The New Jersey Department of Environmental Protection (NJDEP) was consulted on the remedy for sediments of the lower 8.3 miles of the Lower Passaic River in accordance with CERCLA §121(f), 42 U.S.C. §9621(f), and it concurs with the selected remedy (see Appendix IV). In addition, EPA and NJDEP have consulted with the U.S. Army Corps of Engineers (USACE), National Oceanic and Atmospheric Administration (NOAA) and U.S. Fish and Wildlife Service (USFWS), key federal stakeholders in the Lower Passaic River, Newark Bay and New York-New Jersey Harbor Estuary.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The response action selected in this ROD addresses the risks associated with the contaminated sediments of the lower 8.3 miles of the Lower Passaic River. EPA is selecting a remedy for the lower 8.3 miles that is a final action for the sediments and an interim action for the water column. It represents the second of four planned remedial actions for the Site. The first operable unit (OU1) addressed, through an interim remedy, contaminated soils, groundwater and materials at the former Diamond Alkali facility at 80-120 Lister Avenue in Newark, New Jersey. The third operable unit (OU3) will comprehensively address the 17 miles of the Lower Passaic River Study Area (LPRSA); a remedial investigation and feasibility study (RI/FS) for OU3 will serve as the basis for selecting a remedy for the sediments above RM 8.3 and a river-wide remedy for surface water. The fourth operable unit (OU4) will address the Newark Bay Study Area.

The major components of this selected remedy include the following:

- An engineered cap will be constructed over the river bottom of the lower 8.3 miles, except in areas where backfill may be placed because all contaminated fine-grained sediments have been removed. The engineered cap will generally consist of two feet of sand and may be armored where necessary to prevent erosion of the sand.

- Before the engineered cap is installed, the river will be dredged bank to bank (approximately 3.5 million cubic yards) so that the cap can be placed without increasing the potential for flooding. Depth of dredging is estimated to be 2.5 feet, except in the 1.7 miles of the federally authorized navigation channel closest to Newark Bay.

- The remedy will include sufficient dredging and capping to allow for the continued commercial use of a federally authorized navigation channel in the 1.7 miles of the river closest to Newark Bay and to accommodate reasonably anticipated future recreational use above RM 1.7.

- Dredged materials will be barged or pumped to a sediment processing facility in the vicinity of the Lower Passaic River/Newark Bay shoreline for dewatering. Dewatered materials will be transported to permitted treatment facilities and landfills in the United States or Canada for disposal.

- Mudflats dredged during implementation of the remedy will be covered with an engineered cap consisting of one foot of sand and one foot of mudflat reconstruction (habitat) substrate.

- Institutional controls will be implemented to protect the engineered cap. In addition, New Jersey's existing prohibitions on fish and crab consumption will remain in place and will be enhanced with additional community outreach to encourage greater awareness of the prohibitions until the concentrations of contaminants of concern (COCs) in fish and crab tissue reach protective concentrations corresponding to remediation goals. EPA will share the data and consult with NJDEP about whether the prohibitions on fish and crab consumption can be lifted or adjusted to allow for increased consumption as contaminant levels decline.

- Long-term monitoring and maintenance of the engineered cap will be required to ensure its stability and integrity. Long-term monitoring of fish, crab and sediment will also be performed to determine when interim remediation milestones, remediation goals and remedial action objectives are reached. Other monitoring, such as water column sampling, will also be performed.

In the Proposed Plan, EPA specifically requested public comments on two aspects of its preferred alternative, dredged material management (DMM) scenarios and dredging depths for the federally authorized navigation channel. Three scenarios for dredged material management were under consideration: confined aquatic disposal (CAD) in Newark Bay; off-site disposal with treatment as necessary; and local decontamination and beneficial use. The navigation channel issue addressed whether shallower depths than those incorporated into the preferred alternative might accommodate reasonably anticipated future uses in the lower 2.2 miles of the river. As discussed in the Decision Summary, the comments received on the navigation channel depths led EPA to adjust the preferred alternative identified in the Proposed Plan.

DECLARATION OF STATUTORY DETERMINATIONS

Part 1: Statutory Requirements

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial actions (unless justified by a waiver), is cost effective, and uses permanent solutions and treatment technologies to the maximum extent practicable.

Part 2: Statutory Preference for Treatment

Although CERCLA §121(b) expresses a preference for selection of remedial actions that use permanent solutions and treatment technologies to the maximum extent practicable, there are situations that may limit the use of treatment, including when treatment technologies are not technically feasible or when the extraordinary size or complexity of a site makes implementation of treatment technologies impracticable. The selected remedy would generate approximately 3.5 million cubic yards of contaminated sediments, which is clearly an extraordinary volume of materials; and the sediment treatment technologies investigated under Dredged Material Management Scenario C (Local Decontamination and Beneficial Use) have not been constructed or operated in the United States on a scale approaching the capacity needed for this project, so their technical ability to handle such an extraordinary volume of highly contaminated sediments is uncertain. The selected remedy is estimated to provide treatment of approximately 130,000 cubic yards of contaminated sediment through incineration (the only technology available at this time) off-site to comply with applicable Resource Conservation and Recovery Act (RCRA) standards.

Part 3: Five-Year Review Requirements

The selected remedy will result in hazardous substances, pollutants or contaminants remaining above levels in sediments that allow for unlimited use and unrestricted exposure. Therefore, statutory reviews will be conducted every five years after the initiation of the remedial action to ensure the remedy continues to provide adequate protection of human health and the environment.

DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record file for this Site.

- COCs and their respective concentrations are in Section 5, "Summary of Site Characteristics."
- Baseline risks for human health and the environment represented by the COCs are in Section 7, "Summary of Site Risks."
- Cleanup levels established for COCs and the basis for these levels are in Section 8, "Remedial Action Objectives."
- Current and reasonably anticipated future use assumptions used in the baseline risk assessment and ROD are in Section 6, "Current and Potential Future Site and Resource Uses."
- Estimated capital, operation and maintenance (O&M), and total present value costs, discount rate, and the number of years over which the remedy cost estimates are projected are in Section 10.7, "Cost."
- Key factors that led to selecting the remedy (i.e., how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decisions) are in Section 10, "Comparative Analysis of Alternatives," and Section 13, "Statutory Determinations."

AUTHORIZING SIGNATURE:

Walter E. Mugdan
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Emergency & Remedial Response Division
U.S. Environmental Protection Agency, Region 2

March 3, 2016
Date

DECISION SUMMARY

Lower 8.3 Miles of the Lower Passaic River
Part of the Diamond Alkali Superfund Site
Essex and Hudson Counties, New Jersey

U.S. Environmental Protection Agency
Region II
New York, New York
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1. SITE NAME, LOCATION AND BRIEF DESCRIPTION

The Diamond Alkali Site, U.S. Environmental Protection Agency (EPA) ID# NJD980528996, consists of the former Diamond Alkali facility at 80-120 Lister Avenue in Newark, New Jersey, the Lower Passaic River Study Area (LPRSA), the Newark Bay Study Area and the areal extent of contamination. The LPRSA is located in (flows through) Essex, Hudson, Passaic and Bergen Counties (see Figure 1 in Appendix I). This Record of Decision (ROD) addresses the risks associated with contaminated sediments of the lower 8.3 miles of the LPRSA, which was also referred to in the Proposed Plan as the Focused Feasibility Study Area (FFS Study Area).

The lower 8.3 miles of the Lower Passaic River in northeastern New Jersey extends from the river's confluence with Newark Bay at River Mile (RM) 0 to RM 8.3 near the border between the City of Newark and Belleville Township. The lower 8.3 miles of the Lower Passaic River is part of the LPRSA, which is the 17-mile, tidal portion of the Passaic River, from RM 0 to Dundee Dam (RM 17.4), and its watershed, including the Saddle River (RM 15.6), Third River (RM 11.3) and Second River (RM 8.1). (See Figure 1.)

The 17-mile LPRSA, which is the subject of an ongoing study, is bounded at the upper end by the Dundee Dam, which isolates the Upper Passaic River from the tidal mixing of sediments that influences the lower portions of the river, and at the lower end by the confluence of the Lower Passaic River and Newark Bay. Within the Lower Passaic River, the sediments of the lower 8.3 miles have been identified as a major source of contamination to the rest of the Lower Passaic River and Newark Bay. Unlike rivers that flow in one direction, the tides in the Lower Passaic River move water and suspended sediments back and forth twice a day, meaning that there is no flow-based starting point for cleanup. This supports addressing the most highly contaminated areas first within an overall remediation framework. For these reasons, EPA completed the lower 8.3-mile remedial investigation and focused feasibility study (RI/FFS) to evaluate taking action to address these sediments, while the comprehensive study of the 17-mile LPRSA is completed.

The sediments of the lower 8.3 miles of the Lower Passaic River pose an unacceptable risk to human health and the environment due to the presence of a variety of contaminants, most of which stay in the environment for a long time and bioaccumulate in fish and crab. These contaminants include polychlorinated dibenzo-*p*-dioxins and furans (dioxins and furans), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), Total DDx[1] and other pesticides, mercury, lead and other metals.

The lower 8.3 miles of the Lower Passaic River are located in a highly developed urban area, with approximately 1.4 million people living in Essex County (west bank) and Hudson County (east bank). At the mouth of the river (RM 0) and around Newark Bay, the near-shore land uses

[1] DDT is a common name that refers to an industrially produced, chlorinated pesticide, dichlorodiphenyl-trichloroethane. DDT breaks down in the environment to form 4,4'-dichlorodiphenyldichloroethane (DDD) and 4,4'-dichlorodiphenyldichloroethylene (DDE). The term Total DDx used in this document refers to the sum of DDT, DDD and DDE concentrations.

are commercial and industrial, in part to take advantage of the transportation infrastructure (rail, air and marine). Farther upriver, beginning near RM 4, commercial uses of near-shore properties begin to be mixed with more residential and recreational uses as well. There are narrow bands of park and open space along the river, surrounded by commercial and dense urban residential development. Near RM 7, there are marinas and boat launches along with park land surrounded by more suburban residential neighborhoods. Hard shorelines, such as bulkhead and riprap (some with overhanging vegetation) make up approximately 95 percent of the banks of the lower 8.3 miles, while aquatic vegetation predominates along about 5 percent of the banks. Approximately 100 acres of the 650-acre lower 8.3 miles consist of mudflats. Intertidal mudflats and the associated shallow-water subtidal areas are important habitats for estuarine organisms, providing valuable foraging habitat for fish, blue crab and waterbirds.

The Lower Passaic River has a federally authorized navigation channel which, when it was first constructed in the 1880s, extended to RM 8.1. It was expanded to its maximum length, to RM 15.4, in 1915, with depths ranging from 30 feet (from RM 0 to RM 2.6) to 10 feet at the farthest upstream reaches. After construction, the U.S. Army Corps of Engineers (USACE) dredged the channel regularly to maintain navigation and prevent infilling with sediments. The channel below RM 1.9 was regularly maintained until 1983. The channel above RM 1.9 was dredged periodically through the 1950s, with one segment maintained as late as 1976 (from RM 9.0 to RM 10.2).

As maintenance dredging declined and eventually stopped, this channel filled with sediments. At the same time, industries and municipalities disposed of wastewaters in the river. The coincidence of chemical disposal in the river and the filling-in of the navigation channel created ideal conditions for the accumulation of contaminated sediments in the Lower Passaic River (see Section 5.3 for further discussion).

The Lower Passaic River’s cross-sectional area declines steadily moving upstream from RM 0 to RM 17.4, with a pronounced constriction at RM 8.3 (see Figure 2). At that location, there is also a pronounced change in sediment texture. The river bed below RM 8.3, from bank to bank, is dominated by fine-grained sediments (primarily silts) with pockets of coarser sediments (sand and gravel). Above RM 8.3, the river bed is dominated by coarser sediments with smaller areas of fine-grained sediments, often located outside the channel. About 85 percent of the fine-grained sediment surface area of the Lower Passaic River bed is located below RM 8.3 and, by volume, about 90 percent of fine-grained sediments in the Lower Passaic River are located below RM 8.3. Due to a combination of a wider cross-section and a deeper navigation channel below RM 8.3 (16 to 30 feet) than above RM 8.3 (10 feet), thicker and wider beds of contaminated sediments accumulated below RM 8.3 than above it. The total estimated inventory of contaminated fine-grained sediments in the lower 8.3 miles (surface and deeper sediments combined) is approximately 9.7 million cubic yards (cy).

The contaminants of concern (COCs), discussed in Section 5.2, tend to bind tightly to fine-grained sediment particles. Therefore, the majority of the contamination tends to be found in areas that are predominantly comprised of fine-grained sediments which, for the Lower Passaic River, are the lower 8.3 miles.

2. SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Passaic River was one of the major centers of the American industrial revolution starting two centuries ago. Early manufacturing, particularly textile mills, developed in the area around Great Falls in the city of Paterson, which is eight miles upriver of the Dundee Dam. The Dundee Dam, constructed along with a canal and locks in the mid-nineteenth century on top of an earlier dam, was originally conceived to provide water power to nearby businesses, supporting further industrialization along the banks of the river. By the end of the nineteenth century, a multitude of industrial operations, such as manufactured gas plants, paper manufacturing and recycling facilities, petroleum refineries, shipping, tanneries, creosote wood preservers, metal recyclers and manufacturers of materials such as rubber, rope, textiles, paints and dyes, pharmaceuticals and chemicals, had located along the river's banks as cities such as Newark and Paterson grew. Industrial operations and municipalities used the river for wastewater disposal. To date, over 100 industrial facilities have been identified as potentially responsible for discharging contaminants into the river including, but not limited to, dioxins and furans, PCBs, PAHs, DDT and other pesticides, mercury, lead and other metals.

Along with the Dundee Dam, which physically isolates Dundee Lake and the upper river from lower river influences, another defining component of the development and urbanization of the Lower Passaic River was the construction of a navigable channel for commercial vessels. Between 1884 and 1915, dredging projects authorized by Congress and constructed by USACE created a federally authorized navigation channel from RM 0 to RM 15.4 (at Wallington, New Jersey). Further deepening of the channel was authorized by Congress in 1930.[2] In 1932, the navigation channel was constructed to its maximum dredged depth: 30 feet from RM 0 to RM 2.6; 20 feet from RM 2.6 to RM 4.6; 16 feet from RM 4.6 to RM 8.1; and 10 feet from RM 8.1 to RM 15.4. USACE performed dredging to maintain the channel through the 1950s above RM 1.9 and until 1983 below RM 1.9. Further details of the federally authorized navigation channel can be found in Section 6.

2.1. Superfund History

The Lower Passaic River is a part of the Diamond Alkali Superfund Site. EPA's response at the Site began at a former manufacturing facility located at 80-120 Lister Avenue in Newark, New Jersey, at RM 3.4. Manufacturing of DDT and other products began at this facility in the 1940s. In the 1950s and 1960s, the facility was operated by the Diamond Alkali Company (later purchased by and merged into Occidental Chemical Corporation, or OCC). Between March 1951 and August 1969, the Diamond Alkali Company manufactured the chemical 2,4,5-trichlorophenol (2,4,5-TCP) and the herbicides 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), ingredients in the defoliant "Agent Orange." A by-

[2] Rivers and Harbors Act of 1930, Pub. L. 520.

product of the manufacturing was 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD), the most toxic form of dioxin. These substances have all been found in Lower Passaic River sediment and fish/crab tissue.

2.1.1. Preliminary Actions

Based on investigations by NJDEP and EPA, the Diamond Alkali Site was placed on the National Priorities List in 1984. After further investigations and several emergency response actions that addressed dioxin found on nearby properties, EPA issued a ROD in 1987 to select an interim containment remedy for the Lister Avenue facility. The remedy consisted of capping, subsurface slurry walls, and a groundwater collection and treatment system to prevent exposure to contaminated soil (that originated at the facility and that was brought back to the facility from neighboring lots), and prevent further releases to the river.

Construction of the remedy at the 80-120 Lister Avenue facility was carried out by OCC and the owner of the facility, Chemical Land Holdings, Inc., now Tierra Solutions, Inc. (Tierra), under EPA oversight. Construction was completed in 2001. Maintenance of the facility is performed by Tierra on OCC's behalf, under EPA oversight. EPA performs periodic reviews of the remedy.

2.1.2. The Six-Mile Study

In 1994, OCC agreed to an administrative order on consent (AOC) with EPA to investigate a six-mile stretch of the Lower Passaic River (RM 1 to RM 7), with the work performed by Tierra on OCC's behalf. This investigation found COCs that originated from the Diamond Alkali facility, in particular, 2,3,7,8-TCDD and pesticides, throughout the six miles, with the highest concentrations adjacent to the 80-120 Lister Avenue facility. This investigation also found many other COCs not clearly linked to Diamond Alkali's operations, and indicated that contaminated sediments moved into and out of the six-mile stretch, leading to the conclusion that a more comprehensive study was required. In 2002, EPA expanded the scope of the investigation to include the entire 17-mile Lower Passaic River.

2.1.3. The 17-Mile Study

While working with OCC and Tierra on the Lister Avenue facility and the first studies of the river, EPA also identified other potentially responsible parties (PRPs) for the Lower Passaic River. A number of companies that owned or operated facilities from which hazardous substances were potentially discharged to the river formed the Cooperating Parties Group (CPG). In 2004, EPA signed a settlement agreement with CPG members in which the settling parties agreed to pay for EPA to perform the 17-mile LPRSA remedial investigation and feasibility study (RI/FS). The settlement agreement was amended in 2005 and 2007, adding more parties to reach a total of over 70 settling parties. From 2004 to 2007, EPA investigated contamination in sediments and water of the Lower Passaic River, and investigated the major tributaries, combined sewer overflows (CSOs) and stormwater outfalls (SWOs) to the river. In 2007, CPG members entered into a new AOC with EPA, in which the settling parties agreed to take over the performance of the 17-mile LPRSA RI/FS from EPA. Since 2007, the membership of the CPG has continued to change. EPA understands that some of the settling parties that signed the AOC are no longer members of the CPG and, also, that the CPG may include members that are not signatories to the AOC.

The CPG performed sampling for the RI between 2008 and 2014, and has submitted to EPA draft human health and ecological risk assessments, and draft RI and FS reports. These documents are currently under review. While EPA cannot predict with precision the timing for completion of the 17-mile LPRSA RI/FS, selection of a remedy for the 17-mile LPRSA likely will not occur before 2017. However, the lower 8.3-mile RI/FFS prepared by EPA to support this ROD did incorporate data collected by EPA and the CPG for the 17-mile LPRSA RI/FS, among other datasets, and EPA has shared its lower 8.3-mile findings with the CPG to support the 17-mile RI/FS.

2.1.4. The Newark Bay Study

In 2004, EPA and OCC signed an AOC in which OCC agreed to conduct a separate RI/FS of the Newark Bay Study Area (Newark Bay and portions of the Hackensack River, Arthur Kill and Kill van Kull), investigating the extent of dioxin contamination and co-located contaminants, under EPA oversight. As with the 1994 agreement, Tierra is performing the work on OCC’s behalf. This study of Newark Bay is ongoing.

2.1.5. The Tierra Removal

In June 2008, EPA, OCC and Tierra signed an AOC for a non-time-critical removal action to remove 200,000 cy of contaminated sediment from the river (from RM 3.0 to RM 3.8) adjacent to the 80-120 Lister Avenue facility. This action is referred to as the "Tierra Removal." Sediment at depth adjacent to the facility has been found to have the highest levels of 2,3,7,8-TCDD measured in the river. Dredging, dewatering and transport off site of the first 40,000 cy of sediment (known as Phase 1 of the Tierra Removal) was completed in 2012. The AOC contemplates that Phase 2 (160,000 cy) will undergo a separate engineering study and proposal that will be submitted to the public for review and comment at a later date. In 2015, Tierra, on behalf of OCC, collected additional samples in the Phase 2 area. As of the date of this ROD, EPA and OCC are in discussions with respect to Phase 2. Both phases of this removal action are considered “source removal” projects.

2.1.6. The RM 10.9 Removal

In June 2012, EPA and the CPG signed an AOC for a time-critical removal action to address the risks posed by high concentrations of dioxins, PCBs and other contaminants found at the surface of a mudflat on the east bank of the river at RM 10.9 in Lyndhurst, New Jersey. This action is referred to as the "RM 10.9 Removal." The action involved placing an engineered cap over contaminated sediments, thereby reducing exposure and preventing migration of the contamination to other parts of the river. In order to ensure that the action did not exacerbate flooding, a sufficient volume of surface sediments was first dredged from the area to make space for the cap. The CPG began work in 2013 and substantially completed it in 2014, with the exception of a relatively small area of contaminated sediments located above a utility pipeline that runs under the river. An investigation of this area is ongoing. The AOC also required a Long Term Monitoring Plan, which, as of the date of this ROD, has not been completed. This time-critical removal action is not a final remedy; a final decision for the RM 10.9 Removal area will be made by EPA as part of the 17-mile LPRSA ROD.

2.1.7. The Lower 8.3-Mile Study

Concurrent with these river studies and removal actions, EPA concluded that since the lower 8.3 miles of the river contain the bulk of the contaminated sediment which is the source of most of the risk associated with the Lower Passaic River, addressing this portion of the river first would better support the overall protection of human health and the environment than would awaiting the outcome of the 17-mile LPRSA RI/FS to make a decision for the entire Lower Passaic River. Because about 90 percent of the fine-grained (and, therefore, more heavily contaminated) sediment is below RM 8.3, EPA undertook a targeted RI and FFS of the lower 8.3 miles, which led to this ROD. The nature and extent of the contamination in the lower 8.3 miles of the Lower Passaic River and the remedial alternatives summarized in this ROD are described in greater detail in two documents: the *Remedial Investigation Report for the Focused Feasibility Study of the Lower Eight Miles of the Lower Passaic River* (RI Report) and the *Focused Feasibility Study Report for the Lower Eight Miles of the Lower Passaic River* (FFS Report). Both documents are available in the Administrative Record.

2.1.8. The Lower Passaic River Restoration Project

In 2002, at the time that the 17-mile LPRSA RI/FS was being developed, EPA also formed a partnership with USACE, the State of New Jersey, the National Oceanic and Atmospheric Administration (NOAA) and U.S. Fish and Wildlife Service (USFWS) [referred to as “the Partner Agencies”], to conduct a joint study that would bring each agency’s authorities to bear on the complex environmental problems of the Lower Passaic River. The goal of the Lower Passaic River Restoration Project is to remediate contaminated sediments, improve water quality, restore degraded shorelines, restore and create new habitats and enhance human use along the 17-mile Lower Passaic River and in several tributaries from Dundee Dam near Garfield, to Newark Bay. Actions by EPA to address contaminated sediments under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, is one aspect of the Project.

3. HIGHLIGHTS OF COMMUNITY PARTICIPATION

The Diamond Alkali Site has generated a high level of public interest since it was first identified, beginning with EPA’s actions in the 1980s to remove dioxins from the neighborhoods around the Lister Avenue facility, which is located in the Ironbound section of Newark, a community that has experienced a number of other negative environmental consequences from multiple industrial and commercial operations, giving rise to environmental justice concerns. With the expansion of the scope of the project to encompass the 17-mile tidal portions of the river and Newark Bay, EPA's community outreach efforts have also expanded. A more detailed history of community involvement at the Site is provided in the *Lower Passaic River Restoration Project and Newark Bay Study Community Involvement Plan*, dated June 2006. In order to foster community involvement at the Site, beginning in 2004, EPA convened quarterly meetings with stakeholders including the Partner Agencies, municipalities, PRPs and other interested parties and members of the public called Project Delivery Team (PDT) meetings. At the PDT meetings, EPA reported on progress on various aspects of the Lower Passaic River investigation and cleanup work that was underway, including the focused study of the lower 8.3 miles of the river. In 2011, PDT meetings were replaced by Community Advisory Group (CAG) meetings.

In 2009, EPA facilitated the formation of a CAG, comprised of stakeholders with a broad range of interests. Representatives of EPA, NJDEP and the other Partner Agencies routinely attend CAG meetings, which are open to the public and generally held on a monthly basis, at which any stakeholder may be invited by the CAG chairs to share Diamond Alkali/Passaic River-related information with the community. In 2014, at the CAG's request, EPA provided the CAG with a Technical Assistance Services for Communities (TASC) contractor to respond to the CAG's technical questions related to the lower 8.3-mile RI/FFS.

In 2004, EPA awarded a Technical Assistance Grant (TAG) to the Passaic River Coalition (PRC) to assist the community in the interpretation of technical documents generated by the study of the Lower Passaic River, including the lower 8.3-mile RI/FFS. The PRC was the TAG recipient until 2013. In 2013, the New York/New Jersey Baykeeper applied for and was awarded the TAG, and continues to be the TAG recipient. The TAG advisor also provides technical assistance to the CAG.

EPA's early outreach efforts included alerting the public about New Jersey's prohibitions and advisories on fish and crab consumption for the tidal Passaic River and Newark Bay. Exposure to even low levels of contaminants through fish and crab consumption may have long-lasting health effects on people. The New Jersey prohibitions on fish and crab consumption are based on the levels of mercury, PCBs and dioxins in fish and crab. These contaminants can be especially harmful to women of childbearing age, pregnant women and nursing mothers. Children are also at risk of developmental and neurological problems if exposed to these chemicals. The NJDEP and New Jersey Department of Health have issued consumption advisories (available on the agencies' web sites) to guide anglers and other members of the public if fish and crab are harvested from within New Jersey State waters.

EPA's community participation responsibilities include soliciting community and stakeholder information, needs and opinions related to ongoing and reasonably anticipated future uses of the Lower Passaic River, including the lower 8.3 miles. EPA published an early draft FFS on its website in June 2007, inviting comment from any and all stakeholders. Written comments were submitted by the CPG, Sediment Management Workgroup, Ironbound Community Corporation, Natural Resources Defense Council and New York/New Jersey Baykeeper (jointly), Passaic

River Coalition, Biogenesis Enterprises, and Friends of the Passaic River. Further outreach efforts included convening PDT workgroup meetings to discuss formulating remedial alternatives, discussing current and future uses of the river with the CAG, convening a meeting of a broad range of stakeholders (from PRPs to municipal officials to environmental and community groups) in February 2011 to share views about remedial alternatives, discussing recreational uses of the river below Dundee Dam with rowing clubs, and consulting with USACE on current and future uses of the federally authorized navigation channel. This is discussed in more detail in Section 6.

While developing its remedial plan for the lower 8.3 miles of the Lower Passaic River, EPA's Region 2 office consulted with EPA's Contaminated Sediments Technical Advisory Group (CSTAG) and National Remedy Review Board (NRRB), each of which provides an opportunity for community participation. The work at the Diamond Alkali Site has been extensively reviewed by the CSTAG, a technical advisory group that monitors the progress of and provides advice regarding large, complex or controversial sediment sites being addressed by the Superfund program. For the February 2008 CSTAG meeting, eight stakeholder groups associated with the Site were invited to present to the CSTAG their views of how the Region had applied EPA's 11 sediment management principles (Office of Solid Waste and Emergency Response [OSWER] Directive 9285.6-08) to this project. Four invitees made presentations to the CSTAG, including the City of Newark, Ironbound Community Corporation, Passaic River Coalition, and CPG. Written comments were submitted by the CPG, Natural Resources Defense Council and New York/New Jersey Baykeeper (jointly), and Passaic River Coalition. The February 2008 CSTAG meeting and subsequent progress calls in 2009 were held during the development of the FFS for the lower 8.3 miles of the Lower Passaic River. In 2012, prior to the NRRB/CSTAG joint review of the lower 8.3-mile RI/FFS, EPA Region 2 prepared a summary of the RI/FFS that would be presented to the NRRB and CSTAG, so that stakeholders could provide meaningful input to the NRRB and CSTAG. Written comments were submitted to the NRRB and CSTAG by the Passaic River Coalition, Volcano Partners, Tierra, the New York/New Jersey Baykeeper, CPG, the CAG, the State of New Jersey, USACE, and the Ironbound Community Corporation.

The RI and FFS Reports for the lower 8.3 miles of the Passaic River, and EPA's Proposed Plan for remediation of this portion of the Site were released to the public for comment on April 11, 2014 via the web site www.ourPassaic.org. These documents were also made available to the public in the Administrative Record file maintained at the Newark Public Library, 5 Washington Street, Newark, New Jersey, the Elizabeth Public Library, 11 South Broad Street, Elizabeth, New Jersey, and in the EPA Region 2 Records Center at 290 Broadway, New York City. A notice of availability of the Administrative Record was published in the Star Ledger and Luso Americano on April 25, 2014. EPA also developed fact sheets summarizing the Proposed Plan in Spanish and Portuguese to support its outreach to those communities. In addition, select documents from the Administrative Record were made accessible online at:

http://www.ourPassaic.org
http://www.epa.gov/region02/superfund/npl/diamondalkali

A public comment period for the Proposed Plan and supporting documents was originally scheduled to extend from April 21, 2014 through June 20, 2014. EPA received requests to extend the public comment period to allow additional time for consideration of and comment on the Proposed Plan. In response to these requests, EPA extended the public comment period to July 21, 2014, then to August 20, 2014, at which time the comment period closed. EPA accepted comments by mail and also established a web mail box to accept emailed public comments.

In addition, EPA held a series of public meetings to present the findings of the RI, the FFS and EPA's Proposed Plan to the public, including local residents and officials, those who use the river for recreational or commercial purposes, and any other interested parties. Meetings were held in three communities: on May 7, 2014, at 7:00 pm at the Portuguese Sports Club, 55 Prospect Street, Newark, New Jersey; on May 21, 2014, at 6:00 pm at the Franklin School Auditorium, 100 Davis Avenue, Kearny, New Jersey; and on June 23, 2014, at 2:00 pm at the Belleville Senior Citizens Recreation Center, 125 Franklin Avenue, Belleville, New Jersey. At these meetings, representatives of EPA answered questions concerning the remedial alternatives developed as part of the FFS. Transcripts of these meetings are included in Appendix V of this ROD. Responses to comments received by EPA at these public meetings and in writing during the public comment period are included in the Responsiveness Summary (also in Appendix V).

Although not part of the formal public comment process, EPA also participated in two public forums, as follows: a "Morning Dialogue" on June 2, 2014, sponsored by Montclair State University to present information and answer questions about the RI/FFS and Proposed Plan from local government representatives; and a "Restoring Our River" forum on June 10, 2014, sponsored by the Ironbound Community Corporation to present information about the Proposed Plan to the local community. EPA also attended two Passaic River CAG meetings and a New York-New Jersey Harbor and Estuary Program Citizens Advisory Committee meeting, all open to the public, to present information and answer questions about the RI/FFS and Proposed Plan.

While EPA anticipated and accepted public comments on all of the alternatives discussed in the Proposed Plan, EPA sought public comments on two specific aspects of its preferred alternative: dredged material management (DMM) scenarios (choice of off-site disposal versus a confined aquatic disposal [CAD] site in Newark Bay) and navigational depths (whether shallower depths might accommodate reasonably anticipated future uses in the lower 2.2 miles of the river). The goal of this focused request for public comments was to ensure that community and stakeholder positions on these two issues and any new relevant information would be included in the Administrative Record and considered in the selection of the remedy. EPA's focused outreach occurred during its public meetings, but beyond these formal meetings (that are required under the Superfund statute), EPA also participated in a forum sponsored by the New Jersey Institute of Technology on July 22, 2014 that focused on dredged material disposal and navigation channel issues in the Proposed Plan.

EPA's assessment of the public comments solicited for the DMM scenarios and for the navigation depths are further discussed in Section 10.9.

4. SCOPE AND ROLE OF OPERABLE UNIT

As discussed in EPA's December 2005 *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*, EPA is employing three strategies to address the risks posed by the contamination at the Site: a phased approach, early actions and adaptive management.

4.1. Phased Approach and Early Actions

EPA often divides cleanup activities at complex sites into different areas or operable units (OUs), so that cleanup of environmental media or areas that have been characterized can occur while the nature and extent of contamination at the remainder of the site is still being investigated. Such a phased approach provides for site contamination to be addressed in a more expeditious manner, generally prioritizing response actions to accelerate risk reduction and to provide additional technical site information on which to base long-term risk management decisions. This includes taking removal actions to address imminent threats to human health while also pursuing a long-term cleanup strategy.

The Diamond Alkali Site, which includes the Lower Passaic River, has been divided by EPA into four operable units:[3]

> **Operable Unit 1 (OU1)** includes the 80-120 Lister Avenue facility and is addressed by the 1987 ROD. This is an interim containment remedy, which consists of capping, subsurface slurry wall and flood wall, and a groundwater collection and treatment system, completed in 2001. The interim remedy prevents exposure to contaminated soil (including soil that originated at the facility and that was brought back to the facility from neighboring lots), and prevents further releases to the river and groundwater. Tierra (on behalf of OCC) performs operation and maintenance of the OU1 remedy, and continues to monitor the performance of the remedy to assure the protectiveness of the actions taken to date. Based upon facility monitoring data, this OU is no longer an ongoing source of contamination to the Passaic River. Pursuant to CERCLA's requirements for remedy review, EPA has been evaluating the protectiveness of this interim remedy at least every five years since it was complete. Beginning in 2015, EPA expects to evaluate the performance of the interim remedy and the current availability of technologies that may be appropriate to address the on-site contamination over the long term. A final remedy for OU1 will be selected in the future.
>
> **Operable Unit 2 (OU2)** includes the lower 8.3 miles of the Lower Passaic River. The remedy selected in this document addresses the sediments of the lower 8.3 miles, the most contaminated segment of the river and a primary ongoing contaminant source to the rest of the river and Newark Bay. After considering comments on the Proposed Plan,

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[3] EPA uses OU numbers for managing its investigation and remediation in phases. The second five-year review (June 8, 2011) identified OU2 as the Lower Passaic River and OU3 as the Newark Bay Study. EPA has concluded that renumbering the OUs as they are described here will best support the management of the project from this point forward.

EPA is selecting a remedy for the lower 8.3 miles that is a final action for the sediments and an interim action for the water column.

Operable Unit 3 (OU3) includes the 17-mile LPRSA. After completion of the on-going RI/FS, EPA expects to select a remedy that addresses the entire Lower Passaic River, consisting of the contaminated sediments above RM 8.3 and the water column for the entire study area. The CPG performed sampling for this RI between 2008 and 2014, and has submitted to EPA draft human health and ecological risk assessments, and draft RI and FS reports[4]. These are currently under review by EPA. The lower 8.3-mile RI/FFS relied upon data collected by EPA and the CPG for the 17-mile RI/FS, and EPA has shared its lower 8.3-mile findings with the CPG to support the 17-mile RI/FS. EPA has concluded that addressing the sediments of the lower 8.3 miles first will be consistent with any remedy selected for OU3. The basis for this conclusion is further discussed in Sections 4.2 and 5.

Operable Unit 4 (OU4) The on-going Newark Bay Study Area RI/FS is expected to be completed following the 17-mile LPRSA RI/FS.

In addition to these implemented and planned remedial activities, the Diamond Alkali Site is being addressed by a series of other early response actions (called “removal actions” under CERCLA) that address highly contaminated areas of the river, namely, the Tierra Removal and the RM 10.9 Removal discussed previously in Section 2.1.

4.2. Basis for Selecting the OU2 Remedy First

As discussed in the Proposed Plan, EPA has determined that selecting a final remedy at this time for the sediments of the lower 8.3 miles of the Lower Passaic River is consistent with the EPA’s approach of using operable units when a phased analysis is necessary or appropriate given the size or complexity of a site. EPA considered awaiting the conclusion of the 17-mile LPRSA RI/FS rather than selecting a remedy for only part of the Lower Passaic River. EPA concluded that the remedy for the lower 8.3 miles will be consistent with any remedy selected for the remainder of the Diamond Alkali Site, including the Lower Passaic River and Newark Bay Study Areas, for reasons discussed below.

EPA investigated potential COC sources to the Lower Passaic River, including atmospheric deposition, groundwater, industrial point sources, the Upper Passaic River (above Dundee Dam), Newark Bay, major tributaries, CSOs and SWOs. Data and screening-level analyses show that contaminated sediments that are already present on the river bottom in the lower 8.3 miles and that are resuspended and then resettle as a result of natural processes are, by a large margin, the biggest component of recently deposited sediment in the Lower Passaic River (see Section 5.3).

[4] Under a separate AOC, an investigation of potential discharges of hazardous substances from CSOs and SWOs into the 17-mile LPRSA is being conducted by Tierra on behalf of OCC.

In comparison, Upper Passaic River and Newark Bay contributions of COCs are small and all other sources are minor.

The COCs tend to bind tightly to fine-grained sediment particles. Therefore, the highest concentrations of COCs tend to be found in areas that are predominantly comprised of fine-grained sediments, which, for the Lower Passaic River, are the lower 8.3 miles. As described in Section 5, sediment sampling data show that concentrations of COCs at levels that far exceed the remediation goals (described in Section 8.1.4) are found throughout the surface sediments (generally considered to be the top six inches) of the lower 8.3 miles, bank to bank. Data further show that median concentrations of COCs in surface sediments of the lower 8.3 miles have remained almost unchanged in the last 18 years (1995-2013), indicating that additional time will not result in meaningful improvements in surface sediment conditions. The selected remedy for the lower 8.3 miles: (1) addresses the part of the 17-mile Lower Passaic River that contains the vast majority of the sediments to which COCs tend to bind; and (2) is based on the physical characteristics of sediment texture, supported by chemical data on the spatial and temporal extent of contamination. EPA concluded that the selected remedy will be consistent with the remedial alternatives likely to be developed and considered for a 17-mile LPRSA, because, with about 90 percent of the contaminated fine-grained sediments located in the lower 8.3 miles and elevated concentrations of COCs found throughout the surface sediments of the lower 8.3 miles, a bank-to-bank remedy is the only way to achieve risk-based goals. Furthermore, these findings, coupled with the tidal nature of the water body, necessitate addressing the “worst” portions of the river first (as opposed to beginning at the farthest upstream point as would be the likely approach with a nontidal system). Therefore, any remedy selected for the 17-mile LPRSA would necessarily begin with the lower 8.3 miles, and include bank-to-bank remediation in the lower 8.3 miles.

4.3. Adaptive Management

Given the complexity and uncertainty involved with remediating sediment sites, especially at such a large scale, EPA supports the use of an adaptive management approach to addressing a site. As discussed in the EPA guidance titled “Contaminated Sediment Remediation Guidance for Hazardous Waste Sites” (December 2005): “Project managers are encouraged to use an adaptive management approach, especially at complex sediment sites to provide additional certainty of information to support decisions. In general, this means testing of hypotheses and conclusions and reevaluating site assumptions as new information is gathered. This is an important component of updating the conceptual site model. For example, an adaptive management approach might include gathering and evaluating multiple data sets or pilot testing to determine the effectiveness of various remedial technologies at a site. The extent to which adaptation is cost-effective is, of course, a site-specific decision.”

EPA’s phased approach to addressing the Site has allowed EPA to update and adjust the conceptual site model during the investigation of the Lower Passaic River.

EPA expects that during implementation of the selected remedy for the lower 8.3 miles of the Passaic River, information and experience gained as a result of earlier stages of the implementation will inform later stages of the remedial action. Further, this action will inform and be integrated with subsequent remedies selected after completion of the 17-mile LPRSA RI/FS and the Newark Bay Study Area RI/FS. This will allow for appropriate adjustments or modifications to enable efficient and effective remedy implementation, providing a means to address uncertainties promptly and inform specific design decisions. Any remedy modifications will be made and documented in accordance with the CERCLA process and EPA's "A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents" (July 1999), through a memorandum to the Site file, an Explanation of Significant Differences or an Amendment to the ROD.

4.4. Lower Passaic River Restoration Project

With the selection of this remedy, EPA is furthering the goals of the Lower Passaic River Restoration Project consistent with its authority under CERCLA. EPA expects that selection of this remedy will be a necessary step towards the partnership's broader (CERCLA and non-CERCLA) goals for the river, with additional steps to be taken under other authorities. For instance, the USACE's Hudson Raritan Estuary-Lower Passaic River Ecosystem Restoration program[5] may be able to move ahead with habitat restoration projects that had been deferred pending remediation of the lower 8.3 miles of the river.

5. SUMMARY OF SITE CHARACTERISTICS

5.1. Summary of Sampling Results and Other Investigations

The lower 8.3-mile RI and FFS Reports evaluated contamination in the Lower Passaic River and Newark Bay using data from field investigations that were conducted from the 1990s through 2013 by federal and state agencies, PRPs (such as the CPG and OCC) under EPA oversight, and academic institutions. The investigations that support this ROD include: bathymetric, geophysical and geotechnical surveys; river flow and sediment transport studies; sediment erosion studies; sediment sampling for contaminants; water quality studies; fish and crab tissue sampling; habitat surveys; a dredging pilot study; and sampling at CSOs and SWOs. Additional investigations and modeling were conducted to study the fate and transport of the COCs in the lower 8.3 miles of the Lower Passaic River. In addition to other information, the lower 8.3-mile RI/FFS incorporated the following data from the 17-mile LPRSA RI/FS:

- 2005 sediment bed erosion tests (Sedflume and Gust Microcosm)
- 2005-2007 high resolution sediment coring program
- 2005 small volume water column sampling program
- 2006 low resolution sediment coring program
- 2007-2008 berylium-7 bearing sediment collection program
- 2008 tributary, CSO and SWO sampling program

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[5] Available at: http://www.nan.usace.army.mil/Missions/Navigation/NewYorkNewJerseyHarbor/HudsonRaritanEstuary.aspx

- 2008 low resolution sediment coring program
- 2009-2010 benthic and surface sediment program
- 2009-2010 physical water column monitoring program
- 2010 high-flow water column suspended solids sampling
- 2011-2012 chemical water column monitoring program
- 2009-2010 fish community and tissue collection surveys
- 2010 habitat identification survey
- 2010 summer/fall avian community survey
- 2007 through 2012 single and multi-beam bathymetric surveys
- 2011-2012 RM 10.9 characterization sampling
- 2012 background benthic sediment sampling
- 2012 low resolution supplemental sediment sampling program

More detail can be found in the RI Report for the lower 8.3 miles and other documents in the Administrative Record file. Subsequent to the close of the public comment period, EPA conducted additional evaluations during the preparation of the Responsiveness Summary (Appendix V), in order to fully respond to comments received on the Proposed Plan, reviewing the following additional data, which had not been available to EPA at the time the RI/FFS was prepared: 2012 background fish tissue survey; 2013 chemical water column sampling; and 2013 low resolution second supplemental sampling program. These studies are also included in the Administrative Record file.

5.2. Contaminants of Concern

EPA has identified many hazardous substances in the lower 8.3-mile sediments. The following eight COCs[6] pose the greatest potential risks to human health and the environment in the lower 8.3 miles of the Lower Passaic River. COC concentrations in surface sediments and at depth in the lower 8.3 miles are shown in Tables 1 and 2, respectively, in Appendix II.

Dioxins and furans are human health and ecological COCs. They are by-products of chemical manufacturing, combustion (either in natural or industrial settings), metal processing and paper manufacturing. The dioxin congener[7] 2,3,7,8-TCDD is the most toxic form of dioxin. 2,3,7,8-TCDD and other dioxin congeners were by-products in manufacturing processes at the former Diamond Alkali facility and elsewhere. The herbicides manufactured at the former Diamond

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[6] This section identifies whether a chemical was identified as a human health and/or an ecological COC for the lower 8.3 miles of the Lower Passaic River in the risk assessments, as discussed in Section 7. While all of the ecological COCs cause unacceptable risks to some or all of the receptors evaluated, risk-based preliminary remediation goals (PRGs) were developed for dioxins, PCBs, mercury and Total DDx, because they are representative COCs and because there were multiple lines of evidence developed to evaluate how the alternatives would achieve PRGs for these four COCs after remediation (see Section 8.1.2).

[7] The “dioxins and furans” referred to in this ROD describe 75 individual polychlorinated dibenzo-p-dioxins and 135 polychlorinated dibenzofurans that are considered related compounds, or “congeners.” Tetrachlorodibenzo-p-dioxin (TCDD), refers to a group of dioxin congeners with four chlorine atoms, and 2,3,7,8-TCDD is a congener with a specific arrangement of those chlorine atoms in its molecular structure.

Alkali facility included “Agent Orange,” a defoliant manufactured for military purposes and shipped in drums with an orange stripe. Dioxins stay in the environment for a long time and bioaccumulate in fish and crab. Dioxins are classified as a probable human carcinogen. Toxic effects in humans include reproductive problems, problems in fetal development or early childhood, immune system damage and cancer. In birds and mammals, effects include developmental and reproductive problems, hemorrhaging and immune system problems.

PCBs are human health and ecological COCs. They are manmade chemicals that were banned in the late 1970s. PCBs refers to a group of 209 congeners. Some of the congeners are referred to as dioxin-like PCBs, because they have chemical structures, physico-chemical properties and toxic responses similar to 2,3,7,8-TCDD. Some commercial PCB mixtures are known in the United States by an industrial trade name, Aroclor. Because they do not burn easily and are good insulating materials, PCBs were used widely as coolants and oils, and in the manufacture of paints, caulking and building material. PCBs stay in the environment for a long time and bioaccumulate in fish and crab. PCBs are classified as probable human carcinogens. Children exposed to PCBs may develop learning and behavioral problems later in life. PCBs are known to impact the immune system and may cause cancer in people who have been exposed to them over a long time. In birds and mammals, PCBs can cause adverse effects such as anemia and injuries to the liver, stomach and thyroid gland. PCBs also can cause problems with the immune system, behavioral problems and impaired reproduction.

Mercury is a human health and ecological COC. It is a metal that is released to the environment through a variety of processes, including metals processing, burning of coal, improper disposal of medical and other wastes, industrial effluent discharge, and atmospheric deposition. Mercury stays in the environment for a long time and bioaccumulates in fish and crab. Once mercury is released to the environment, it can be converted to the biologically toxic form of methyl mercury. Most of the mercury in fish and crab tissue is present as methyl mercury, so the RI/FFS risk assessments evaluated all of the mercury detected in fish and crab as methyl mercury. Toxic effects in humans include developmental and reproductive problems, and effects on the brain, nervous system and kidney. In birds and mammals, mercury can cause adverse effects in the central nervous system.

DDT (dichlorodiphenyltrichloroethane) and its primary breakdown products, dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE), are ecological COCs. DDT is a pesticide that was banned for use in the United States in 1972. It was used widely to control insects on crops and to control mosquitoes that spread malaria. These compounds bioaccumulate in fish and crab, are persistent in the environment and can cause adverse reproductive effects such as eggshell thinning in birds. The concentrations of these three forms of DDT are summed together for evaluation and collectively referred to as Total DDx throughout the ROD and associated documents.

Copper is an ecological COC. It is a metal that enters the environment through releases from factories that make or use copper metal or compounds, leachate from landfills, combustion of fossil fuels, wood processing, fertilizer production and from natural sources such as dust from soils, volcanoes and forest fires. Although copper is an essential dietary element at low levels, at higher levels it is highly toxic in aquatic environments and bioaccumulates in fish and crab. Copper can cause adverse effects in fish, invertebrates and amphibians. Copper impacts growth, development and causes organ problems in birds and mammals.

Dieldrin is an ecological COC. It is a pesticide that is no longer produced or used, but was once used extensively as an insecticide on crops or to control termites. It bioaccumulates in fish and crab, and is persistent in the environment. Dieldrin is highly toxic to aquatic crustaceans and fish. Dieldrin also causes liver damage, central nervous system effects and suppression of the immune system in mammals and eggshell thinning in birds.

PAHs are ecological COCs. These chemicals are a major component of petroleum products, and are formed during incomplete burning of coal, oil, gas, wood or other substances. PAH molecules are composed of two or more carbon and hydrogen rings. Low molecular weight (LMW) PAHs have two or three rings, while high molecular weight (HMW) PAHs have more than three rings. There are more than 100 different PAHs, which generally occur as complex mixtures. Typically, PAHs are readily metabolized by fish and wildlife, and do not bioaccumulate in aquatic food webs. They can persist in the environment under certain conditions. PAHs are toxic to invertebrates and cause inhibited reproduction, delayed emergence, sediment avoidance and mortality. In fish, PAHs cause liver abnormalities and impairment of the immune system. PAHs can cause adverse effects on reproduction, development and immunity in birds and mammals.

Lead is an ecological COC. Lead occurs naturally in the environment, but most of the higher levels found in the environment come from mining or factories that use lead compounds. Lead is also released into the air during the burning of coal, oil or waste. Lead is persistent in the environment, but does not bioaccumulate in aquatic organisms. Lead can cause muscular and neurological effects in fish. It is also toxic to invertebrates and can cause damage to the nervous system in birds and mammals.

5.3. Sediment Conceptual Site Model

The Lower Passaic River is a partially-stratified estuary. The tides drive a wedge of denser salt water from Newark Bay north into the river along the bottom part of the water column, under a top layer of fresher water flowing in from the Upper Passaic River over Dundee Dam. The upstream limit of the salt wedge is called the salt front. Near the salt front, where the salt wedge first meets the freshwater flow, estuarine circulation creates a cloud of suspended sediments called the estuarine turbidity maximum (ETM), resulting in elevated suspended sediment concentrations in part or all of the water column, depending on flow conditions. During low flow conditions, the salt front and ETM can reach as far upstream as approximately RM 12, while during storm events they may be pushed out to Newark Bay. Under typical flow conditions, the salt front and ETM are located between RM 2 and RM 10 and move back and forth along about four miles of the river each tidal cycle (twice a day). The movement of the salt wedge, as reflected by the movements of the salt front and ETM, causes surface sediments in the river to resuspend and redeposit on each tidal cycle, resulting in longitudinal mixing of the surface sediments. This results in median surface sediment concentrations of COCs that do not vary significantly with river mile from RM 2 to RM 12 (see Figures 3, 4 and 5 in Appendix I; similar figures for other COCs are available in RI Report Figures 4-17a, 4-18a, 4-32a, 4-45a and 4-46a).

As discussed in Section 1, the Lower Passaic River's cross-sectional area declines steadily from RM 0 to RM 17.4, with a pronounced constriction at RM 8.3, where there is also a pronounced change in sediment texture (shown in Figure 2). The river bed below RM 8.3, from bank to bank, is dominated by fine-grained sediments with pockets of coarser sediments (sand and gravel). Since most of the COCs are hydrophobic and tend to bind tightly to the organic carbon on fine-grained sediment particles, elevated concentrations of COCs are found bank to bank in the lower 8.3 miles. Data show that, between RM 0 and RM 8.3, surface sediments in the navigation channel are as highly contaminated as those in the shoals, based on median concentrations (see Figures 6, 7 and 8 in Appendix I; similar figures for other COCs are available in RI Report Figures 4-23a, 4-24a, 4-38a, 4-55a, 4-56a). In other words, data show that elevated concentrations of COCs are ubiquitous in surface sediments of the lower 8.3 miles, bank to bank.

Maintenance of the navigation channel ended in some reaches in the 1930s and in much of the rest of the river after 1950 (except for the lower 1.9 miles, which were maintained until 1983), at which time the formerly dredged channel began to fill in with sediments. During the same period, industrial activities along the river grew, and industries and municipalities disposed of wastewaters in the river. The coincidence of chemical disposal in the river and the filling-in of the navigation channel created ideal conditions for the accumulation of contaminated sediments in the Lower Passaic River. When maintenance dredging was significantly curtailed after 1950, sediment infilling rates in the navigation channel were relatively high (approximately four inches per year). This process coincided with a period when industries and municipalities most actively disposed of wastewaters in the river, so the deepest sediments are the most highly contaminated (see Table 2 in Appendix II). Beginning in the 1970s and 1980s, industrial discharges declined as a result of Clean Water Act regulations, and the channel began to fill with less contaminated sediment, leading to a slow decline in concentrations over several feet of sediment. Recently much of the dredged channel has filled in and the river has begun to reach a quasi-steady state.

The surface sediments have the most direct consequences on risks to human health and the environment, so understanding current conditions in the surface sediments and predicting future conditions was a central focus of the FFS. Sediment erosion studies were performed to assess the degree to which more contaminated deeper sediments influence conditions in shallow sediments. These studies show that the critical shear stress (the minimum force exerted by water flowing along the river bed needed to cause sediment particles to start to erode) typically increases with depth, so that shallow sediments are more easily erodible, but sediments become less and less erodible deeper in the river bed. This is due to the consolidation or compression of deeper sediments over time caused by the weight of overlying sediments.

In recent years, overall infilling has slowed considerably and alternates with some scouring during high flow events, resulting in a quasi-steady state condition, so that the river is no longer steadily filling with “cleaner” sediments from elsewhere. Daily tidal action resuspends and redeposits the contaminated surface sediments, while occasional scouring during high flow events (storms) uncovers and resuspends deeper, more highly-contaminated sediments contributing additional contamination to the surface sediments and slowing the natural recovery process. Based on five multi-beam bathymetry surveys conducted between 2007 and 2012, erosion of 0 to 12 inches occurred in 40 percent to 47 percent of the lower 8.3 miles in each of the survey intervals. Erosion of more than 18 inches occurred in 2 percent to 4 percent of the lower 8.3 miles in each of the survey intervals.

The RI and FFS assessed the degree to which filling with newer, “cleaner” sediments from elsewhere, a natural recovery process, might allow the river to improve on its own. Dated high resolution sediment cores show that contaminant concentrations in approximately the top two feet of sediments have declined extremely slowly in recent years. In addition, sampling from 1995 through 2013 confirms that lower 8.3-mile surface sediment median contaminant concentrations have remained almost unchanged over that 18-year period (see Figures 9, 10 and 11 in Appendix I; similar figures for other COCs are available in RI Report Figures 4-26, 4-27, 4-41, 4-60 and 4-61). COC concentrations in surface sediments are summarized in Table 1 in Appendix II.

Based on analyses discussed in the RI Report for the lower 8.3 miles, direct atmospheric deposition, groundwater discharge and industrial point sources of contaminants currently are not significant contributors of COC mass (i.e., sediment particles and the COCs bound to them) to the recently deposited sediments[8] of the Lower Passaic River. The Upper Passaic River, Newark Bay, the three main tributaries, and CSOs and SWOs were sampled between 2005 and 2011. Results of a mass balance[9] show that the tributaries, CSOs and SWOs are minor contributors of COCs, since they are minor contributors of sediment particles compared to the Upper Passaic River and Newark Bay, and the mass of contaminants delivered by those particles is low compared to the sediments of the Lower Passaic River main stem. For COCs such as 2,3,7,8-TCDD, Total PCBs and mercury, concentrations on sediment particles from the tributaries, CSOs and SWOs are clearly lower than those on Lower Passaic River surface sediments. Current contributions to the recently deposited sediments of the Lower Passaic River are summarized in Table 3 in Appendix II. Resuspension of Lower Passaic River sediments contributes well over 90 percent of the dioxin in recently deposited sediments of the Lower Passaic River, followed by Newark Bay (approximately 5 percent) and the Upper Passaic River (3 percent or less). Resuspension of Lower Passaic River sediments contributes approximately 80 percent of PCBs and DDE in recently deposited sediments, followed by the Upper Passaic River (approximately

[8] As described in RI/FFS Appendix C, recently deposited sediments are beryllium-7 (Be-7) bearing sediments. Be-7 is a naturally occurring radioisotope with a short half-life (53 days) that binds to sediment particles. The presence of Be-7 in surface sediments indicates that the associated solids were deposited on the sediment bed within approximately the last six months.

[9] A “mass balance” assesses inputs to and outputs from a “system” (in this case, recently deposited sediments within the Lower Passaic River) understanding that all the mass must be accounted for. For this mass balance, the change in contaminant mass in recently deposited sediments equals the difference between the sum of contaminants coming into the system from various sources and the sum of contaminants going out of system to other places.

10 percent) and Newark Bay (less than 10 percent). Similar trends are shown for copper, mercury and lead, further supporting the conclusion that resuspension of highly contaminated surface sediments already in the lower 8.3 miles of the river is the predominant contributor to COC mass in the water column, and thus to COC concentrations in fish and crab tissue. As discussed in Section 10.1, these percentage contributions would be altered dramatically through active remediation of the lower 8.3 miles. For example, bank-to-bank replacement of the highly contaminated riverbed with effectively clean material would greatly reduce the component of the mass balance that comes from resuspension of Lower Passaic River sediments. This would reduce the overall contaminant levels in surface sediment, but it would also have the effect of increasing the relative percentage contribution of the Upper Passaic River, Newark Bay and the Lower Passaic River above RM 8.3 to COCs depositing on top of the newly replaced lower 8.3-mile riverbed.

Under current conditions, the daily movement of contaminated surface sediments combined with the occasional uncovering and resuspension of deeper, more highly contaminated sediments in the lower 8.3 miles are the primary ongoing source of COCs to the water column and surface sediments of the Lower Passaic River.

5.4. Fish and Crab Tissue

In the lower 8.3 miles of the Lower Passaic River, contaminant concentrations in fish[10] and blue crab tissue have similar patterns and trends to those observed in the surface sediments. Spatially, there is a broad range of contaminant concentrations in fish and crab tissue (more than an order of magnitude), but there is little or no trend in COC median concentrations with river mile (see Figures 12, 13 and 14 in Appendix I; similar figures for other COCs and species are available in RI/FFS Appendix A, Data Evaluation Report No. 6, Figures 2-1 through 2-4).

Lipid-normalized contaminant concentrations[11] in fish and crab tissue have not consistently increased or decreased with time from 1999 to 2010, consistent with surface sediment COC concentrations, which also have remained almost unchanged over approximately the same time period (see Figures 15 and 16 in Appendix I; similar figures for other COCs and species are available in RI/FFS Appendix A, Data Evaluation Report No. 6, Figures 2-8 through 2-11).

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[10] In order to account for the various types of fish that may be consumed by anglers on the lower 8.3 miles, white catfish, white perch, white sucker, common carp, smallmouth bass and American eel were collected during the 17-mile LPRSA RI/FS. In the ecological risk assessment, brown bullhead were added to the above six species to represent piscivorous and omnivorous life histories characteristic of the lower 8.3 miles, and mummichog were collected to represent forage fish.

[11] Tissue contaminant concentrations were normalized by lipid concentrations (i.e., each tissue contaminant concentration was divided by the lipid concentration of the fish analyzed) in order to focus on changes in tissue contaminant concentrations over time that are not related solely to changes in lipid concentrations over time. Lipid content is a measure of the amount of fats and oils in the fish and crab tissue.

6. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

The New Jersey Surface Water Quality Standards classify the Lower Passaic River from its mouth to the Second River (RM 0 to RM 8.1) as saline-estuarine 3 (SE3), with designated uses including secondary contact recreation (activities where the probability of water ingestion is minimal, including, but not limited to, boating and fishing). The Lower Passaic River from Second River to Dundee Dam (RM 8.1 to RM 17.4) is classified as freshwater 2 non-trout (FW2-NT) and saline-estuarine 2 (SE2). Designated uses for FW2-NT and SE2 include secondary contact recreation. Designated uses for FW2-NT also include primary contact recreation (activities that involve a significant ingestion potential, including, but not limited to, wading, swimming, diving, surfing and water skiing).

The Clean Water Act, as revised in 1972, set a national goal to restore and maintain the chemical, physical and biological integrity of the Nation's waters, with interim goals that all waters be fishable and swimmable where possible. Currently, the Lower Passaic River is not fishable and swimmable due to chemical contamination and other factors. CERCLA does not supplant the Clean Water Act, which addresses pollutants in the water column through various mechanisms such as permitting programs and the water quality implementation plan. This ROD, issued under CERCLA to address contaminated sediment in the lower 8.3 miles, will support the Clean Water Act goals by addressing a source of contamination to the water column.

New Jersey prohibits the consumption, and sale for consumption, of fish and crab from the Lower Passaic River (RM 0 to RM 17.4) due to contamination by PCBs, dioxin and mercury. Eating, selling or taking (harvesting) blue crab from the Newark Bay Complex and tidal Passaic River is prohibited (N.J.A.C. 7:25-14.11).

As discussed in Sections 1 and 2, the Lower Passaic River has a federally authorized navigation channel from RM 0 to RM 15.4 that was constructed beginning in the 1880s and maintained by USACE through the 1950s in most of the lower 8.3 miles (except in the lowest 1.9 miles, which were maintained through 1983). As discussed in Section 10.2, Section 10 of the Rivers and Harbors Act (33 U.S.C. § 403) is a location-specific Applicable or Relevant and Appropriate Requirement (ARAR) with which the remedy for the lower 8.3 miles will comply. Section 10 prohibits creation of any obstruction to the navigable capacity of any waters of the United States without Congressional authorization, subject to the permitting authority provided to the Department of the Army. As described in Section 2, the navigation channel for the Lower Passaic River is currently authorized by federal law at depths ranging from 30 feet (RM 0 to 2.6) to 10 feet (RM 8.1 to 15.4). Only Congress can change these current authorized channel depths, and it has not done so, nor is EPA aware that any de-authorization process is underway.

In addition, according to Superfund guidance, reasonably anticipated future land and waterway uses in the lower 8.3 miles of the Lower Passaic River should be considered during the development of remedial alternatives and remedy selection. USACE is responsible for the operation and maintenance of the nation's waterway system to ensure efficient and safe passage of commercial and recreational vessels. USACE also has the Federal responsibility for establishing and maintaining a variety of U.S. water transportation information systems and thus is qualified to assess current and anticipated future uses for the Lower Passaic River navigation channel.

In a 2010 Lower Passaic River Commercial Navigation Analysis report, USACE identified various physical constraints such as shallow depths, narrow widths and low vertical clearance bridges that potentially limit commercial use of the navigation channel above RM 1.2. A berth-by-berth analysis for 1997-2006 included in the report documented that the lower 1.7 miles of the channel are still in use for commercial navigation by a number of companies. These waterway users have responded to the depth constraints resulting from the lack of maintenance dredging in recent years by moving barges in and out at high tide, by moving barges in and out less than fully loaded or by using smaller barges. A 2009 USACE survey of commercial users, also included in the 2010 report, showed potential future commercial use of the channel up to RM 2.2. However, EPA has not identified or received any information of actual commercial use of the channel above RM 1.7. In a February 6, 2014 letter, USACE confirmed that 2011 Waterborne Commerce data, the last year analyzed as of the writing of the letter, indicated a significant volume of waterborne commerce was transported that year within the Lower Passaic River, and concluded that “The current and projected future level of commercial traffic is sufficient to justify maintenance dredging of the channel should it be required, subject to budget limitations.”

Many of the municipalities with river frontage on the lower 8.3 miles have published master plans that call for the expansion and improvement of parks and open space along the river that will lead to greater access to the river and improved ecological habitat. The opening of Riverfront Park in Newark at approximately RM 4 in 2013 is a prime example of how implementation of the city’s master plan is leading to greater access to and use of the river. Throughout the Lower Passaic River, particularly between RM 2 and RM 12, college, high school and community rowing clubs use the river for recreation and competition.

7. SUMMARY OF SITE RISKS

As part of the RI/FFS, baseline human health and ecological risk assessments were conducted to estimate the current and future effects of contaminants in sediments of the lower 8.3 miles of the Lower Passaic River on human health and the environment. A baseline risk assessment is an analysis of the potential adverse human health and ecological effects of releases of hazardous substances from a site or operable unit in the absence of any actions or controls to mitigate such releases, under current and future land and resource uses. The baseline risk assessment includes a human health risk assessment (HHRA) and an ecological risk assessment (BERA). They provide the basis for taking action and identify the contaminants and exposure pathways that need to be addressed by the remedial action. The baseline risk assessments are detailed in RI/FFS Appendix D. This section of the ROD summarizes the results of the baseline risk assessments.

As discussed in Section 5.3, risks are mainly posed by contaminants that are in the sediments of the lower 8.3 miles as a result of historical discharges from former industrial operations and municipalities along the Lower Passaic River. In addition, some contaminants are also coming into the lower 8.3 miles from the Upper Passaic River above Dundee Dam, from Newark Bay and from the Lower Passaic River above RM 8.3. In accordance with EPA's policies and guidance, the baseline risk assessments quantified risks and health hazards as the total exposure to contaminants in the lower 8.3 miles, without consideration of the contribution of background or other incoming contaminants to those exposures.

7.1. Human Health Risk Assessment

The Site-specific HHRA estimated cancer risks and noncancer health hazards from exposures to a set of chemicals in the lower 8.3 miles of the Lower Passaic River. While other exposure scenarios were considered, as discussed in Section 7.1.2.1, the HHRA focused primarily on angler/sportsman and other family members consuming self-caught fish and crab.

A four-step process is used for assessing site-related human health risks:

- *Hazard Identification* – uses the analytical data collected to identify the contaminants of potential concern (COPC) at the site for each medium, with consideration of a number of factors explained below;
- *Exposure Assessment* - estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways by which humans are potentially exposed;
- *Toxicity Assessment* - determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response); and
- *Risk Characterization* - summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site-related cancer risks and noncancer hazards. The risk characterization also identifies contamination with concentrations which exceed acceptable levels, identified in the NCP and EPA guidance as an excess lifetime cancer risk greater than 10^{-6} to 10^{-4} or a noncancer Hazard Index (HI) greater than 1; contaminants at these concentrations are considered COCs and are typically those that will require remediation at the site. Also included in this section is a discussion of the uncertainties associated with these risks.

Based on the results of Superfund HHRAs conducted for other river sites with bioaccumulative COCs, EPA concluded that consumption of fish and crab is associated with the highest cancer risks and noncancer health hazards compared to other exposure pathways such as ingestion, dermal contact or inhalation of chemicals in surface water or sediment during recreational activities. Despite New Jersey's prohibitions on fish and crab consumption, and harvesting blue crab in the Newark Bay Complex (Newark Bay and its tributaries, including the tidal Lower Passaic River), numerous published studies undertaken in recent decades (see RI/FFS Appendix D for a list of studies) show that people are catching and eating fish and crab along the banks of the Lower Passaic River and Newark Bay. Therefore, the only pathway of exposure evaluated quantitatively in the HHRA was the consumption of self-caught fish or crab from the lower 8.3

miles of the Lower Passaic River by the adult angler/sportsman and other family members (i.e., under the assumption, consistent with EPA guidance and site-specific information, that the angler shares his or her catch with an adolescent and a child). Other exposure pathways will be evaluated in the 17-mile LPRSA RI/FS.

7.1.1. Hazard Identification

The HHRA was conducted using the analytical results of the fish and blue crab tissue samples collected throughout the lower 8.3 miles of the Lower Passaic River during the late summer/early fall 2009 by the CPG for the 17-mile LPRSA RI/FS. The fish/crab data included species from different feeding guilds that are commonly caught and abundant in the lower 8.3 miles. Tissue chemistry data from six fish species (American eel, common carp, smallmouth bass, white catfish, white perch, and white sucker) were used to derive an equal-weighted average concentration to represent chemical concentrations to which someone eating fish would be exposed. The blue crab was selected to assess exposures of people eating crab because it is commonly caught and consumed in the lower 8.3 miles. Crabs were evaluated based on total tissue including the edible white meat (or muscle) from the thoracic cavity, claws, and legs, and the hepatopancreas, based on well-documented eating and cooking practices that result in a reasonable percentage of New Jersey anglers being exposed to both tissue types.

COPCs evaluated in the HHRA consisted of those contaminants considered to be most bioaccumulative, most persistent in the environment, and most toxic to human beings. Those COPCs identified in the HHRA as posing the greatest risk are referred to as COCs, and are the primary focus of the response action proposed in this ROD. Table 4 in Appendix II identifies the COCs and their chemical-specific characteristics (e.g., range of concentrations, frequency of detection, exposure point concentration [EPC] and associated statistical basis) for fish and crab tissue.

The COCs are:

- Dioxin/furans[12]

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[12] Dioxin/furan congeners were evaluated as TCDD toxicity equivalence (TEQ) based on individual congener toxicity equivalence factors (TEFs). Dioxin-like compounds (including 2,3,7,8-TCDD, other dioxin/furan congeners and dioxin-like PCBs) typically occur as mixtures in the environment. The toxicity of dioxin-like compounds can be assessed by considering their toxicity relative to 2,3,7,8-TCDD. A TEF is a measure of the relative potency of a compound to cause a particular toxic or biological effect relative to 2,3,7,8-TCDD. By convention, 2,3,7,8-TCDD is assigned a TEF of 1.0, and the TEFs for other compounds with dioxin-like effects range from 0 to 1. The consensus TEF values published in 2005 by the World Health Organization and recommended by EPA in the 2010 guidance "Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin-like Compounds" (EPA/100/R-10/005) are used in the risk evaluations. For a single dioxin-like compound, TCDD TEQ is the product of the concentration of the dioxin-like compound in the environment and its corresponding TEF; total TEQ for a mixture of dioxin-like compounds is the sum of the individual TCDD TEQs across those compounds. The TCDD TEQ provides a means for determining the toxicity of a mixture of dioxin-like compounds, in the absence of toxicity values for those compounds.

- PCBs[13]
- Mercury[14]

7.1.2. Exposure Assessment

Consistent with Superfund policy and guidance, the HHRA is a baseline human health risk assessment and therefore assumes no remediation or institutional controls to mitigate or remove hazardous substance releases. Cancer risks and noncancer HIs were calculated based on estimates of reasonable maximum exposures (RME) and central tendency exposures (CTE) to describe the magnitude and range of exposures that might be incurred by receptor groups under current and future conditions at the site. The RME is defined as the highest exposure that is reasonably expected to occur at a site, whereas the CTE is intended to reflect central (more typical) estimates of exposure. The objective of providing both the RME and CTE exposure cases is to bound the risk estimates, although decisions are based on the RME consistent with the NCP. The receptors and exposure scenarios that were identified as potentially complete and evaluated in the HHRA are the angler/sportsman and other family members consuming self-caught fish and crab (adult, adolescent and child), as summarized in Table 5 of Appendix II.

7.1.2.1. Conceptual Site Model (CSM)

The CSM for the HHRA (Figure 17 in Appendix I) considered current and future conditions in the lower 8.3 miles of the Passaic River to describe the magnitude and range of exposure by various receptors and age ranges (i.e., adults, adolescents and children). As discussed in Section 7.1, the only pathway of exposure evaluated quantitatively in the HHRA was the consumption of self-caught fish or crab from the lower 8.3 miles of the Lower Passaic River by the adult angler/sportsman and other family members (i.e., under the assumption, consistent with EPA guidance and site-specific information, that the angler shares his or her catch with an adolescent and a child). Table 5 in Appendix II provides the rationale for inclusion of the receptors and exposure pathway. Other exposure pathways, such as recreational exposures, will be evaluated in the 17-mile LPRSA RI/FS.

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[13] PCBs were evaluated as the sum of 12 dioxin-like congeners (TCDD TEQ based on individual congener TEFs) and the sum of non-dioxin-like congeners. The PCB contribution to the TCDD TEQ was separately evaluated in the risk assessments, and to avoid "double-counting" of exposures and risks, the 12 dioxin-like PCB congeners were excluded from quantification of Total PCBs. As a result, the term "Total PCBs" has a slightly different meaning in the risk assessments compared to the RI/FFS. However, the mass of dioxin-like congeners is a trivial fraction of the aggregate concentration and the two approaches to quantifying Total PCBs result in very similar concentration estimates.

[14] Due to a lack of methylmercury analytical results in the tissue dataset used for this HHRA, results for elemental mercury (the form of mercury for which most of the data were available) were used as a surrogate for methylmercury. Data for total mercury and methylmercury were assumed to be equivalent and treated as if all were methylmercury; however, mercury data may slightly overestimate the methylmercury concentration and thus, may result in a potential slight overestimate of noncancer health hazards.

7.1.2.2. Exposed Population

Adults (over 18 years), adolescents (aged 7 to 18 years) and young children (1 to 6 years) can be exposed to COCs in the lower 8.3 miles as a result of catching and consuming fish or crab. The FFS evaluated exposures to the adult angler/sportsman and other immediate family members (i.e., young child) who consume fish or crab provided by an adult angler. The HHRA also considered the adolescent as another possible angling receptor who may catch fish or crab and consume their catch, or consume fish or crab caught by their angling parent.

7.1.2.3. Ingestion Rates of Self-Caught Fish or Crab (IR)

The Ingestion Rate (IR) is the amount of fish or crab an individual catches in the lower 8.3 miles and consumes on a daily basis based on averaging the reported consumption rate in 1 year over 365 days. IRs for fish and crab are annualized and are presented in grams eaten per day (g/day). For purposes of the HHRA, it was assumed that an RME individual consumed either crab or fish but not both.

Fish IRs for the HHRA were developed from a detailed evaluation of LPRSA-pertinent angler and creel surveys and related literature, as documented in EPA Region 2 Technical Memorandum, “Fish and Crab Consumption Rates for the LPRSA Human Health Risk Assessment” dated February 2012. This analysis provided fish consumption rates for the RME individual of 35 g/day (or 56 eight-ounce fish meals/year) and 3.9 g/day (or 6.2 eight-ounce fish meals/year) for the CTE.

IRs for the child and adolescent consuming fish were based on the assumption that the intake for the child will be approximately one-third that of the adult and intake for the adolescent will be approximately two-thirds that of the adult. The RME IR of 12 g/day is used for the child receptor and 23 g/day is used for the adolescent receptor. For the CTE, an IR of 1.3 g/day is used for the child receptor and 2.6 g/day is used for the adolescent receptor.

The crab IRs for the adult angler were calculated as 21 g/day for the RME (or 34 eight-ounce crab meals per year) and 3.0 g/day (or 4.9 eight-ounce crab meals per year) for the CTE. IRs for the child and adolescent receptors were estimated assuming rates one third and two thirds those of the adult IR, respectively, as was assumed for fish ingestion. Thus, for the RME, an IR of 7.0 g/day is used for the child receptor and 14 g/day is used for the adolescent receptor. For the CTE, an IR of 1.0 g/day is used for the child receptor and 2.0 g/day is used for the adolescent receptor.

7.1.2.4. Exposure Duration (ED)

In the RI/FFS HHRA, for the adult angler/sportsman, exposure was assumed to occur for 6 years as a child and 24 years as an adult, for a total RME ED of 30 years, consistent with EPA human health risk assessment guidance in use at the time. For the adolescent angler/sportsman, exposure was assumed to occur for 12 years (from ages 7 through 18 years) for the RME. The CTE ED for adult receptors was 9 years, based on the 50th percentile value for years living in the current home from EPA's 2011 *Exposure Factors Handbook*. For the adolescent and child CTE exposures, 6 years and 3 years were assumed, respectively, based on EPA's 1991 Standard Default Exposure Assumptions. In response to comments, EPA evaluated the 2014 updated Standard Default Exposure Assumptions (OSWER Directive 9200.1-120), released after the RI/FFS was completed. The updated assumptions changed the adult ED from 24 years to 20 years and the total ED from 30 years to 26 years. As shown in the Responsiveness Summary in Appendix V, incorporating the updated assumptions does not significantly affect the calculated cancer risks and does not alter noncancer values at all. The risk estimates calculated with the updated EDs are presented in Tables 8 through 11 in Appendix II.

7.1.2.5. Cooking Loss for Fish

Contaminant losses from cooking may be a function of the cooking method (*e.g.*, baking, frying or broiling), cooking duration, temperature during cooking, preparation techniques (*i.e.*, trimmed versus untrimmed, with or without skin), lipid content of the fish, fish species, magnitude of contamination in the raw fish, extent to which lipids separated during cooking are consumed, reporting method, and/or experimental study design. In addition, personal preferences for various preparation and cooking methods and other related habits (such as consuming pan drippings) may result in consumption of contaminants "lost" from the fish upon cooking. Based on these uncertainties and the variability in cooking methods, a zero percent cooking loss was assumed for the RME individual. Chemical-specific cooking losses were developed for individual chemicals and evaluated in the CTE assessment.

7.1.2.6. Other Exposure Assumptions

In the RI/FFS HHRA, the body weight of the adult was assumed to be 70 kilograms (kg, 154 pounds) based on EPA's 1991 Standard Default Exposure Assumptions, the guidance in use at the time of RI/FFS completion. In response to comments, EPA evaluated the 2014 updated Standard Default Exposure Assumptions, released after the RI/FFS was completed. The updated assumptions changed the adult body weight to 80 kg (176 pounds). As shown in the Responsiveness Summary (Appendix V), incorporating this updated assumption does not significantly affect the calculated risks and health hazards. The risk/hazard estimates calculated with the updated body weight are presented in Tables 8 through 17 in Appendix II. None of the other exposure assumptions were affected by the 2014 updated Standard Default Exposure Assumptions. The body weight for the young child used in the HHRA was 15 kg (33 pounds), consistent with EPA's 2014 Standard Default Exposure Assumptions. The mean body weight for the adolescent was assumed to be 52 kg (115 pounds), consistent with EPA's 2011 *Exposure Factors Handbook* (a factor unaffected by the 2014 updates). The value for lifetime used in the RI/FFS HHRA cancer calculations was 70 years, consistent with EPA's 2014 Standard Default Exposure Assumptions.

7.1.3. Toxicity Assessment

The toxicity assessment determines the types of adverse health effects associated with exposure to COCs and the relationship between the magnitude of exposure (dose) and severity of adverse effects (response). Potential health effects include increased risk of developing cancer over a lifetime. Other noncancer health effects, such as changes in the normal function of organs within the body (e.g., changes in the effectiveness of the immune response), are also evaluated.

Potential cancer effects are expressed as the probability that an individual will develop cancer over a lifetime based on the exposure assumptions described in Section 7.1.2. The cancer slope factor (CSF) is a plausible upper bound estimate of carcinogenic potency used to calculate cancer risk from exposure to carcinogens, by relating estimates of lifetime average chemical intake to the incremental probability of an individual developing cancer over a lifetime.

Noncancer health effects were evaluated using reference doses (RfDs). An RfD is an estimate of a daily oral exposure for a given duration to the human population (including susceptible subgroups) that is likely to be without an appreciable risk of adverse health effects over a lifetime. Chronic RfDs are specifically developed to be protective against long-term exposure to COCs.

7.1.3.1. Sources of Toxicity Information

Toxicity criteria were selected according to OSWER Directive 9285.7-53, which recommends a hierarchy of human health toxicity values for use in risk assessments at Superfund sites. The hierarchy is as follows: 1) EPA's Integrated Risk Information System (IRIS); 2) EPA's Provisional Peer-Reviewed Toxicity Values (PPRTVs); and 3) other sources of information such as the California Environmental Protection Agency (CalEPA) and EPA's Health Effects Assessment Summary Tables (HEAST). This information is presented in Appendix II, Table 6 (cancer toxicity data summary) and Table 7 (noncancer toxicity data summary). Additional toxicity information for the COCs is presented in the RI/FFS HHRA.

7.1.3.2. Cancer Assessment

Table 6 in Appendix II provides a summary of the CSFs used in the assessment along with the source of the information. EPA has determined that dioxins and PCBs are probable human carcinogens. For the fish/crab ingestion route, the CSF for Total PCBs is 2 milligrams per kilograms per day (mg/kg-day) based on the bioaccumulation of this contaminant in fish and crab and was obtained from IRIS.

For dioxins/furans (TCDD TEQ [D/F]) and dioxin-like PCBs 9TCDD TEQ [PCBs]), the HHRA used toxicity information for dioxin (2,3,7,8-TCDD) provided in EPA's 1997 Health Effects Assessment Summary Tables, a Tier 3 toxicity value. The CSF for dioxin of 150,000 mg/kg-day is also consistent with the recommendation in the EPA 1996 PCB reassessment, "PCBs: Cancer Dose-Response Assessment and Application of Environmental Mixtures." The HHRA also identified several other CSFs for dioxins that meet the Tier 3 Toxicity Hierarchy criteria. The other Tier 3 toxicity values are discussed further in Section 7.1.5.3.

7.1.3.3. Noncancer Assessment

Table 7 in Appendix II provides the chronic oral RfDs for the COCs and the source of the toxicity information for mercury, PCBs and dioxins/furans. The oral RfD for total PCBs was based on Aroclor 1254. The oral RfD for total PCBs is 2 x 10^{-5} and the critical effects include effects on the immune system and eyes. The oral RfD for dioxins/furans is 7 x 10^{-10} mg/kg-day and exposure is associated with dermal, developmental, immunological and reproductive critical effects. The oral RfD for mercury, assumed to be methyl mercury, is 1 x 10^{-4} mg/kg-day and the critical effect is on the central nervous system.

7.1.3.4. Dioxin TEF Approach

For dioxins/furans (TCDD TEQ [D/F]) and dioxin-like PCBs (TCDD TEQ [PCBs]), the consensus TEF values published in 2005 by the World Health Organization and recommended by EPA in the 2010 TEF guidance (EPA/100/R-10/005) were used in the risk evaluations.

7.1.4. Risk Characterization

Risk characterization involves estimating the magnitude of the potential adverse health effects associated with the COCs. It also involves making judgments about the nature of the human health threat to the defined receptor populations. The risk characterization combines the results of the dose-response (toxicity assessment) and exposure assessment to calculate cancer risks and noncancer health hazards. In accordance with EPA’s guidelines, this assessment assumes that the effects of all contaminants are additive through a specific pathway within an exposure scenario.

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk (a unitless probability of an individual’s developing cancer) is calculated by multiplying the chronic daily intake averaged over 70 years (mg/kg-day) and the slope factor (per mg/kg-day).

These risks are probabilities that usually are expressed in scientific notation (e.g., 1 x 10^{-6}). An excess lifetime cancer risk of 1 x 10^{-6} indicates a probability that the RME individual has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an “excess lifetime cancer risk” because it would be in addition to the risks of cancer individuals face from other exposures. The upper-bound excess lifetime cancer risks derived in this assessment are compared to the risk range of 10^{-4} (one in ten thousand) to 10^{-6} (one in one million) established in the NCP. EPA’s goal of protection for cancer risk is 10^{-6} and risks greater than 10^{-4} typically will require remedial action.

The potential for noncancer health effects is estimated by comparing the average daily dose (ADD) of a chemical for adult, adolescent and child with the RfD for the specific route of exposure (e.g., oral). The ratio of the intake to reference dose (ADD/RfD) for an individual chemical is the hazard quotient (HQ). When an RfD is available for the chemical, these ratios are calculated for each chemical that elicits a noncancer health effect. Typically, chemical-specific HQs are summed to calculate an HI value for each exposure pathway. EPA's goal of protection for noncancer health effects is an HI equal to 1. When the HI exceeds 1, there may be a concern for health effects. This approach can result in a situation where HI values exceed 1 even though no chemical-specific HQs exceed 1 (i.e., adverse systemic health effects would be expected to occur only if the receptor were exposed to several contaminants simultaneously). In this case, chemicals are segregated by similar effect on a target organ, and a separate HI value for each effect/target organ is calculated. If any of the separate HI values exceed 1, adverse, noncancer health effects are possible. It is important to note, however, that an HI exceeding 1 does not predict a specific disease.

7.1.4.1. Cancer Assessment

The HHRA shows that all of the risks associated with the RME are greater than the goal of protection established in the NCP of 10^{-6} (i.e., one additional cancer in 1,000,000 people). All of the risks associated with the RME are also greater than the 10^{-4} cancer risk that typically would require remedial action at a site or operable unit (see Tables 8 and 9 in Appendix II). In addition, cancer risks to the average exposed (CTE) individual associated with ingestion of fish and crab are above EPA's goal of protection of 10^{-6} (see Tables 10 and 11 in Appendix II).

For the RME adult and child combined receptor (Table 8), a cancer risk of 4×10^{-3} for consumption of fish or 1×10^{-3} for consumption of crab indicates that eating fish or crab from the lower 8.3 miles may cause four additional cancers in a population of 1,000 people or one additional cancer in a population of 1,000 people, respectively, under the stated exposure assumptions. For the adolescent receptor (Table 9), a cancer risk of 2×10^{-3} for consumption of fish or 6×10^{-4} for consumption of crab indicates that eating fish or crab from the lower 8.3 miles may cause two additional cancers in a population of 1,000 people or six additional cancers in a population of 10,000 people, respectively, under the stated exposure assumptions.

The primary contributors to the excess risk are dioxins/furans (70 percent for fish consumption and 82 percent for crab consumption), dioxin-like PCBs (11 percent for fish consumption and 12 percent for crab consumption) and non-dioxin-like PCBs (16 percent for fish consumption and 5 percent for crab consumption). The other COPCs contributed a combined 3 percent to the excess cancer risk.

7.1.4.2. Noncancer Health Hazards

The results for noncancer health hazards from the HHRA are summarized in Tables 12 through 14 in Appendix II for the RME scenarios and Tables 15 through 17 in Appendix II for the CTE scenarios. For the RME child who eats fish or crab from the lower 8.3 miles, the HIs are 196 and 67, respectively, which are above EPA's goal of protection of an HI equal to 1. RME results for the adult and adolescent also are above EPA's goal of protection of an HI equal to 1. In addition, noncancer HIs for the CTE individual associated with ingestion of fish and crab are above EPA's goal of protection.

Dioxin/furans and PCBs combined contribute more than approximately 98 percent of the excess hazard, while the remaining excess hazard is associated with methyl mercury for all receptors for ingestion of both fish and crab. The total noncancer HI exceeded the goal of protection and the individual HQs based on critical effect also exceeded a threshold of 1 for these contaminants.

7.1.5. Uncertainties

The HHRA was conducted consistent with EPA risk assessment guidance, guidelines and policies. The application of these procedures is designed to reduce potential uncertainty and ensure consistency. The process of evaluating cancer risks and noncancer health hazards involves multiple steps. Significant uncertainties are discussed in this section; a full discussion of uncertainties is included in RI/FFS Appendix D.

The procedures and inputs used to assess risks in EPA's evaluation, as in all such assessments, are subject to a wide variety of uncertainties. In general, the main sources of uncertainty include:

- Environmental chemistry sampling and analysis
- Environmental parameter measurement
- Exposure parameter estimation
- Toxicological data

Environmental sampling and parameter measurement uncertainties may be introduced through sample collection and preparation methods. Laboratory uncertainties include both random and systematic errors which affect the precision and accuracy of the sample results. Data were collected under EPA-approved QAPPs and the data were validated to reduce the uncertainties involved with laboratory measurement of COCs in environmental samples. Only validated data were used in the risk assessment, which reduced potential uncertainties.

7.1.5.1. Hazard Identification Uncertainties

The HHRA focused on the evaluation of COPCs in fish and crab that were the most bioaccumulative, persistent in the environment and most toxic to human receptors. As a result, other COPCs found in fish and crab were not evaluated in the HHRA, resulting in a potential underestimate of risks and hazards. Since the most persistent contaminants were evaluated, the impact of this uncertainty is most likely limited.

Due to a lack of methyl mercury analytical results in the tissue dataset used for this HHRA, results for elemental mercury (the form of mercury for which most of the data were available) were used as a surrogate for methyl mercury, consistent with EPA guidance. Therefore, EPCs derived using mercury data may slightly overestimate the methyl mercury concentration and thus result in a potential slight overestimate of noncancer health hazards.

7.1.5.2. Exposure Assessment Uncertainties

Uncertainties in the exposure assessment are related to estimates of how often an individual would actually come in contact with the COCs, the period of time over which such exposure would occur and the models used to estimate the concentrations of the COCs at the point of exposure.

Exposure to dioxin, dioxin-like compounds, PCBs and other bioaccumulative compounds in sensitive subpopulations, such as breast-fed children of mothers who consume contaminated fish, was not evaluated quantitatively. These compounds are lipophilic and concentrate in breast milk. Therefore, risks are more likely to be underestimated for these sensitive populations.

Individuals may be exposed to COCs from eating game (e.g., turtles, waterfowl) found in the lower 8.3 miles. Waterfowl may contain high concentrations of dioxins and PCBs in their fat and internal organs. However, because there are no historical data on chemical concentrations in the tissues of these organisms, consumption of waterfowl, turtles, and other species is qualitatively evaluated in the HHRA and identified as an area of uncertainty. For individuals who consume these animals in addition to fish and crab, cancer risks and noncancer health hazards would be expected to be higher.

The HHRA evaluated exposure from fish or crab consumption. For those individuals who consume fish or crab and also engage in other activities that result in other types of exposure to COCs in sediment and surface water (such as sculling, wading or swimming in the lower 8.3 miles), the cancer risks and noncancer hazards may be underestimated. Such exposures are not expected to meaningfully increase the risk or hazards, because the fish/crab ingestion pathway has been found to outweigh all other pathways at other sites where both fish ingestion and recreational uses were evaluated. Other exposure pathways in addition to fish/crab ingestion will be evaluated in the 17-mile HHRA.

There is uncertainty in the fish and crab ingestion rates used due to inherent uncertainties in how creel-angler surveys are conducted and how survey results are converted to consumption rates. The potential exists that the risks may be either underestimated or overestimated. EPA’s analysis relied on published information and EPA obtained the raw survey data to calculate the IRs for fish and crab. EPA’s analysis was consistent with other regional and national surveys, supporting the conclusion that the selected IRs for fish and crab are consistent with an RME.

The ingestion rate for crab consumption was based on a survey conducted over a 3-month period during which individuals reported catching and consuming crab. This rate did not take into consideration the number of meals eaten throughout the remainder of the year when anglers may continue to catch crab or may consume frozen crab caught during the 3-month period. The ingestion rate for crab may be underestimated for individuals who catch crab for periods longer than three months.

The potential exists that the risks may be either underestimated or overestimated based on the ingestion rate. The ingestion rates used in the HHRA showed consistency with other surveys both regionally and nationally. This assessment supports the conclusion that the selected consumption rates for fish and crab are consistent with an RME.

The HHRA evaluated exposure from fish or crab consumption. Cancer risks and noncancer health hazards for individuals that consume both fish and crab may potentially be underestimated depending on the frequency with which an individual consumed both fish and crab.

EPCs for fish were based on tissue samples including both skinless and skin-on fillet samples, consistent with EPA guidance (Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 2 – Risk Assessment and Fish Consumption Limits, Third Edition [EPA 823-B-00-008]). EPCs derived for organic COCs in fish may be overestimated for those individuals consuming only skinless fillets since fatty tissues concentrate many organic compounds. Conversely, the EPC derived for methyl mercury in fish may be underestimated for those individuals consuming only skinless fillets (mercury concentrates in muscle tissue). EPCs for all COPCs may be underestimated for those individuals consuming whole fish.

EPCs for crab were based on samples including both muscle and hepatopancreas tissue. Incorporating hepatopancreas results is a potential overestimate of the EPC concentration for chlorinated COCs for those individuals who remove the hepatopancreas before cooking the crab. However, consumption surveys conducted by NJDEP have found that 15 percent of respondents indicate they consumed the hepatopancreas and that even those consumers who do not deliberately eat the hepatopancreas are likely to be exposed to its contents due to its fluid nature and its dispersion in cooking liquid.

Use of an equal-weighted average concentration to represent the EPC for fish ingestion in the HHRA assumes that individuals consume only the six fish species caught during the late summer/early fall 2009 sampling event (American eel, common carp, smallmouth bass, white catfish, white perch and white sucker) and that each of these species is equally consumed. This assumption is reasonable, because the six species are commonly caught and abundant in the lower 8.3 miles; in the absence of site-specific information about fish species consumption preferences and consumption patterns, the use of six species that account for distinct ecological groups of fish consumed by anglers is more representative than use of a single species. The assumption of equal intake of the representative species may under or overestimate risks and hazards for those individuals with specific fish preferences.

Reported cooking losses vary considerably among the numerous studies reviewed and little information is available to quantify personal preferences among anglers for various preparation and cooking methods, and other related habits (such as consumption of pan drippings). The assumption that there is no loss during cooking or preparation used in the RME estimate of cancer risk and noncancer health hazard is consistent with the RME individual, but may overestimate risks and hazards for individuals depending on their cooking method preferences.

The HHRA used a 30-year default value for ED for the angler, representing an upper bound residential tenure at a single location. The angler was assumed to be a fairly permanent resident in the area. An evaluation was conducted using 2000 U.S. Census data for Essex and Hudson Counties which quantified (1) how long residents are staying within their county and (2) how long residents stay within the two-county area. The results of this evaluation indicated that, at the 95th percentile, the number of years that an individual stayed in the two-county area was about 95 years and the number of years that an individual stayed in each county was about 55 to 60 years. Therefore, risks and hazards may be underestimated based on the assumption of a 30-year ED by a factor of 1.5 to 2.

7.1.5.3. Toxicity Assessment Uncertainties

Uncertainties in toxicological data occur in extrapolating both from animals to humans and from high to low doses of exposure, as well as from the difficulties in assessing the toxicity of a mixture of chemicals. These uncertainties are addressed by making conservative assumptions concerning risk and exposure parameters throughout the assessment. As a result, the risk assessment provides upper-bound estimates of the risks to populations near a site or operable unit and thus it is highly unlikely to underestimate actual risks related to the site.

One area of uncertainty is related to the CSF used in the calculations. For dioxin, a Tier 3 value was used in the calculation of the cancer risks and an IRIS RfD was used to calculate the non-cancer hazards. As indicated in the HHRA, the currently available Tier 3 cancer slope factor values are comparable to the HEAST value of 150,000 per mg/kg-day (e.g., CalEPA 130,000 per mg/kg-day, EPA's Office of Health and Environmental Assessment (OHEA) value of 156,000 per mg/kg-day). The recalculation of risks using these comparable HEAST, CalEPA or EPA OHEA values would not significantly change the calculated risks.

Another area of uncertainty is related to the TEFs. The HHRA was conducted in accordance with EPA's 2010 TEF guidance. In addition, the primary contributor to the risk at the operable unit is 2,3,7,8-TCDD which is the basis for the other TEFs.

At sites with PCB contamination, the cancer risks and noncancer hazards from PCB exposure are typically evaluated based on a mixture of PCB congeners. However, the presence of the 12 dioxin-like PCBs at concentrations greater than the non-dioxin-like PCBs typically found at a site can result in greater impacts from PCBs at lower concentrations. In the lower 8.3 miles of the LPR, for fish ingestion as an example, the RME cancer risk of 5×10^{-4} for dioxin-like PCBs [TCDD TEQ (PCBs)] is approximately equivalent to the RME cancer risk calculated without consideration of the dioxin-like PCB congeners (*i.e.*, 6×10^{-4} for total PCBs) as shown on Table 8 in Appendix II. Therefore, there was no evidence of enhanced exposure to dioxin-like PCBs.

7.1.5.4. Uncertainty Assessment Conclusion

Overall, the HHRA found that the cancer risks and noncancer health hazards for the RME individual consuming fish or crab exceeded the acceptable cancer risk range and goal of protection of an HI of 1 for the RME individual including all age groups. EPA would not expect any potential overestimate or underestimate of risk based on the identified uncertainties to significantly change the calculated cancer risks and noncancer health hazards.

7.2. Ecological Risk Assessment

The site-specific baseline ecological risk assessment (BERA) evaluated ecological risks associated with exposure to chemicals in the lower 8.3 miles of the Lower Passaic River. Ecological receptors evaluated include aquatic organisms (including benthic macroinvertebrates and fish) and aquatic-dependent wildlife.

The approach used in the BERA to assess site related ecological risks consists of the following four components:

- **Problem Formulation** is a qualitative evaluation of contaminant release, migration, and fate; identification of COPECs, receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study.
- **Exposure Assessment** is a quantitative evaluation of contaminant release, migration, and fate; characterization of exposure pathways and receptors; and measurement or estimation of exposure point concentrations.
- **Ecological Effects Assessment** includes literature reviews, field studies, toxicity tests and linking contaminant concentrations to effects on ecological receptors.
- **Risk Characterization** includes measurement or estimation of both current and future adverse effects.

7.2.1. Problem Formulation

Sediment and fish tissue data collected by EPA, USACE and NOAA within the 17-mile Lower Passaic River from 1990 to 2001 (latest available at the time the initial screening was conducted) were evaluated for quality and used in a screening process to identify COPECs. Any bioaccumulative chemical that was detected in the samples was identified as a COPEC and any essential nutrient was excluded as a COPEC. Then, the maximum detected concentration of each analyte in sediment and fish tissue was compared to effects-based screening values (Effects Range Low [ER-L], Threshold Effect Levels [TELs] and sediment quality threshold concentrations) from NOAA and other widely used, published sources. The screening process, which incorporates Steps 1 and 2 of the ecological risk assessment process, is documented in the *Lower Passaic River Restoration Project Pathways Analysis Report*, July 2005. All COPECs evaluated in the BERA were retained as COCs because all exceeded a Hazard Quotient (HQ) of 1 for one or more receptor categories evaluated (Table 18 in Appendix II). The COCs that were the largest contributors to total ecological risk were selected for evaluation in the BERA, as follows:

- TCDD TEQ
    - Dioxin/furans (as TCDD TEQ)
    - PCB congeners (sum of 12 dioxin-like congeners as TCDD TEQ)
    - 2,3,7,8-TCDD
- Total PCBs (sum of nondioxin-like congeners)
- Total DDx (sum of DDE, DDD and DDT)
- Dieldrin
- PAHs
    - High molecular weight PAHs (HMW PAHs)
    - Low molecular weight PAHs (LMW PAHs)
- Mercury
- Copper
- Lead

TEQs based separately on the dioxin/furan and PCB congeners were evaluated in order to quantify their relative importance to the total TCDD TEQ risks in the BERA. Ecological risks associated with exposure to 2,3,7,8-TCDD alone were also evaluated for invertebrates which lack aryl hydrocarbon receptors.[15] Other COPECs are being evaluated in the 17-mile LPRSA RI/FS.

The ecological effects of the COCs are profiled in RI/FFS Appendix D and summarized in Section 5.2.

Although the lower 8.3 miles of the Lower Passaic River is in a densely-populated urban area, a wide range of ecological receptors may be exposed to the COCs, including the following:

- Benthic invertebrates (represented by invertebrates that live in/on the sediment) and blue crab
- Forage fish (represented by mummichog)
- Piscivorous fish (represented by white perch and American eel)
- Aquatic-dependent birds (represented by great blue heron)
- Aquatic-dependent mammals (represented by mink)

The receptors listed above were evaluated for exposure to COCs through direct contact with and incidental ingestion of sediments, as well as ingestion of contaminated prey. Table 19 in Appendix II summarizes the ecological exposure pathways of concern evaluated in the ERA. To assess exposures to early life stages (the most sensitive to dioxin-like effects), fish and herring gull embryo viability was also evaluated. The assessment endpoints evaluated in the BERA were protection and maintenance (i.e., survival, growth and reproduction) of each community of ecological receptors listed above.

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[15] The TEF additive risk approach is not appropriate for organisms that lack aryl hydrocarbon receptors, because aryl hydrocarbon receptor activation is necessary for expression of toxic responses following exposure to dioxin-like compounds.

7.2.2. Exposure Assessment

The BERA, which encompasses Steps 3 to 8 of the EPA eight-step ecological risk assessment guidance (EPA 540-R-97-006), estimated risks to ecological receptors based on sediment and fish and crab tissue data collected during the 17-mile LPRSA RI/FS.

Sediment exposures experienced by ecological receptors were represented by COC concentrations (i.e., 95 percent upper confidence level [UCL]) in the top six inches of sediment. Since the conceptual site model shows that elevated concentrations of COCs are ubiquitous in surface sediments of the lower 8.3 miles, bank-to-bank, the entire lower 8.3 miles was considered a single exposure point for a majority of the evaluated receptors. A subset of the aquatic environment that is periodically exposed during low tide (*i.e.*, mudflats or "shoals") was also considered as a second exposure point for the sediment medium because some ecological receptors reside primarily in this habitat.

Two fish EPCs (for the mummichog and generic fish[16] categories) were used so that potential trophic levels (i.e., piscivorous versus forage) could be considered in the BERA. Concentrations were based on the 95 percent UCL. In addition, inclusion of forage fish, which are typically found in shoals rather than a channel environment, provides a more realistic estimate of modeled dietary exposures for wading birds such as the heron. The generic fish category was used in the BERA to evaluate potential bioaccumulation hazards to the piscivorous and omnivorous fish species that use the Lower Passaic River for at least part of their life cycles as well as aquatic-dependent wildlife that rely on this resource. COC concentrations in the generic fish were calculated using a combination of whole body and reconstituted whole body tissue data for the fish species caught in the sampling programs.

Since there were no site-specific egg residue data available to evaluate early life stages, fish and avian egg tissue concentrations were estimated by applying uptake factors to adult fish tissue concentrations to model transfer from either maternal tissue (fish egg analysis) or fish prey tissue (piscivorous bird egg analysis).

Exposure models were developed for both the heron and mink receptors to estimate the daily intake rate (i.e., daily dose) of each COC; each model incorporated natural history information and species characteristics, such as diet composition, ingestion rates, body weights and foraging ranges.

[16] A number of fish species were collected for the 17-mile LPRSA RI/FS, including American eel, brown bullhead, common carp, smallmouth bass, white catfish, white perch and white sucker. These species are representative of the primary piscivorous and omnivorous life histories characteristic of the Lower Passaic River and their tissue data were combined into a "generic fish" to estimate EPCs.

7.2.3. Ecological Effects Assessment

The effects data linking contaminant concentrations to effects on ecological receptors were derived from published literature (see Table 20 in Appendix II). They are consistent with and supported by laboratory toxicity and benthic community data collected during the 17-mile LPRSA RI/FS.

The primary source of sediment benchmarks used to evaluate direct-contact exposures to sediment for benthic macroinvertebrates was an EPA 2005 study of marine macroinvertebrate survival in laboratories after exposure to field-collected sediments with a range of contaminant levels from various benthic habitats in coastal North America ("Predicting Toxicity to Amphipods from Sediment Chemistry," EPA/600/R-04/030). Chemical concentrations corresponding to a 20 percent and 50 percent probability of observing toxicity (termed "T20" and "T50" models, respectively) were selected to provide lower- and upper-bound sediment benchmarks for the BERA. The study determined that the magnitude of the toxic effect (i.e., decreased survival) predicted by the models was strongly correlated with the predicted probability of toxicity. The study provided T20 and T50 values for copper, lead, mercury, dieldrin and Total PCBs that were used in the BERA as sediment benchmarks. For those COCs lacking T20/T50 values, NOAA ER-L and Effects Range-Median (ER-M) values were used to identify the range of contaminant concentrations over which an adverse toxicological response is increasingly likely to occur. ER-L and ER-M values were selected as lower- and upper-bound sediment benchmarks for LMW PAHs, HMW PAHs and Total DDx. Finally, a site-specific sediment benchmark for 2,3,7,8-TCDD was developed in 2007 by USFWS based on sediment and suspended solids analytical data collected from the Arthur Kill and oyster effect data (see RI/FFS Appendix D for more details). The oyster is an appropriate endpoint species, since its occurrence in the lower 8.3 miles of the Lower Passaic River was documented by the 17-mile LPRSA RI/FS and it was historically an important resource.

To evaluate whether exposure to COCs that have bioaccumulated in fish and crab tissues, and in fish and bird embryos, is likely to cause adverse effects, critical body residues (CBRs) were developed from published literature for each COC and each ecological receptor. Selection of each CBR, including rationale for application of extrapolation factors where appropriate, is discussed in detail in RI/FFS Appendix D. As discussed in Section 7.2.1, dioxin CBRs were compared to crab and fish tissue EPCs based on 2,3,7,8-TCDD and TCDD-TEQ concentrations, respectively.

To evaluate the potential effects to wildlife associated with exposure to COCs through incidental sediment ingestion and consumption of contaminated prey, Toxicity Reference Values (TRVs) were developed from published literature for each COC and each ecological receptor (great blue heron and mink). Selection of each TRV, including the rationale for application of extrapolation factors where appropriate, is discussed in detail in RI/FFS Appendix D.

7.2.4. Risk Characterization

The risk characterization combines the exposure and effects assessments to derive quantitative estimates of risk for each endpoint. Risks were calculated based on both the low and high estimates of toxicity to provide lower and upper bound estimates of risk, respectively. Each individual risk estimate for a given receptor for each chemical was calculated as an HQ, which is the ratio of the EPC to a given toxicological benchmark. If the HQ is equal to or less than 1, then no adverse health effects are expected as a result of exposure. If the HQ is greater than 1, then adverse health effects are possible.

Risks to benthic invertebrates were evaluated in two ways. First, for invertebrates other than crabs, lower 8.3-mile sediment contaminant concentrations (from the exposure assessment described in Section 7.2.2) were compared to sediment benchmarks (from the ecological effects assessment in Section 7.2.3). In the lower 8.3 miles, sediment concentrations for all COCs exceeded the sediment benchmarks (see Table 21 in Appendix II). Based on the magnitude of exceedances of sediment benchmarks, 2,3,7,8-TCDD, Total DDx, Total PCBs, PAHs, dieldrin and mercury were found to contribute most substantially to risks to invertebrates other than crabs. Second, for crab, a comparison was made between crab tissue concentrations and CBRs. Lower 8.3-mile crab tissue concentrations were found to be higher than CBRs for copper, mercury, Total PCBs and 2,3,7,8-TCDD. Based on the magnitude of exceedances of CBRs, 2,3,7,8-TCDD and Total PCBs were found to contribute most substantially to risks to crabs.

Risks to piscivorous fish and forage fish were evaluated by comparing lower 8.3-mile tissue concentrations (from the exposure assessment) to CBRs (from the ecological effects assessment). (See Table 22 in Appendix II.) Fish tissue concentrations were found to be higher than CBRs for copper, PCBs and dioxins/furans. Estimates of fish egg concentrations were greater than egg CBRs for dioxins/furans.

Risks to aquatic-dependent birds and mammals were evaluated by comparing modeled daily doses of COCs (from the exposure assessment) to TRVs (from the ecological effects assessment), and by comparing estimated contaminant concentrations in eggs from fish-eating birds to CBRs (see Tables 23a and 23b in Appendix II). For the heron consuming fish, only dioxins/furans modeled daily doses exceeded the TRVs. The estimated bird egg concentrations substantially exceeded CBRs for PCBs, dioxins/furans and Total DDx. For the mink, modeled daily doses were higher than toxicological reference values for dioxins/furans, PCBs and mercury.

7.2.5. Uncertainties

BERAs are based on calculations using sample data collected to represent the nature and extent of contamination, toxicological information on COCs from laboratory and field studies, and conservative assumptions regarding the exposure of sensitive ecological receptors. There is a degree of uncertainty associated with exposure modeling and HQ calculations even when available site-specific information is used in the assessment. Significant uncertainties are discussed in this section; a full discussion of uncertainties is included in RI/FFS Appendix D.

7.2.5.1. Problem Formulation

The BERA focused on a subset of COPECs that were the largest contributors to total ecological risk, as discussed in Section 7.2.1. As a result, other COPECs found in sediment, fish and crab were not evaluated in the BERA, resulting in a potential underestimate of ecological risks.

The BERA also did not evaluate all potentially complete exposure pathways or ecological receptors, so overall risks may be underestimated.

7.2.5.2. Exposure Assessment

The fish tissue sampling program was designed to meet objectives for both the HHRA and BERA. As a consequence, the size and age of the fish collected could not be specific to the ecological wildlife modeled. Although larger prey can be speared and brought to shore for dismemberment and consumption, typical fish prey for the great blue heron tends to be less than 25 centimeters according to EPA's 1993 *Wildlife Exposure Factors Handbook*. Inclusion of larger fish prey in the sample set used to calculate the generic fish EPCs for the BERA would tend to overestimate exposures to piscivorous birds that feed on forage fish and smaller size categories of other fish because fish body burdens generally increase with size and age.

The great blue heron exposure scenario may lead to overestimates of Site-related risk, because it is assumed that 100 percent of risk to the population is resulting from exposures in the lower 8.3 miles. It is possible that piscivorous birds like the great blue heron may selectively feed in locations with lower concentrations of contaminants during some portion of their time in the lower 8.3 miles, although the concentrations of COCs at or exceeding the EPCs are broadly distributed across the lower 8.3 miles of the Lower Passaic River. Also, in this urbanized region, elevated exposures to at least some of the COCs outside of the lower 8.3 miles are also possible.

Published values for exposure parameters for wildlife receptors were assumed to represent wildlife in the Lower Passaic River. Parameters used included smallest home ranges, smallest average body weights (adult females), and typical sediment and food ingestion rates. Overall, these are conservative assumptions that potentially result in the exposures (and risks) encountered by typical individuals being overestimated. However, these assumptions do not consider juvenile receptors that may have higher ingestion rates relative to body weight, and exposures for these more sensitive life stages are likely to have been underestimated.

7.2.5.3. Ecological Effects Assessment

The T20/T50 sediment benchmarks are based on a narrow subset of the benthic and epibenthic soft bottom estuarine community and may not be robust predictors of effects for organisms with different life histories, exposures and/or toxicological sensitivities. Despite this concern, single species toxicity test results and benthic community metrics appear to be reasonably well correlated for most sediment-borne chemical stressors evaluated.

Use of the most sensitive species to select CBRs likely resulted in an overestimate of risks for the residue-based analysis. Species such as salmon and trout are not found in the Lower Passaic River, and the risks quantified in the residue-based analysis for the generic fish category were likely conservatively estimated. Use of tissue residue effect data for species such as the domesticated chicken, which is known to be particularly sensitive to PCBs and 2,3,7,8-TCDD, also resulted in conservative risk estimates. Further, selective breeding of the domesticated chicken for egg production could have affected overall sensitivities. Recently published work (see Responsiveness Summary in Appendix V for a list) categorized various avian species according to their relative sensitivity to dioxins and dioxin-like compounds. Three general categories of decreasing sensitivity have been identified, with the domesticated chicken and four other species categorized as Type 1, the ring-necked pheasant as Type 2 and species such as herring gull, double-crested cormorant and great blue heron (all potential avian receptors in the Lower Passaic River) as Type 3. The lack of obvious evolutionary relationships among the bird species in each of the categories suggests that taxonomic relatedness is not necessarily a strong predictor of relative sensitivity to compounds with dioxin-like effects. Because fewer than half of the bird species documented in the lower 8.3 miles have been categorized in this way, it is prudent to be conservative in selecting toxicity thresholds. In general, the procedures employed in the selection of CBRs tended to result in conservative risk estimates; however, this is appropriate, because suitable tissue residue data for certain COCs were limited and may not have been based on relevant sensitive species or life stages.

TRVs are typically based on results of tests performed on test animals under laboratory conditions and extrapolated to wildlife species in their natural habitat; selected values are generally conservatively developed as the lowest of the lowest observed adverse effects levels for well-conducted studies that evaluated ecologically relevant endpoints (survival, growth and reproduction). Results are then used to develop TRVs as daily dietary exposures. Because the most conservative values available are typically used, risks are more likely to be overestimated than underestimated. In the case of the mink receptor, well-conducted toxicity test results are available and were used to develop the TRVs. Risks are also likely to be overestimated because researchers typically attempt to minimize the variability in contaminant exposure when conducting laboratory toxicity studies and use more bioavailable forms of chemicals in the prepared diets.

7.2.5.4. Uncertainty Assessment Conclusion

Overall, the BERA found that the ecological risks to a wide range of receptors (benthic invertebrates, forage fish, piscivorous fish, and aquatic-dependent birds and mammals) exceeded EPA’s goal of an HQ equal to 1. The finding of unacceptable ecological risk would not change even when the range of uncertainties is considered.

7.3. Basis for Remedial Action

The response action selected in this ROD is necessary to protect public health or welfare and the environment from actual or threatened releases of hazardous substances into the environment. A response action is necessary for the sediments of the lower 8.3 miles of the Lower Passaic River portion of the Diamond Alkali Superfund Site at this time because:

Human Health Risk: The risk of an RME individual developing cancer or noncancer health effects as a result of COC exposure from ingestion of fish or crab in the lower 8.3 miles of the Lower Passaic River exceeds the acceptable risk range identified in the NCP. Specifically, fish and crab consumption risks and HIs for the RME scenarios exceed CERCLA-acceptable risk levels of an excess cancer risk of 10^{-6} to 10^{-4} and a noncancer goal of protection of an HI of 1.

Ecological Risk: Risks to all ecological receptors (benthic invertebrates, fish, aquatic birds and aquatic mammals) exceed acceptable levels (HQ equal to 1).

8. REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) describe what a remedial action is expected to accomplish. The following RAOs have been established for the lower 8.3 miles of the Lower Passaic River:

- Reduce cancer risks and noncancer health hazards for people eating fish and crab by reducing the concentrations of COCs in the sediments of the lower 8.3 miles.

- Reduce the risks to ecological receptors by reducing the concentrations of COCs in the sediments of the lower 8.3 miles.

- Reduce the migration of COC-contaminated sediments from the lower 8.3 miles to upstream portions of the Lower Passaic River and to Newark Bay and the New York-New Jersey Harbor Estuary.

These RAOs address human exposure through fish and/or crab consumption, and ecological exposures. The unacceptable exposures identified in the risk assessments are primarily derived from elevated COC concentrations in surface sediments that result in bioaccumulation of COCs in fish and crab. Addressing these sediments will reduce COC concentrations in biota, including fish and crab tissue, thereby significantly reducing potential human health risks and hazards, and ecological risks. By addressing exposure to and mobility of the surface sediments, the remedial action is expected to achieve the RAOs.

Reasonably anticipated future land and waterway uses in the lower 8.3 miles include the continued use of the federally authorized navigation channel for commercial navigation. Except for the two miles closest to Newark Bay, the federally authorized navigation channel in the lower 8.3 miles has not been regularly maintained in recent years. Based on EPA’s analysis of USACE’s 2010 Lower Passaic River Commercial Navigation Analysis report and comments submitted to EPA on the Proposed Plan, EPA does not anticipate that the channel above RM 1.7 is likely to be used for commercial navigation in the foreseeable future. The lowest 1.7 miles are currently used for commercial navigation, and USACE has indicated that maintaining the channel for this stretch is consistent with its current and reasonably anticipated future use. USACE has advised that based on current information about reasonably anticipated future use of the channel, it will support a recommendation for Congressional action to deauthorize the federal navigation channel from RM 1.7 to RM 8.3.

The communities along the banks of the lower 8.3 miles currently use the river for recreational purposes, and have provided their master plans for future increased recreational access, which can be anticipated to increase the recreational use. Thus, the reasonably anticipated future uses above RM 1.7 will be similar to if not greater than the current recreational uses.

8.1. Preliminary Remediation Goals

There are no chemical-specific federal or State of New Jersey standards for the COCs in sediment. Therefore, EPA developed Site-specific, risk-based preliminary remediation goals (PRGs) for the lower 8.3-mile sediments. Below is a discussion of how the PRGs were developed in the RI/FFS, and what led EPA to select the final remediation goals.

8.1.1. Human Health PRGs

Risk-based sediment concentrations to protect human health were developed based on fish or crab tissue concentrations of COCs (dioxins, PCBs and mercury) that would allow adult anglers to eat self-caught fish or crab from the lower 8.3 miles of the Lower Passaic River at a 10^{-6} cancer risk level or a noncancer HI of 1 as the goal of protection (see Table 24 in Appendix II[17]). Protective concentrations in tissue were also developed for risk levels of 10^{-5} and 10^{-4} (the last of which is typically the level that triggers the need for remedial action at a site). Protective concentrations in fish and crab tissue were calculated based on the site-specific adult consumption rates of 35 g/day for fish or 21 g/day for crab used in the HHRA. These consumption rates are equivalent to 56 eight-ounce fish meals per year or 34 eight-ounce crab meals per year. Additional tissue concentrations were developed for 12 eight-ounce fish or crab meals per year (or one meal per month), for use as interim remediation milestones (Table 24, columns 8-10). Interim remediation milestones are fish and crab tissue concentrations to be used during monitoring after remedy implementation to evaluate if contaminant concentrations in fish and crab tissue are decreasing as expected. EPA will share monitoring data and consult with NJDEP about whether the prohibitions on fish and crab consumption can be lifted or adjusted to allow for increased consumption as contaminant levels decline.

Sediment concentrations needed to meet protective fish and crab tissue concentrations were estimated using site-specific biota-sediment accumulation relationships developed from the COC

[17] All PRGs in Table 24 reflect were adjusted from the Proposed Plan based upon the updated ED and BW metrics discussed in Section 7.1.2.

concentrations in sediments and co-located fish or crab tissue concentrations. These relationships between sediment and tissue concentrations take into account the possibility that some of the fish or crab may have been exposed to contamination outside of the lower 8.3 miles of the Lower Passaic River, and are consistent with research showing that tissue concentrations may not decline at the same rate as sediment concentrations after sediments are remediated. These risk-based sediment PRGs for human health are presented in Table 25 in Appendix II, columns 3-8 and 12-13, along with the interim remediation milestones (columns 9-11 and 14).

8.1.2. Ecological PRGs

While all of the COCs discussed in Section 7.2 cause unacceptable risks (HQ greater than 1) to some or all of the receptors evaluated, risk-based PRGs were developed for dioxins, PCBs, mercury and Total DDx, because they are representative COCs (based on the magnitude of HQs and number of receptors affected) and because there were multiple lines of evidence developed to evaluate how the alternatives would achieve PRGs for these four COCs after remediation. In addition, most active alternatives (i.e., alternatives other than No Action) designed to address these COCs would also address the other COCs.

Sediment PRGs that would be protective of benthic invertebrates were developed based on the sediment benchmarks used to evaluate risks in the BERA. The benchmarks are published literature values shown through independent research to be good predictors of toxicity.

Tissue concentrations that would be protective of crab and fish were developed based on the CBRs used to evaluate risks in the BERA. Prey tissue concentrations that would be protective of birds and mammals were developed based on the TRVs used to evaluate risks in the BERA. The corresponding sediment concentrations needed for each species to meet the protective tissue concentrations were then estimated using the site-specific non-linear regressions described in Section 8.1.1.

Table 25 in Appendix II (column 2) presents the overall ecological risk-based sediment PRGs for the representative COCs. The overall ecological risk-based PRG for each COC is the lowest of the PRGs developed for each category of receptor, so that all of the organisms, including the most sensitive species, will be protected.

8.1.3. Background Concentrations and other Potential Contributors of COCs

The Dundee Dam (RM 17.4) physically isolates Dundee Lake and other Upper Passaic River sediments from Lower Passaic River influences. Conditions above Dundee Dam meet EPA's definition of "background" as constituents or locations that are not influenced by releases from the Site, including both anthropogenic and naturally derived substances. The concentrations of the COCs detected in recently deposited sediments collected from the Upper Passaic River immediately above Dundee Dam are representative of current background conditions for the lower 8.3 miles of the Lower Passaic River and are listed in Table 26 in Appendix II. While the Superfund program generally does not clean up to concentrations below natural or anthropogenic background levels, in the Lower Passaic River, the flow of suspended sediment over Dundee Dam is just one of many contributors to sediment contamination in the lower 8.3 miles. Sediment particles coming from above Dundee Dam make up about one third of recently deposited sediment in the lower 8.3 miles. When, after remediation, these particles flow to the lower 8.3 miles, they will mix with the other particles in the system (including cleaner particles in the water column that would result from a remediated lower 8.3 miles); after they are deposited, they also will mix with the clean cap or backfill material. So contamination in the top six inches (the bioactive zone) can end up being less than the background concentrations coming over Dundee Dam, as predicted by the mechanistic model developed by EPA to support its analyses in the RI/FFS and Proposed Plan and the model updated in response to comments for EPA's final decision-making in the ROD (see Section 10.3).

While COCs (particularly PCBs) entering the lower 8.3 miles from above the dam and other incoming COCs, such as from Newark Bay and the Lower Passaic River above RM 8.3, are relatively small contributors of COCs to the recently deposited surface sediments of the lower 8.3 miles, as compared to the resuspension of lower 8.3-mile sediments, they will be more important contributors to recontamination of an implemented remedy for the lower 8.3 miles, particularly in the case of the bank-to-bank alternatives described in Section 9. EPA expects that overall COC concentrations will decline over time as the Lower Passaic River above RM 8.3 and Newark Bay are remediated through actions selected after the completion of the 17-mile RI/FS and Newark Bay RI/FS, respectively. Furthermore, EPA expects that programs developed under the Clean Water Act will address PCBs and other COCs above Dundee Dam by working with NJDEP to identify and mitigate these loadings. Such actions, taken while the remedy for the lower 8.3 miles is being designed and implemented, will reduce the incoming COCs, minimize the degree of recontamination and allow the selected remedy to achieve RAOs.

8.1.4. Selected Remediation Goals

PRGs become final remediation goals when EPA selects a remedy after taking into consideration all public comments. The NCP identifies a 10^{-6} cancer risk level or a noncancer hazard of 1 as the goal of protection for determining remediation goals for alternatives when applicable or relevant and appropriate requirements (ARARs) are not available or are not sufficiently protective. EPA has concluded that a 10^{-6} cancer risk for the fish and crab consumption exposure pathway cannot be attained through remediation, given the Site's urban setting and the ubiquity of Site COCs in the environment. However, a remedy that includes active remediation and natural recovery provides the conditions for eventually achieving protective levels within EPA's risk range of 10^{-4} and 10^{-6} and an HI of 1 for the lower 8.3 miles of the Lower Passaic River (see Section 10.1 for further discussion). For the COCs with human health PRGs, remediation goals within the risk range and at an HI equal to 1 were selected, so they are protective of human health. For mercury and Total DDx, remediation goals at an HQ equal to 1 were selected, so they are protective of the environment. The remediation goals for the lower 8.3 miles are summarized in Table 25 in Appendix II (bolded numbers).

Nearly all surface sediment samples in the lower 8.3 miles have COC concentrations that exceed one or more of the PRGs, which has led to the development of remedial alternatives that address the lower 8.3 miles bank to bank (Alternatives 2 and 3, described in Section 9.2). EPA's analysis indicates that a combination of active remediation in the lower 8.3 miles and natural recovery would result in surface sediment concentrations of dioxins/furans at or near the remediation goals based on human health PRGs in the lower 8.3-miles under these two alternatives.[18] For the other COCs, a combination of active remediation in the lower 8.3 miles and natural recovery will be needed to achieve surface sediment concentrations in the lower 8.3 miles approaching the remediation goals based on human health PRGs, with additional actions in the Lower Passaic River above RM 8.3, in Newark Bay, and above Dundee Dam needed to reduce recontamination from incoming COCs and maintain the lower surface sediment concentrations achieved by the lower 8.3-mile remediation. For dioxins and PCBs, it is unlikely that the ecological PRGs could be met under any of the alternatives, even with natural recovery processes. However, given that bank-to-bank remediation of the lower 8.3 miles is necessary to achieve protection of human health (see Section 10.1), ecological PRGs for dioxin and PCBs would not result in any additional remediation in the sediments of the lower 8.3 miles and were not selected as remediation goals.

9. DESCRIPTION OF REMEDIAL ALTERNATIVES

CERCLA §121(b)(1), 42 U.S.C. §9621(b)(1), mandates that remedial actions must be protective of human health and the environment, be cost-effective, and use permanent solutions and alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. CERCLA §121(b)(1) also establishes a preference for remedial actions which employ, as a principal element, treatment to permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants and contaminants at a site. CERCLA §121(d), 42 U.S.C. §9621(d), further specifies that a remedial action must require a level or standard of control of the hazardous substances, pollutants, and contaminants, which at least attains ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA §121(d)(4), 42 U.S.C. §9621(d)(4). Detailed information about the remedial alternatives is provided in the FFS Report.

9.1. Common Elements of the Active Alternatives

Four remedial alternatives were evaluated in detail (described in Section 9.2). All of the active alternatives (i.e., alternatives other than "No Action") contain some common elements, as described below. In addition, the cost of each of the active alternatives has been estimated considering each of the three DMM scenarios separately in turn, also described below.

[18] This does not preclude evaluation of remedial actions in the LPR above RM 8.3 upon completion of the 17-mile RI/FS.

9.1.1. Institutional Controls

New Jersey's prohibitions on fish and crab consumption currently in place would continue under all of the alternatives. To increase the awareness of the prohibitions and reduce the number of anglers and family members consuming their catch, each active alternative would include enhanced outreach efforts conducted by EPA and NJDEP in every municipality on both shores of the lower 8.3 miles of the Lower Passaic River. The enhanced outreach would educate community members about the NJDEP consumption prohibitions and advisories and emphasize that they will remain in place during and after remediation until remedial action objectives are reached.

For the active alternatives that rely on an engineered cap for protectiveness, additional institutional controls would be necessary to maintain cap integrity in perpetuity. Such institutional controls to protect the engineered cap might include:

- Restrictions on construction and dredging in the lower 8.3 miles except in the federally authorized navigation channel, implemented by NJDEP Tidelands Commission through existing regulatory provisions;
- Restrictions on construction and dredging below the depths of the federally authorized navigation channel, implemented by USACE through existing permitting requirements;
- Restrictions on bulkhead maintenance in the lower 8.3 miles, implemented by NJDEP Tidelands Commission and USACE through existing regulatory and permitting requirements;
- Additional institutional controls to protect the cap could be developed during remedial design.

9.1.2. Dredging

Dredging is an element of all of the active alternatives. Prior to dredging, large debris would be removed. The FFS assumed that dredging would occur using a mechanical dredge fitted with an environmental clamshell bucket, although costs for a hydraulic dredge were also estimated. The most appropriate and effective equipment for dredging and dredged-material transport will be determined during the design phase. The FFS assumed use of two primary mechanical dredges equipped with 8-cy environmental clamshell buckets. The production rate for each of the two dredges was conservatively estimated to be 2,000 cy per 24-hour day, based on the results of a pilot study of environmental dredging conducted in the lower 8.3 miles of the Lower Passaic River by USACE and NJDOT in 2005. A smaller secondary dredge would operate at a lower production rate around obstructions such as bridge abutments and bulkheads. Dredging was assumed to occur for 32 weeks per year to account for equipment maintenance, weather and a period during which work may halt to allow for fish migration (known as a "fish window"). Analyses developed by EPA since issuing the Proposed Plan identified engineering solutions to minimize bridge openings during dredged materials transport, and added time to the schedule to more fully account for equipment downtime and for fish windows during which construction may be curtailed to accommodate fish migration or spawning. As discussed in Section 14, changes to the schedule to accommodate these additions did not increase the total remedy duration substantially from that estimated in the Proposed Plan and did not change the relative durations among alternatives, so did not change EPA's comparative analysis results from the Proposed Plan. The revised durations are presented in the alternative descriptions in Section 9.2. During the remedy design, a fish migration study will be conducted to better define the fish window.

9.1.3. Engineered Capping

Engineered capping is a key element of two of the active alternatives. The term "engineered capping" refers to placing materials of known characteristics in specifically designed thicknesses over contaminated sediments to sequester them in place (i.e., isolate them from the environment). The engineered cap is planned to consist of sand with varying grain sizes and amounts of organic carbon, designed to provide chemical isolation and to protect against disturbance from bioturbation (mixing of clean cap materials with contaminated sediment by burrowing organisms), erosion, and consolidation and settling of underlying sediments.

During remedial design, other capping technologies (i.e., materials used for capping and how they are applied) that are shown to be equivalently protective may be evaluated. Based on observed sediment bed erosion trends and modeling results, certain areas of the river may need to be armored to reduce the erosion of the sand material, particularly after high flow events. The exact areas and armoring methods will be determined during remedy design. The engineered cap must be monitored and maintained in perpetuity. For cost-estimation purposes, the FFS assumed a 2-foot thick engineered sand cap with six inches of armor stone in some areas. Dredged mudflats would be reconstructed with a layer of sand (or equivalent material) under approximately one foot of habitat substrate.

During remedial design, EPA will evaluate enhanced capping technologies, such as the use of additives (e.g., activated carbon or organoclay) to create a reactive cap or thin-layer capping technologies where conditions are conducive to such approaches. USACE habitat restoration plans for the New York-New Jersey Harbor Estuary could provide additional information on appropriate habitat reconstruction techniques. EPA anticipates that re-deposition of fine-grained material over capped and armored areas will occur over time, making these areas similar in grain size to non-capped areas. Based on studies at other dredged sites, it is expected that, over time, the re-colonized benthic community will likely be similar to the benthic community currently found in the Lower Passaic River, or exhibit greater diversity and abundance than current conditions due to reduced surface sediment contamination.

9.1.4. Removal Actions

All alternatives assume that the Tierra Removal (Phases 1 and 2) and RM 10.9 Removal will have been completed, since they are governed by existing agreements. The agreement for Phase 2 of the Tierra Removal, which EPA entered into with OCC and Tierra in 2008, contemplated the siting and use of a confined disposal facility[19] (CDF) as a receptacle for the dredged materials. However, this has not occurred and may no longer be practicable, in which case alternate disposal options would be considered. If the approach for addressing the Phase 2 sediments has not been determined by the time the lower 8.3-mile remedial design is underway, EPA expects that this work will be integrated with the lower 8.3-mile remedy in a coordinated and consistent manner.

9.1.5. Five-Year Reviews

Five-year reviews will be required for any of the active remedial alternatives that result in some hazardous substances, pollutants or contaminants remaining in sediments above levels that would allow for unlimited use and unrestricted exposure. This is the case for all except Alternative 2 with DMM Scenarios B and C. In addition, EPA conducts five-year reviews at sites where the time required to achieve the RAOs exceeds five years, as is expected for all the active alternatives.

9.1.6. Dredged Material Management (DMM) Scenarios

9.1.6.1. DMM Scenario A: Confined Aquatic Disposal (CAD)

CAD cells have been shown to be a viable disposal option at other Superfund sediment sites. They can be a technically feasible and cost effective means to dispose of contaminated sediments. The bottom of Newark Bay consists of approximately 60 feet of clay beneath a few feet of silts. In the context of the lower 8.3-mile action, CAD cells would be containment pits excavated into the clay bottom that could serve as disposal sites for contaminated sediments dredged out of the lower 8.3 miles of the Lower Passaic River. In this DMM Scenario, one to three CAD cells approximately 50 feet deep would be excavated into the Newark Bay bottom (see FFS Report Figure 4-1). For cost-estimation purposes, it was assumed that the clay excavated to create the CAD cells would be disposed of in an ocean disposal area, such as the Historic Area Remediation Site in the New York Bight east of Sandy Hook. Final disposal locations would be determined during remedy design. The CAD site would be surrounded by a temporary sheet pile and silt curtain containment system to minimize impacts to Newark Bay during construction and dredged material placement.

The dredged materials would be barged directly to the CAD site in a split hull or bottom dump barge and disposed of in the CAD cells under water. Resource Conservation and Recovery Act (RCRA) regulations exclude dredged material that is subject to the requirements of Clean Water Act Section 404 from the definition of hazardous waste. Dredged material under DMM Scenario A would meet this exclusion, so there would be no requirement that lower 8.3-mile sediments be characterized and/or treated prior to disposal in CAD cells. After each CAD cell is filled, an

[19] A confined disposal facility (CDF) is an engineered structure, built on land or in the water (on the sediment bed) to hold contaminated dredged material, isolating it from the surrounding environment. An in-water CDF may be constructed with sheet pile walls or other containment structures, either against the shore or as an island. Once an in-water CDF is filled, it would be capped, converting open water to dry land.

engineered cap would be placed over the dredged material as final cover, restoring the Bay bottom.

9.1.6.2. DMM Scenario B: Off-Site Disposal

Off-Site Disposal includes two possible components: incineration and landfilling. In the off-site disposal scenario, some lower 8.3-mile sediments have the potential to be characterized as hazardous under RCRA regulations. Based on waste characterization sampling of sediment removed from the river during Phase I of the Tierra Removal, EPA identified that some sediments may be considered hazardous, resulting in a requirement to treat those sediments prior to land disposal; however, RCRA regulations require treatment not just for chemicals that caused the sediments to be classified as hazardous, but for all “underlying hazardous constituents” (i.e., any other chemicals exceeding RCRA’s land disposal standards). At this time, incineration is the only technology known to be able to treat sediments if those sediments are characterized as hazardous under RCRA and contain dioxin as an underlying hazardous constituent at concentrations requiring treatment. The ash generated by incineration under this scenario would be disposed of in a RCRA Subtitle C (hazardous waste) landfill. Dredged materials characterized as non-hazardous may be disposed of directly in a landfill without treatment. Since the private parties that performed the Phase 1 Tierra Removal and the RM 10.9 Removal disposed of dredged material in RCRA Subtitle C facilities, EPA expects that the dredged material generated by this action will also go to Subtitle C facilities; and for cost-estimation purposes, placement in a RCRA Subtitle C landfill outside of New Jersey (because there are no RCRA Subtitle C landfills operating in New Jersey) was assumed. Further, the State of New Jersey has no permitted Subtitle D landfills that are authorized to accept dredged materials from coastal or tidal waters for disposal as solid waste, as such materials are specifically excluded from the definition of solid waste under New Jersey regulations.

The dredged materials would be barged or pumped to an upland sediment processing facility in the vicinity of the Lower Passaic River or Newark Bay shorelines. Debris and sand would be separated for disposal or potential beneficial use. The remaining fine-grained material would be actively dewatered using filter presses or another technology to be determined during remedy design. The contaminated water generated from dewatering would be treated at a wastewater treatment plant at the processing facility to meet NJDEP water quality standards and discharged to the Lower Passaic River or Newark Bay. For cost-estimation purposes, EPA assumed that the dewatered dredged material would be transported by rail for disposal, with less than 10 percent requiring incineration and the other approximately 90 percent going directly to permitted landfills. Facilities qualified to accept the materials for treatment and/or disposal have been identified in the United States and Canada.

9.1.6.3. DMM Scenario C: Local Decontamination and Beneficial Use

Local Decontamination and Beneficial Use includes three components: thermal treatment, sediment washing and solidification/stabilization. In this scenario, some lower 8.3-mile sediments have the potential to be characterized as hazardous under RCRA standards. According to pilot tests of the decontamination technologies, only thermal treatment technologies were able to treat sediments to the applicable RCRA standards if those sediments are characterized as hazardous and contain dioxin as an underlying hazardous constituent. Fine-grained dredged materials characterized as non-hazardous could be treated with a sediment washing technology. Approximately one to two percent of lower 8.3-mile sediments may meet New Jersey standards for beneficial use with little or no treatment. In the FFS, it was assumed that this small percentage would be solidified and stabilized with a binding material such as Portland cement, and then be beneficially used in an industrial setting.

The dredged materials would be barged or pumped to an upland sediment processing facility in the vicinity of the Lower Passaic River or Newark Bay shorelines. Debris and sand would be separated for disposal or potential beneficial use. The portion of the fine-grained material to be decontaminated using thermal treatment and solidification/stabilization would be actively dewatered using filter presses or other technology to be determined during remedy design. The portion of the fine-grained material to be decontaminated using sediment washing would be dewatered after treatment. Water used in sediment washing and generated from dewatering would be treated at a water treatment plant at the processing facility to meet NJDEP water quality standards and discharged to the Lower Passaic River or Newark Bay. For cost-estimation purposes, EPA assumed that less than 10 percent of the dredged materials would require thermal treatment and would generate beneficial use end-products, approximately 90 percent would undergo sediment washing (and potential solidification/stabilization if necessary) for use as RCRA Subtitle D landfill cover in or out of New Jersey, and the remaining few percent would be used for industrial beneficial use with only stabilization.

9.2. Remedial Alternatives

9.2.1. Alternative 1: No Action

Present Value: $0
Construction Time: 0 years

The Superfund program requires that the No Action alternative be considered as a baseline for comparison with the other alternatives. The No Action alternative would not include any remedial measures, although the Tierra and RM 10.9 Removals are assumed to have been implemented. New Jersey's prohibitions on fish and crab consumption would remain in place.

9.2.2. Alternative 2: Deep Dredging with Backfill

Present Value:	
With DMM Scenario A	$1.21 Billion
With DMM Scenario B	$2.84 Billion
With DMM Scenario C	$2.57 Billion
Construction Time:	14 years

Deep Dredging with Backfill is a bank-to-bank remedy that would involve dredging all contaminated fine-grained sediments throughout the lower 8.3 miles of the Lower Passaic River (9.7 million cy) and placing a layer of backfill[20] over the dredged area to mitigate the effect of residuals[21] remaining after dredging. Backfill would not be maintained after placement, since the intent is that dredging would remove the inventory of contaminated sediments that could become mobile. This alternative is intended to remove the contaminated sediment inventory causing the current and potential future risks in the lower 8.3 miles. This alternative would result in the dredging of the federally authorized navigation channel over its full length within the lower 8.3 miles, since the contaminated sediment inventory is coincident with historic in-filling of the authorized navigation channel.

Within the horizontal limits of the authorized navigation channel, the depth of contaminated fine-grained sediment corresponds well with the depth of historical dredging. Therefore, the depth of dredging under Alternative 2 is assumed to be the historically constructed channel depth plus an additional three feet to account for historical dredging accuracy and over-dredging.[22] The resulting sediment removal depths (all in mean low water [MLW]) are shown in Table 27 in Appendix II.

Outside the horizontal limits of the navigation channel (in the shoals), the depth of contaminated fine-grained sediment to be dredged varies from 3 feet to 20 feet below the sediment surface. Final dredging depths would be refined in the remedy design. Mudflats dredged during implementation of Alternative 2 would be reconstructed to their original grade and would include one foot of mudflat reconstruction (habitat) substrate. USACE habitat restoration plans for the New York-New Jersey Harbor Estuary could provide additional information on appropriate habitat reconstruction techniques.

Dredged materials removed would be managed in accordance with one of three DMM scenarios described in Section 9.1.6.

The construction time estimate (14 years) includes time for dredging, backfilling and dredged material disposal. The construction duration is driven by the time required for dredging and is not influenced by the choice of DMM scenario, because EPA assumes that DMM facilities would be designed and constructed to manage the dredged material throughput without adding to the time needed.[23]

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[20] For cost-estimation purposes, the FFS assumed an average 2-foot backfill layer.
[21] Dredging residuals are the small amounts of contaminated sediments that are inevitably left behind after dredging.
[22] Given the inherent inaccuracies of dredging equipment used for navigational dredging, dredge operators are allowed to "over-dredge," or dredge to depths beyond the project design depth, to make sure that the design depth is achieved. Dredges are more accurate today than historically, so over-dredge allowances are smaller today.
[23] Construction duration for DMM Scenario C is more uncertain than for the other two scenarios, because the decontamination technologies evaluated in DMM Scenario C have not been constructed and operated in the United States on a scale approaching the capacity needed for this alternative.

New Jersey's fish and crab consumption prohibitions and advisories would remain in effect (with enhanced outreach to increase awareness) until the remedial action objectives are met.

Because Alternative 2 with DMM Scenario A would result in hazardous substances, pollutants or contaminants remaining in the sediments above levels that would allow for unlimited use and unrestricted exposure (in Newark Bay CAD cells), CERCLA would require that five-year reviews be conducted. In addition, Alternative 2 under all DMM scenarios would require more than five years to achieve the remedial action objectives. Therefore, in accordance with EPA policy, five-year reviews would be conducted for Alternative 2, DMM Scenario B or C until the RAOs are achieved.

9.2.3. Alternative 3: Capping with Dredging for Flooding and Navigation

Present Value:	
With DMM Scenario A	$0.85 Billion
With DMM Scenario B	$1.38 Billion
With DMM Scenario C	$1.36 Billion
Construction Time:	6 years

Capping with Dredging for Flooding and Navigation is a bank-to-bank remedy that would place an engineered cap over the entire river bottom throughout the lower 8.3 miles of the Lower Passaic River. Before placement of the engineered cap, enough contaminated fine-grained sediment (3.5 million cy, based on an assumed cap thickness of 2 feet) would be dredged so that the cap could be placed without causing additional flooding and to allow for the continued use of the federally authorized navigation channel between RM 0 and RM 1.7.

This alternative includes dredging in portions of the 300-foot wide, federally authorized navigation channel to reasonably anticipated future use depths. The extent and depths of the navigation channel included in Alternative 3 as presented in the Proposed Plan were based on EPA's analysis of USACE's 2010 Lower Passaic River Navigation Analysis report and extensive consultation with USACE and NJDEP. In response to comments on the Proposed Plan, EPA reexamined available information pertaining to current and future commercial uses of the navigation channel submitted and obtained during the public comment period, as documented in the Responsiveness Summary (Appendix V). In further consultation with USACE and NJDEP, EPA has adjusted the extent and depths of the navigation channel included in Alternative 3 to the following: 30 feet MLW from RM 0 to RM 0.6 and 20 feet MLW from RM 0.6 to RM 1.7. Associated adjustments in dredging volume, construction duration and project costs were made and are presented in the ROD.

Where dredging depths coincide with the federally authorized navigation channel (RM 0 to RM 0.6), an additional 3 feet would be dredged to account for historical dredging accuracy and over-dredging. Because this action is expected to dredge all contaminated fine-grained sediments within the channel below RM 0.6, an engineered cap may not be required and a layer of backfill would be placed to mitigate the effect of dredging residuals. Between RM 0.6 and RM 1.7, where dredging depths are shallower than the current federally authorized channel, an estimated 5.5 feet of sediment below the proposed channel depth would be dredged to accommodate an engineered cap; the additional depth provides for a cap protection buffer and allowance for future maintenance dredging. Resulting dredging depths (all in MLW) are shown in Table 28 in Appendix II.

Since some of the capped areas would be shallower than the federally authorized channel depths, it would be necessary to pursue both modification of the authorized depth (from RM 0.6 to RM 1.7) and deauthorization (from RM 1.7 to RM 8.3) of the federal navigation channel through Congressional action. USACE has advised that it will support such modification of authorized depths, and deauthorization of navigation channel.

Between RM 1.7 and RM 8.3, dredging would be performed to allow for the installation of an engineered cap without additional flooding and to accommodate reasonably anticipated recreational future uses. While commercial navigation is not an expected future use above RM 1.7, additional dredging is included in this alternative to account for the recreational uses discussed in Sections 6 and 8. Between RM 1.7 and RM 8.3, sufficient dredging would be performed to provide a depth of at least 10 feet below MLW over a designated 200-foot width (reduced to a 150-foot width between RM 8.1 and RM 8.3) to accommodate reasonably anticipated future recreational uses. Between RM 1.7 and RM 8.3, this would mean dredging approximately 2.5 feet below the existing sediment surface, with most of that depth necessary to prevent additional flooding due to the placement of the engineered cap and some smoothing of a few areas to achieve at least 10 feet below MLW. Final dredging depths may be refined in the remedial design to better account for flooding and recreational use, but still allow for enough dredging to ensure cap stability and integrity.

Dredged materials removed would be managed in accordance with one of three DMM scenarios described in Section 9.1.6. The construction time estimate (6 years) includes time for dredging, backfilling and dredged material disposal. The construction duration is driven by the time required for dredging and is not influenced by the choice of DMM scenario, because EPA assumes that the DMM facilities could be designed and constructed to manage the dredged material throughput without adding to the time needed.[24]

Mudflats dredged during implementation of Alternative 3 would be reconstructed to their original grade. The engineered cap over the mudflats would consist of 1 foot of sand and 1 foot of mudflat reconstruction substrate (but can vary depending on conditions) that would provide a suitable habitat to support current and expected future ecological uses. USACE habitat restoration plans for the New York-New Jersey Harbor Estuary could provide additional information on appropriate habitat reconstruction techniques.

[24] Construction duration for DMM Scenario C is more uncertain than for the other two scenarios, because the decontamination technologies evaluated in DMM Scenario C have not been constructed and operated in the United States on a scale approaching the capacity needed for this alternative.

Institutional controls and monitoring would be implemented after construction. New Jersey's fish and crab consumption prohibitions and advisories would remain in effect (with enhanced outreach to increase awareness) until the remedial action objectives are met. Other permanent institutional controls are likely to include restrictions on activities that might disturb the engineered cap, as discussed in Section 9.1.1.

Because Alternative 3 would result in hazardous substances, pollutants or contaminants remaining in the sediments of the lower 8.3 miles above levels that would allow for unlimited use and unrestricted exposure, CERCLA would require that five-year reviews be conducted.

9.2.4. Alternative 4: Focused Capping, with Dredging for Flooding

Present Value:	
With DMM Scenario A	$0.36 Billion
With DMM Scenario B	$0.56 Billion
With DMM Scenario C	$0.59 Billion
Construction Time:	2.5 years

Focused or "hotspot" remedies are commonly considered for large sediment sites. To allow for an evaluation of whether a more focused approach to addressing the contaminated sediments of the lower 8.3 miles could meet the remedial action objectives, EPA evaluated an alternative consisting of dredging and capping the discrete areas of the lower 8.3 miles that EPA identified as releasing the most contaminants into the water column. Focused Capping with Dredging for Flooding includes dredging of contaminated fine-grained sediments (1 million cy) in selected portions of the lower 8.3 miles of the Lower Passaic River (cumulatively, approximately 220 acres or about one third of the lower 8.3-mile sediment surface) with the highest gross and net fluxes of COCs (see Figure 18[25] in Appendix I). These areas are those that have high surface concentrations of COCs and experience high erosional forces (i.e., shear stresses), so that this alternative accounts for the stability of the sediment bed and the mobility of contaminants within it, in accordance with EPA's December 2005 *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*. Dredging would occur to a depth of about 2.5 feet to allow for installation of an engineered cap without causing additional flooding, as discussed in Alternative 3.

Alternative 4 would not include any dredging to accommodate the continued use of the channel for navigation, or to accommodate future recreational uses. Since some of the capped areas would be shallower than the federally authorized channel depths, it would be necessary to pursue deauthorization of those portions of the federal navigation channel through Congressional action.

[25] In response to comments, EPA made various changes to the sediment transport and organic carbon-contaminant fate and transport models, as discussed in the Responsiveness Summary (Appendix V) and Attachment E. The updated models were used to identify areas in the lower 8.3 miles with the highest gross and net fluxes of COCs that are shown in Figure 18.

Dredged materials removed would be managed in accordance with one of three DMM scenarios described in Section 9.1.6. The construction time estimate (2.5 years) includes time for dredging, capping and dredged material disposal. The construction duration is driven by the time required for dredging and is not influenced by the choice of DMM scenario, because EPA assumes that the DMM facilities could be designed and constructed to manage dredged material throughput without adding to the time needed.

Mudflats dredged during implementation of Alternative 4 would be reconstructed to their original grade. The engineered cap over the mudflats would consist of 1 foot of sand and 1 foot of mudflat reconstruction (habitat) substrate, but can vary depending on conditions.

Institutional controls and monitoring would be implemented after construction. New Jersey's fish and crab consumption prohibitions and advisories would remain in effect (with enhanced outreach to increase awareness) until remedial action objectives are met. Other institutional controls would include restrictions on activities that could result in contact with uncapped sediments, or restrictions on activities that could disturb the engineered caps, as discussed in Section 9.1.1.

Because Alternative 4 would result in hazardous substances, pollutants or contaminants remaining in the sediments of the lower 8.3 miles above levels that would allow for unlimited use and unrestricted exposure, CERCLA would require that five-year reviews be conducted.

10. COMPARATIVE ANALYSIS OF ALTERNATIVES

In selecting a remedy, EPA considered the factors set out in CERCLA §121, 42 U.S.C. §9621, by conducting a detailed analysis of the viable remedial response measures pursuant to the NCP, 40 CFR §300.430(e)(9) and OSWER Directive 9355.3-01. The detailed analysis in the FFS Report consisted of an assessment of the individual response measures against each of the evaluation criteria. This section profiles the relative performance of each alternative against the nine criteria, noting how it compares to the other alternatives under consideration.

Threshold Criteria - *The first two criteria are known as "threshold criteria" because they are the minimum requirements that each response measure must meet to be eligible for selection as a remedy.*

10.1. Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

A primary requirement of CERCLA is that the selected remedial action be protective of human health and the environment. An alternative is protective if it reduces current and potential future risks associated with each exposure pathway at a site to acceptable levels for the human health and ecological receptors.

Alternative 1 (No Action) would not be protective of human health and the environment. Under Alternative 1, the resuspension and redeposition of contaminated sediments in the lower 8.3 miles of the Lower Passaic River would continue to contaminate the surface sediments and biota in the lower 8.3 miles, so that the unacceptable risks to humans and the environment calculated in the baseline risk assessment would continue in the future. Sediment data show that some decline in surface sediment concentrations is occurring over time due to natural recovery processes, although these processes have slowed considerably over approximately the past 15 to 20 years as the navigation channel has filled in and the river has begun to reach a quasi-steady state. Computer modeling results[26] for Alternative 1 show that the decline in concentrations is extremely slow, so that in the period of 2020 to 2046 (26-year period[27] chosen to allow comparison to the 26-year period after construction for the active alternatives), human health total cancer risk (sum for the adult and child for all COCs) would be 4×10^{-3} and 2×10^{-3} for fish and crab consumption, respectively; these levels exceed the acceptable risk range. The total noncancer health hazards for the adult would be 100 and 44 for fish and crab consumption, respectively, and for the child would be 194 and 84 for fish and crab consumption, respectively; these levels exceed the goal of protection of an HI equal to 1. By the end of the period 2020 to 2049 (30-year period chosen to allow comparison to the 30-year period after construction for the active alternatives), ecological HQs for benthic invertebrates would range from 0.1 to 200, with HQs for copper, mercury, Total PCBs and 2,3,7,8-TCDD exceeding 1; for fish would range from 0.1 to 200, with HQs for copper, Total PCBs and dioxins/furans exceeding 1; and for wildlife would range from 0.07 to 200, with HQs for lead in birds exceeding 1 and HQs for mercury, total PCBs, dioxin-like PCBs and dioxins/furans in mammals exceeding 1.

Alternative 2 and 3 would replace the highly contaminated riverbed of the lower 8.3 miles with effectively clean material (sand), bank to bank. There is no more comprehensive way to remediate the sediments of the lower 8.3 miles. EPA's modeling results show that, after the sand is placed bank-to-bank in the lower 8.3 miles, incoming COCs from above Dundee Dam, from Newark Bay and from the Lower Passaic River above RM 8.3 will gradually recontaminate the new riverbed surface. EPA's model underestimates the effectiveness of the bank-to-bank remedies because, while the model assumes that the incoming COCs will remain constant until

[26] As noted in footnote 25, in response to comments, EPA made various changes to the sediment transport and organic carbon-contaminant fate and transport models, as discussed in the Responsiveness Summary (Appendix V) and Attachment E. Throughout the ROD, where model results are discussed, EPA is referring to the updated model results.

[27] As discussed in Section 7.1.2.4, the 2014 updated Standard Default Exposure Assumptions, released after the RI/FFS was completed, changed the adult ED from 24 years to 20 years and the total ED from 30 years to 26 years. In response to comments, EPA updated the risk estimates and other related analyses with the updated EDs, including the modeling period over which future human health risk reductions are compared. The 2014 updates did not affect the ecological risk assessment, so that the modeling period over which future ecological risk reductions are compared remains 30 years, the same as used in the Proposed Plan.

the end of the simulation period (until the early 2060s), EPA expects that those COCs will decline over time as the Lower Passaic River above RM 8.3 and Newark Bay are remediated through actions selected under CERCLA. Furthermore, EPA expects that Clean Water Act programs will address COCs coming in from above Dundee Dam. Such actions, taken while the remedy for the lower 8.3 miles is being designed and implemented, will reduce the incoming COCs and minimize the degree of recontamination, allowing the bank-to-bank remedies (Alternatives 2 and 3) to achieve protectiveness by achieving the cancer risk range of 10^{-4} to 10^{-6}, noncancer HIs equal to or less than 1 and ecological HQs equal to or less than 1.

Alternative 2 (Deep Dredging with Backfill) and Alternative 3 (Capping with Dredging for Flooding and Navigation) would both protect human health and the environment to approximately to the same degree, because both would result in the remediation of surface sediments bank to bank in the lower 8.3 miles, and those lower 8.3-mile surface sediments would be subjected to similar levels of recontamination from the influx, mixing and deposition of sediment that enters from above Dundee Dam, from between the dam and RM 8.3, and from Newark Bay. The sediments of the lower 8.3 miles of the Lower Passaic River are currently a major source of COCs to the river above RM 8.3 and to Newark Bay. Addressing the sediments in the lower 8.3 miles by dredging or capping bank to bank would eliminate a major source of contamination to the rest of the Lower Passaic River and Newark Bay, thereby reducing the contamination brought back into the lower 8.3 miles from those areas over time.

Alternative 2 would address the unacceptable risks and hazards due to COCs in the lower 8.3-mile sediments by removing the extensive inventory of contaminated fine-grained sediments from RM 0 to RM 8.3 (approximately 9.7 million cy). Dredging residuals that remain in the lower 8.3 miles after construction would be covered by a 2-foot layer of backfill.

- For just dioxins/furans, computer models predict that implementation of Alternative 2 would reduce risks so that in the 26-year period after construction (2034 to 2059), the human health total cancer risk (for the adult and child) would be 5×10^{-5} and 2×10^{-5} for fish and crab consumption, respectively. The noncancer health hazard for the adult would be 1 and 0.4 for fish and crab consumption, respectively, and for the child would be 2 and 0.8 for fish and crab consumption, respectively.
- For all human health COCs (dioxins/furans, PCBs and mercury) combined, computer models predict that the human health total cancer risk (for the adult and child for all COCs) would be 5×10^{-4} and 4×10^{-4} for fish and crab consumption, respectively, in the 26-year period after construction. The noncancer health hazard for the adult would be 13 and 9 for fish and crab consumption, respectively, and for the child would be 24 and 17 for fish and crab consumption, respectively. The computer models show that recontamination from dioxin-like PCBs is a primary reason that risks and hazards rise gradually over time from the lowest levels achieved upon construction completion, such that in the 26-year period after construction, risks and hazards exceed the acceptable risk range and HI of 1. The risks and hazards would be above EPA’s goals, so Alternative 2 would incorporate institutional controls such as fish and crab consumption prohibitions and advisories enhanced by additional outreach to ensure protectiveness.

For the ecological COCs, thirty years after construction (2063), ecological HQs for benthic invertebrates would range from 0.05 to 8, with HQs for mercury, Total PCBs and 2,3,7,8-TCDD exceeding 1; for fish would range from 0.08 to 8, with HQs for copper and dioxins/furans exceeding 1; and for wildlife would range from 0.02 to 7, with HQs for mercury, total PCBs, dioxin-like PCBs and dioxins/furans in mammals exceeding 1.

Alternative 3 would address the unacceptable risks due to COCs in the sediments of the lower 8.3 miles of the Lower Passaic River by sequestering the extensive inventory of contaminated sediments in the lower 8.3 miles under a bank-to-bank engineered cap.

- For just dioxins/furans, computer models predict that implementation of Alternative 3 would reduce risks so that in the 26-year period after construction (2026 to 2051), the human health total cancer risk (for the adult and child) would be 6×10^{-5} and 2×10^{-5} for fish and crab consumption, respectively. The noncancer health hazard for the adult would be 1 and 0.5 for fish and crab consumption, respectively, and for the child would be 2 and 1 for fish and crab consumption, respectively.
- For all human health COCs (dioxins/furans, PCBs and mercury) combined, computer models predict that the human health total cancer risk (for the adult and child for all COCs) would be 5×10^{-4} and 4×10^{-4} for fish and crab consumption, respectively. The noncancer health hazard for the adult would be 14 and 10 for fish and crab consumption, respectively, and for the child would be 29 and 20 for fish and crab consumption, respectively. The computer models show that recontamination from dioxin-like PCBs is a primary reason that risks and hazards rise gradually over time from the lowest levels achieved upon construction completion, such that in the 26-year period after construction, risks and hazards exceed the acceptable risk range and HI of 1. Risks and hazards would be above EPA’s goals, so Alternative 3 would incorporate institutional controls such as fish and crab consumption prohibitions and advisories enhanced by additional outreach to ensure protectiveness.

For ecological COCs, thirty years after construction (2055), ecological HQs for benthic invertebrates would range from 0.05 to 9, with HQs for mercury, Total PCBs and 2,3,7,8-TCDD exceeding 1; for fish would range from 0.08 to 10, with HQs for copper and dioxins/furans exceeding 1; and for wildlife would range from 0.02 to 9, with HQs for mercury, total PCBs, dioxin-like PCBs and dioxins/furans in mammals exceeding 1.

As discussed above, EPA’s model underestimates the effectiveness of the bank-to-bank remedies because it does not account for any reduction in incoming COCs over time as the Lower Passaic River above RM 8.3 and Newark Bay are remediated under the Superfund program and COCs from above Dundee Dam are addressed under Clean Water Act programs. Such actions, taken while the remedy for the lower 8.3 miles is being designed and implemented, will reduce the incoming COCs and minimize the degree of recontamination, allowing the bank-to-bank remedies (Alternatives 2 and 3) to achieve protectiveness.

Alternative 4 (Focused Capping with Dredging for Flooding) would address the unacceptable risks due to COCs in lower 8.3-mile sediments to some extent by capping the areas that contribute the most contaminant flux to the water column; the discrete areas of sediments to be capped would add up to about one-third of the surface of the lower 8.3 miles of the Lower Passaic River. Computer models predict that implementation of Alternative 4 would reduce risks, so that in the 26-year period after construction (2023 to 2048), human health total cancer risk (for adult and child for all COCs) would be 1×10^{-3} and 7×10^{-4} for fish and crab consumption, respectively. The noncancer health hazard for the adult would be 33 and 17 for fish and crab consumption, respectively, and for the child would be 68 and 34 for fish and crab consumption, respectively. The noncancer health hazards would be above EPA's goal of an HI of 1, so Alternative 4 would incorporate institutional controls such as fish and crab consumption prohibitions and advisories enhanced by additional outreach to ensure protectiveness. Thirty years after construction (2052), ecological HQs for benthic invertebrates would range from 0.08 to 20, with HQs for mercury, Total PCBs and 2,3,7,8-TCDD exceeding 1; for fish would range from 0.09 to 30, with HQs for copper and dioxins/furans exceeding 1; and for wildlife would range from 0.04 to 30, with HQs for mercury, total PCBs, dioxin-like PCBs and dioxins/furans in mammals exceeding 1.

EPA's computer model predicts that, 26 to 30 years post-remediation, the cancer risks, noncancer health hazards and ecological risks achieved by Alternative 4 are higher than those achieved by Alternatives 2 and 3. Those predictions are consistent with the body of data collected over the past 20 years and the conceptual understanding of the river system presented under Section 5. The data show that lower 8.3-mile surface sediments have average COC concentrations that are almost 100 times higher than the remediation goals. Given the ubiquitous nature of highly contaminated sediments in the lower 8.3 miles, capping discrete areas totaling about one-third of the lower 8.3 miles is unlikely to lead to decreases in COC concentrations equal to or greater than those that would be achieved by bank-to-bank remediation. Even though the sediment areas evaluated for capping in Alternative 4 are those that contribute the most contaminant flux to the water column, the contaminated sediments in the remaining two-thirds of the lower 8.3 miles not addressed by Alternative 4 still include elevated concentrations of COCs that would contribute to risk by remaining in place, potentially being resuspended with the tide or in storm events to recontaminate the adjacent capped areas. While EPA's model also underestimates the effectiveness of Alternative 4, because it does not account for any reduction in incoming COCs over time, the effect of recontamination on the protectiveness of Alternative 4 includes and is greatly exacerbated by the resuspension of highly contaminated sediments from the unremediated two-thirds of the lower 8.3-mile riverbed redepositing on adjacent capped areas. While EPA actions under the Superfund and Clean Water Act programs may reduce the incoming COCs in the future, the resuspension of highly contaminated sediments from the unremediated two-thirds of the lower 8.3 miles will continue unabated.

Under Alternatives 2, 3 and 4, for DMM Scenario A (CAD), an engineered cap would be placed over the CAD cells in Newark Bay and the cap would be monitored and maintained in perpetuity. In consultations prior to the release of the Proposed Plan, the State of New Jersey, NOAA and USFWS, in their roles as natural resource trustees, expressed serious concerns about the disposal of highly contaminated sediment from the Lower Passaic River into a CAD cell in Newark Bay and the associated potential impacts to the aquatic environment. An additional concern of the Trustees was the scale and footprint of the CAD cells that would be required, which would be substantially larger than other CAD cells sited for environmental remediation in other waters of the United States.

These concerns are discussed further in Section 10.5, because EPA has analyzed these impacts as short-term, temporary impacts during remedy construction. However, NOAA has advised EPA that the presence of open CAD cells in Newark Bay for 2.5 to 14 years, as EPA calculated would be necessary under the three active alternatives, could have long-term impacts on some species that are dependent on limited bay bottom habitat for critical life stages. In contrast, DMM Scenarios B (Off-Site Disposal) and C (Local Decontamination and Beneficial Use) have no comparable environmental impact on the aquatic environment of Newark Bay.

10.2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Section 121 (d) of CERCLA and NCP §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4). <u>Applicable requirements</u> are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those State standards identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable.

<u>Relevant and appropriate requirements</u> are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site. Only those State standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for invoking a waiver.

Any alternative considered by EPA must comply with all federal and state environmental standards, requirements, criteria or limitations, unless they are waived under certain specific conditions.

Alternative 1 (No Action) would not contribute toward eventual achievement of federal and state surface water ARARs. Since there is no active remediation associated with this alternative, action-specific and location-specific ARARs do not apply.

Compliance with surface water quality ARARs is both a short-term requirement during remediation and a long-term requirement after the remediation at the Diamond Alkali Site, including in the Lower Passaic River and Newark Bay, is completed. In the short term, actions would be taken during the implementation of Alternatives 2 (Deep Dredging with Backfill), 3 (Capping with Dredging for Flooding and Navigation) and 4 (Focused Capping with Dredging for Flooding) to reduce construction-related surface water quality impacts. Alternatives 2, 3 and 4 are designed to address sediment contamination in the lower 8.3 miles of the Lower Passaic River. Although remediation of contaminated sediment would contribute to improved water quality, implementation of any of these alternatives, by itself, would be unlikely to achieve compliance with ARARs in the water column. However, because this ROD only addresses the sediment portion of the lower 8.3 miles and is an interim action for the water column, and is only part of the remedial activities under consideration for the 17-mile Lower Passaic River and Newark Bay, compliance with surface water ARARs would more likely be achieved and therefore more appropriately addressed after additional response actions have been implemented.

Alternatives 2, 3 and 4 would satisfy the location-specific and action-specific ARARs, such as the requirements of the Clean Water Act that would apply to dredging and the RCRA requirements that would apply to management of dredged materials. Alternatives 2, 3 and 4, which include placement of material on the river bottom, would need to be implemented in compliance with the Clean Water Act, 33 U.S.C. §404(b)(1) and 40 CFR Part 230, which require that disturbance to aquatic habitat be minimized to the extent possible. Compliance with the substantive elements of New Jersey Flood Hazard Control Act Rules, including those addressing placement of material in the flood hazard area and impacts to riparian zones would also be required.

Alternative 3 includes capping within the federally authorized navigation channel without enough dredging to accommodate the authorized depth from RM 0.6 to RM 8.3. In order to comply with Section 10 the Rivers and Harbors Act (33 U.S.C. § 403), which is a location-specific ARAR, as well as the navigation channel depths authorized by Congress, Alternative 3 would require both modification of the Congressionally-authorized navigation channel depths (from RM 0.6 to RM 1.7) and deauthorization of the navigation channel (from RM 1.7 to RM 8.3) through Congressional action. As discussed in Section 8, USACE has advised that it will support recommendations to Congress to accomplish these changes.

Alternative 4 includes capping within portions of the federally authorized navigation channel, without any dredging to accommodate the authorized depth in areas of the river between approximately RM 2.7 to RM 8.3. In order to comply with Section 10 of the Rivers and Harbors Act, Alternative 4 would require de-authorization of the federal navigation channel from approximately RM 2.7 to RM 8.3 through Congressional action. Since USACE has advised that it will support a recommendation for Congressional action to deauthorize the federal navigation channel from RM 1.7 to RM 8.3, USACE would likely also support the recommendation for Congressional action required for Alternative 4.

A complete list of ARARs can be found in Table 29 in Appendix II.

Primary Balancing Criteria *- The next five criteria, criteria 3 through 7, are known as "primary balancing criteria." These criteria involve the assessment of factors between response measures so that the best option will be chosen, given site-specific data and conditions.*

10.3. Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk that will remain on site following remediation and the adequacy and reliability of controls.

Alternative 1 (No Action) would not be effective in addressing the contaminated sediments that are causing the unacceptable risks identified in the baseline risk assessments. Natural recovery processes would cause some decline in surface sediment concentrations over time. Computer modeling results (see Figures 19, 20, 21 and 22 in Appendix I) for Alternative 1 show that, by the early 2060s (end of the model simulation period), surface sediment concentrations in the lower 8.3 miles of the Lower Passaic River would remain above all of the remediation goals for any COC.

- For dioxin, by the early 2060s, lower 8.3-mile surface sediment concentrations are predicted to reach approximately 0.5 ug/kg or ppb (micrograms per kilogram or parts per billion), which is over 60 times higher than the remediation goal.
- For PCBs, by the early 2060s, lower 8.3-mile surface sediment concentrations are predicted to reach approximately 920 ug/kg or ppb, which is almost 20 times higher than the remediation goal.
- For mercury, by the early 2060s, lower 8.3-mile surface sediment concentrations are predicted to reach approximately 2000 ug/kg or ppb, which is almost 30 times higher than the remediation goal.
- For Total DDx, by the early 2060s, lower 8.3-mile surface sediment concentrations are predicted to reach approximately 90 ug/kg or ppb, which is approximately 300 times higher than the remediation goal.

Alternative 1 (No Action) would not include any containment systems and would not rely on institutional controls to address COC contamination in lower 8.3-mile sediments.

Under Alternative 2 (Deep Dredging with Backfill), approximately 9.7 million cy of contaminated sediments covering approximately 650 acres of river bottom between RM 0 and RM 8.3 would be permanently removed from the ecosystem of the Lower Passaic River after construction is completed. Dredging residuals remaining in the lower 8.3 miles would be covered by a layer of backfill. Under Alternative 3 (Capping with Dredging for Flooding and Navigation), approximately 3.5 million cy of contaminated sediments covering approximately 650 acres of river bottom between RM 0 and RM 8.3 would be permanently removed from the ecosystem of the Lower Passaic River, followed by construction of a two-foot engineered cap (or placement of backfill where appropriate) over the entire lower 8.3 miles. A significant decline in surface sediment concentrations in the lower 8.3 miles is predicted for COCs under both alternatives (see Figures 19, 20, 21 and 22 in Appendix I).

- For dioxin, by the early 2060s, lower 8.3-mile surface sediment concentrations are predicted to reach approximately 0.01 ppb for Alternatives 2 and 3, which is approximately at the remediation goal.
- For PCBs, by the early 2060s, lower 8.3-mile surface sediment concentrations are predicted to reach approximately 200 ppb (Alternative 2) and 260 ppb (Alternative 3), which are approximately four and six times higher than the remediation goal, respectively.
- For mercury, by the early 2060s, lower 8.3-mile surface sediment concentrations are predicted to reach approximately 700 ppb for Alternatives 2 and 3, which is approximately ten times higher than the remediation goal.
- For Total DDx, by the early 2060s, lower 8.3-mile surface sediment concentrations are predicted to reach approximately 30 ppb for Alternatives 2 and 3, which is approximately 100 times higher than the remediation goal.

Alternatives 2 and 3 would incorporate fish and crab consumption prohibitions and advisories to ensure protectiveness of human health. EPA's modeling predicts that for dioxin and PCBs, shortly after construction completion, lower 8.3-mile surface sediment concentrations would reach the interim remediation milestones that correspond to interim protective fish and crab tissue concentrations, sufficiently protective to potentially allow NJDEP to consider lifting or relaxing the stringency of prohibitions on fish and crab consumption (e.g., allowing one fish meal per month, as opposed to the current prohibitions on consumption of fish or crab from the Lower Passaic River).

EPA's modeling of each of the alternatives predicted that in order to achieve COC concentrations approaching as closely as possible to remediation goals, bank-to-bank remediation in the lower 8.3 miles is necessary. Modeling results also predicted that bank-to-bank alternatives would reduce surface sediment concentrations for some of the COCs to below background levels in the future. This is because sediment particles coming over Dundee Dam make up only about one third of recently deposited sediment in the lower 8.3 miles, and when those particles flow down to the lower 8.3 miles, they mix with the other particles in the system (including cleaner particles in the water column that would result from a remediated lower 8.3 miles). The model took into consideration this mixing of newly arriving background contamination with clean material introduced as part of the remedy and predicted that the top six inches (the bioactive zone) could be less contaminated post-remediation than the background concentrations coming over Dundee Dam.

EPA's modeling results also show that, after bank-to-bank remediation of the lower 8.3 miles, incoming COCs from above Dundee Dam, from Newark Bay and from the Lower Passaic River above RM 8.3 will gradually recontaminate the new riverbed surface. EPA's model underestimates the effectiveness of the bank-to-bank remedies because, while the model assumes that the incoming COCs will remain constant until the end of the simulation period (until the early 2060s), EPA expects that those COCs will decline over time as the Lower Passaic River above RM 8.3 and Newark Bay are remediated through actions selected after the completion of the 17-mile RI/FS and Newark Bay RI/FS, respectively, and Clean Water Act programs will address COCs from above Dundee Dam. Such actions, taken while the remedy for the lower 8.3 miles is being designed and implemented, will reduce the incoming COCs and minimize the degree of recontamination, allowing the bank-to-bank remedies (Alternatives 2 and 3) to achieve protectiveness.

Alternative 2 would not rely on a containment system to maintain protectiveness in the lower 8.3 miles of the Lower Passaic River over the long term, since the contaminated fine-grained sediments would be removed. Note that a containment system (i.e., CAD cells in Newark Bay) was considered as one of the DMM scenarios for this alternative (see below).

Alternative 3 would be effective in the long term in limiting exposure to risks posed by COCs in the lower 8.3-mile sediments provided the integrity of the engineered cap is maintained. Therefore, the cap would need to be monitored and maintained in perpetuity. Engineered caps have been demonstrated to be effective over the long term in sequestering contaminated sediments at other Superfund sites, when they are properly designed and maintained. For cost-estimation purposes, the engineered cap for the lower 8.3 miles was assumed to consist of sand with a grain size large enough to withstand a 100-year storm with less than 3 inches of erosion (a fraction of the cap's thickness), thus minimizing the likelihood that cap integrity would be compromised during a storm event or season. Certain areas of the river were assumed to need armoring for further protection against erosion. The cost estimate also assumed periodic cap inspections and necessary maintenance at regular intervals and after storm events.

For Alternative 4 (Focused Capping with Dredging for Flooding), approximately 1.0 million cy of contaminated sediments in discrete areas totaling approximately 220 acres of river bottom between RM 0 and RM 8.3 would be permanently removed, followed by placement of a two-foot engineered cap over those areas dredged. As discussed in Section 10.1, Alternative 4 would not achieve as much risk reduction as Alternatives 2 and 3, because the contaminated surface sediments in the two-thirds of the lower 8.3 miles of the Lower Passaic River that remain unaddressed would contribute to risk by remaining in place and would recontaminate adjacent capped areas. Computer modeling results (see Figures 19, 20, 21 and 22 in Appendix I) show that, by the early 2060s (end of the model simulation period), lower 8.3-mile surface sediment concentrations would remain above the remediation goals.

- For dioxin, by the early 2060s, lower 8.3-mile surface sediment concentrations are predicted to reach approximately 0.05 ppb, over six times higher than the remediation goal.
- For PCBs, by the early 2060s, lower 8.3-mile surface sediment concentrations are predicted to reach approximately 400 ppb, approximately 8 times higher than the remediation goals.
- For mercury, by the early 2060s, lower 8.3-mile surface sediment concentrations are predicted to reach approximately 1200 ppb, almost 20 times higher than the remediation goal.
- For Total DDx, by the early 2060s, lower 8.3-mile surface sediment concentrations are predicted to reach approximately 45 ppb, approximately 150 times higher than the remediation goals.

EPA's modeling predicts that, for dioxin and PCBs, shortly after construction completion for Alternative 4, lower 8.3-mile surface sediment concentrations would be reduced below the first interim remediation milestone corresponding to tissue concentrations that would allow adult anglers to eat 12 eight-ounce fish or crab meals per year at a 10^{-4} cancer risk level. However, the noncancer hazard would still be too great for NJDEP to consider lifting or relaxing the stringency of prohibitions on fish and crab consumption. Although, by the early 2060s, dioxin surface sediment concentrations are predicted to reach the interim remediation milestone corresponding to tissue concentrations that would allow adult anglers to eat 12 eight-ounce fish or crab meals per year at an HI equal to 1, PCB surface sediment concentrations are not predicted to be reduced enough to achieve any other interim remediation milestones or remediation goals.

The protectiveness of Alternative 4 depends on the ability to accurately identify the discrete areas that release the most contaminants into the water column and need to be addressed by dredging and capping. A great degree of uncertainty is associated with this process, as a result of the complex estuarine environment of the lower 8.3 miles. In addition, while EPA's model also underestimates the effectiveness of Alternative 4, because it does not account for any reduction in incoming COCs over time, the effect of recontamination on the protectiveness of Alternative 4 includes and is greatly exacerbated by the resuspension of highly contaminated sediments from the unremediated two-thirds of the lower 8.3-mile riverbed redepositing on adjacent capped areas. While EPA actions under the Superfund and Clean Water Act programs may reduce the incoming COCs in the future, the resuspension of highly contaminated sediments from the unremediated two-thirds of the lower 8.3 miles will continue unabated.

For Alternatives 2, 3 and 4, under DMM Scenario A (CAD), the engineered caps over the CAD cells would have to be monitored and maintained in perpetuity in order to ensure that this disposal method remained protective of human health and the environment over time. In contrast, there is no such requirement for DMM Scenario B (Off-Site Disposal) or DMM Scenario C (Local Decontamination and Beneficial Use), because existing landfills already have provisions for long-term monitoring and maintenance by landfill owners and operators.

DMM Scenario B relies on off-site treatment facilities (at this time, incinerators) and landfills which are in operation and have proven to be reliable technologies. The reliability of local decontamination technologies (DMM Scenario C), such as thermal treatment and sediment washing, is more uncertain since they have not been built and operated in the United States on a scale approaching the capacity needed for this project. In addition, sediment washing may be less effective when the matrix contains multiple contaminants and consists of a large proportion of finer particles like silts and clays as is true of Lower Passaic River sediments. Multiple treatment passes may be needed under such conditions.

10.4. Reduction of Toxicity, Mobility, or Volume of Contaminants Through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

This criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and/or significantly reduce the toxicity, mobility or volume of hazardous substances as their principal element.

For Alternative 1 (No Action), there would be no reduction of toxicity, mobility or volume through treatment.

For the active alternatives, reduction of mobility and volume of contaminated sediments in the lower 8.3 miles of the Lower Passaic River would be achieved by dredging and capping, not through treatment. The ultimate reduction of toxicity, mobility and volume for the sediments removed from the lower 8.3 miles depends on the DMM Scenario selected. Alternative 2 (Deep Dredging with Backfill), would result in removal of 9.7 million cy of contaminated sediments by dredging, followed by 3.5 million cy for Alternative 3, and 1 million cy for Alternative 4. By removing nearly three times as much sediment volume from the riverbed as the next nearest alternative, Alternative 2 will result in substantially more treatment overall under either of the DMM scenarios that include treatment. If, as discussed in Section 9.1.3, EPA were to identify an enhanced capping technology that included additives to create a reactive cap for use in some areas of the lower 8.3 miles, Alternatives 3 and 4 might include some *in situ* treatment.

For Alternatives 2, 3 and 4, under DMM Scenario A (CAD), the mobility of the COCs removed from the lower 8.3 miles of the Lower Passaic River would be effectively eliminated not through treatment, but by sequestering the dredged sediments in CAD cells under an engineered cap that would need to be monitored and maintained in perpetuity. There would be no reduction in toxicity, mobility or volume of the COCs through treatment.

Under DMM Scenario B (Off-Site Disposal), RCRA land disposal requirements will result in treatment of some dredged sediment through incineration that would reduce the toxicity, mobility and volume of the COCs removed from the lower 8.3 miles of the Lower Passaic River. Under DMM Scenario B, Alternative 2 is expected to treat the largest volume of Site contaminants, followed by Alternative 3, then Alternative 4. Amounts to be incinerated or landfilled are estimated in Table 30 in Appendix II, although actual distributions between the two categories would depend on the results of characterization for disposal.

Under DMM Scenario C (Local Decontamination and Beneficial Use), thermal treatment and sediment washing would reduce the toxicity, mobility, and volume of the COCs removed from the lower 8.3 miles of the Lower Passaic River through treatment, while stabilization would reduce mobility through treatment without reducing toxicity or volume. Because DMM Scenario C anticipates treatment for nearly all the dredged sediments (regardless of which alternative is selected), it performs best under this evaluation criterion. Amounts to be treated under each technology are estimated in Table 31 in Appendix II, although actual distributions between the three treatment categories would depend on the results of characterization for disposal.

10.5. Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community and the environment during construction and operation of the remedy until cleanup levels are achieved.

This criterion addresses the effects of each alternative during construction and implementation until RAOs are met. It considers risks to the community, on-site workers and the environment, available mitigation measures and time frame for achieving the response objectives.

10.5.1. Short-Term Effectiveness: Potential Adverse Impacts on Communities and Workers During In-River Construction

The impacts due to construction in the river are mainly driven by the volume dredged and duration of construction for each alternative. Alternative 1 would not involve any construction that would present a risk to the community or workers. Implementation of Alternative 2 would have larger impacts on the community and workers than Alternative 3, because construction would last longer (14 years) and would involve handling of a larger volume of contaminated sediments (9.7 million cy). Implementation of Alternative 3 would have less of an impact on the community, workers and the environment than Alternative 2, although those impacts would still be important to mitigate, since the construction period would last 6 years and would involve handling of 3.5 million cy of contaminated sediments. Alternative 4 would also cause adverse impacts on the community, workers and the environment during construction, but those impacts would be smaller than those caused by Alternatives 2 and 3, because of the relatively short construction period (2.5 years) and smaller volume of contaminated sediments handled (1.0 million cy) relative to Alternatives 2 and 3.

Impacts to communities from construction of Alternatives 2, 3 and 4 would include temporary noise, light, odors, blocked views, traffic, potential air quality impacts and disruptions to commercial and recreational river users in the lower 8.3 miles of the Lower Passaic River (operating for a few months at a given location). These impacts could be lessened through use of best management practices documented in community health and safety plans, but disruptions would still be significant, since dredging and backfilling or capping is expected to proceed 24 hours a day, six days per week and 32 weeks per year.

Potential occupational risks to site workers from construction of Alternatives 2, 3 and 4 could include direct contact, ingestion and inhalation of COCs from the surface water and sediments and routine physical hazards associated with construction work and working on water. Measures to minimize and mitigate such risks would be addressed in worker health and safety plans, by the use of best management practices and by following properly approved health and safety procedures.

10.5.2. Short-Term Effectiveness: Potential Adverse Impacts on the Environment During In-River Construction

Under Alternatives 2, 3 and 4, dredging would result in resuspension of contaminated sediments, which would cause fish and other organisms in the water to be exposed to higher concentrations of contaminants than are usually present in the water column. Studies have shown that dredging can result in resuspension loss of 1 percent to 3 percent of the material removed. The volume dredged under each alternative and the concentrations of contaminants on the resuspended sediments drive this adverse impact. Alternative 2 would have the most impact on the environment when compared to Alternatives 3 and 4, because Alternative 2 would have the largest volume dredged, and the deepest dredging into the sediment bed where contaminant concentrations are highest, leading to the greatest mass of COCs released through dredging over the longest construction period (14 years, as opposed to 6 years for Alternative 3 and 2.5 years for Alternative 4). Alternative 3 would have less impact on the environment than Alternative 2, but more than Alternative 4.

Risks due to resuspension could be minimized through proper equipment selection, control of sediment removal rates (through careful operation of the dredging equipment) and the application of best management practices in all in-river operations. Environmental impacts from construction would include temporary loss of benthos and habitat for the ecological community in dredged areas and in areas affected by resuspension of contaminated sediments during dredging. Habitat replacement measures would be implemented to mitigate these impacts. Since the remedial action would improve and replace existing open water, mudflat and intertidal habitat, no additional compensatory mitigation measures would be necessary for this aspect of the remediation. Natural benthic re-colonization following a disturbance is usually fairly rapid, and can begin within days after perturbation. In many cases, full recovery to pre-disturbance species composition and abundance occurs within a few years.

10.5.3. Short-Term Effectiveness: Impacts on Communities, Workers and the Environment from Disposal Options

The impacts associated with the disposal options are mainly driven by the mode of transportation for the dredged materials and amount of local processing of dredged materials.

For Alternatives 2, 3 and 4, under DMM Scenario A (CAD), EPA assumed that the CAD cells would be sited in the part of Newark Bay where the thickest layer of clay (approximately 60 feet) is likely to be found. Dredged materials from the lower 8.3 miles of the Lower Passaic River would be barged to the Newark Bay CAD site so an upland sediment processing facility on the banks of the Lower Passaic River or Newark Bay would not be necessary. This would minimize on-land impacts to the community, but increase traffic in the bay. Since major container terminals are located in Newark Bay near the CAD sites that EPA considered in the FFS, increased barge traffic to and from the CAD site may interfere with existing port commercial traffic and increase the potential for waterborne commerce accidents. Depending on the alternative, EPA estimates that approximately 2 to 4 barges a day would be needed to transport dredged materials from the lower 8.3 miles of the Lower Passaic River to a CAD site in Newark Bay, which would increase vessel traffic from the Lower Passaic River to Newark Bay by approximately 50 percent compared to current conditions documented in USACE's *Waterborne Commerce Statistics*.

While dredged materials would also have to be barged or pumped to an upland processing facility under DMM Scenarios B (Off-Site Disposal) or C (Local Decontamination and Beneficial Use), an FFS-level survey of land along the shoreline of the lower 8.3 miles of the Lower Passaic River and Newark Bay showed a number of locations suitable for an upland processing facility. Siting the upland processing facility adjacent to the shoreline within the area to be dredged would minimize the impact of increased in-water traffic associated with DMM Scenarios B and C and avoid interference with the major container terminals in Newark Bay to the extent possible.

DMM Scenarios B and C would cause more on-land impacts to the local community and workers compared to DMM Scenario A. These disposal options would require the siting of a 29- to 38-acre (depending on the alternative and scenario) upland sediment processing facility on or near the banks of the Lower Passaic River or Newark Bay. For cost and schedule-estimation purposes, the facility was assumed to operate for 24 hours a day, 6 days a week, 32 weeks[28] each year for 2.5 to 14 years (depending on the alternative). Best efforts to minimize impacts on the local community and workers would be implemented; however, operation of the facility would still result in more odors, noise, light pollution, potential air quality impacts, greater risk of accidents from equipment operation and increased traffic on local roads than DMM Scenario A, which does not need an upland sediment processing facility. DMM Scenario B would have less impact on the local community and workers than DMM Scenario C, because DMM Scenario B involves less processing of dredged materials at the upland processing facility than DMM Scenario C. For DMM Scenario B, only coarse material separation and dewatering would need to be performed at the upland processing facility before materials are loaded onto rail cars and shipped off site to a RCRA permitted disposal facility. For DMM Scenario C, material

[28] For cost and schedule estimation purposes, dredging and capping or backfill was assumed to occur for 32 weeks a year. Within the 35-week construction season discussed in the Responsiveness Summary (Appendix V), three non-consecutive weeks of downtime for equipment maintenance and weather-related downtime were assumed, since such events cannot be predicted.

separation, dewatering, thermal treatment, sediment washing and solidification/stabilization would occur at the upland processing facility before the beneficial use end-products are loaded into trucks or railcars to be sent to their final destination. Less processing of dredged materials at the upland processing facility means less equipment operating for the duration of the project and a smaller footprint for the upland processing facility. Measures to minimize and mitigate impacts on the community would be addressed in community health and safety plans, and by the use of best management practices.

Under DMM Scenario A, construction and operation of the CAD site could have substantial impacts on the aquatic environment, some of which could be lessened through engineering controls. Computer simulations of CAD cells placed in Newark Bay and operated without any dissolved- and particulate-phase controls were modeled over short time periods. Modeling results indicated contaminant losses from the CAD cells of approximately 1 percent of the mass placed, even over the short time period modeled (seven days), and assuming placement of a small amount of dredged materials in the CAD site (approximately 38,400 cy). Based on these modeling results, the CAD site conceptual design used for developing DMM Scenario A in the FFS includes sheet pile walls on all sides and a silt curtain across the entrance channel, intended to lessen the migration of dissolved and particulate-phase contaminants out of the CAD cells during construction and operation. Even with the use of sheet pile walls and a silt curtain, some of the dissolved-phase contamination could still escape during dredged material disposal.

Intertidal and subtidal shallows, such as those where CAD cells would be located, provide valuable habitat for various aquatic species, including areas designated by NOAA as Essential Fish Habitat.

In a letter dated March 10, 2014, the Federal Trustees urged EPA not to consider alternatives that include disposal of contaminated sediment into the waters of Newark Bay. They explained that a CAD cell in this situation would be unprecedented in terms of the potential for adverse effects to aquatic habitat, the high concentrations of contaminants, the volume of sediment and the footprint (acres) of the CAD cell. They observed that some species (particularly winter flounder) use the Bay bottom to lay their eggs and will not spawn if those areas are disturbed or not accessible. Young-of-the-year flounder tend to burrow in the sediment rather than swim away from threats; they are not likely to swim away from a dredge and run a high risk of being entrained during construction, operation and closing of the CAD site. The Trustees distinguished Newark Bay in this regard from the species and locations involved in Superfund CAD cells at Puget Sound and New Bedford Harbor. The Trustees also concluded that other species that use the Bay (such as juvenile *Alosines,* bay anchovy and silverside) are prey species for federally managed species such as bluefish, summer flounder and windowpane. Therefore, adverse impacts on the prey species would result in reduction in prey and would be considered an adverse impact to Essential Fish Habitat. In addition, the Trustees observed that several species in Newark Bay have special status, including Atlantic sturgeon, which is federally listed as an endangered species.

The State of New Jersey has expressed similar concerns, including in a letter dated March 12, 2014, from NJDEP Commissioner Bob Martin to EPA Administrator Gina McCarthy. The Commissioner noted that use of a CAD cell for disposal of the required volume and concentration of dioxin-contaminated dredged material is unprecedented. He noted that dioxins are highly persistent, bio-accumulative and toxic chemicals that are highly resistant to degradation from biotic or abiotic processes. Consequently, NJDEP is not willing to support disposal of dioxin-contaminated sediment in Newark Bay.

In a November 30, 2012, letter, USACE stated that CAD cells can be constructed and operated with only localized short-term impacts and with the least impacts to the surrounding communities. CAD cells have been implemented all over the country, including the construction, use and recent capping of the Newark Bay Confined Disposal Facility. They noted that conditions in Newark Bay are favorable based on natural presence of a thick impermeable red-clay shelf over bedrock in a Bay with a well-established, already impacted, depositional environment (i.e., very low potential for erosion due to storm events) ensuring the secured and consolidated disposal of contaminated sediment in the long-term.

Operation of the CAD site would involve discharging dredged materials into waters of the United States for 14 years under Alternative 2, 6 years under Alternative 3 and 2.5 years under Alternative 4. The area of the open waters subject to temporary impacts from construction and operation of the CAD site would be approximately 171 acres for Alternative 2, 80 acres for Alternative 3 and 19 acres for Alternative 4. In addition to restoring the bay bottom at the completion of the project, compensatory mitigation for the CAD site would be required; that is, provision of a separate mitigation site to offset the temporal ecological losses to habitat and their functional value while the habitat is being restored. For FFS cost estimation purposes, local mitigation banks have been tentatively identified to provide the mitigation necessary to offset the temporal losses associated with the Alternatives 3 and 4 CAD site. Existing mitigation banks could only provide about 55 percent of the total mitigation acreage necessary to offset the temporal losses associated with the Alternative 2 CAD site. Additional acres could be provided through restoration of sites identified in USACE’s Hudson-Raritan Estuary Comprehensive Restoration Plan and Lower Passaic River Ecosystem Restoration Plan. The cost of mitigation is included in the cost of the alternatives that include DMM Scenario A. Furthermore, in addition to habitat loss, there is the potential for fish and semi-aquatic birds moving into the open CAD cells during their 2.5- to 14-year operation and being exposed to highly concentrated contamination by direct contact or ingestion of prey.

DMM Scenarios B and C would have much less impact on the aquatic environment than DMM Scenario A, because they would not involve the discharge of contaminated sediments through the water column and into CAD cells. While DMM Scenarios B and C have greater on-land impacts (discussed above) due to the need for an upland processing facility, those impacts can be mitigated through proven technologies such as air pollution control technology and buffer zones around construction sites.

10.5.4. Short-Term Effectiveness: Time Until Remedial Response Objectives are Achieved

See Figures 19 through 22 in Appendix I for modeling results for Alternatives 1 through 4. Under Alternative 1 (No Action), lower 8.3-mile surface sediment concentrations would still be approximately 20 to 300 times higher than any of the remediation goals by the early 2060s (end of the model simulation period). Under Alternative 4 (Focused Capping with Dredging for Flooding), surface sediment concentrations would be approximately 6 to 150 times higher than any of the remediation goals by the early 2060s. For dioxin and PCBs, shortly after construction completion for Alternative 4, lower 8.3-mile surface sediment concentrations are predicted to be reduced below the first interim remediation milestone corresponding to tissue concentrations that would allow adult anglers to eat 12 eight-ounce fish or crab meals per year at a 10^{-4} cancer risk level, although lifting or relaxing prohibitions on fish and crab consumption would not be recommended because of still-elevated noncancer hazard.

For Alternatives 2 (Deep Dredging with Backfill) and 3 (Capping with Dredging for Flooding and Navigation), lower 8.3-mile surface sediment concentrations would reach levels approximately at remediation goals for dioxin and approximately four to 100 times higher than the remediation goals for PCBs, mercury and Total DDx by the early 2060s. For dioxin and PCBs, shortly after construction completion, lower 8.3-mile surface sediment concentrations are predicted to reach the interim remediation milestones that correspond to interim protective fish and crab tissue concentrations, potentially allowing NJDEP to consider lifting or relaxing the prohibitions on fish and crab consumption. Alternative 3 would achieve significant reductions in surface sediment concentrations sooner than Alternative 2 because of the shorter construction period (6 versus 14 years).

As discussed in Section 10.1, EPA's model underestimates the effectiveness of the bank-to-bank remedies because it does not account for any reduction in incoming COCs over time as the Lower Passaic River above RM 8.3 and Newark Bay are remediated under CERCLA and COCs from above Dundee Dam are addressed under Clean Water Act programs. Such actions, taken while the remedy for the lower 8.3 miles is being designed and implemented, will reduce the incoming COCs and minimize the degree of recontamination, allowing the bank-to-bank remedies (Alternatives 2 and 3) to achieve protectiveness. In contrast, while EPA's model also underestimates the effectiveness of Alternative 4 in the same way, the effect of recontamination on the protectiveness of Alternative 4 includes and is greatly exacerbated by the resuspension of contaminated sediments from the unremediated two-thirds of the lower 8.3-mile riverbed and deposition on adjacent capped areas. While EPA actions under the Superfund and Clean Water Act programs discussed above may reduce incoming COCs in the future, the resuspension of highly contaminated sediments from the unremediated two-thirds of the lower 8.3 miles will continue unabated.

10.6. Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

There are no implementability issues for Alternative 1 (No Action), which does not involve any active remediation.

For Alternatives 2 (Deep Dredging with Backfill) and 3 (Capping with Dredging for Flooding and Navigation), every step of the in-river construction (debris removal, dredging, backfilling, engineered capping and dredged material transport) would be technically implementable, although careful planning would be needed to overcome the substantial challenges involved in the handling of such large volumes of dredged materials. Equipment and technical expertise for dredging and backfill/cap placement are available through several commercial firms. While a large amount of backfill and cap material would be needed, adequate resources have been preliminarily identified at several local borrow sources.

The lower 8.3-mile river bed is crossed by utilities of various sizes and depths, in a number of locations. The much deeper dredging for Alternative 2 would affect more utilities than the shallower dredging for Alternatives 3 or 4. The remedy design will include procedures to more precisely locate utilities in the lower 8.3 miles and determine appropriate dredging off-sets, if necessary.

The lower 8.3 miles of the Lower Passaic River is crossed by 13 bridges of various heights. Some of the bridges can only be opened with extreme difficulty to allow the passage of river vessels, because they are heavily used for commuter rail (e.g., Dock Street Bridge) or automobile traffic, or because of their age and infrastructure condition. All of the active alternatives would be affected by the need to open the bridges occasionally to allow construction equipment and dredged materials through. During dredging, low profile barges exist that can pass beneath all but two of the bridges and other engineering options, such as bypass pumping, are available to transport dredged materials under the remaining two bridges, so that bridge openings are expected to be infrequent events that can be timed to minimize transportation disruptions. This issue is not expected to pose an undue hardship to bridge operators or users. The FFS incorporates the assumption that the necessary coordination, which may include assisting bridge authorities with engineering evaluations and maintenance of the bridges, would occur during the remedial design phase of the project.

In-river construction of Alternative 4 (Focused Capping with Dredging for Flooding) could be seen as more easily implementable than Alternatives 2 and 3, because smaller volumes of dredged materials would need to be handled and less capping material would be involved. However, under Alternative 4, the process of reliably identifying discrete areas that release the most contaminants into the water column would involve a great degree of uncertainty given the complex estuarine environment of the lower 8.3 miles. The river bottom changes constantly as the tides move back and forth twice a day and unpredictably as storm events scour different areas depending on intensity, location and direction of travel.

For the in-river work of Alternatives 2, 3 and 4, no insurmountable administrative issues are anticipated in getting the necessary regulatory approvals for sediment removal or engineered cap and backfill placement. Since a large number of the activities are expected to occur on site (as defined under CERCLA §121(e)(1) and 40 CFR 300.5), federal, state and local permits would not be required. However, as discussed in Section 13.2, all substantive requirements will be met, unless there is a documented basis for a waiver. Permits are expected to be obtained from the appropriate local, state and federal agencies for actions that occur off site.

For Alternative 3, since some of the capped areas would be shallower than the federally authorized channel depths, it would be necessary to pursue both modification of the authorized depth (from RM 0.6 to RM 1.7) and deauthorization (from RM 1.7 to RM 8.3) of the federal navigation channel through Congressional action. USACE has advised that it will support those modification and deauthorization recommendations to Congress. For Alternative 4, since some of the capped areas would be shallower than the federally authorized channel depths (above approximately RM 2.7), it would be necessary to pursue deauthorization of the federal navigation channel from RM 2.7 to RM 8.3 through Congressional action. Since USACE has advised that it will support a recommendation for Congressional action to deauthorize the federal navigation channel from RM 1.7 to RM 8.3, USACE would likely also support the recommendation for Congressional action required for Alternative 4. However, as discussed above, the process of reliably identifying discrete areas that release the most contaminants into the water column involves a high degree of uncertainty given the complex estuarine environment of the lower 8.3 miles. If, during design, such discrete areas are identified in the navigation channel below RM 1.7, Alternative 4 may face an administrative implementability hurdle with respect to obtaining deauthorization or modification of the navigation channel in the lower 1.7 miles of the river. Given the current and reasonably anticipated future use of the navigation channel, such Congressional action might not be obtained.

The technical and administrative implementability of the DMM Scenarios vary. Every step involved in DMM Scenarios A (dredged material placement in CAD cells) and B (dewatering, dredged material transport and off-site disposal) is technically implementable with proper planning. The technologies have been successfully implemented at other Superfund sites. For the processing site that is eventually selected, based on EPA's analysis during the FFS and in response to comments, EPA expects that dewatering, water treatment and transfer facilities with good rail access and suitable wharf facilities can be developed. The large volume of sediments to be handled would need significant logistical coordination. For DMM Scenario B, several incinerators and landfills have been identified as potentially having capacity to receive lower 8.3-mile dredged material by rail.

The decontamination technologies involved in DMM Scenario C (thermal treatment and sediment washing) have not been constructed and operated in the United States on a scale approaching the capacity needed for this project, so their technical ability to handle large volumes of highly contaminated sediments is more uncertain.

- At least four thermal treatment technologies were identified as potentially able to treat lower 8.3-mile dredged sediments. Pilot demonstrations were conducted by USACE for three of these technologies with Passaic River-Newark Bay sediments and for one technology with Lower Fox River (Wisconsin) sediments. All achieved over 99 percent removal efficiencies for a variety of COCs, including dioxins, PCBs, PAHs and metals, although the demonstrations involved relatively small volumes and short durations.

- At least four vendors have developed sediment washing technologies. In 2005-2006, one vendor conducted a pilot demonstration with Passaic River-Newark Bay sediments that involved sufficiently high processing rates for a limited period of time to be considered equivalent to commercial scale operation. The technology achieved variable removal efficiencies (ranging from less than 10 percent to 80 percent depending on the contaminant) for dioxins and furans, PCBs, PAHs and metals. While data from the demonstration did not conclusively establish that the system would be effective in treating all contaminants to New Jersey standards so as to allow the end product to be used beneficially without restrictions, it is possible that sediment washing, combined with solidification and stabilization technology, would enable the end product to be used as RCRA Subtitle D landfill cover. However, most recently, in mid-2012, bench-scale studies by two sediment washing technology vendors showed that their technologies were unable to reduce Lower Passaic River sediment contamination to levels low enough for beneficial use.

DMM Scenario A (CAD) is a technically viable, cost-effective solution that has been constructed and maintained in a protective manner in other locations, including Newark Bay, and Superfund sites such as New Bedford Harbor and Puget Sound Naval Shipyard. From 1997 to 2012, a CAD cell with a capacity of 1.5 million cy was operated in Newark Bay by the Port Authority of New York and New Jersey and USACE for the disposal of navigational dredged material from the Newark Bay watershed (not for disposal of sediment dredged for environmental remediation).

However, in this case, DMM Scenario A (CAD) faces unique and significant administrative and legal impediments, because the State of New Jersey has asserted ownership of the bay bottom and strongly opposes construction of a CAD site in Newark Bay, citing the high concentrations of dioxin in Lower Passaic River sediments and unprecedented volume of contaminated sediment as a primary reason it should not be disposed of in the aquatic environment. The State's position is articulated in letters dated November 28, 2012, from Governor Chris Christie to former EPA Administrator Lisa Jackson and March 12, 2014, from NJDEP Commissioner Martin to EPA Administrator Gina McCarthy. While EPA has authority to acquire property interests when needed to conduct a remedial action under Section 104(j)(1) of CERCLA, including by condemnation if necessary, Section 104(j)(2) requires prior State assurance that the State will accept the property interest when the remedial action is complete. In the March 12, 2014 letter, NJDEP stated that it will not provide the assurance required by Section 104(j)(2). Therefore, the State's opposition is likely to make DMM Scenario A administratively infeasible. Given the State's position, DMM Scenario A (CAD) is unlikely to satisfy the NCP balancing criterion of implementability and the modifying criterion of state acceptance, discussed below.

For DMM Scenario B (Off Site Disposal), administrative feasibility is less of a concern, although siting a 29- to 38-acre (depending on the alternative) upland processing facility may be challenging in the dense urban areas around the Lower Passaic River and Newark Bay. For DMM Scenario C (Local Decontamination and Beneficial Use), administrative feasibility is less of a concern than for DMM Scenario A but more of a concern than for DMM Scenario B, because Scenario C involves more upland area for dredged material processing (32 to 38 acres depending on the alternative). It also involves the construction of a thermal treatment plant, which may be subject to more stringent limitations on air emissions. In Governor Christie's November 28, 2012, letter, the State of New Jersey also expressed opposition to siting a thermal treatment facility near densely populated urban areas that are already burdened with environmental impacts, particularly from air pollutants. However, the letter acknowledged that decontamination technologies such as those described in DMM Scenario C should be considered in conjunction with off-site disposal.

10.7. Cost

Includes estimated capital and long-term operation and maintenance (O&M) present value costs.

Cost estimates are summarized in Table 32 in Appendix II. A discount rate of 7 percent was used in the present value calculations, consistent with EPA guidance.

The primary cost drivers for each remedy are the quantity of sediments to be dredged and the method of disposal. Thus, the Alternative 2 capital cost under each DMM scenario is greater than the Alternative 3 capital cost under the corresponding DMM scenario, which in turn is greater than the Alternative 4 capital cost under the corresponding DMM scenario, because Alternative 2 involves dredging and managing the largest volume of contaminated sediments, while Alternative 4 involves dredging and managing the least. All Alternative 3 and 4 operation and maintenance (O&M) costs are greater than Alternative 2 O&M costs, because Alternatives 3 and 4 would involve long-term monitoring and maintenance of an engineered cap in the lower 8.3 miles, while Alternative 2 does not involve any maintenance of the backfill (because contaminated inventory is not left behind). Annual average O&M costs for Alternative 3 and 4 over the 30 year post-construction period are comparable, at estimated present values of approximately $1.4 to $1.6 million for both Alternatives 3 and 4.

Costs for DMM Scenario B were developed with the assumption that in addition to dredged material characterized as hazardous, dredged materials that do not require treatment prior to land disposal will be placed in a RCRA Subtitle C (hazardous waste) landfill outside of New Jersey (because there are no RCRA Subtitle C landfills operating in New Jersey). EPA believes that use of RCRA Subtitle C landfills for disposal is likely since the private parties that performed the Phase 1 Tierra Removal and the RM 10.9 Removal disposed of dredged material in RCRA Subtitle C facilities. Further, the State of New Jersey has no permitted Subtitle D landfills that are authorized to accept dredged material as solid waste for disposal. Dredged materials from coastal or tidal waters otherwise regulated under New Jersey law are specifically excluded from the definition of solid waste under New Jersey regulations.

Costs associated with local decontamination technologies (DMM Scenario C) are somewhat uncertain, since these technologies have not been built and operated in the United States on a scale approaching the capacity needed for this project. In particular, sediment washing may be less effective when the matrix contains multiple contaminants and consists of a large proportion of finer particles like silts and clays. Multiple treatment passes might be needed, which would increase cost.

Modifying Criteria *- The final criteria 8 and 9, are known as "modifying criteria." Community and support agency acceptance are factors that are assessed by reviewing comments received during the public comment period, including new information made available after publication of the proposed plan that significantly changes basic features of the remedy with respect to scope, performance, or cost.*

10.8. State Acceptance

Indicates whether based on its review of the RI/FFS reports and the Proposed Plan, the state supports, opposes, and/or has identified any reservations with the selected response measure.

The State of New Jersey concurs with the selected remedy. A letter of concurrence is attached as Appendix IV.

10.9. Community Acceptance

Summarizes the public's general response to the response measures described in the Proposed Plan and the RI/FFS reports. This assessment includes determining which of the response measures the community supports, opposes, and/or has reservations about.

Community acceptance of the selected remedy for the sediments of the lower 8.3 miles of the Lower Passaic River was evaluated based upon the comments received during the public comment period. There was overwhelming support for a remediation of the Lower Passaic River. Opinions on how that remediation should take place were more diverse. Several paper petitions sponsored by environmental, labor, university and local community groups generated over two thousand signatures in favor of the preferred alternative in the Proposed Plan (Capping with Dredging for Flooding and Navigation, with Off-Site Disposal). EPA also received almost two hundred form e-mails and pre-printed post cards supporting a concept suggested by the CPG in its comments, which the CPG describes as a "Sustainable Remedy,"[29] an option not evaluated in the Proposed Plan. An additional 30-40 post cards expressed concern over the construction impacts of a bank-to-bank remedy.

Some elected officials on the federal, state and local levels expressed support for the preferred alternative and others expressed opposition to the preferred alternative. The CAG, which is composed of approximately 20 members representing local citizens and businesses, environmental and recreational groups, municipalities and educators, supported the preferred alternative, with two minority opinions supporting Alternative 2 (Deep Dredging with Backfill) with off-site disposal or CAD. Some environmental groups supported the preferred alternative, while others supported Alternative 2 with off-site disposal or local decontamination. Groups representing businesses and economic development generally expressed support for the CPG's "Sustainable Remedy." Many local boating and rowing clubs expressed concern over the impacts on their ability to use the river during the construction of a bank-to-bank remedy. Companies that have received notices of potential responsibility that submitted comments all opposed a bank-to-bank remedy, and most supported the CPG's "Sustainable Remedy." Each of the active alternatives (i.e., alternatives other than "No Action") received support from various individual stakeholders, and many local residents expressed concern over the construction impacts of any remediation, even if they wrote to support some form of remediation.

While requesting comments on all aspects of the Proposed Plan, EPA provided focused public outreach on two aspects of the preferred alternative: the choice of off-site disposal versus a CAD site in Newark Bay and the dredging depths for the federally authorized navigation channel from RM 0 to RM 2.2. Of the commenters who specifically commented on off-site disposal versus CAD, more expressed support for than opposition to off-site disposal and conversely, more expressed opposition to than support for CAD, for reasons that are described in the Responsiveness Summary. Note that many of those who expressed opposition to a CAD site in Newark Bay identified themselves as residents of the Ironbound in Newark, a community with a number of potential environmental justice concerns.

Of those who specifically commented on the navigation channel, some supported dredging the navigation channel to the maximum extent while others expressed the opinion that deeper dredging in the navigation channel should not have been included in any of the alternatives. Some commenters stated that the analysis in the 2010 USACE report should be updated to include the latest information on navigation in the Lower Passaic River. Entities who identified themselves as operating within the lower 0.6 miles of the Passaic River supported dredging and

[29] During the development of the RI/FFS and Proposed Plan, and in their comments on the Proposed Plan, the CPG did not submit enough information for EPA to evaluate the conceptual remedy that the CPG calls a "Sustainable Remedy." EPA did develop and include a less than bank-to-bank, or focused, remedial alternative (Alternative 4) in the RI/FFS and Proposed Plan. Alternative 4 includes dredging and capping discrete areas of the lower 8.3 miles that release the most contaminants into the water column. Those areas cumulatively total approximately 220 acres of the surface of the lower 8.3 miles. The CPG's "Sustainable Remedy" would address discrete areas of highest surface sediment concentrations in the 17-mile stretch of the Lower Passaic River that would cumulatively total approximately 150 acres of the surface of the 17 miles.

maintaining the navigation channel as critical to their businesses or operations. Commenters' reasons for supporting or opposing deeper dredging in the navigation channel are described in the Responsiveness Summary.

Appendix V, the Responsiveness Summary, addresses the comments received at the public meetings and written comments received during the public comment period.

11. PRINCIPAL THREAT WASTE

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP §300.430(a)(1)(iii)(A)). Principal threat wastes are source materials that include or contain hazardous substances, pollutants or contaminants that act as a reservoir of contaminants that can migrate to groundwater, surface water or air, or act as a source for direct exposure. Contaminated groundwater generally is not considered to be a source material; however, non-aqueous phase liquids in groundwater may be viewed as source material. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. Low-level threat wastes are those wastes that generally can be reliably contained and present only a low risk in the event of exposure. The identification of principal and low level threats is made on a site-specific basis to help streamline and focus waste management options by categorizing the suitability of the waste for treatment or containment.

The dioxin, PCB and other COC concentrations in sediments throughout the lower 8.3 miles of the Lower Passaic River are present at levels contributing to 10^{-3} risks for humans consuming fish and crab caught in the lower 8.3 miles, a risk level that can be used as a basis for identifying principal threat waste. Although the engineering and sediment transport modeling work done as part of the FFS has determined that the deeper sediment, despite its toxicity, can be reliably contained, EPA nevertheless considers the most highly contaminated sediments as principal threat wastes at the site. As such, EPA has considered treatment as a component of dredged material management. EPA does not believe that additional treatment of all the sediment in the lower 8.3 miles is practicable or cost effective, given the high volume of sediment, the number of COCs that would need to be addressed, and the lack of applicable treatment technologies.

12. SELECTED REMEDY

Based upon an evaluation of the results of Site investigations, input from the NRRB and the CSTAG, the detailed analysis of the various remedial alternatives, and public comments, EPA has selected Alternative 3 (Capping with Dredging for Flooding and Navigation) with DMM Scenario B (Off-Site Disposal) as the remedy for OU2, the sediments of the lower 8.3 miles of the Lower Passaic River.

The major components of the selected remedy include the following:

- An engineered cap will be constructed over the river bottom of the lower 8.3 miles, except in areas where backfill may be placed because all contaminated fine-grained sediments have been removed. The engineered cap will generally consist of two feet of sand and may be armored where necessary to prevent erosion of the sand.

- Before the engineered cap is installed, the river will be dredged bank to bank (approximately 3.5 million cubic yards) so that the cap can be placed without increasing the potential for flooding. Depth of dredging is estimated to be 2.5 feet, except in the 1.7 miles of the federally authorized navigation channel closest to Newark Bay.

- The remedy will include sufficient dredging and capping to allow for the continued commercial use of a federally authorized navigation channel in the 1.7 miles of the river closest to Newark Bay and to accommodate reasonably anticipated future recreational use above RM 1.7.

- Dredged materials will be barged or pumped to a sediment processing facility in the vicinity of the Lower Passaic River/Newark Bay shoreline for dewatering. Dewatered materials will be transported to permitted treatment facilities[30] and landfills in the United States or Canada for disposal.

- Mudflats dredged during implementation of the remedy will be covered with an engineered cap consisting of one foot of sand and one foot of mudflat reconstruction (habitat) substrate.

- Institutional controls will be implemented to protect the engineered cap. In addition, New Jersey's existing prohibitions on fish and crab consumption will remain in place and will be enhanced with additional community outreach to encourage greater awareness of the prohibitions until the concentrations of COCs in fish and crab tissue reach protective concentrations corresponding to remediation goals. EPA will share the data and consult with NJDEP about whether the prohibitions on fish and crab consumption advisories can be lifted or adjusted to allow for increased consumption as contaminant levels decline.

- Long-term monitoring and maintenance of the engineered cap will be required to ensure its stability and integrity. Long-term monitoring of fish, crab and sediment will also be performed to determine when interim remediation milestones, remediation goals and remedial action objectives are reached. Other monitoring, such as water column sampling, will also be performed.

[30] At this time, incineration is the only technology known to be able to treat sediments to the applicable RCRA standards if those sediments are characterized as hazardous under RCRA and contain dioxin as an underlying hazardous constituent at concentrations requiring treatment.

This is the first of three remedies to be selected for the Lower Passaic/Newark Bay waterway: separate RI/FSs are being conducted for the full 17-mile LPRSA and for the Newark Bay Study Area, and EPA expects the three remedies to be integrated into a comprehensive response action.

Further details on the selected remedy for the sediments of the lower 8.3 miles of the Lower Passaic River include:

12.1. Dredging to Allow For Engineered Capping

Prior to installing an engineered cap bank to bank in the lower 8.3 miles of the Lower Passaic River, dredging to approximately 2.5 feet below the existing sediment surface will be performed to prevent the engineered cap from causing additional flooding. That is, when the remedy is complete, the elevation of the bottom of the river will approximate its current depth. While the FFS evaluated dredging using a mechanical dredge fitted with an environmental clamshell bucket, hydraulic dredging may also be used for some or all of the work if this is determined to be appropriate during design. If, during design, other dredging methods are identified, they will be evaluated as well.

Except as discussed in Section 12.2, the depth of dredging will be governed by the thickness of the cap. An engineered cap will be installed to provide chemical isolation, and protect against disturbance from natural processes (e.g., bioturbation) and weather events. Areas of the river that are subject to higher erosion potential may need armoring to reduce loss of cap material. The cap thickness is expected to be, on average, 2 feet, although it may be determined during remedy design that the cap thickness can vary in segments of the lower 8.3 miles as long as protectiveness is maintained.

Dredging and capping will proceed in sequence to minimize the period in which deeper contaminated sediments are exposed. The final amount to be dredged, thickness of the engineered cap and material to be used for the cap will be determined during remedy design.

Dredging/capping are assumed to occur for 32 weeks per year to account for equipment maintenance, weather-related delays and the fish window. During the remedy design, a fish migration study will better define the fish window.

The selected remedy also includes the reconstruction of dredged mudflats to their original grade, with an engineered cap that would consist of 1 foot of sand and 1 foot of mudflat reconstruction (habitat) substrate.

12.2. Navigation Channel Capping/Dredging

The selected remedy includes dredging the 300-foot wide federal navigation channel from RM 0 to RM 1.7 to accommodate continued and reasonably anticipated future use as shown in Table 33 in Appendix II.

12.3. Dredging for Recreational Use

Above RM 1.7, dredging will provide for at least 10 feet below MLW to accommodate reasonably anticipated future recreational uses, as shown in Table 33 in Appendix II.

12.4. Dredged Materials Management

This action will result in the dredging of approximately 3.5 million cy of contaminated sediments, which will be disposed of in the following way:

- Dredged materials will be barged or pumped to an upland sediment processing facility in the vicinity of the Lower Passaic River/Newark Bay shorelines for debris screening, sand separation and active dewatering using filter presses. The upland sediment processing facility will include a water treatment plant to treat contaminated water generated from sediment dewatering to meet NJDEP water quality standards before discharging it to the Lower Passaic River or Newark Bay.

- Non-hazardous coarse-grained materials (sand) separated during processing will be disposed of at a local landfill, or be beneficially used in compliance with applicable regulations.

- Dewatered dredged materials will be transported to permitted landfills in the United States or Canada for disposal.

- Some lower 8.3-mile sediments have the potential to be characterized as hazardous under RCRA standards. At this time, incineration is the only technology known to be able to treat sediments to the applicable RCRA standards if those sediments are characterized as hazardous under RCRA and contain dioxin as an underlying hazardous constituent at concentrations requiring treatment. The ash generated by incineration will be disposed of in a RCRA Subtitle C landfill.

- Dredged materials characterized as non-hazardous may be disposed of directly in a landfill without treatment. For cost-estimation purposes, placement in a RCRA Subtitle C (hazardous waste) landfill outside of New Jersey was assumed, since that was the disposal method selected by private parties performing both Phase 1 of the Tierra Removal and the RM 10.9 Removal.

12.5. Performance Standards

Performance standards related to remedy implementation will be developed during the remedy design in consultation with the State of New Jersey and federal Natural Resource Trustees, based on environmental and scientific criteria. These performance standards will be incorporated in design documents. The standards will promote accountability and ensure that the remedy meets the action-specific ARARs.

12.6. Habitat Restoration

Measures to reconstruct habitat impacted by the dredging and capping will be implemented, including habitat assessment and surveys during remedy design. The design will address placement of habitat recovery material and aquatic vegetation and is discussed further in Section 9.2.3.

12.7. Monitoring, Engineered Cap Maintenance and Institutional Controls

During construction (i.e., dredging, capping and upland sediment processing facility operations), water, air and biota monitoring will be conducted to evaluate whether the project is being managed efficiently to mitigate releases of contaminants to the environment. In instances where water or air quality standards are exceeded, the construction activity that caused the exceedance will be evaluated and additional mitigation measures will be implemented. After construction, monitoring of fish, crab and sediment will be conducted to determine when interim remediation milestones and remedial action objectives are reached.

During and after construction, New Jersey's prohibitions on fish and crab consumption, with enhanced community outreach to improve awareness, will remain in place until RAOs are met. EPA and NJDEP will share data and evaluate whether and when New Jersey may lift prohibitions on fish and/or crab consumption, replacing them with advisories that can be adjusted to allow for increased consumption as contaminant levels decline.

After construction, monitoring and maintenance of the engineered cap will be required both on a regular basis and after significant storm events. Institutional controls prohibiting disturbance of the engineered cap will be necessary to maintain cap integrity.

Frequency of monitoring during and after construction activities will be identified in monitoring plans developed during remedial design.

12.8. Adaptive Management

As discussed in EPA's "Contaminated Sediment Remediation Guidance for Hazardous Waste Sites" (December 2005) Section 2.7, adaptive management is encouraged in addressing large and complex contaminated sediment sites. Further, in its 2007 report on sediment dredging at Superfund sites, the National Research Council (NRC) noted the "difficulty in predicting dredging effectiveness and the limited number of available alternative technologies." The NRC also noted that environmental responses to remediation are complex and difficult to predict. The NRC recommended an "adaptive management approach" which it defined as "[t]he use of a structured process of selecting a management action, monitoring the effects of the action, and applying those lessons to optimize a management action…." The NRC noted that adaptive management is "context-specific" and involves an active learning process. The NRC also noted that adaptive management is not a means to permit or sanction a less rigorous cleanup or avoid public input, and stressed the importance of working in concert with site stakeholders so they can contribute to adapting the remedy if necessary. The NRC also stated that it is important not only to evaluate new information as it becomes available, but also to document deviations from the plan, if any.

Given the complexity and uncertainty involved with remediating sediment sites, especially at such a large scale, as recommended by the NRC, EPA expects to employ an adaptive management approach during the remedial design and implementation of the remedy. This will allow for appropriate adjustments to ensure efficient and effective remediation. Information critical to the successful implementation of the remedy will be evaluated; for example, models may be reviewed and updated and new projections made which may provide the opportunity for modifications to the remedial action to be considered, if appropriate. As discussed in Section 9.1.3, during remedy design, EPA will evaluate enhanced capping technologies, such as the use of additives (e.g., activated carbon or organoclay) to create a reactive cap or thin-layer capping technologies where conditions are conducive to such approaches. As appropriate, remedy modifications will be made and documented in accordance with the CERCLA process, through a memorandum to the Site file, an Explanation of Significant Differences or an Amendment to the ROD.

Furthermore, EPA will evaluate remedy implementation and modify activities as appropriate to attain remediation goals and remedial action objectives more effectively. This ensures that uncertainties are promptly and effectively addressed, informs specific design decisions, and addresses concerns about how this action will be integrated with the ongoing 17-mile LPRSA RI/FS being carried out by the CPG under EPA oversight.

12.9. Staging Remedy Implementation

The selected remedy will be implemented over an estimated 6 years of active dredging and capping. Accordingly, there will be opportunities to use experience gained, and monitoring data, to influence the implementation and performance of later stages of the remedy. EPA anticipates that, during implementation, some aspects of the remedy can be optimized, improving efficiency and potentially reducing costs. For most of the lower 8.3 miles (outside channel-dredging areas discussed in Section 12.2), the need for dredging prior to capping is derived from information about system stresses that may result from changing the river bottom bathymetry and sediment grain size (affecting the erosional stresses on the cap and the amount of flood-storage capacity within the river). As the cost of the remedy is substantially driven by the cost of dredging and dredged material management, earlier stages of dredging followed by capping can inform later stages, potentially reducing the cost by allowing EPA to evaluate opportunities to potentially reduce the amount of dredging while still allowing for installation of a protective and stable engineered cap.

In addition, EPA expects to select remedies for the Lower Passaic River above RM 8.3 and Newark Bay under the Superfund program and, working with New Jersey, to address COCs from above Dundee Dam under Clean Water Act programs. Such actions, taken while the selected remedy is being designed and implemented, will reduce the incoming COCs and minimize the degree of recontamination, allowing the selected remedy to achieve protectiveness.

12.10. Future Changes to the Navigation Channel

Capping the navigation channel at a depth other than the currently authorized depth will depend on coordination with USACE and the State of New Jersey, and successful completion of the process to obtain Congressional action to modify the depths and deauthorize portions of the navigation channel. Accordingly, the actual channel dredging depths may be refined further prior to implementation of the remedy.

12.11. Upland Sediment Processing Facilities and Local Decontamination and Beneficial Reuse

There may be adaptive management opportunities in the construction of an upland sediment processing facility, including the construction of smaller sediment dewatering and management units that can be expanded as necessary. In addition, while DMM Scenario C has not been selected, primarily for implementability reasons (e.g., the challenges of constructing and operating a sediment decontamination and beneficial reuse facility on a scale approaching the capacity needed for the selected remedy), EPA plans to follow an adaptive management approach to dredged materials management that seeks opportunities for on-site treatment that allows for beneficial reuse, as discussed in more detail in Section 12.13.

12.12. Green Remediation

The environmental benefits of the selected remedy may be enhanced by consideration of technologies and practices during the design of the remedy that are sustainable in accordance with EPA Region 2's Clean and Green policy. This will include consideration of green remediation technologies and practices.

12.13. Rationale For Selection of Alternative 3, DMM Scenario B

The selection of a remedy is accomplished through the evaluation of the nine criteria as specified in the NCP. The preference for the selected alternative and DMM scenario is based upon these principal factors:

Alternative 3 with DMM Scenario B meets the threshold criteria of Overall Protection of Human Health and the Environment and Compliance with ARARs. This alternative, which relies on an engineered cap bank-to-bank over the entire lower 8.3 miles of the Lower Passaic River to isolate the contaminated sediment in the lower 8.3 miles, achieves substantial risk reduction and controls a major source of contamination to the rest of the Lower Passaic River and Newark Bay. EPA will share data and consult with NJDEP about whether New Jersey's prohibitions on fish and crab consumption, incorporated to ensure protection of human health, can be lifted or adjusted to allow for increased consumption as contaminant levels decline. The selected remedy will meet all of the RAOs for the lower 8.3 miles and will accommodate the reasonably anticipated future use in the federally authorized navigation channel, as well as future recreational use. Following are the key factors that led EPA to select this alternative-DMM scenario combination over the others:

- Alternative 3 achieves substantial risk reduction and controls a major source of contamination to the rest of the Lower Passaic River and Newark Bay by sequestering all of the contaminated sediments remaining in the lower 8.3 miles of the Lower Passaic River at the completion of the remedy under a bank-to-bank engineered cap. While engineered caps must be monitored and maintained in perpetuity, they have been demonstrated to be effective for well over 30 years at multiple Superfund sites around the country.

- Alternative 3 reduces the contaminant volume in the lower 8.3 miles of the Lower Passaic River by removing 3.5 million cy of contaminated sediments. Alternative 3 reduces mobility in the lower 8.3 miles by sequestering the remaining 6.2 million cy of contaminated sediments under an engineered cap that will be maintained in perpetuity. Overall toxicity and volume are reduced by incinerating the 5 percent of dredged materials estimated to be characterized as hazardous under RCRA (with dioxin concentrations elevated such that incineration is needed), while overall mobility is effectively eliminated by disposing of the remaining volume (and the ash from incineration) into landfills.

- While both Alternatives 2 and 3 meet the threshold criterion of protectiveness, Alternative 3 will do so in less than half the construction time of Alternative 2 and with a smaller volume dredged than Alternative 2. This means that there will be significantly less short-term impact on the community, workers and the environment.

- DMM Scenario B has less of an on-land impact than DMM Scenario C, since off-site disposal will involve fewer acres for, and less processing at, the upland processing facility than local decontamination. DMM Scenario B has significantly less impact on the aquatic environment than DMM Scenario A, since CAD cells, unlike off-site disposal, would involve managing the placement of dredged materials on 80 acres of Newark Bay bottom over 6 years, potentially impacting species that are dependent on limited bay bottom habitat for critical life stages. In addition, CAD cells could increase the potential that fish and birds could be exposed to highly concentrated contamination in the CAD cells, and increase the potential for waterborne commerce accidents in the busy port.

- The cost estimate for the selected remedy assumes that dredged materials that do not require treatment prior to land disposal will be placed in a RCRA Subtitle C landfill. Because the private parties that performed the Phase 1 Tierra Removal and the RM 10.9 Removal disposed of dredged material in RCRA Subtitle C facilities, EPA believes it likely that the dredged material for this action will also go to Subtitle C facilities. Further, because dredged materials from coastal or tidal waters, otherwise regulated under New Jersey law, are specifically excluded from the definition of solid waste under New Jersey regulations, the State of New Jersey has no permitted Subtitle D landfills that are authorized to accept dredged material as solid waste for disposal.

- The dredging and engineered cap components in Alternative 3 have been demonstrated to be technically and administratively feasible at other Superfund sites. Alternative 3 is more implementable than Alternative 2, because Alternative 3 involves a significantly smaller dredging volume and shallower dredging depths than Alternative 2, which means less challenging logistics for sediment handling and fewer utilities to be located and evaluated. Alternative 3 is more implementable than Alternative 4, because Alternative 3 does not rely on identifying discrete areas of the river that release high fluxes of contaminants into the water column. The river bottom changes constantly as the tides move back and forth twice a day and unpredictably as storm events scour different areas depending on intensity, location and direction of travel, making the identification of the discrete areas that would be remediated under Alternative 4 highly uncertain.

- While the final decisions regarding treatment and disposal locations will be made during remedy design and implementation, for DMM Scenario B, existing incinerators and landfills were identified that are permitted to handle lower 8.3-mile dredged materials, are proven to be reliable technologies and already have provisions for long-term monitoring and maintenance by their owners/operators. In contrast, because the State of New Jersey strongly opposes construction of a CAD site in Newark Bay, DMM Scenario A is likely to face such severe legal and administrative impediments as to make it administratively infeasible. The sediment washing technologies evaluated in DMM Scenario C failed in demonstration tests to reliably reduce Lower Passaic River sediment contamination to levels low enough to allow for beneficial re-use, and thermal treatment technology vendors have not sited or constructed commercial-scale facilities with the demonstrated ability to process the large volumes of sediment that would be dredged under Alternative 3.

- At a present value of $1.38 billion, Alternative 3-DMM Scenario B is less costly than the two most costly alternative-DMM scenario combinations, although more costly than three others (excluding Alternatives 1 and 4, which do not meet the protectiveness threshold criterion).

- The State of New Jersey has concurred with the combination of Alternative 3 and DMM Scenario B.

- On balance, the comments received on the Proposed Plan, particularly from local residents and many community organizations, supported the combination of Alternative 3 and DMM Scenario B.

DMM Scenario C would offer some advantages in terms of permanence and reduction of toxicity, mobility and volume through treatment. However, none of the decontamination technologies tested during the FFS development period proved implementable on a commercial scale, particularly with the large volumes of sediment that would require management under the active alternative evaluated. Several sediment decontamination vendors are continuing to develop their technologies and continue to express interest in handling Lower Passaic River sediments. It is possible that one or more vendors might succeed in demonstrating that their technology could decontaminate Lower Passaic River sediments and might be able to site and construct a local decontamination technology facility. Should this happen during the remedy design phase, EPA could modify the selected remedy through a ROD amendment or Explanation of Significant Differences in such a way as to allow for local decontamination and beneficial use (DMM Scenario C) of all or a portion of the sediment.

Based on information currently available, EPA concludes that the selected remedy meets the threshold criteria and provides the best balance of tradeoffs among the alternatives with respect to the balancing and modifying criteria. The selected remedy will satisfy the statutory requirements of CERCLA §121(b) by being protective of human health and the environment; complying with ARARs; and being cost-effective. Although CERCLA §121(b) also expresses a preference for selection of remedial actions that use permanent solutions and treatment technologies to the maximum extent practicable, there are situations that may limit the use of treatment, including when treatment technologies are not technically feasible or when the extraordinary size or complexity of a site makes implementation of treatment technologies impracticable. The selected remedy would generate approximately 3.5 million cy of contaminated sediments, which is an extraordinary volume of material; and the sediment treatment technologies investigated under DMM Scenario C have not been constructed or operated in the United States on a scale approaching the capacity needed for this project, so their technical ability to handle such an extraordinary volume of highly contaminated sediments is uncertain. The selected remedy is estimated to provide treatment of approximately 130,000 cy of contaminated sediment through incineration off-site to comply with applicable RCRA standards.

12.14. Summary of the Estimated Cost of the Selected Remedy

The estimated capital, long-term O&M and total present value costs, as well as construction time, for the selected remedy are summarized below and detailed in Tables 34 and 35 in Appendix II. The cost estimates, which are based upon estimates developed for similar projects, engineering judgment and construction bids, are order-of-magnitude engineering cost estimates that are expected to be within +50 percent to -30 percent of the actual cost for implementation of the remedy.

Total Present Value Capital Cost:	$1,338,000,000
Average Annual Present Value O&M Cost:	$ 1,468,000
Total Present Value Cost:	$1,382,000,000
Construction Duration:	6 Years

12.15. Expected Outcomes of the Selected Remedy

The selected remedy, Alternative 3 combined with DMM Scenario B, addresses a major source of contamination to the Lower Passaic River and Newark Bay. Risks to humans through fish and crab consumption, risks to ecological receptors due to direct contact and ingestion of contaminated sediments and prey, and resuspension of contaminated sediment acting as an ongoing source of contamination will be mitigated through the installation of an engineered cap over the lower 8.3 miles of the Lower Passaic River, bank to bank (except in areas where backfill may be placed, because all contaminated fine-grained sediments have been removed). To prevent the engineered cap from exacerbating flooding, removal of approximately 2.5 feet of surface sediments will be necessary. This is the first stage of a multi-phased action to address human health and ecological risks posed by contaminated sediments, water and biota in the entire 17 miles of the Lower Passaic River and in Newark Bay. The installation of an engineered cap will address exposures by remediating contaminated sediments in the lower 8.3 miles, thereby improving water column concentrations and lowering fish and crab tissue concentrations. Modeling predicts that fish and crab tissue concentrations may be reduced sufficiently after remedy implementation to allow for some adjustments of the current prohibitions on fish and crab consumption to allow for some consumption. Actions taken to reduce the incoming COCs and minimize the degree of recontamination will result in further improvements in fish and crab tissue concentrations. EPA does expect that some level of fish and crab consumption prohibitions or advisories will be needed during construction of the remedy and after construction completion to maintain the protectiveness of the remedy.

The model-projected outcomes for the lower 8.3 miles of the Lower Passaic River, described above, underestimate the effectiveness of the selected remedy, because they do not account for any reduction in incoming COCs over time as the Lower Passaic River above RM 8.3 and Newark Bay are remediated under the Superfund program and COCs from above Dundee Dam are addressed under Clean Water Act programs. Such actions, taken while the selected remedy is being designed and implemented, will reduce the incoming COCs and minimize the degree of recontamination, allowing the selected remedy to achieve protectiveness. This action for the sediments of the lower 8.3 miles of the Lower Passaic River will effectively eliminate the sediments of the lower 8.3 miles as an ongoing source of contamination to the other study areas. The upper nine miles of the Lower Passaic River and Newark Bay, which cover a greater surface area than the lower 8.3 miles of the Lower Passaic River, but account for less of the contaminant loading into the system, may see risk reduction from the implementation of the lower 8.3-mile remedy alone. At the same time, because the vast majority of the contaminated sediments are present in the lower 8.3 miles, and bank-to-bank remediation is necessary to address the unacceptable risk associated with these sediments, any remedy for the 17-mile Lower Passaic River that includes the lower 8.3 miles would necessarily have to address these contaminated sediments. For these reasons, EPA expects that the selected remedy for the sediments of the lower 8.3 miles will be consistent with any remedy selected for Lower Passaic River and Newark Bay.

Except for the two miles closest to Newark Bay, the federally authorized navigation channel in the lower 8.3 miles has not been regularly maintained in recent years. Based on EPA's analysis of USACE's 2010 Lower Passaic River Commercial Navigation Analysis report and comments submitted to EPA on the Proposed Plan, EPA does not anticipate that the channel above RM 1.7 is likely to be used for commercial navigation in the foreseeable future. The lowest 1.7 miles are currently used for commercial navigation, and USACE has indicated that maintaining the channel from RM 0 to RM 1.7 is consistent with its current and reasonably anticipated future use. USACE has advised that based on current information about reasonably anticipated future use of the channel, it will support recommendations for Congressional action to: 1) deauthorize the federal navigation channel from RM 1.7 to RM 8.3; and 2) modify the authorized depths of the federal navigation channel from RM 0.6 to RM 1.7 to the depths identified in the selected remedy. Thus, the final capping depths for the federally authorized navigation channel between RM 0 and RM 1.7 that are part of the selected remedy, including those between RM 0.6 and RM 1.7 that are less than the currently authorized channel depths, are consistent with reasonably anticipated future use including commercial navigational use.

Long-term monitoring of the remedy and maintenance of the engineered cap will be conducted to ensure the integrity of the engineered cap and the protectiveness of this remedy. Any identified deficiencies in the engineered cap will be addressed in an expeditious fashion in accordance with an O&M plan, to be developed during remedial design to ensure the continued protectiveness of the selected remedy.

13. STATUTORY DETERMINATIONS

CERCLA §121(b)(1) mandates that a remedial action must be protective of human health and the environment, cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. CERCLA §121(b)(1) also establishes a preference for remedial actions which employ treatment to permanently and significantly reduce the volume, toxicity or mobility of the hazardous substances, pollutants, or contaminants at a site. CERCLA §121(d) further specifies that a remedial action must attain a degree of cleanup that satisfies ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA §121(d)(4).

13.1. Protection of Human Health and the Environment

The selected remedy's components will be protective of human health and the environment by removing or capping principal threat waste from the areas encompassed by this OU, removing and/or reducing the availability of the contaminated sediment throughout the lower 8.3 miles of the Lower Passaic River through surface dredging followed by capping, so that in time, surface sediment will approach remediation goals as closely as possible. Actions selected after the completion of the 17-mile RI/FS and Newark Bay RI/FS will reduce incoming COCs from the Lower Passaic River above RM 8.3 and Newark Bay, respectively, and Clean Water Act programs are expected to address COCs from above Dundee Dam. Such actions, taken while the selected remedy is being designed and implemented, will reduce the incoming COCs and minimize the degree of recontamination, allowing the selected remedy to achieve protectiveness by achieving the cancer risk range of 10^{-4} to 10^{-6}, noncancer HIs equal to or less than 1 and ecological HQs equal to or less than 1.

The selected remedy for the sediments of the lower 8.3 miles of the Lower Passaic River will be protective of human health and the environment. The selected remedy, Alternative 3, will prevent exposure and ingestion risks to humans and ecological receptors associated with contaminated sediments by containing this material under an engineered cap. Because the time frame required to achieve remedial action objectives is long, further risk reduction will be attained in the short-term through enhanced outreach to increase awareness of existing fish and crab consumption prohibitions and advisories, including complementary education efforts to reduce the consumption of self-caught fish and crab while contaminant concentrations remain above remediation goals in the fish and crab tissue.

The extensive dredging, sediment processing and off-site transportation of contaminated material associated with this remedy have the potential for significant impacts on the community and workers during its implementation. Measures to minimize and mitigate the impacts associated with these activities will be addressed in community and worker health and safety plans, by the use of best management practices and by following approved health and safety procedures.

13.2. Compliance with ARARs

CERCLA §121(d) and NCP §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA §121(d)(4). Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site (or operable unit).

The selected remedy sequesters contaminated sediments under an engineered cap over the entire river bottom, throughout the lower 8.3 miles of the Lower Passaic River. EPA expects that during implementation, this remedy will be implemented consistent with identified action-specific and location-specific ARARs and performance standards, and once implemented, will comply with all ARARs. A complete list of the ARARs, and to-be-considered (TBCs) criteria associated with the selected remedy is presented in Table 29 in Appendix II.

Highlights of ARARs:

- Action Specific ARARs -
  - Clean Water Act, 33 U.S.C. §404(b)(1); 40 CFR Part 230
  - New Jersey Pollutant Discharge Elimination System rules, N.J.A.C. 7:14A-12
  - Resource Conservation and Recovery Act, 42 U.S.C. §6921; 40 CFR Parts 262, 264, 268
  - New Jersey Solid Waste Management Act, N.J.S.A. §13:1E-1, et seq., New Jersey Solid and Hazardous Waste Rules, N.J.A.C. 7:26 and 7:26G

- Chemical-Specific ARARs (none)

- Location-Specific ARARs
  - Section 10, Rivers and Harbors Act of 1899, 33 U.S.C. §403
  - Coastal Zone Management Act, 16 U.S.C.§1456; 15 CFR 930.30
  - New Jersey Tidelands Act, N.J.S.A. 12:3
  - New Jersey Waterfront Development Law, N.J.S.A 12:5-3
  - New Jersey Coastal Zone Management Rules N.J.A.C. 7:7
  - New Jersey Flood Hazard Control Act Rules, N.J.A.C. 7:13
  - New Jersey Freshwater Wetlands Protection Act Rules, N.J.A.C. 7:7A.

13.3. Cost Effectiveness

EPA has determined that the selected remedy is cost-effective and represents a reasonable value. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness" (NCP §300.430(f)(1)(ii)(D)). EPA evaluated the "overall effectiveness" of those alternatives that satisfied the threshold criteria (*i.e.*, were protective of human health and the environment and ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, or volume through treatment; and short–term effectiveness). Overall effectiveness was then compared to costs to determine cost-effectiveness. The relationship of the overall effectiveness of the selected remedy was determined to be proportional to costs and hence, the selected remedy represents reasonable value.

Please refer to Tables 34 and 35 in Appendix II for a summary of costs for the selected remedy.

13.4. Use of Permanent Solutions and Alternative Treatment Technologies

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner. Of those alternatives that are protective of human health and the environment and comply with ARARs to the extent practicable, EPA has determined that the selected remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and State and community acceptance.

The selected remedy will provide adequate long-term control of risks to human health and the environment through eliminating and/or preventing exposure to the contaminated sediment and preventing movement of contaminated sediment. The selected remedy is protective with respect to short-term risks.

13.5. Preference for Treatment as a Principal Element

Although CERCLA §121(b) also expresses a preference for selection of remedial actions that use permanent solutions and treatment technologies to the maximum extent practicable, there are situations that may limit the use of treatment, including when treatment technologies are not technically feasible or when the extraordinary size or complexity of a site makes implementation of treatment technologies impracticable. The selected remedy would generate approximately 3.5 million cy of contaminated sediments, which is clearly an extraordinary volume of materials; and the sediment treatment technologies investigated under DMM Scenario C have not been constructed or operated in the United States on a scale approaching the capacity needed for this project, so their technical ability to handle such an extraordinary volume of highly contaminated sediments is uncertain. The selected remedy is estimated to provide treatment of approximately 130,000 cy of contaminated sediment through incineration (the only technology available at this time) off site to comply with applicable RCRA standards. If, during remedial design, EPA identifies an enhanced capping technology that includes additives to create a reactive cap for use in some areas of the lower 8.3 miles, the selected remedy may provide some *in situ* treatment.

13.6. Five-Year Review Requirements

Because the selected remedy will result in hazardous substances, pollutants, or contaminants remaining in sediments above levels that allow for unlimited use and unrestricted exposure, reviews will be conducted every five years after initiation of the remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

14. DOCUMENTATION OF SIGNIFICANT CHANGES

In response to comments received on the Proposed Plan, EPA has altered some aspects of the preferred alternative (Alternative 3 with DMM Scenario B) in the Proposed Plan in formulating the selected remedy. This section briefly describes the changes, which are discussed in more detail in the Responsiveness Summary in Appendix V.

<u>Selected Remediation Goals</u>. EPA received comments that the human health risk assessment supporting the Proposed Plan should have been updated to reflect the 2014 Updated Default Exposure Assumptions (released after the RI/FFS was completed). In response to these comments, EPA used the updated assumptions to calculate risk and hazard estimates used to support remedy selection as set forth in this ROD:

- The updated assumptions changed the adult exposure duration from 24 years to 20 years and the total exposure duration from 30 years to 26 years. As shown in the Responsiveness Summary in Appendix V, incorporating the updated assumptions does not significantly affect the calculated cancer risks and does not alter noncancer values.
- The updated assumptions changed the adult body weight from 70 kg (154 pounds) to 80 kg (176 pounds). As shown in the Responsiveness Summary, incorporating this updated assumption does not significantly affect the calculated risks and health hazards.
- In addition to recalculating the risk and hazard estimates, EPA also used the updated assumptions to recalculate the human health PRGs, which resulted in the dioxin and PCB remediation goals, both based on human health PRGs, changing by 14 percent (from 7.1 ppt to 8.3 ppt) and 17 percent (from 44 ppb to 50 ppb), respectively.

Navigation Channel. EPA received comments on the depths and extent of dredging in the federally authorized navigation channel included in Alternative 3. In response to those comments, EPA, in consultation with USACE and NJDEP, reexamined available information pertaining to current and future land use and commercial uses of the Lower Passaic River navigation channel submitted and obtained during the public comment period:

- In 1930, Congress authorized the navigation channel depth for the portion of the Passaic River from RM 0 to RM 2.6 to be 30 feet, and has not modified this authorized navigation channel depth since that time.
- Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. § 403) is a location-specific ARAR with which the remedy for the lower 8.3 miles will comply. In addition, it is EPA policy to consider reasonably anticipated future land and waterway uses during the remedy selection process in general, and in the development of remedial alternatives in particular.
- In developing a preferred alternative that included capping that would not permanently obstruct the navigable capacity of the Lower Passaic River in contravention of the Congressionally authorized navigational depth and Section 10 of the Rivers and Harbors Act and that would accommodate reasonably anticipated future commercial navigational use, EPA evaluated USACE's 2010 Lower Passaic River Commercial Navigation Analysis report, which assessed the current and potential future status of commercial navigation on the Lower Passaic River.
- During the comment period, commenters stated that the analysis in the 2010 USACE report should be updated to include the latest data on navigation (waterborne commerce statistics) in the Lower Passaic River. By letter dated February 6, 2014, USACE confirmed that 2011 Waterborne Commerce Data (the last year analyzed as of the writing of the letter) indicated a significant volume of waterborne commerce was transported that year within the Lower Passaic River, consistent with its prior analysis of 1997-2006 data. The letter also stated that "The current and projected future level of commercial traffic is sufficient to justify maintenance dredging of the channel should it be required, subject to budget limitations."

- Based on EPA's reexamination of information pertaining to commercial navigation in recent years, EPA adjusted the depths of the navigation channel included in the selected remedy to better reflect current commercial use, as follows: 30 feet from RM 0 to RM 0.6 and 20 feet from RM 0.6 to RM 1.7. The selected remedy does not include any dredging above RM 1.7 except as needed to accommodate the engineered cap and to smooth some areas prior to cap placement to achieve a minimum final water depth of approximately 10 feet for reasonably anticipated future recreational uses.
- Since the selected remedy anticipates that from RM 0.6 to RM 8.3, the Lower Passaic River will be permanently capped at depths shallower than the federally authorized navigation channel depths, it will be necessary to obtain Congressional authorization to: 1) modify the authorized depth from RM 0.6 to RM 1.7; and 2) deauthorize the federal navigation channel from RM 1.7 to RM 8.3. USACE has advised that it will support those modification and deauthorization recommendations to Congress.
- The adjustment to the depths of the navigation channel, as well as a few other minor volume adjustments made in response to other comments, resulted in a change to the estimated dredging volume for the selected remedy of less than 20 percent, from 4.3 million cubic yards to 3.5 million cubic yards. Changes in construction time and cost are discussed below.

<u>Opening and Closing of Bridges</u>. EPA received comments expressing concern that implementation of the preferred alternative would require the bridges over the Passaic River to be opened and closed many times a day, disrupting road, rail and pedestrian traffic, adversely impacting businesses, interfering with emergency response and stressing aging infrastructure to the point of breakage. In response to these comments, EPA re-evaluated the bridges in the lower 8.3 miles:

- EPA concluded that out of 13 bridges, low profile barges exist that can pass beneath all but two of the bridges without opening them.
- The two bridges that present the greatest challenges to navigation as a result of vertical clearance handle vehicular traffic. They are located in the upper portion of the lower 8.3 miles, at RM 5.7 and RM 6.1. Accordingly, the amount of dredged material that will be moved past these bridges will be far less than the total of 3.5 million cubic yards addressed by the selected remedy. EPA concluded that there are a number of engineering options available to transport materials under these two bridges without opening them, and evaluated bypass pumping between RM 5.7 and RM 6.1 in detail in the Responsiveness Summary for inclusion in the cost estimate that supports the ROD. The final decision on the approach to be taken will be addressed during the remedial design phase.
- Although any of the bridges may still need to be opened to allow construction equipment through, such openings are expected to be infrequent events that can be timed to minimize transportation disruptions. This issue is not expected to pose an undue hardship to bridge operators or users. Necessary coordination, which may include assisting bridge authorities with engineering evaluations and maintenance of the bridges, will occur during the remedial design phase of the project.

Construction Time and Cost. EPA received comments stating that the construction time for the preferred alternative was underestimated. In response to these comments, EPA re-evaluated the following factors affecting dredging productivity raised by commenters:

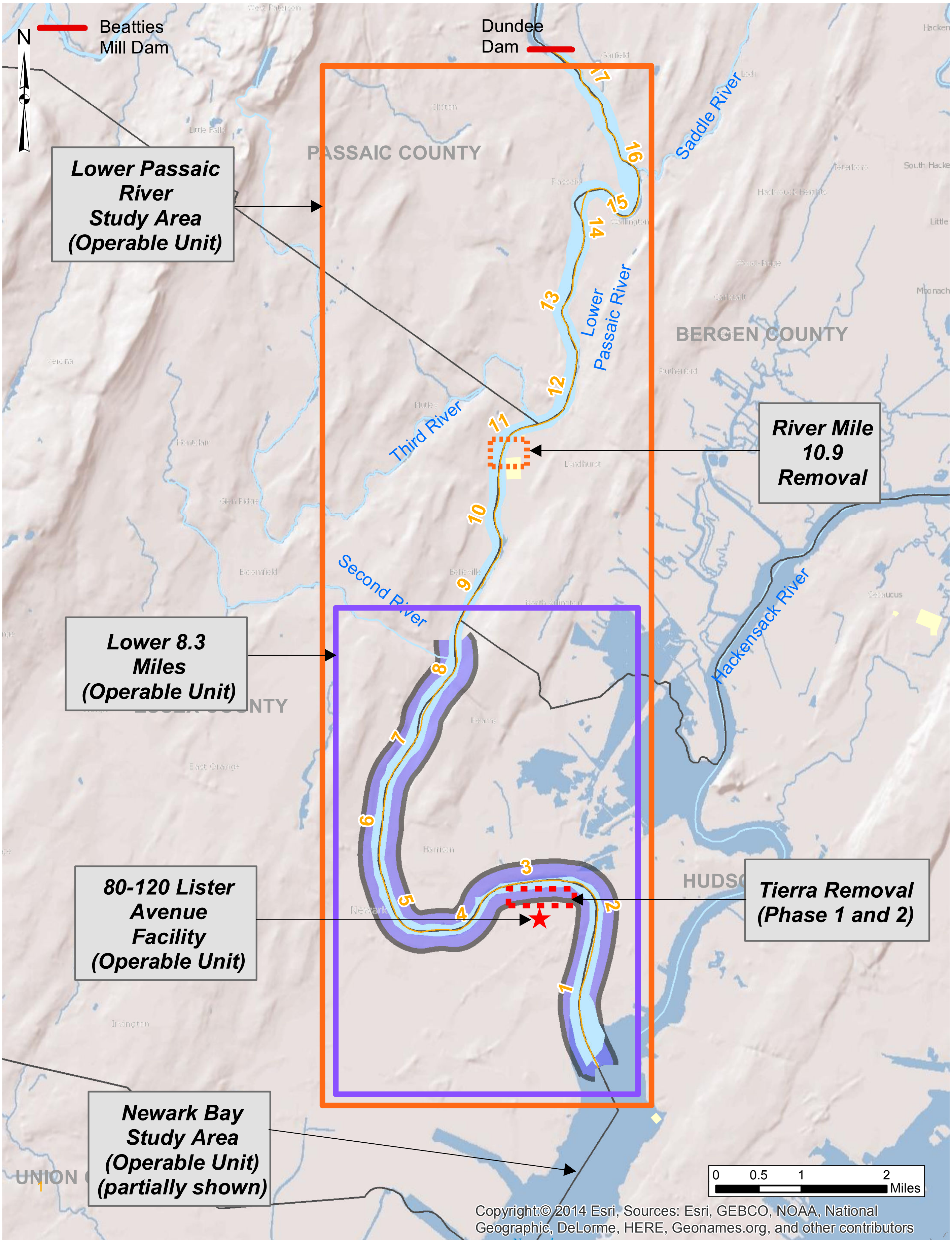
- EPA added time to the schedule to more fully account for fish windows, allow for an additional three weeks of downtime for extreme weather events and equipment breakdown; and EPA revised construction sequencing to account for the engineering solutions discussed above that significantly reduced the need for bridge openings. EPA also made revisions to account for the adjustments in the depths of the navigation channel included in the selected remedy, as discussed above.
- These revisions did not substantially increase the total construction time for the active remedies. Changes were from 11 to 14 years for Alternative 2, from 5 to 6 years for Alternative 3 (the selected remedy) and from 2 to 2.5 years for Alternative 4. These increases did not change the relative durations among alternatives, and so did not change EPA's comparative analysis results from the Proposed Plan.
- These revisions also resulted in changes to the costs of the active remedies that did not change the relative costs among alternatives, and so did not change EPA's comparative analysis results from the Proposed Plan. Updated costs are presented in Section 9.2. For the selected remedy, present value costs changed approximately 20 percent, from $1.73 billion to $1.38 billion.

All of these estimates are based on limited data and will be refined during remedial design. All changes are within the expected accuracy of feasibility study cost estimates of +50 percent to -30 percent. They are within the range of adjustments that would normally be made during remedial design, and do not significantly change the selected remedy.

APPENDIX I

FIGURES

LIST OF FIGURES



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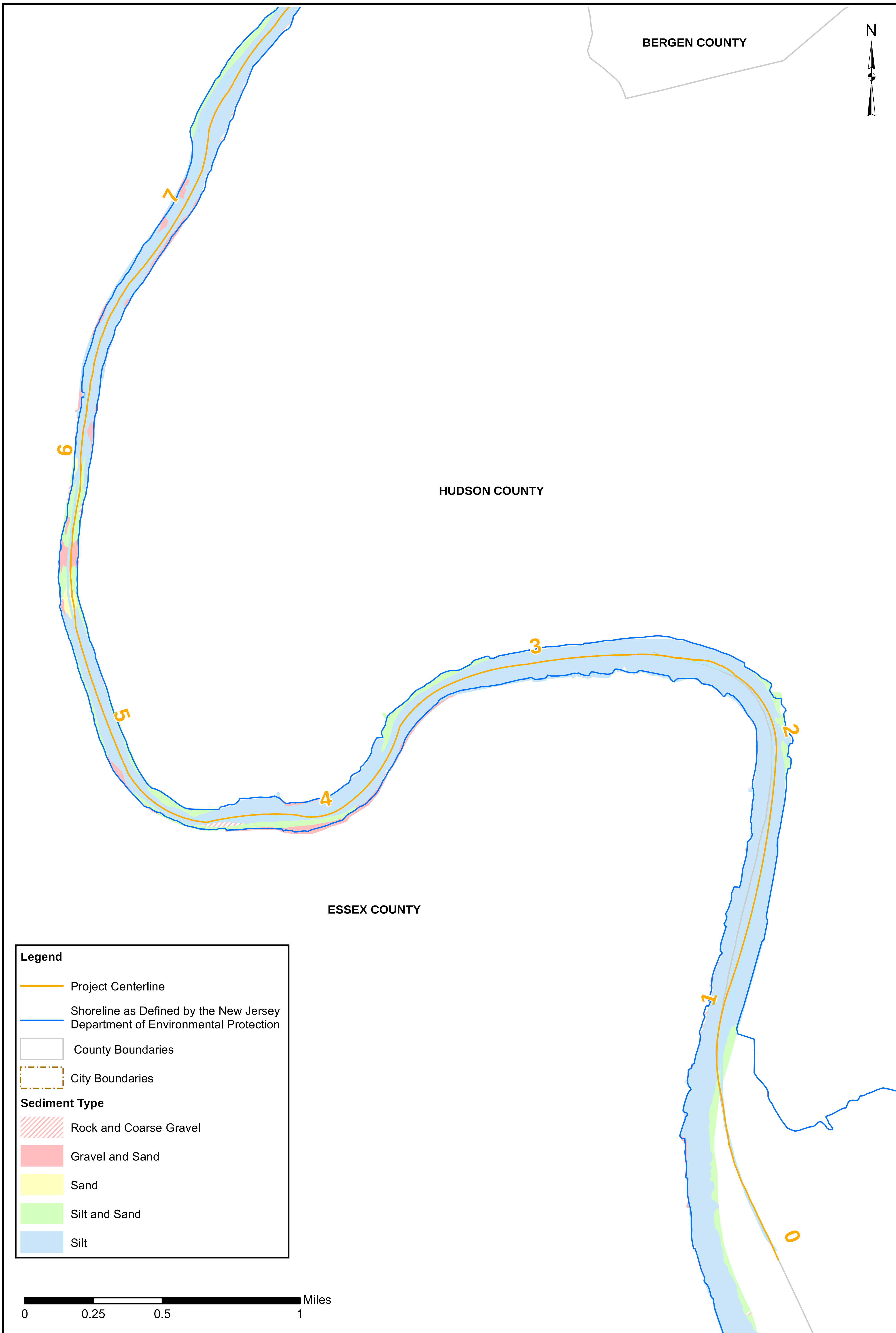
Lower Passaic River Study Area

Lower 8.3 Miles of the Lower Passaic River

Figure 1

2016

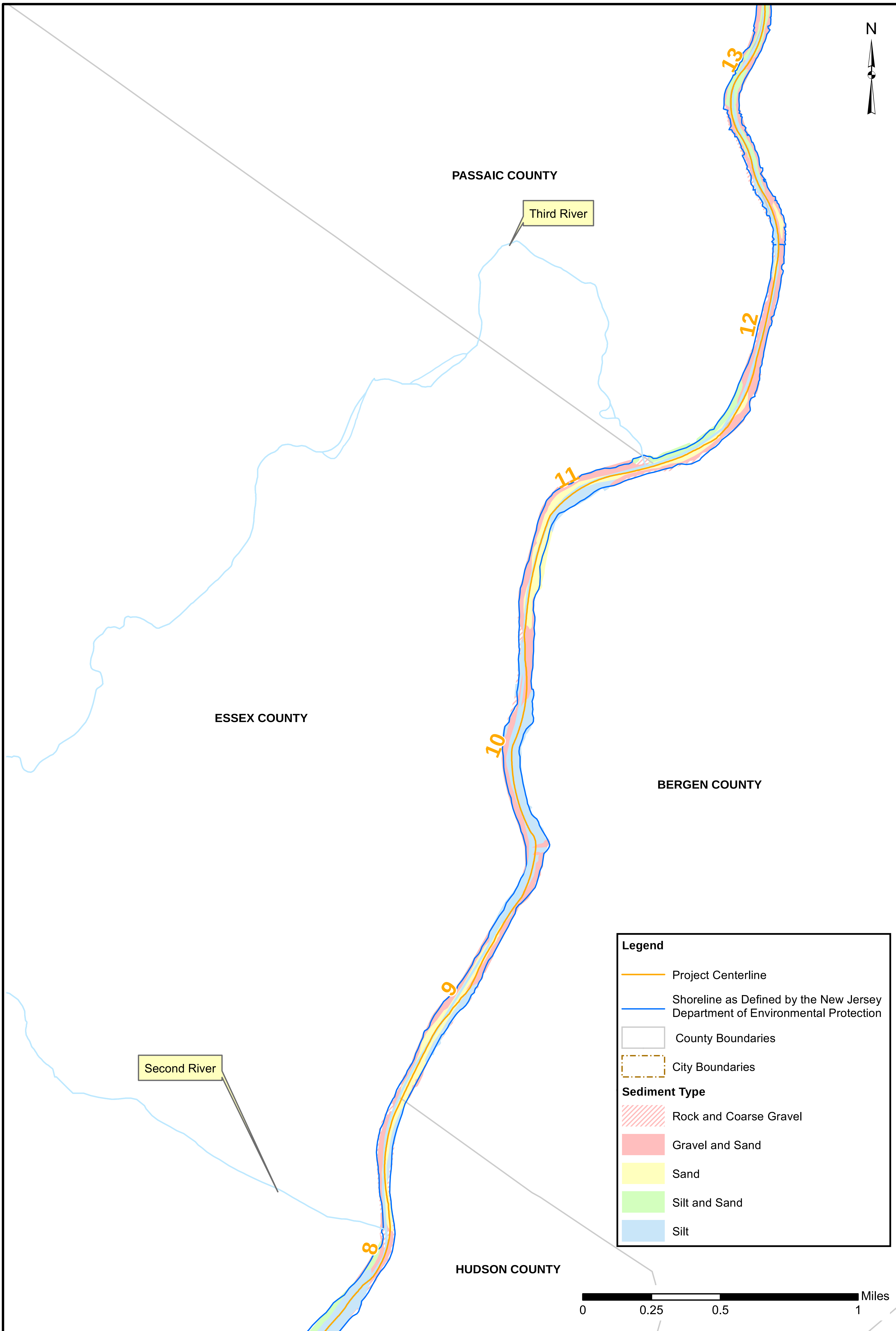


Sediment Texture Type – RM 0 to RM 8

Lower 8.3 Miles of the Lower Passaic River

Figure 2a

2016



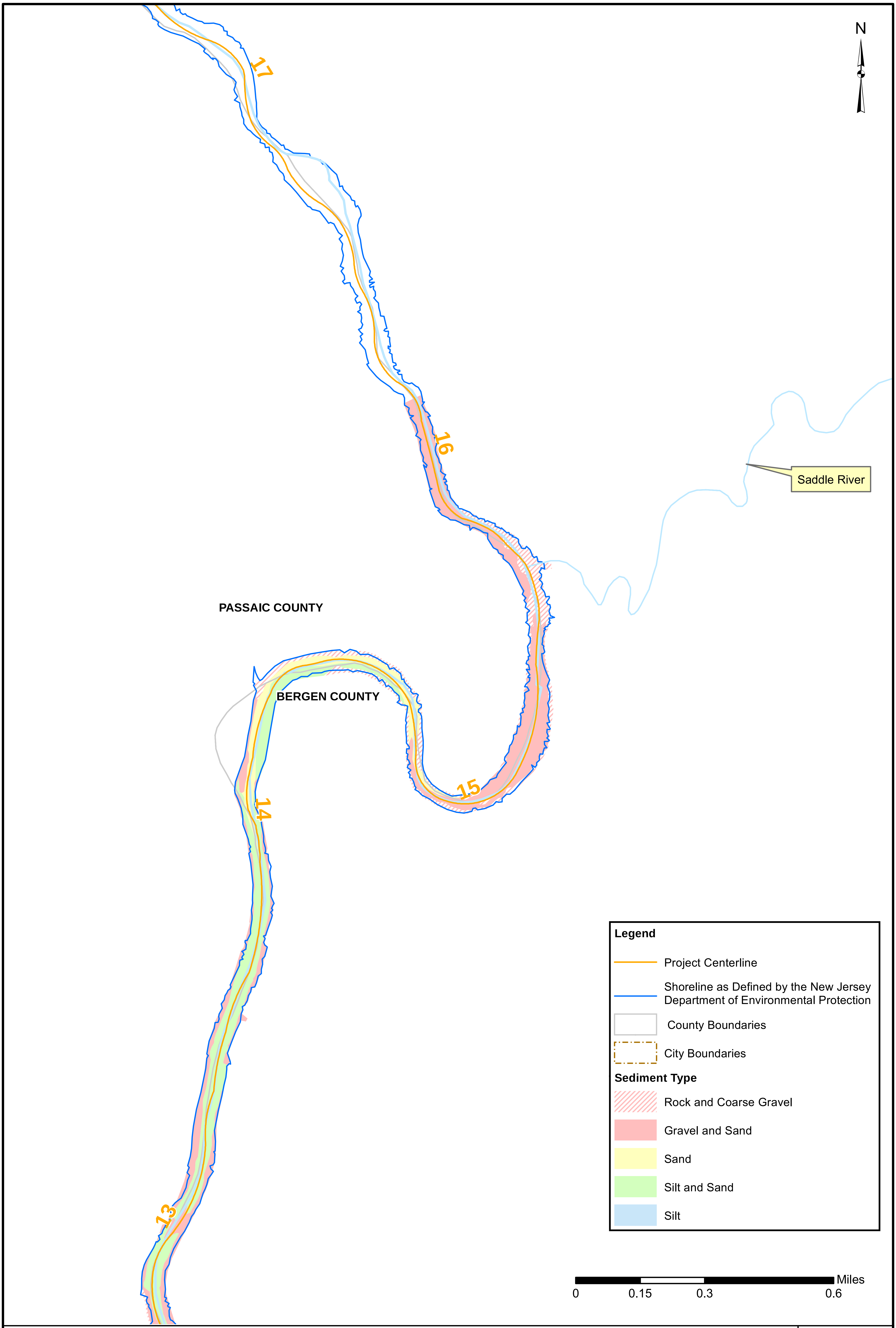
Sediment Texture Type – RM 8 to RM 13

Lower 8.3 Miles of the Lower Passaic River

Figure 2b

2016

Path: S:\Projects\passaic\MapDocuments\Final_FFS_Figures_2014\Figure 1-6 SedimentTexture - base map.mxd



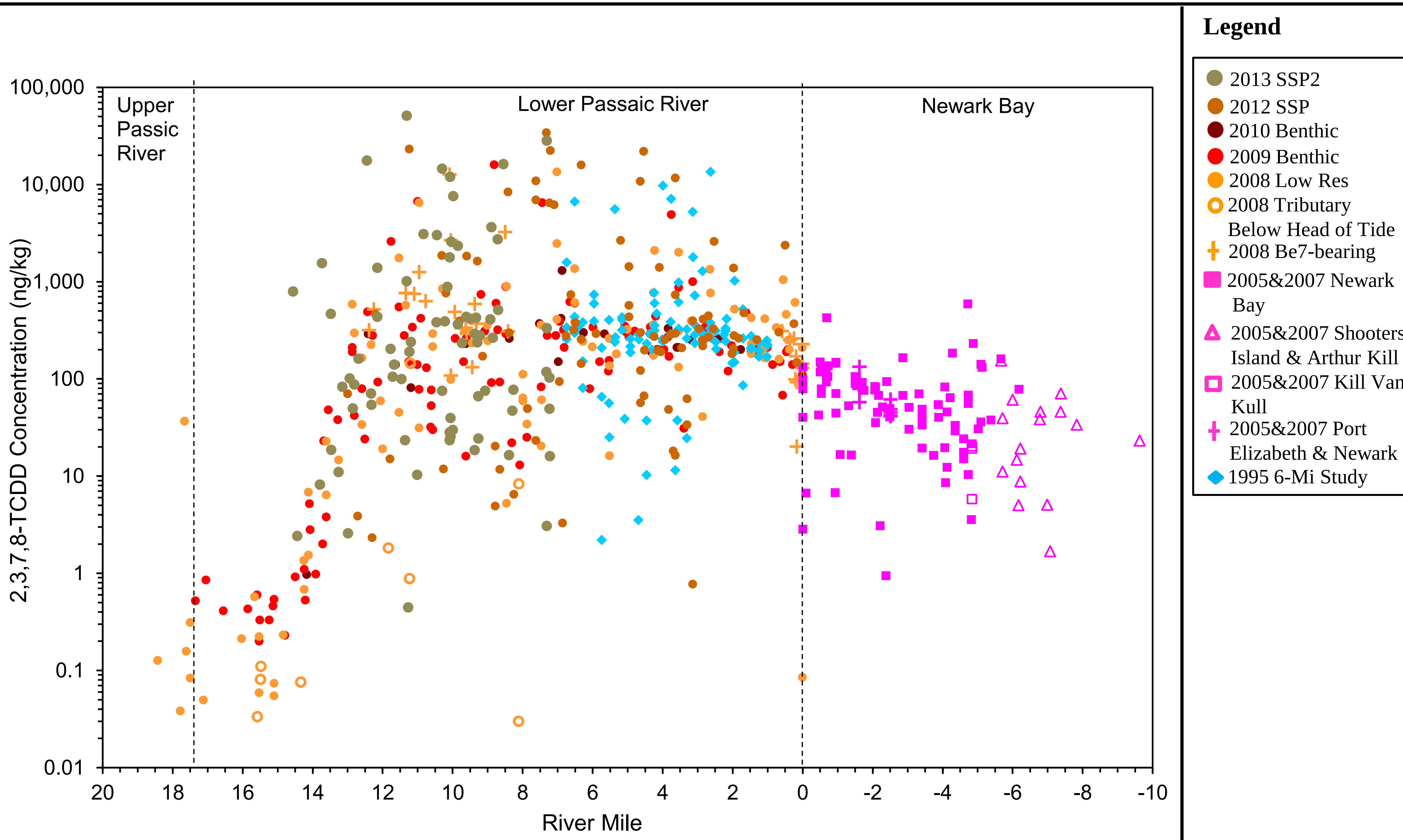
Sediment Texture Type – RM 13 to RM 17

Lower 8.3 Miles of the Lower Passaic River

Figure 2c

2016

Path: S:\Projects\passaic\MapDocuments\Final_FFS_Figures_2014\Figure 1-6 SedimentTexture - base map.mxd



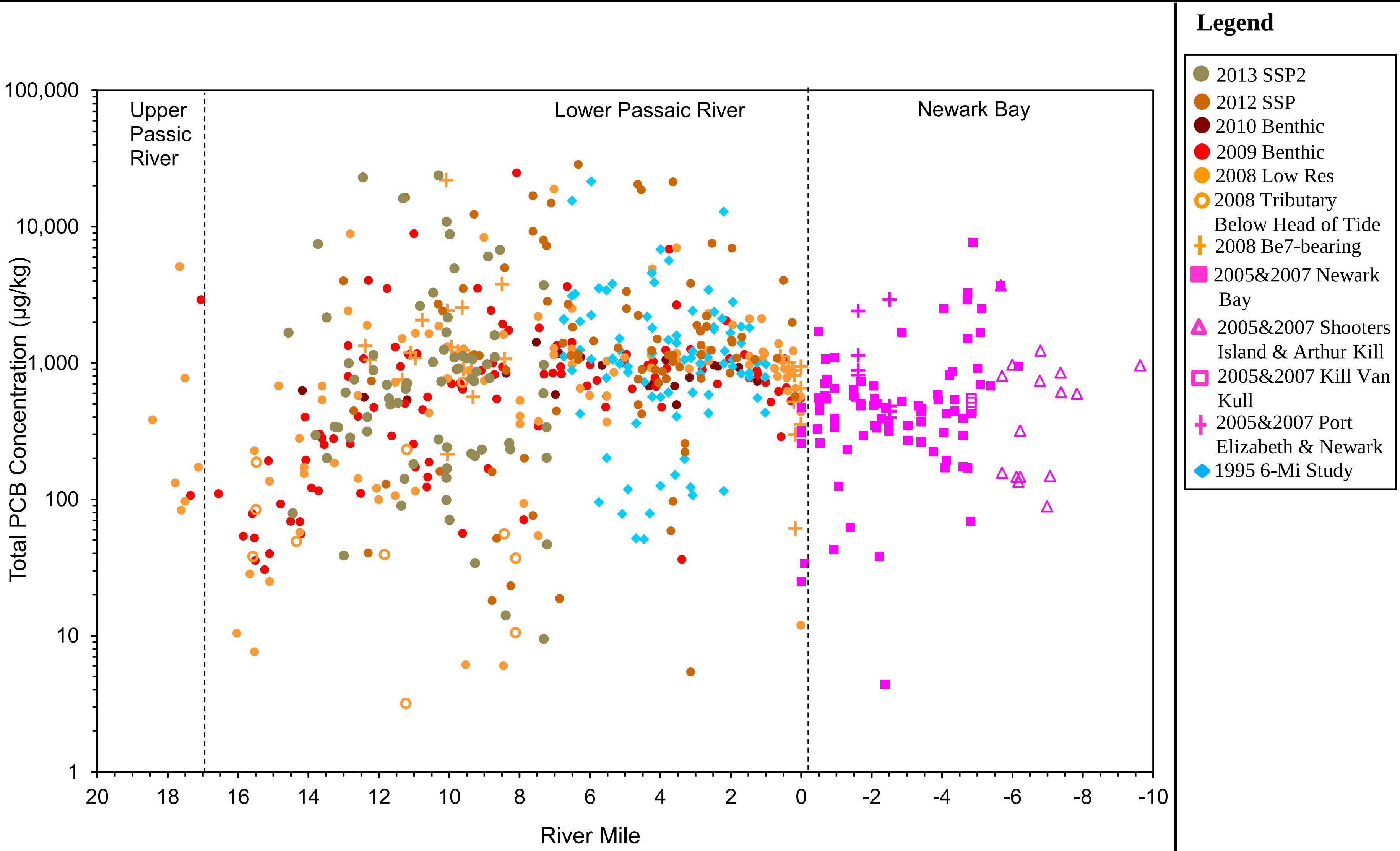
Note: 2,3,7,8-TCDD concentrations generated during the 2008 Low Resolution Coring program were biased low and have been corrected by applying a factor of 1.89 as discussed in the Responsiveness Summary, Appendix V.

2,3,7,8-TCDD Concentration (0-6 inches) vs. River Mile

Figure 3

2016

Lower 8.3 Miles of the Lower Passaic River

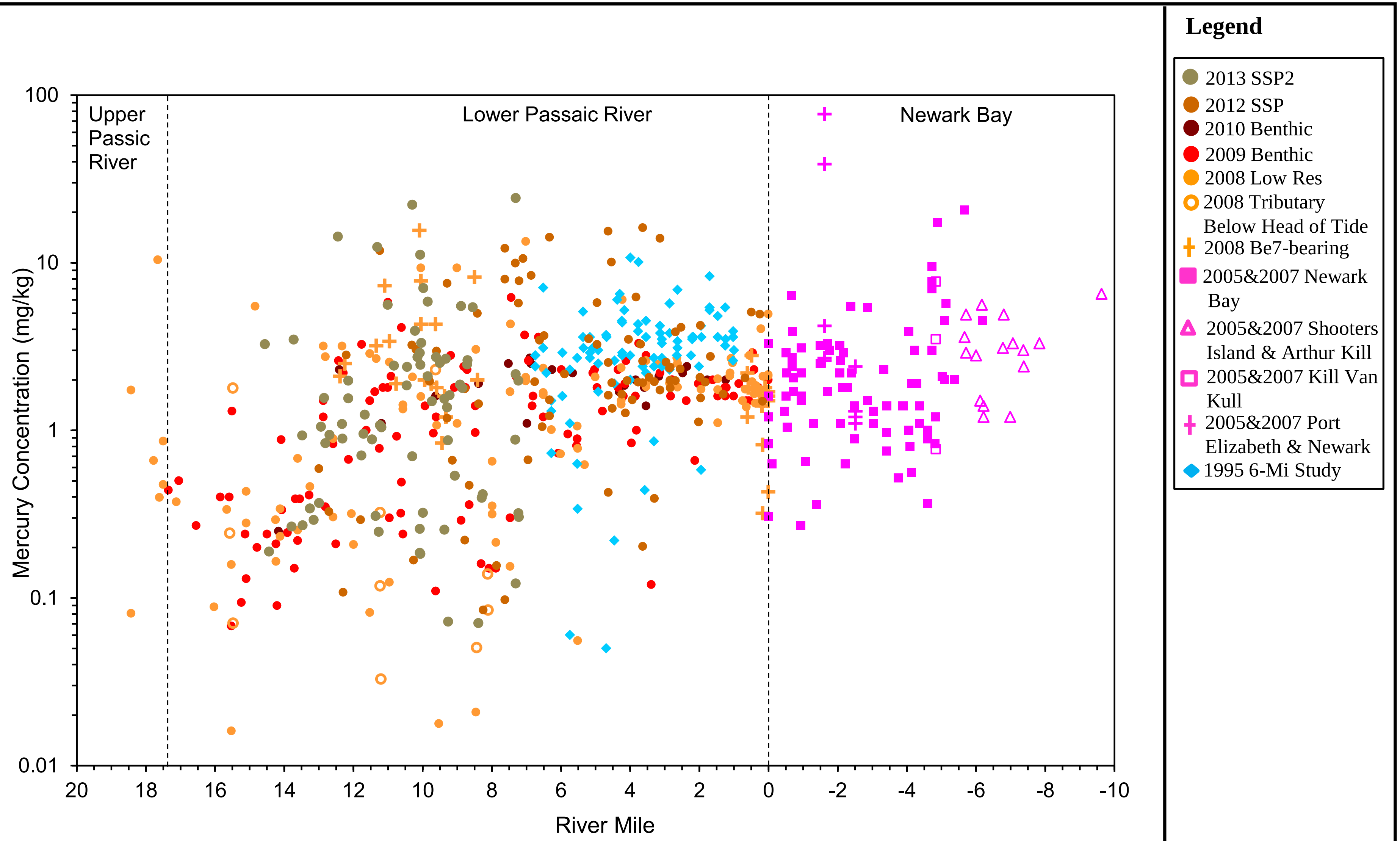


Total PCB Concentration (0-6 inches) vs. River Mile

Figure 4

2016

Lower 8.3 Miles of the Lower Passaic River



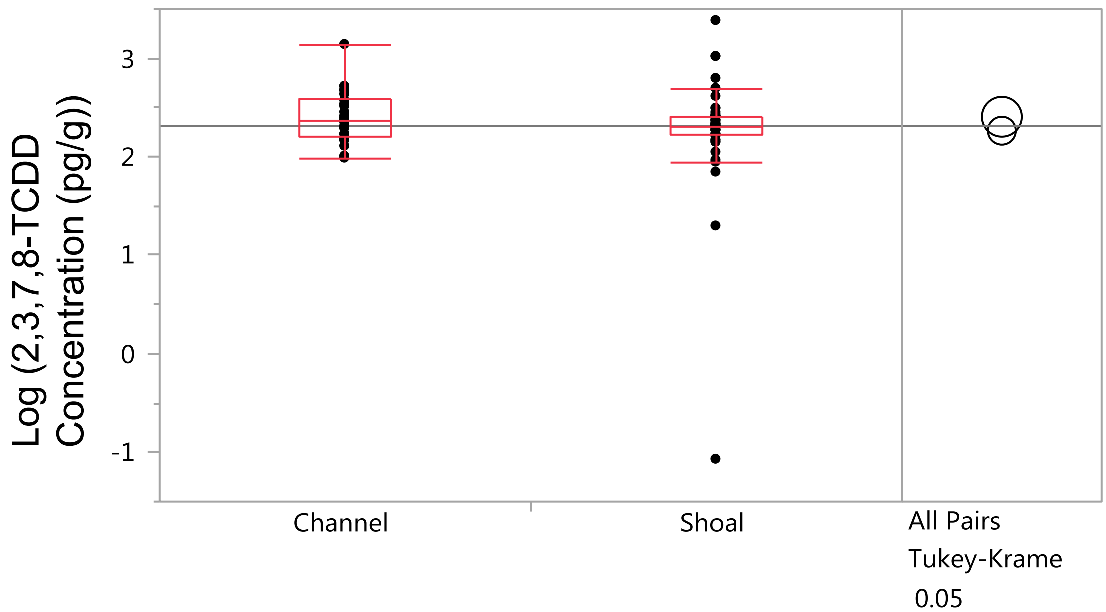
Mercury Concentration (0-6 inches) vs. River Mile

Lower 8.3 Miles of the Lower Passaic River

Figure 5

2016

RM 0 to RM 2



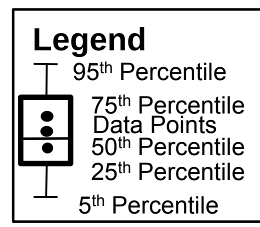
Notes:

1) Horizontal line represents the mean log concentration across all data points, equivalent to the untransformed median concentration.

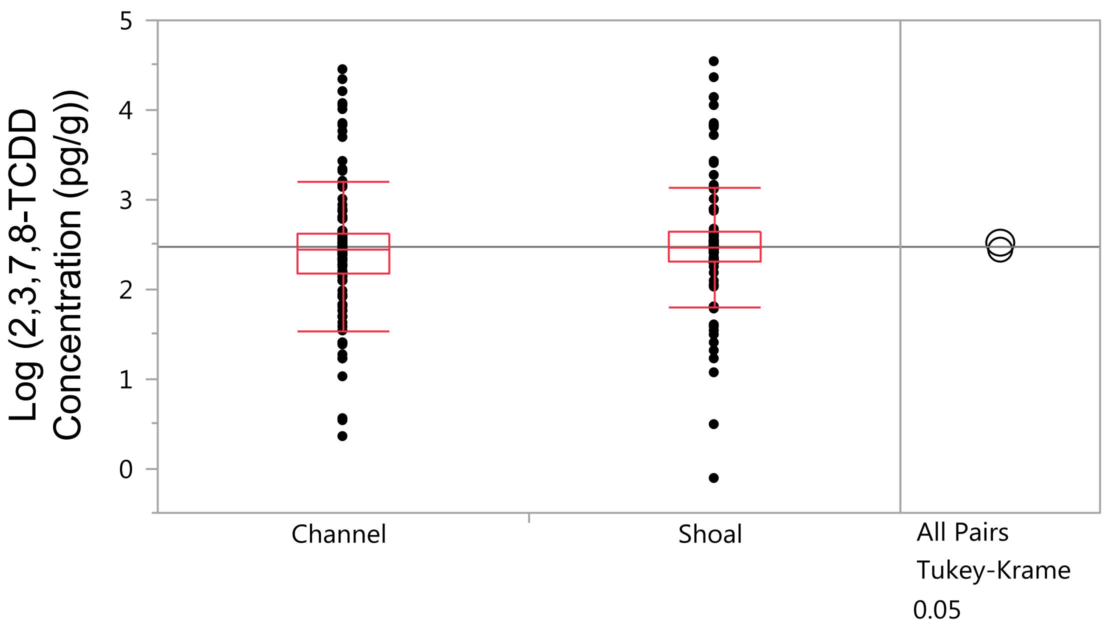
See RI/FFS for explanation of Tukey-Kramer circles.

2) Data included 1995 6-Mi Study, 2008 Be7-bearing, 2008 low res, 2009 benthic, 2010 benthic, 2012 SSP and 2013 SSP2.

3) 2008 Low Resolution Coring data was corrected by applying a factor of 1.89, as discussed in the Responsiveness Summary, Appendix V.

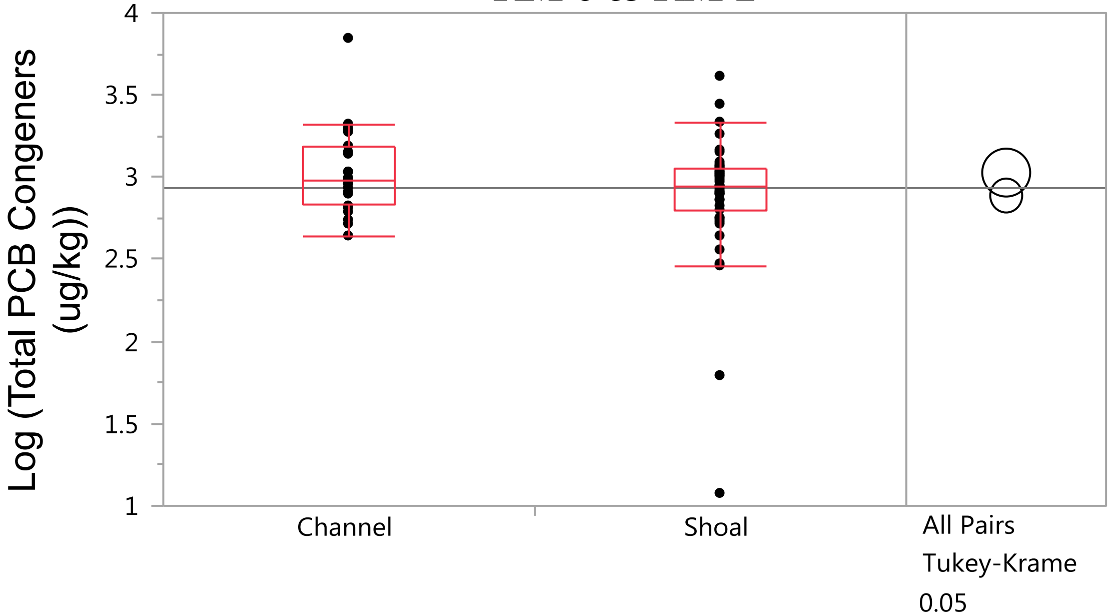


RM 2 to RM 8



2,3,7,8-TCDD Concentrations (0-6 inches) in Channel and Shoals *Lower 8.3 Miles of the Lower Passaic River*	Figure 6 2016

RM 0 to RM 2

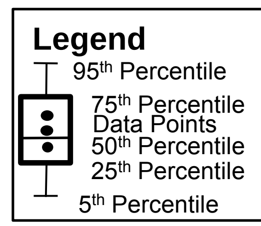


Notes:

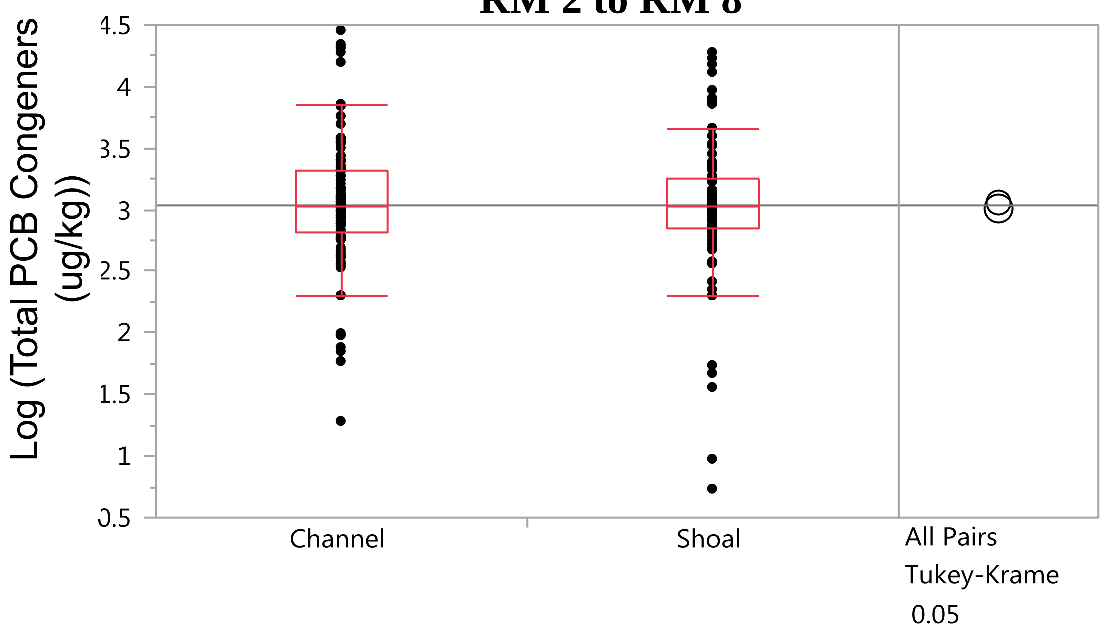
1) Horizontal line represents the mean log concentration across all data points, equivalent to the untransformed median concentration.
See RI/FFS for explanation of Tukey-Kramer circles.

2) Data included 1995 6-Mi Study, 2008 Be7-bearing, 2008 low res, 2009 benthic, 2010 benthic, 2012 SSP and 2013 SSP2.

3) A factor 1.25 was applied to the1995 TPCB concentrations based on matched pairs of congener and Aroclor analysis (see RI/FFS Appendix A for discussion).

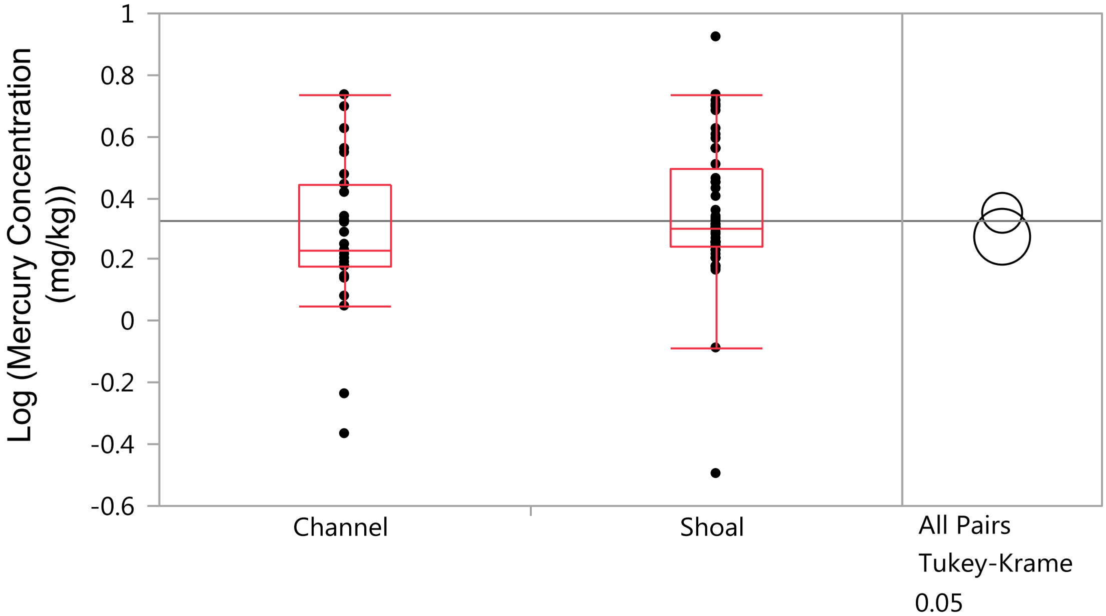


RM 2 to RM 8

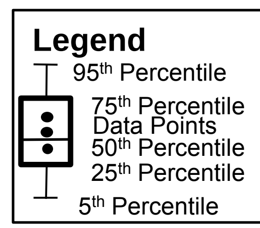


Total PCB Concentrations (0-6 inches) in Channel and Shoals	Figure 7
Lower 8.3 Miles of the Lower Passaic River	2016

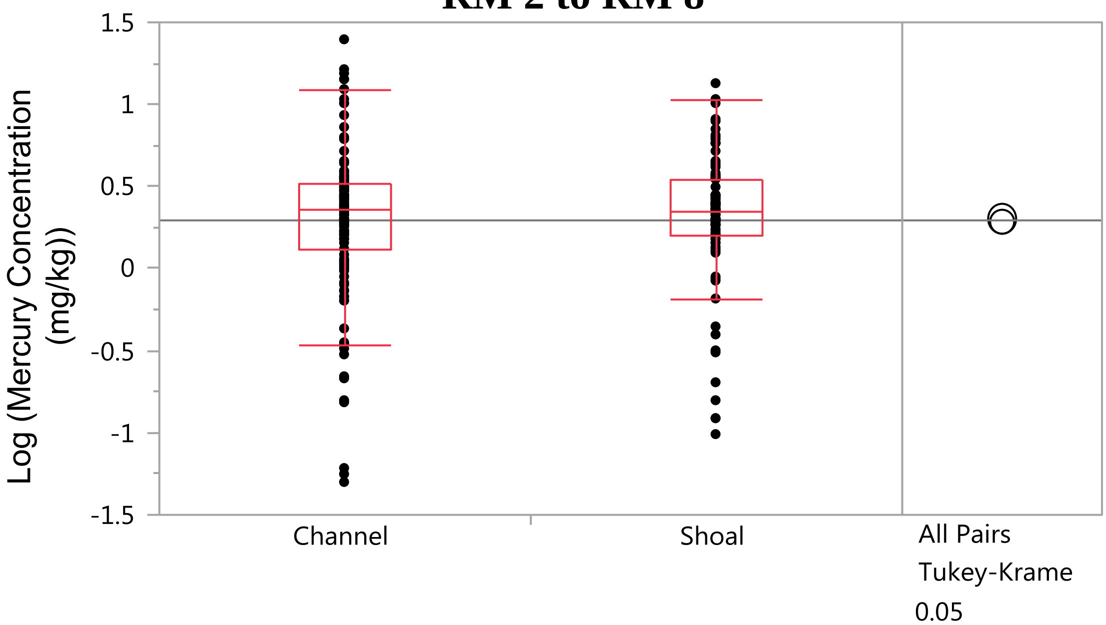
RM 0 to RM 2



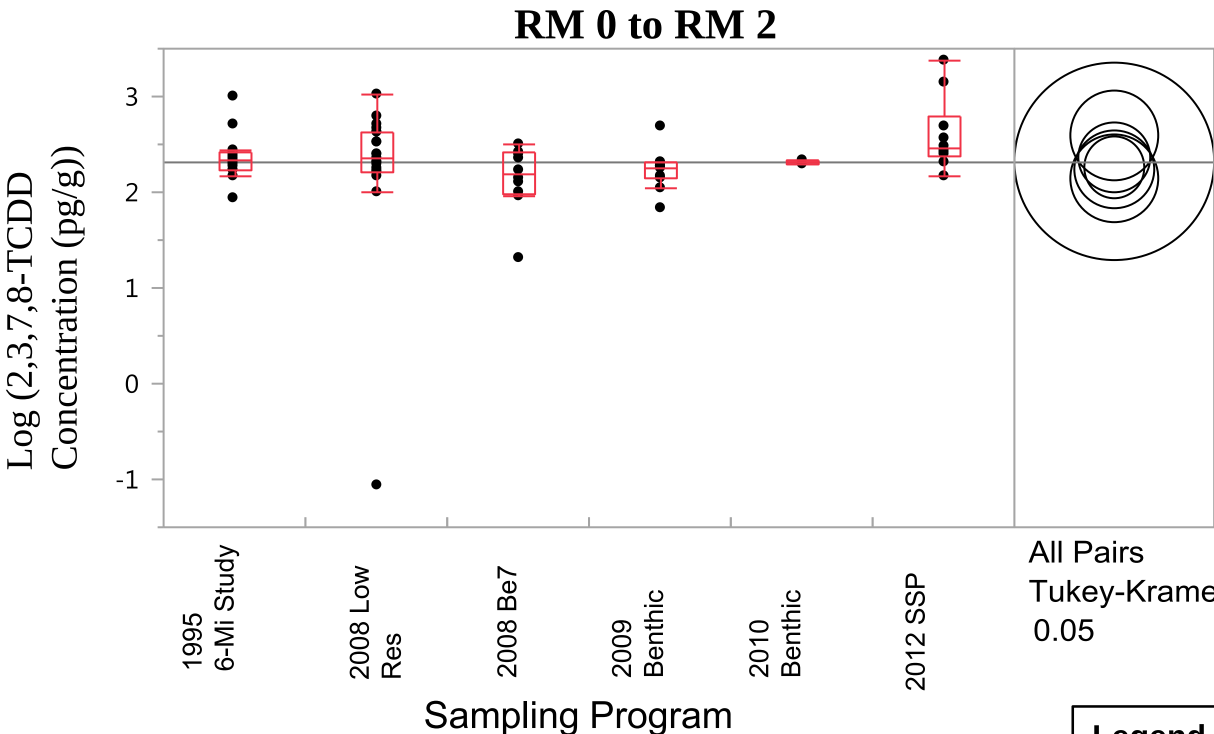
Notes:
1) Horizontal line represents the mean log concentration across all data points, equivalent to the untransformed median concentration.
See RI/FFS for explanation of Tukey-Kramer circles.
2) Data included 1995 6-Mi Study, 2008 Be7-bearing, 2008 low res, 2009 benthic, 2010 benthic, 2012 SSP and 2013 SSP2



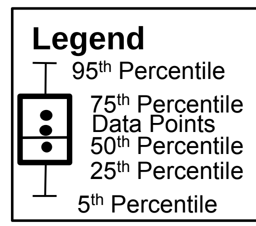
RM 2 to RM 8

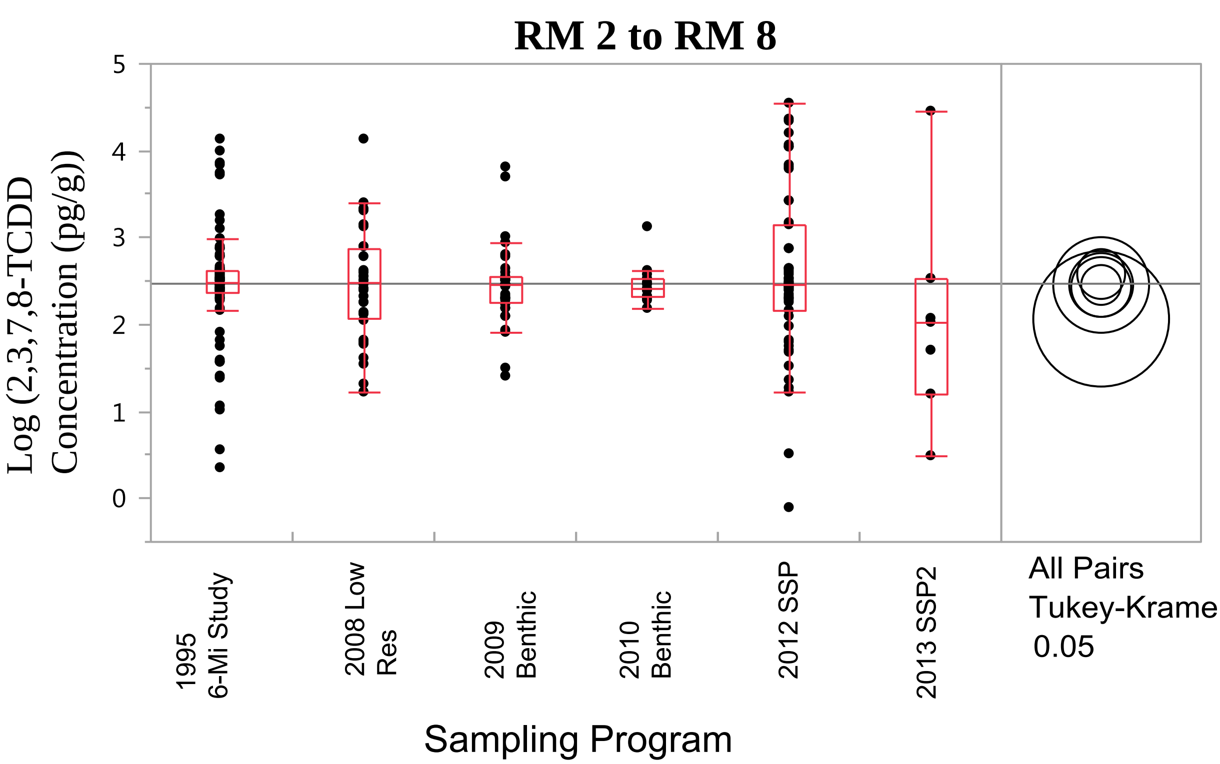


Mercury Concentrations (0-6 inches) in Channel and Shoals *Lower 8.3 Miles of the Lower Passaic River*	Figure 8 2016

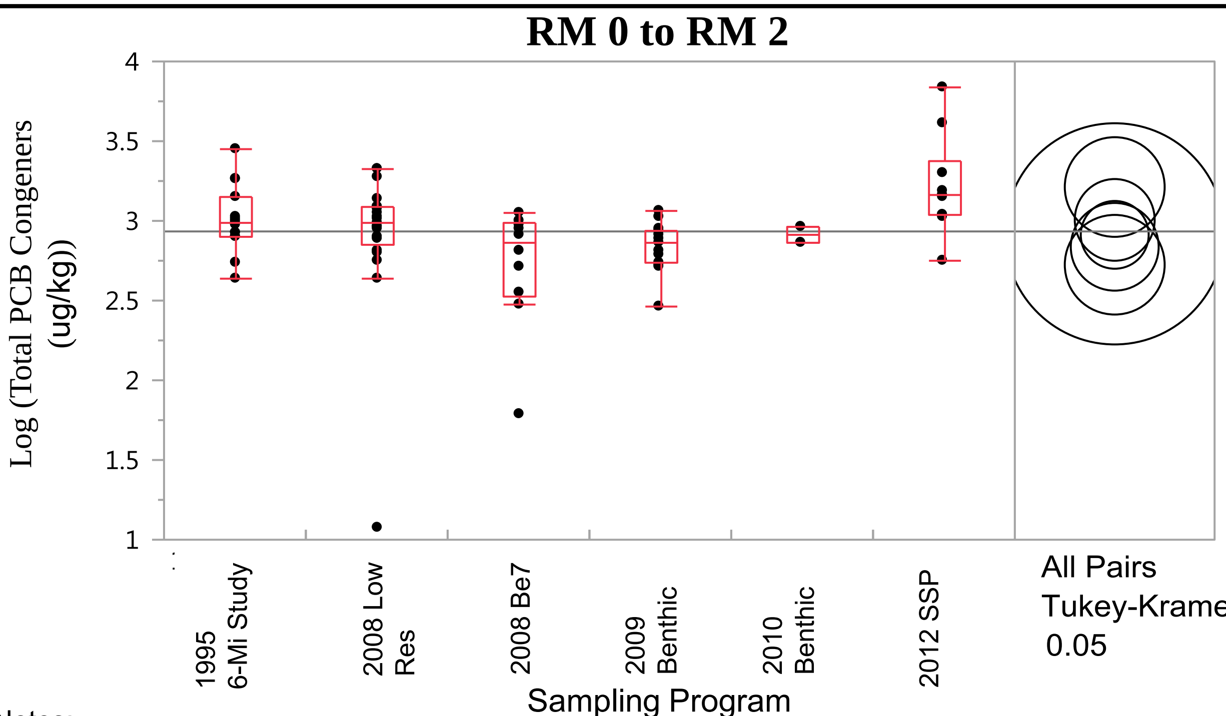


Notes: 1) Horizontal line represents the mean log concentration across all data points, equivalent to the untransformed median concentration.
See RI/FFS for explanation of Tukey-Kramer circles.
2) 2008 Low Resolution Coring data was corrected by applying a factor of 1.89, as discussed in the Responsiveness Summary, Appendix V.





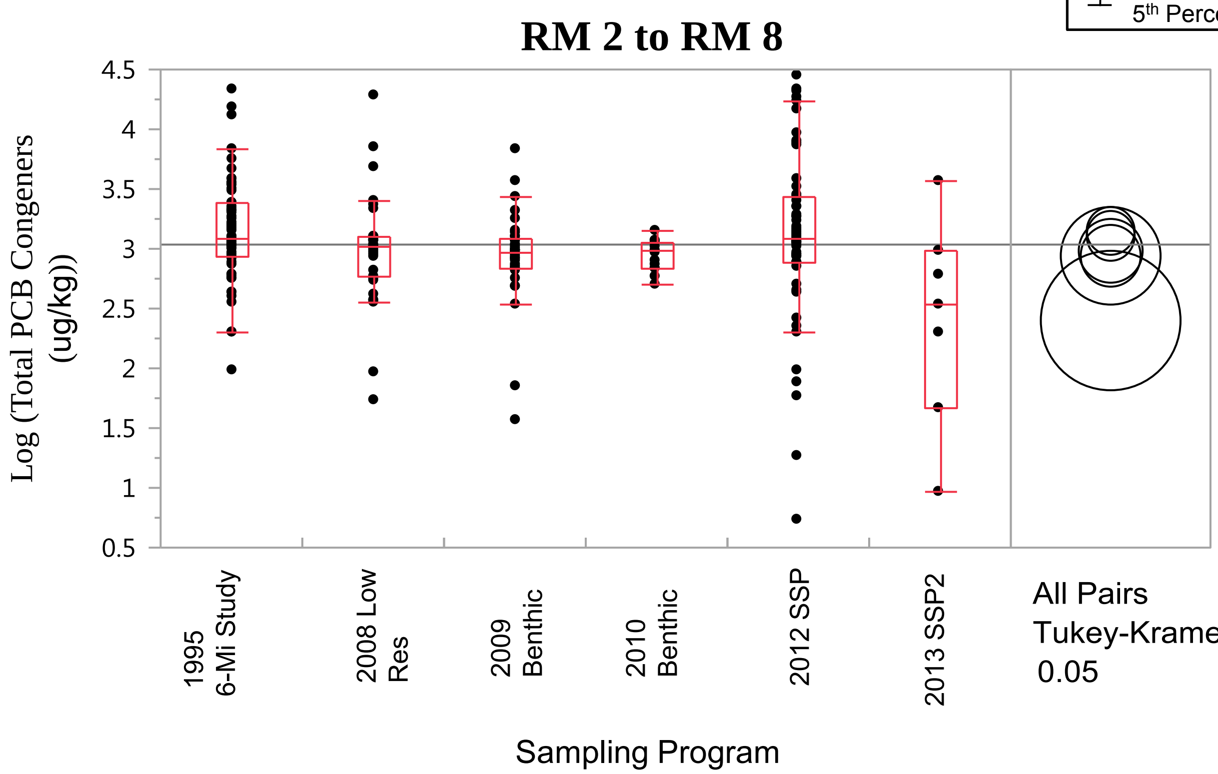
2,3,7,8-TCDD Concentrations (0-6 inches) Over Time	Figure 9
Lower 8.3 Miles of the Lower Passaic River	2016



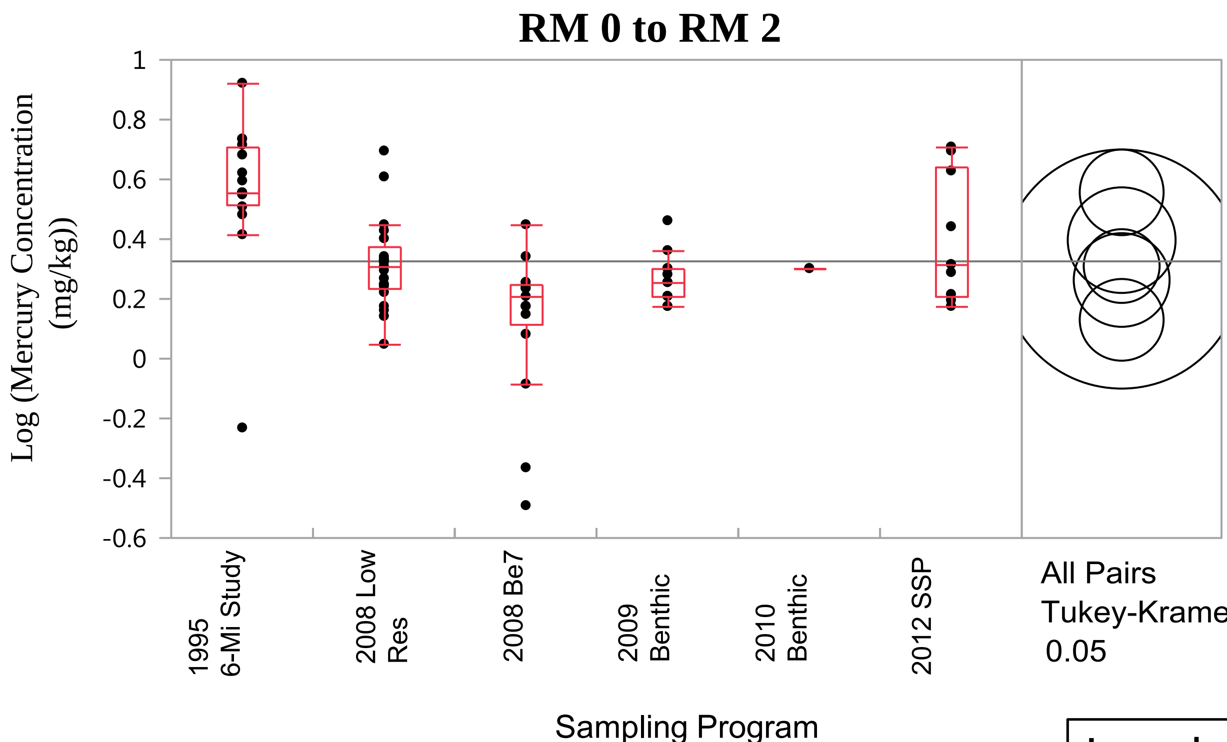
Notes:
1) Horizontal line represents the mean log concentration across all data points, equivalent to the untransformed median concentration.
See RI/FFS for explanation of Tukey-Kramer circles.
2) A factor 1.25 was applied to the1995 6-Mi Study concentrations based on matched pairs of congener and Aroclor analysis (see RI/FFS Appendix A for discussion).

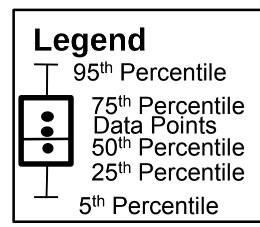
Legend

- 95th Percentile
- 75th Percentile
- Data Points
- 50th Percentile
- 25th Percentile
- 5th Percentile

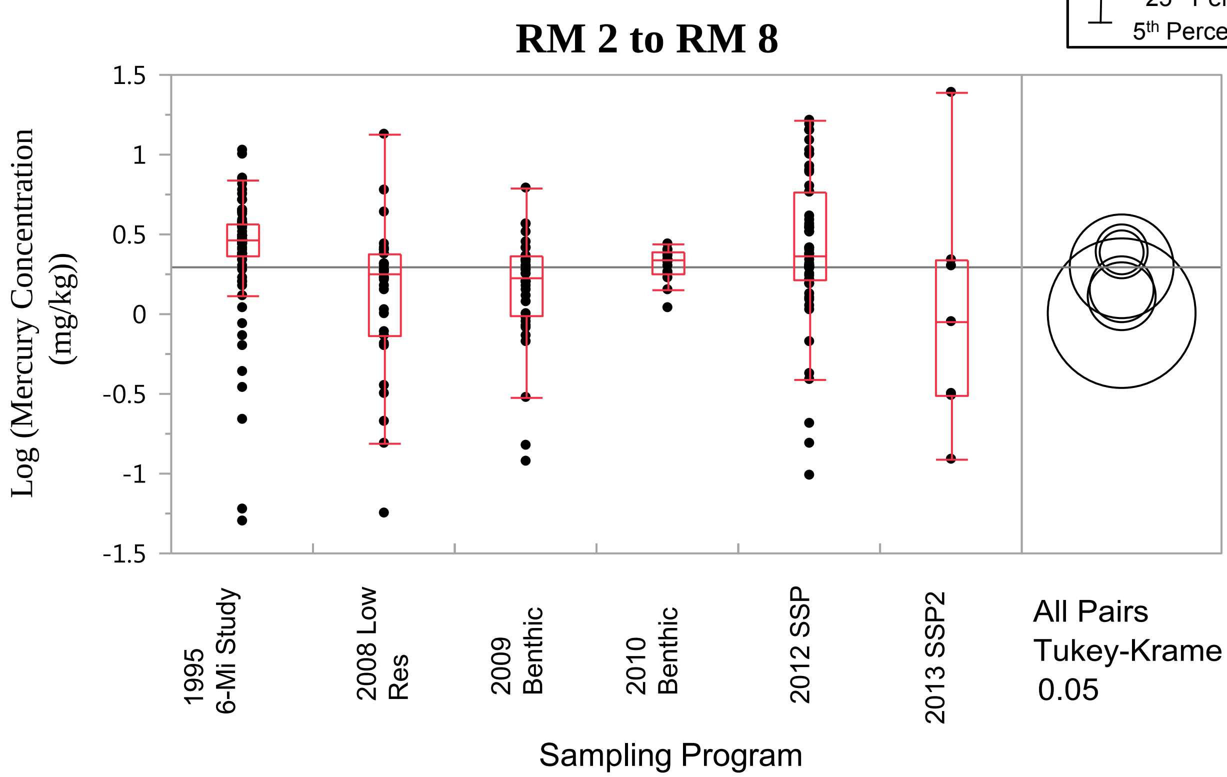


Total PCB Concentrations (0-6 inches) Over Time	Figure 10
Lower 8.3 Miles of the Lower Passaic River	2016





Note: Horizontal line represents the mean log concentration across all data points, equivalent to the untransformed median concentration.
See RI/FFS for explanation of Tukey-Kramer circles..

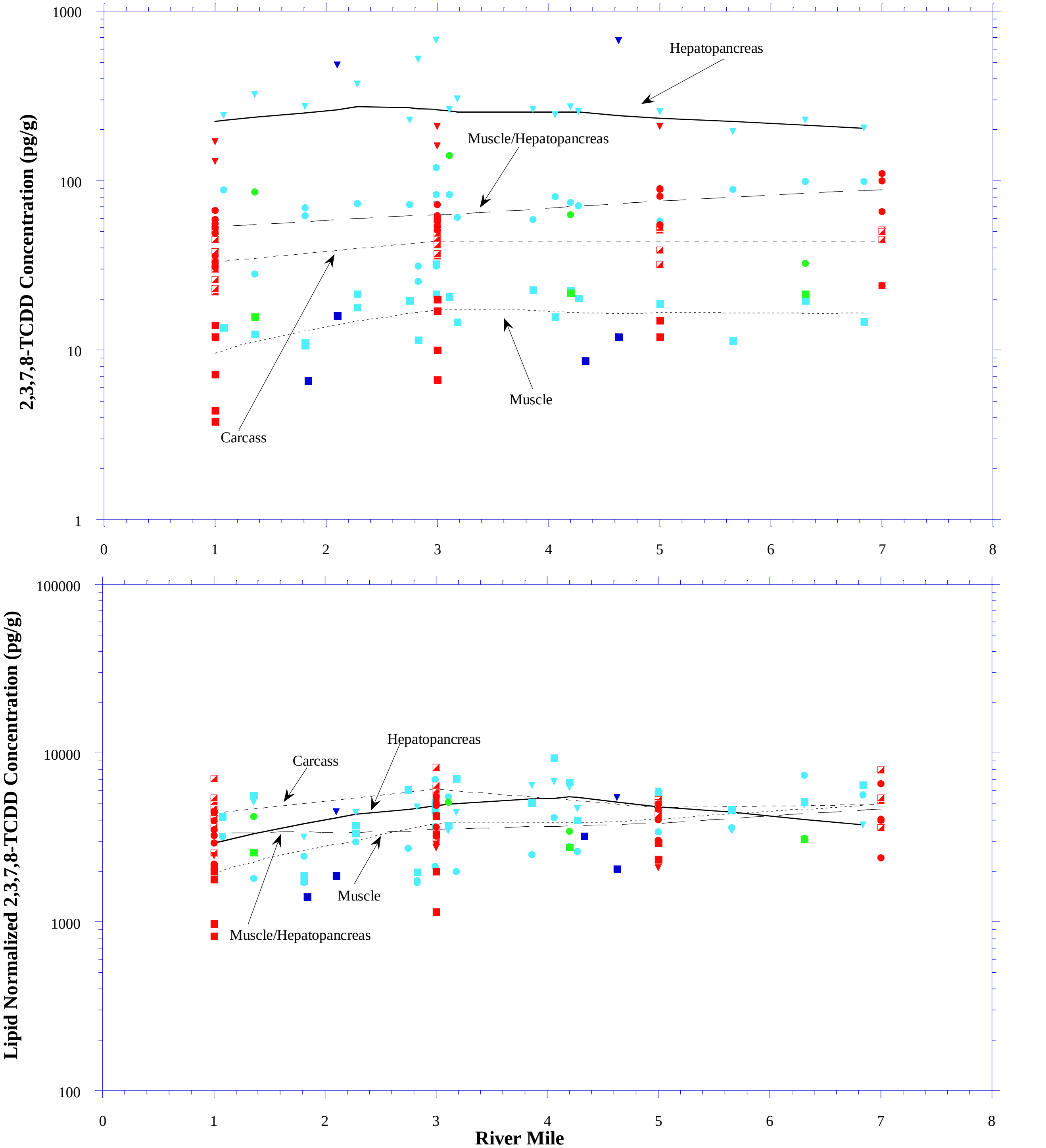


Mercury Concentrations (0-6 inches) Over Time

Lower 8.3 Miles of the Lower Passaic River

Figure 11

2016



Legend

Tissue Sampling Year		Tissue Type	
●	1995	▼	Hepatopancreas
●	1999	■	Muscle
●	2000	●	Muscle/ Hepatopancreas
●	2009	◪	Carcass

Notes

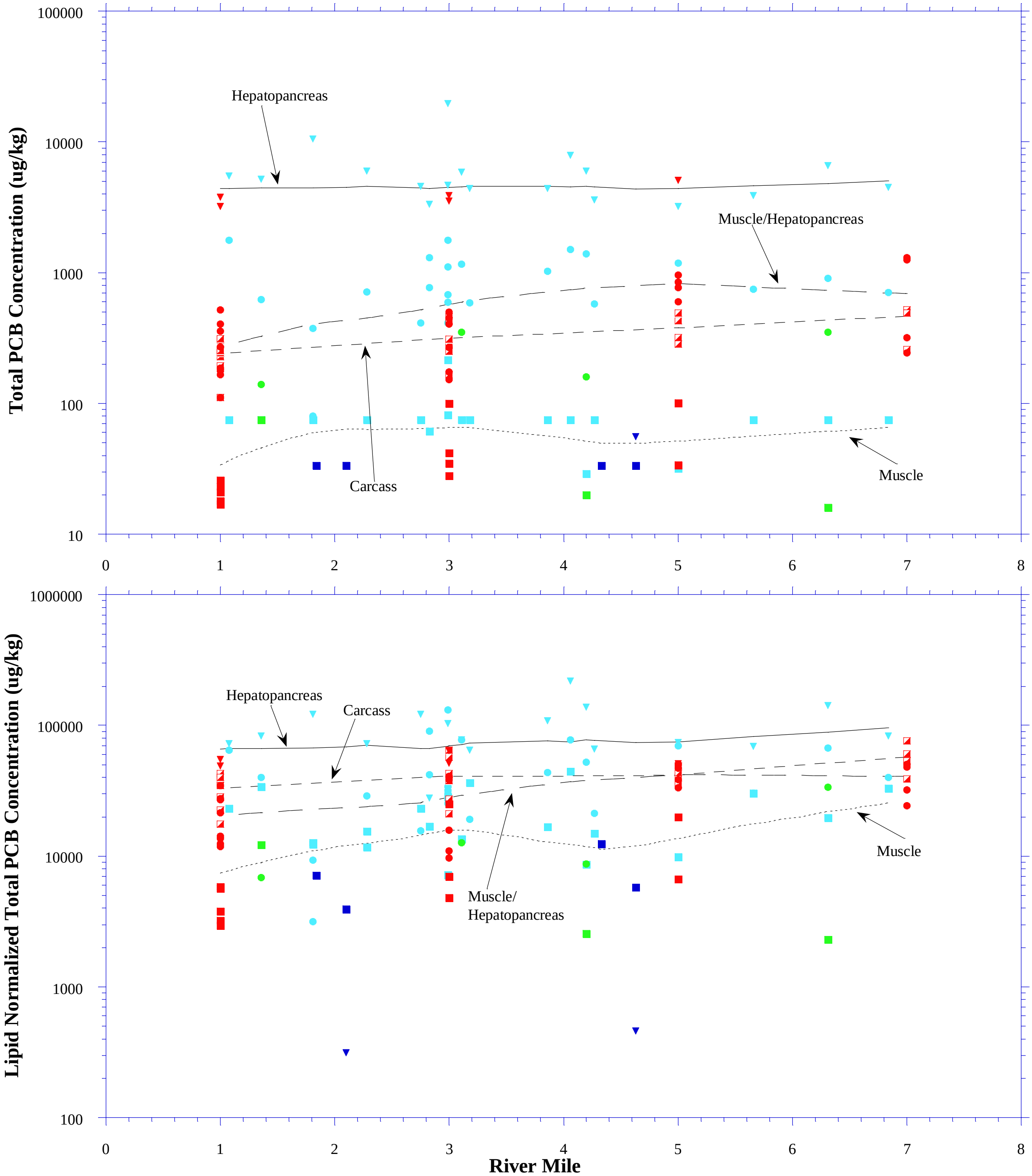
1. Fit Lines are weighted curves for illustration purpose only. These curves are based on all available data for given tissue types.
2. Muscle/Hepatopancreas tissue type includes muscle/hepatopancreas, all edible tissue and whole body – soft tissue.
3. Muscle tissue includes muscle, edible muscle and muscle tissue.

Blue Crab 2,3,7,8-TCDD Concentration vs. River Mile

Lower 8.3 Miles of the Lower Passaic River

Figure 12

2016



Legend

Tissue Sampling Year		Tissue Type	
●	1995	▼	Hepatopancreas
●	1999	■	Muscle
●	2000	●	Muscle/ Hepatopancreas
●	2009	◪	Carcass

Notes

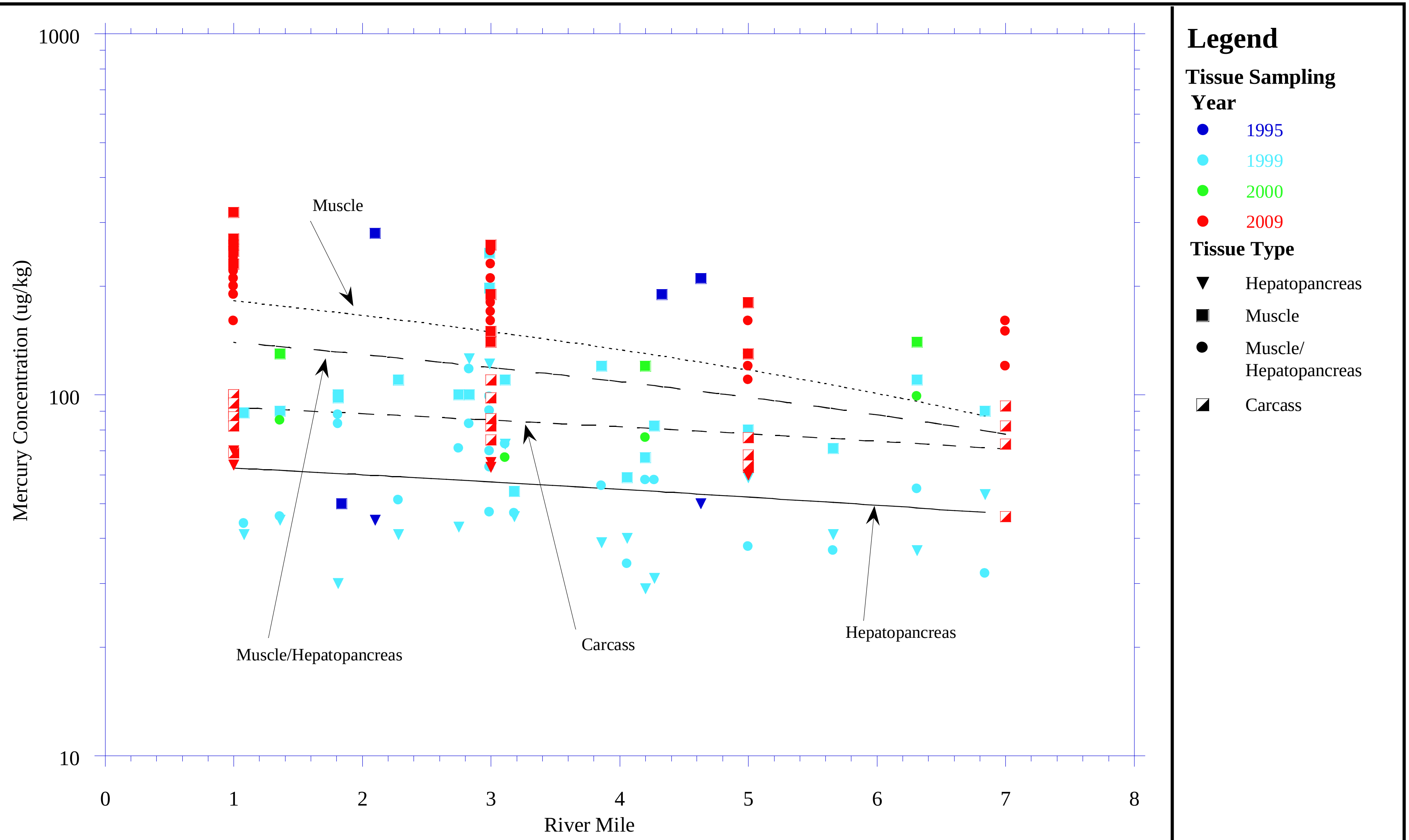
1. Fit Lines are weighted curves for illustration purpose only. These curves are based on all available data for given tissue types.
2. Muscle/Hepatopancreas tissue type includes muscle/hepatopancreas, all edible tissue and whole body – soft tissue.
3. Muscle tissue includes muscle, edible muscle and muscle tissue.

Blue Crab Total PCB Concentration vs. River Mile

Lower 8.3 Miles of the Lower Passaic River

Figure 13

2016



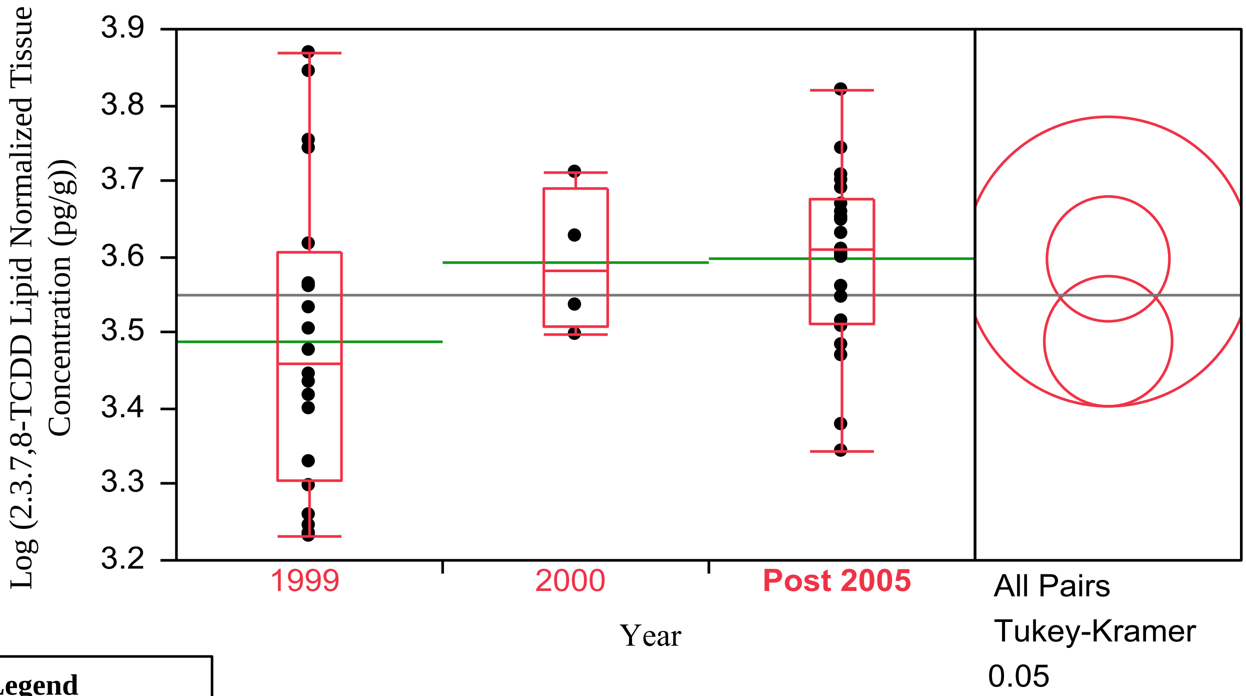
Notes:
1) Mucle/Hepatopancreas tissue type includes muscle/hepatopancreas, all edible tissue and whole body - soft tissue.
2) Muscle tissue type includes edible muscle, muscle and muscle tissue.

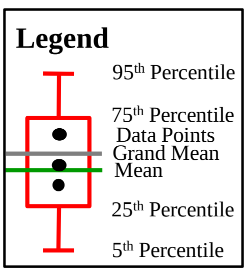
Blue Crab Mercury Concentration vs. River Mile

Lower 8.3 Miles of the Lower Passaic River

Figure 14

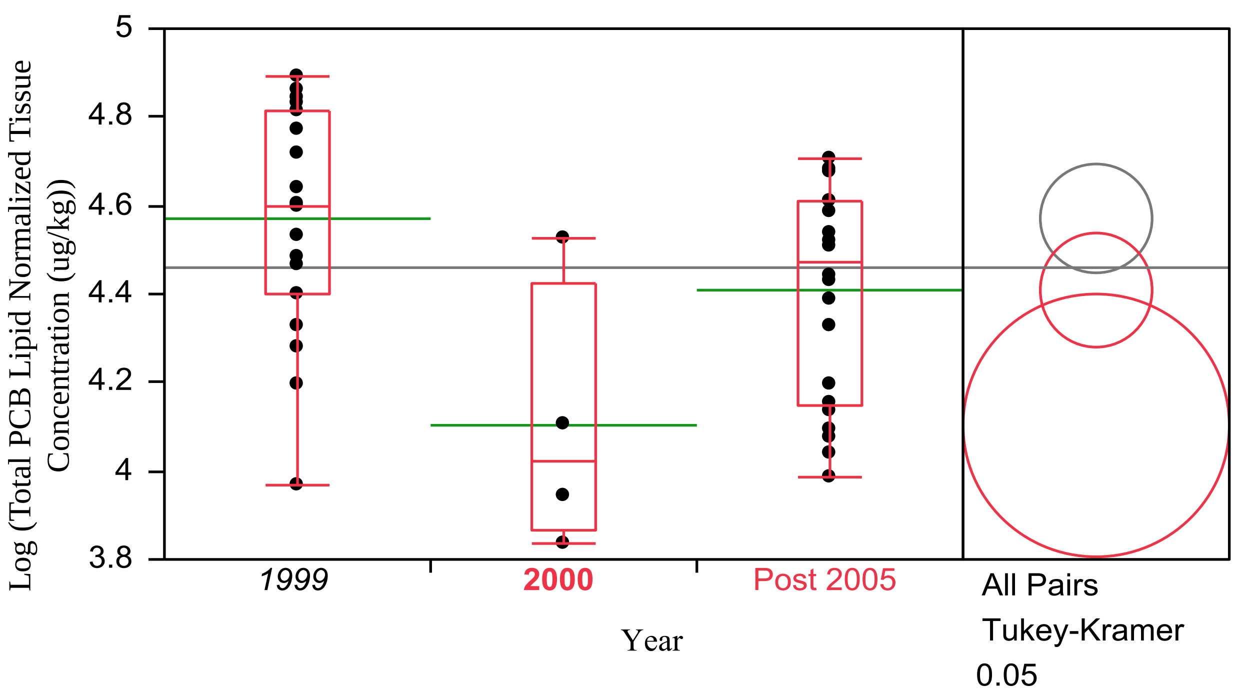
2016



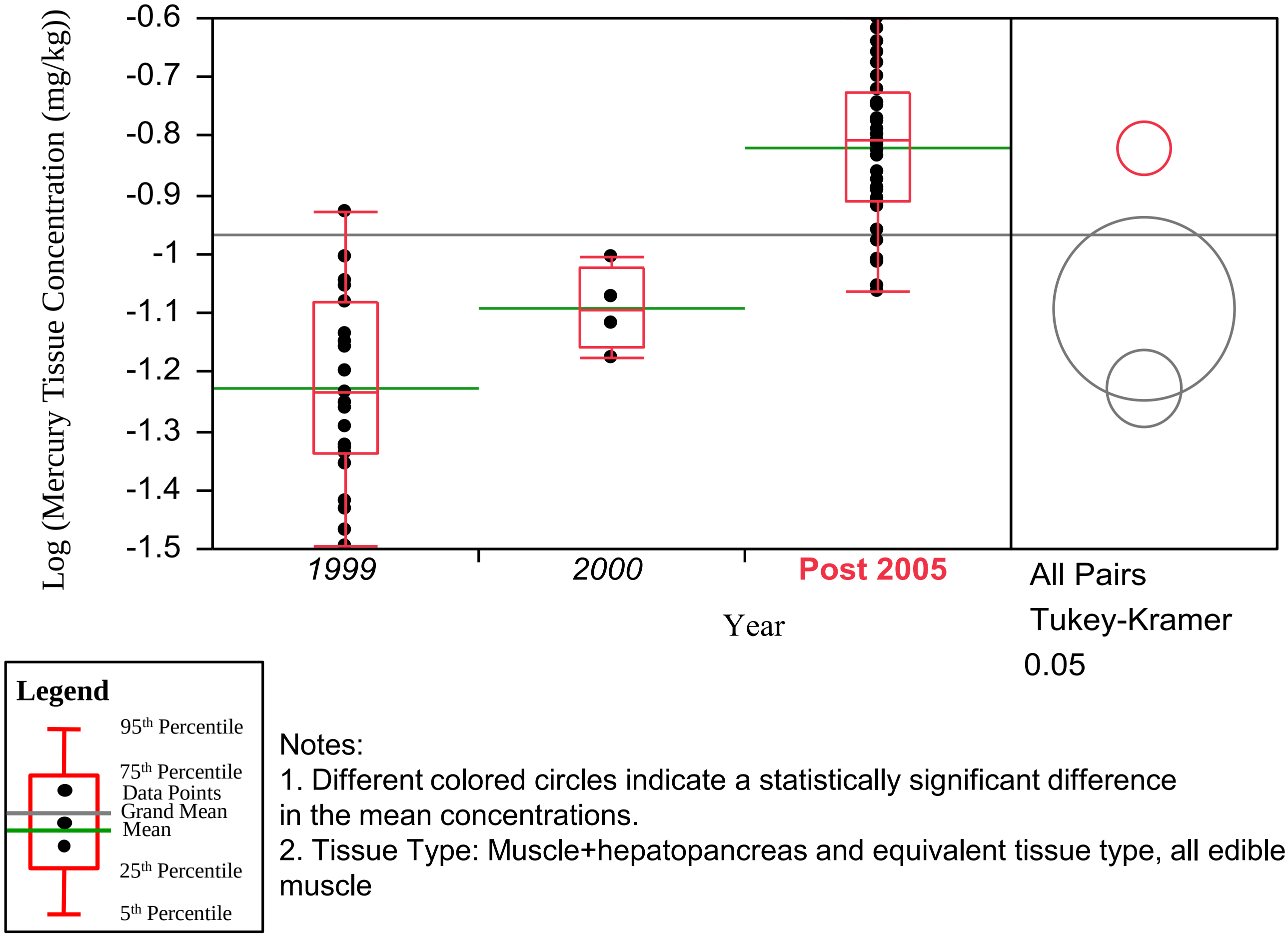


Notes:

1. Different colored circles indicate a statistically significant difference in the mean concentrations.
2. Tissue Type: Muscle+hepatopancreas and equivalent tissue type, all edible muscle



Blue Crab 2,3,7,8-TCDD and Total PCB Concentrations Over Time *Lower 8.3 Miles of the Lower Passaic River*	Figure 15 2016



Notes:

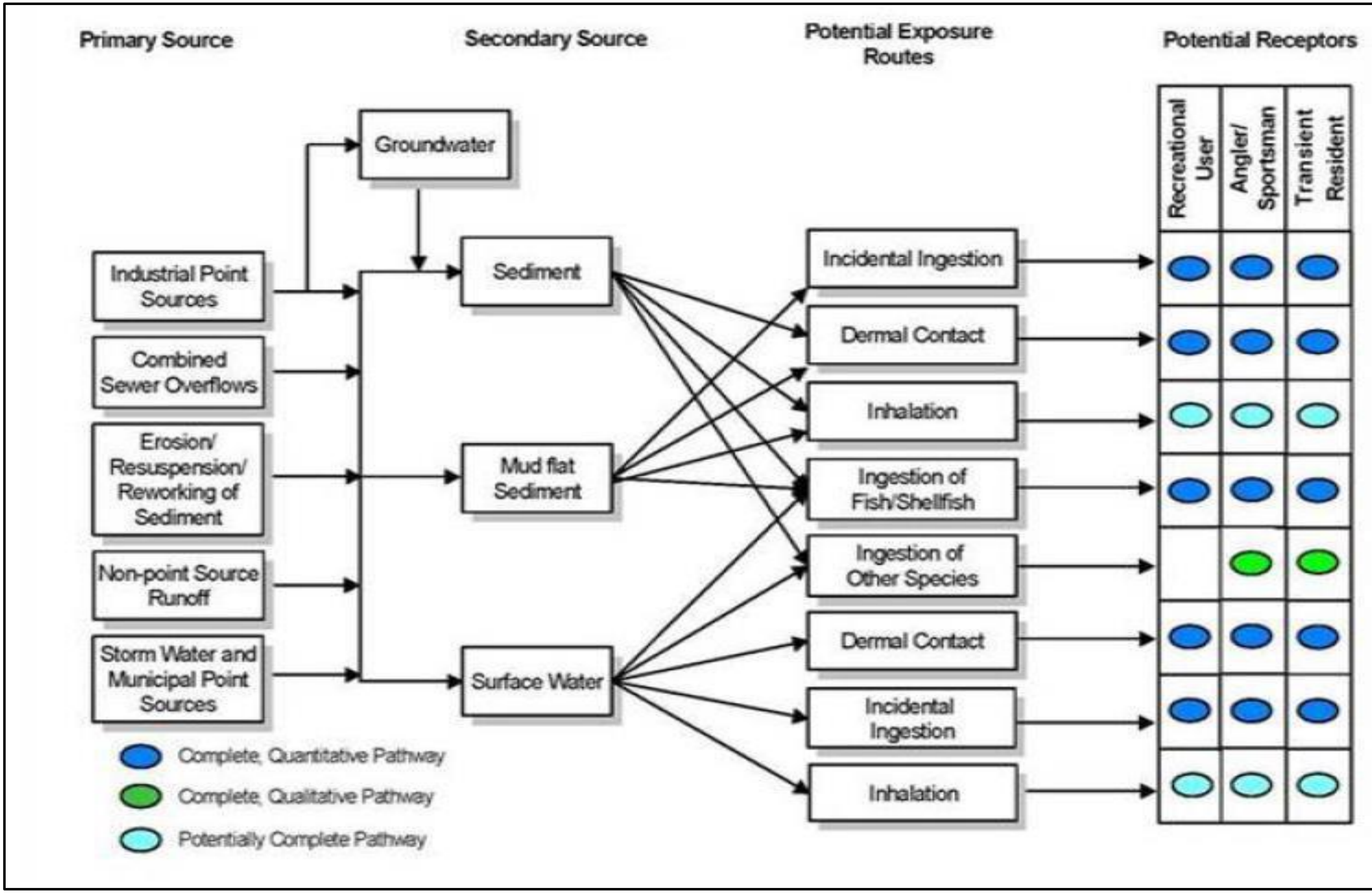
1. Different colored circles indicate a statistically significant difference in the mean concentrations.
2. Tissue Type: Muscle+hepatopancreas and equivalent tissue type, all edible muscle

Blue Crab Mercury Concentrations Over Time

Lower 8.3 Miles of the Lower Passaic River

Figure 16

2016

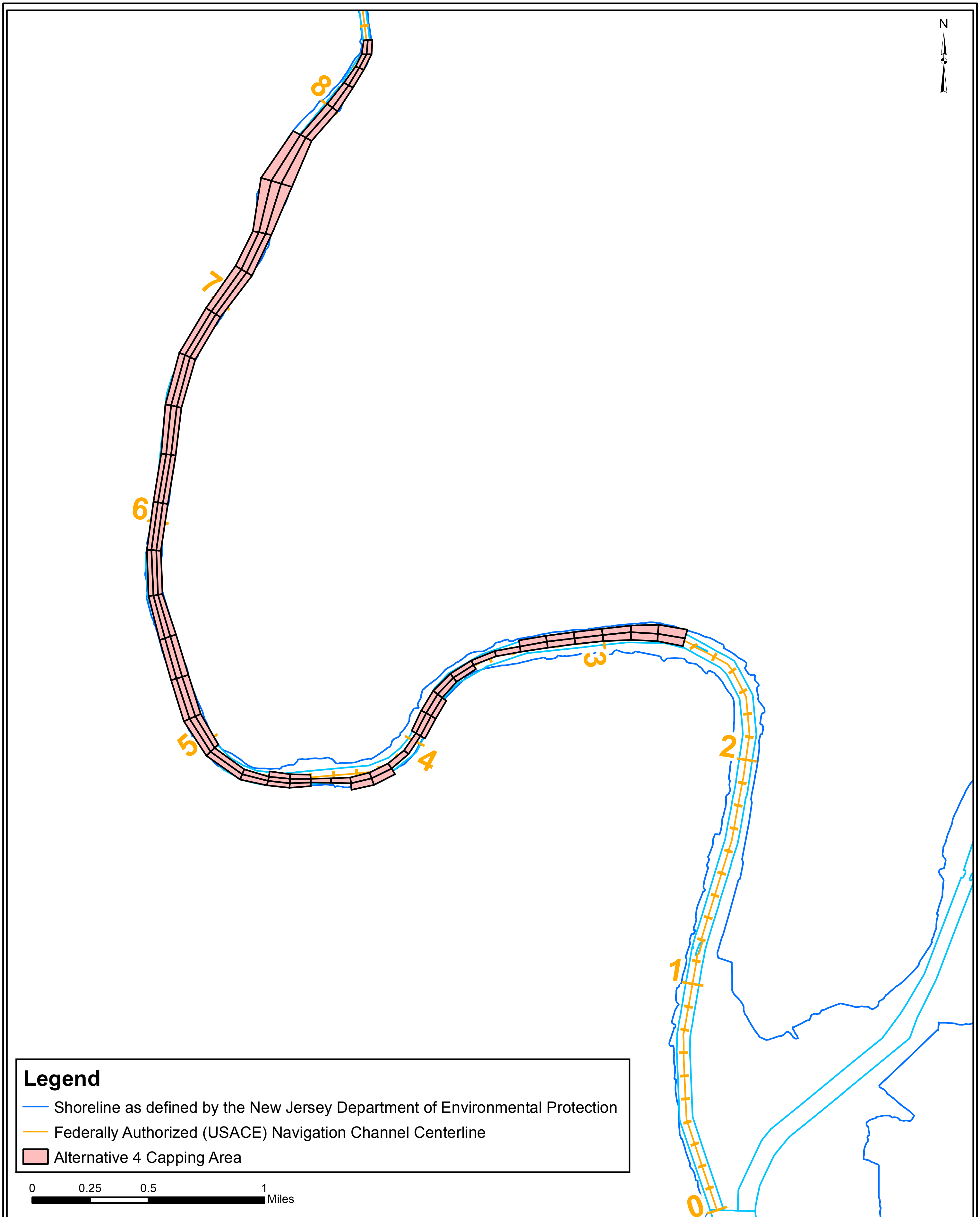


Conceptual Site Model of Potential Human Exposure to COCs

Figure 17

2016

Lower 8.3 Miles of the Lower Passaic River

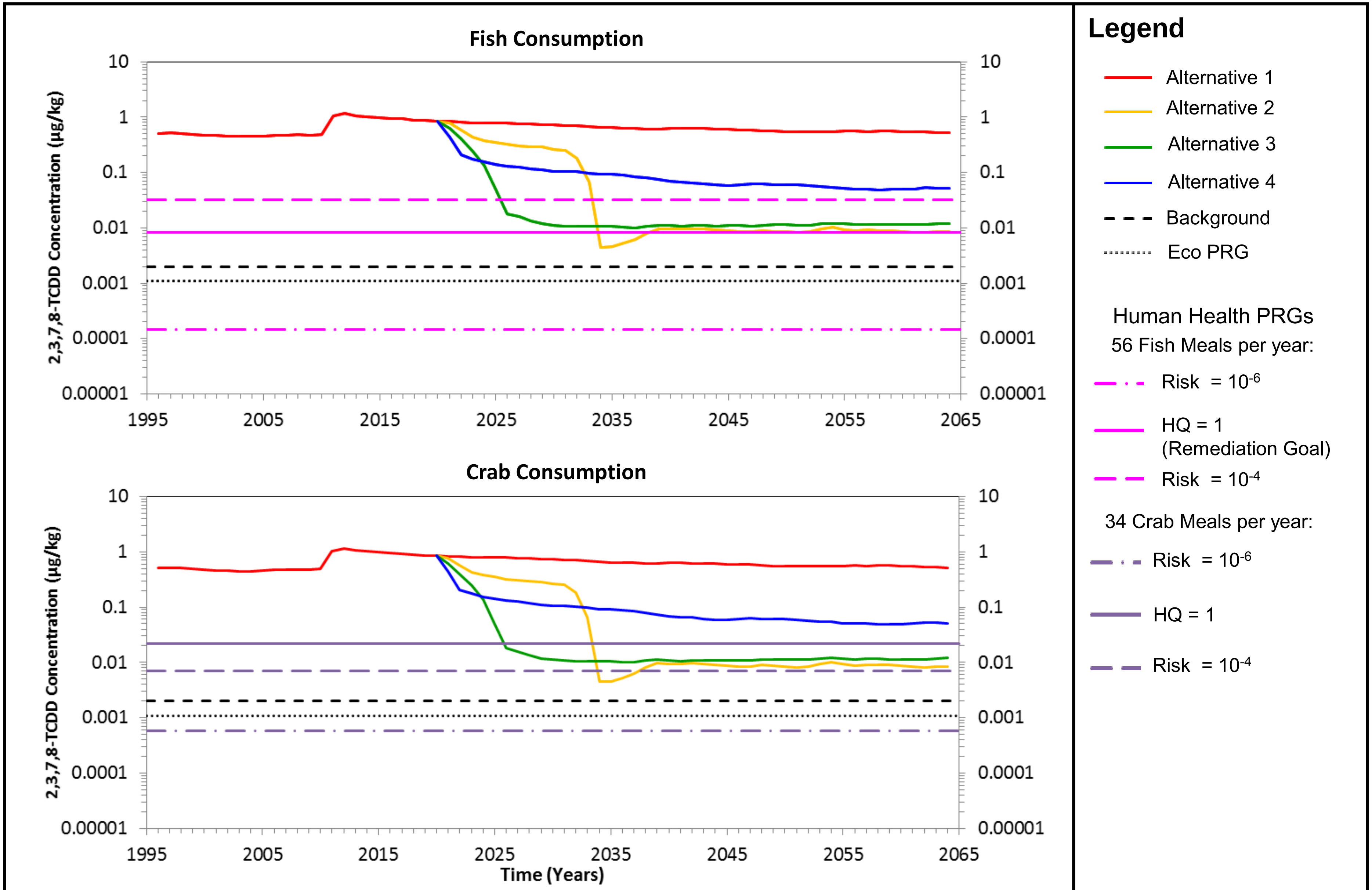


Capping Areas for Alternative 4

Lower 8.3 Miles of the Lower Passaic River

Figure 18

2016

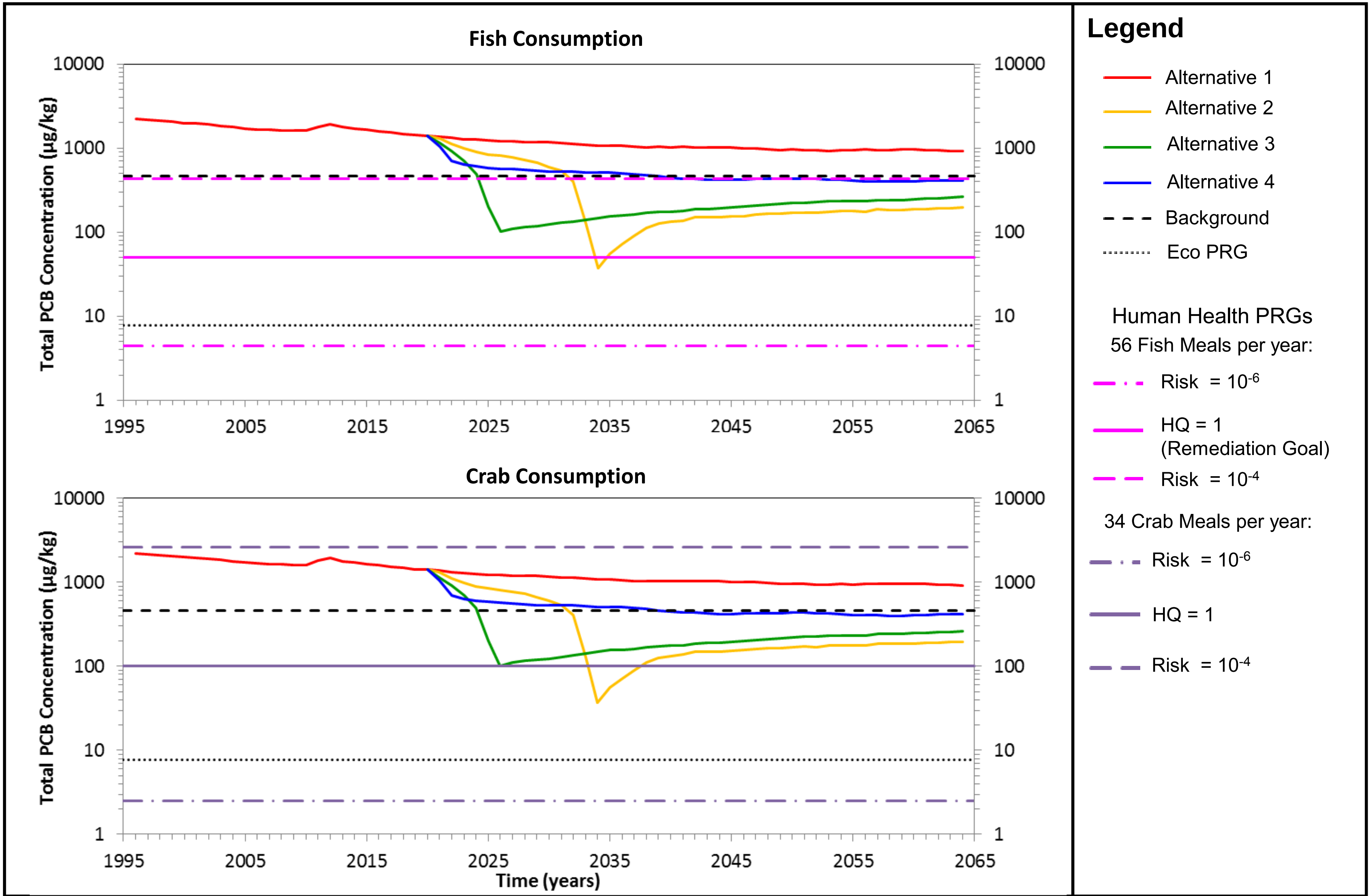


Average 2,3,7,8-TCDD Concentrations in Surface Sediment in the Lower 8.3 Miles vs. PRGs (Log Scale)

Lower 8.3 Miles of the Lower Passaic River

Figure 19

2016

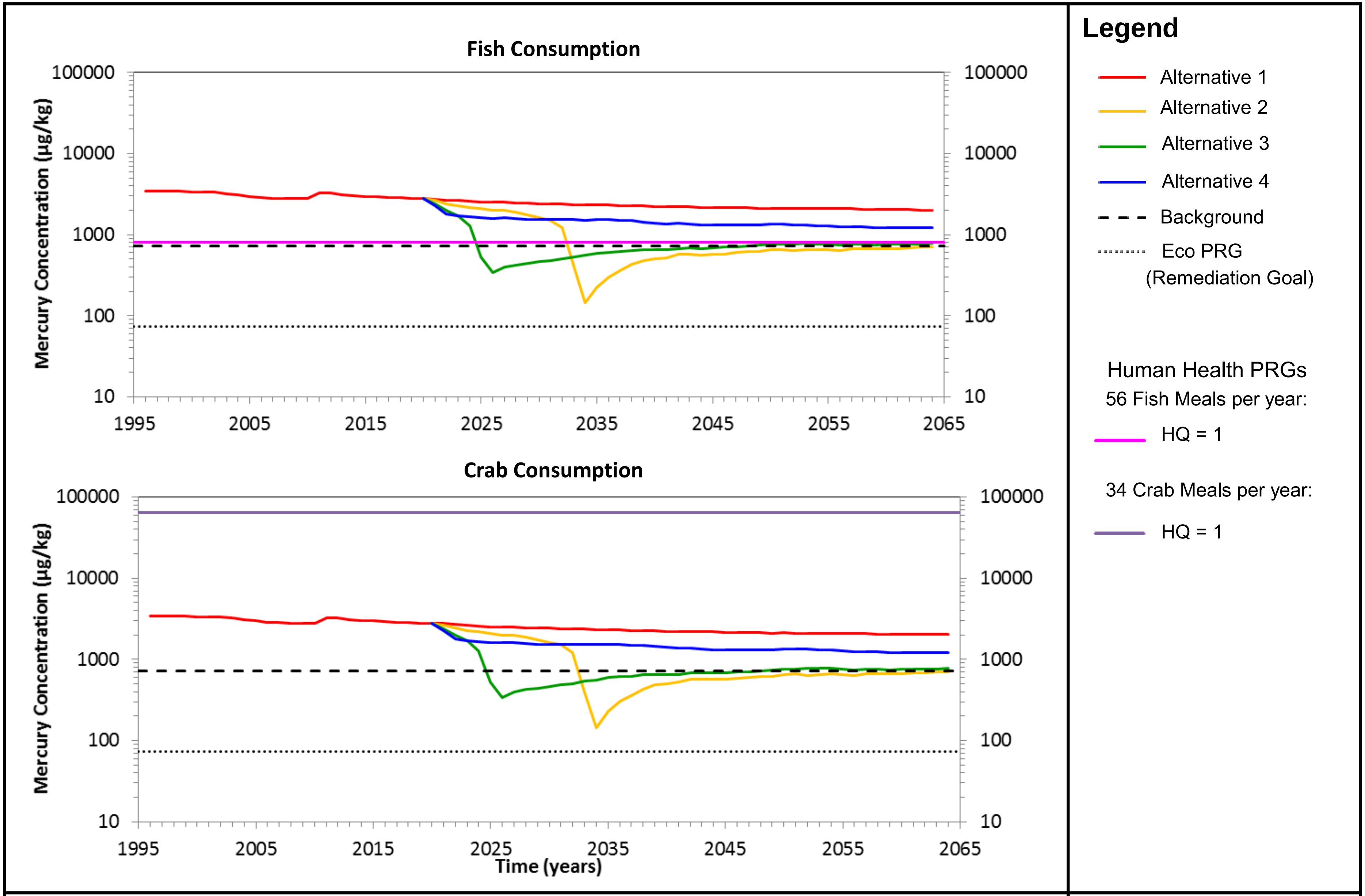


Average Total PCB Concentrations in Surface Sediment in Lower 8.3 Miles vs. PRGs (Log Scale)

Lower 8.3 Miles of the Lower Passaic River

Figure 20

2016

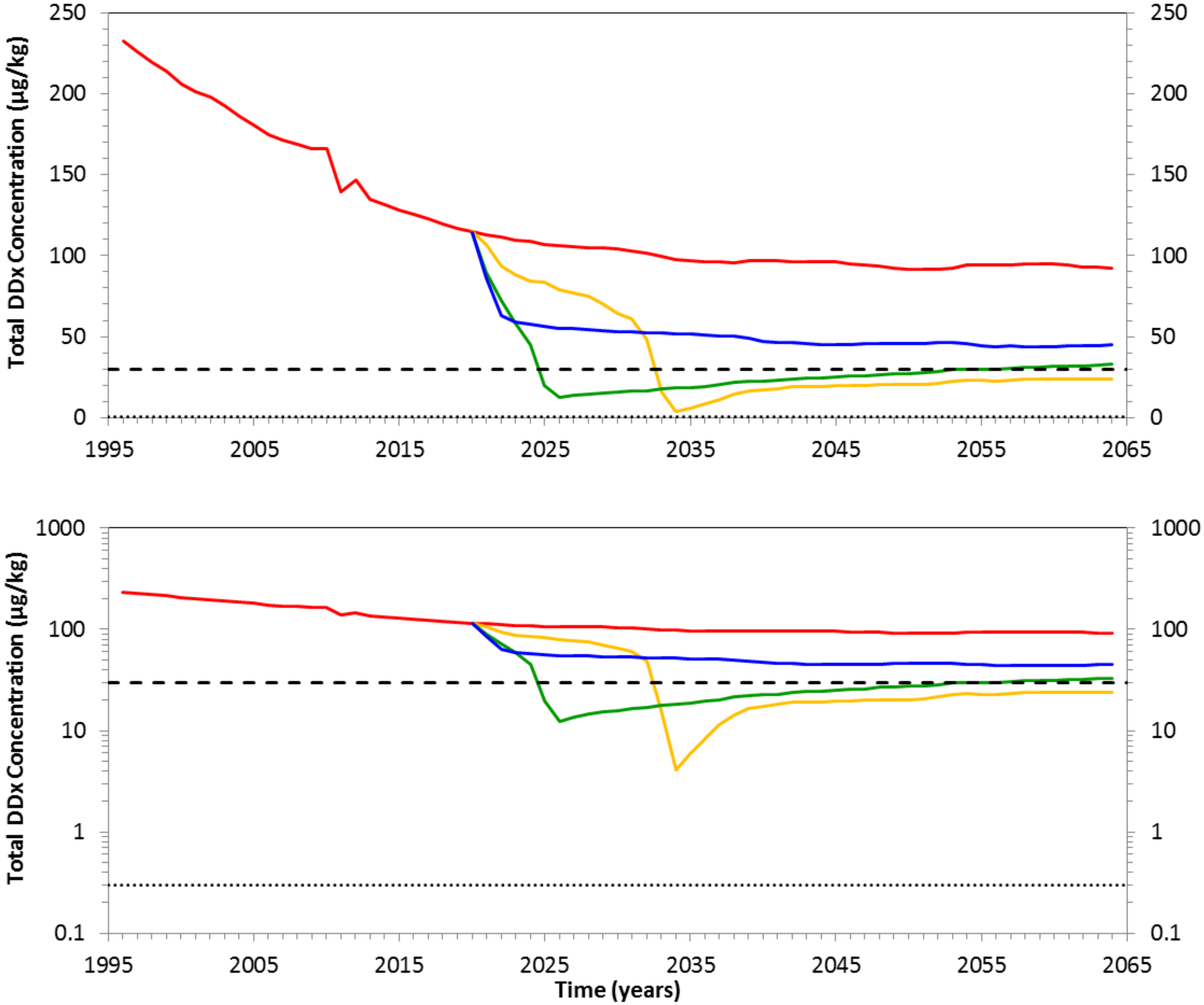


Average Mercury Concentrations in Surface Sediment in Lower 8.3 Miles vs. PRGs (Log Scale)

Figure 21

Lower 8.3 Miles of the Lower Passaic River

2016



Legend

- Alternative 1
- Alternative 2
- Alternative 3
- Alternative 4
- Background
- Eco PRG (Remediation Goal)

Note: Human Health PRGs were not calculated for Total DDX because it does not contribute significantly to human health risk.

Average Total DDx Concentrations in Surface Sediment in Lower 8.3 Miles vs. PRGs (Linear and Log Scale)

Lower 8.3 Miles of the Lower Passaic River

Figure 22

2016

APPENDIX II

TABLES

LIST OF TABLES

Table 1
Contaminants of Concern in Surface Sediments (top 6 inches)

Surface Sediments, 0-6 inches [a]	Unit [b]	Frequency of Detection	Minimum	Maximum	Mean	Median
2,3,7,8-TCDD [c]	pg/g	370/372	0.09	34,100	1,000	280
Total TCDD	pg/g	318/319	2.20	37,900	1,300	400
Total PCBs	ug/kg	364/365	0.10	28,600	1,700	1,000
Total DDT	ug/kg	368/368	0.32	10,200	240	99
Dieldrin	ug/kg	276/362	0.01	150	11	5.20
Total PAHs	mg/kg	368/368	0.21	2,810	47	31
Mercury	mg/kg	380/388	0.05	24	2.75	2.20
Copper	mg/kg	380/382	0.21	2,470	183	170
Lead	mg/kg	375/375	4.40	906	260	235

Notes
Based on 1995 – 2013 data.

[a] The top six inches of sediment is where most organisms in contact with the sediment are exposed to COCs, because it is where they are most active (e.g., burrowing or feeding).

[b] pg/g = picograms per gram or parts per trillion (ppt);
ug/kg = micrograms per kilogram or parts per billion (ppb);
mg/kg = milligrams per kilogram or parts per million (ppm).

[c] 2,3,7,8-TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin is the most toxic form of dioxin.

Table 2
Contaminants of Concern in Sediment below 6 Inches

Contaminant Concentrations in Sediment with Depth	0.5 - 1.5 feet		1.5 - 2.5 feet		2.5 - 3.5 feet		3.5 feet – end*	
	Min-Max	Mean (Median)	Min-Max	Mean (Median)	Min-Max	Mean (Median)	Min-Max	Mean (Median)
2,3,7,8-TCDD (pg/g or ppt)	0.13 – 50,400	2,000 (400)	0.10 – 77,900	3,530 (520)	0.09 – 932,000	9,700 (450)	0.07 – 5,300,000	19,200 (270)
Total TCDD (pg/g or ppt)	0.032 – 27,700	1,980 (500)	0.11 – 60,200	3,320 (610)	0.021 – 67,900	3,600 (580)	0.021 – 2,760,000	12,400 (370)
Total PCBs (ug/kg or ppb)	0.02 – 33,000	2,870 (1,560)	0.02 – 41,800	3,510 (1,810)	0.0062 – 29,960	3,970 (1,590)	0.00059 – 133,000	3,350 (930)
Total DDT (ug/kg or ppb)	0.024 – 4,600	240 (120)	0.02 – 30,800	580 (130)	0.02 – 7,800	450 (180)	0.0038 – 14,000,000	29,200 (120)
Dieldrin (ug/kg or ppb)	0.007 - 250	14 (3.5)	0.024 - 250	16 (3.8)	0.0014 - 580	25 (3.9)	0.0016 – 1,000	27 (3.0)
Total PAHs (mg/kg or ppm)	0.006 – 6,500	72 (30)	0.0013 – 7,750	140 (31)	0.0011 - 720	45 (29)	0.00032 – 1,270	64 (33)
Mercury (mg/kg or ppm)	0.0034 - 28	4.6 (3.6)	0.005 - 29	5.8 (4.3)	0.0074 - 28	5.8 (4.7)	0.0016 – 30	6.5 (5.4)
Copper (mg/kg or ppm)	1.5 – 3,020	270 (210)	3.4 – 1,210	290 (250)	2.3 – 1,040	280 (280)	2.1 – 4,700	330 (310)
Lead (mg/kg or ppm)	1.9 – 17,900	460 (340)	1.7 – 1,100	420 (400)	1.7 – 980	410 (420)	1.0 – 7,860	430 (460)

Notes
Based on 1990-2013 data
* Depth of cores is highly variable, but averages about 12 to 20 feet.

Table 3
Percent Contributions from Various Sources
to Recently-Deposited Surface Sediments of Lower Passaic River

	Upper Passaic River	Newark Bay	Tributaries	CSOs-SWOs	Lower Passaic River Resuspension
Solids	32	14	6	1	48
2,3,7,8-TCDD	0	3	0	0	97
Total TCDD	3	5	0	0	92
Total PCBs	11	6	1	0	81
DDE	10	8	3	1	78
Copper	14	12	1	1	72
Mercury	11	14	0	0	75
Lead	19	7	2	2	71
Benzo(a)pyrene	53	7	5	1	33
Fluoranthene	47	5	6	2	40

Notes
All numbers represent percent of total mass for each contaminant.
Benzo(a)pyrene and Fluoranthene are PAHs.

Table 4
Summary of Contaminants of Concern and Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Current
Medium: Tissue
Exposure Medium: Tissue

Exposure Point	Contaminant of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Units	Statistical Measure
		Min	Max					
Fish Tissue	TCDD TEQ (D/F)	0.0000049	0.00058	mg/kg	39/39	0.00010	mg/kg	95% BCA Bootstrap
	TCDD TEQ (PCBs)	0.0000014	0.000070	mg/kg	39/39	0.00016	mg/kg	95% BCA Bootstrap
	Total PCBs	0.13	5.6	mg/kg	39/39	1.7	mg/kg	95% BCA Bootstrap
	Methyl mercury	0.070	0.83	mg/kg	39/39	0.36	mg/kg	95% Approximate Gamma
Blue Crab Tissue	TCDD TEQ (D/F)	0.000026	0.00012	mg/kg	22/22	0.000075	mg/kg	95% Student's t
	TCDD TEQ (PCBs)	0.00000080	0.000017	mg/kg	22/22	0.000011	mg/kg	95% Student's t
	Total PCBs	0.11	0.69	mg/kg	22/22	0.37	mg/kg	95% Student's t
	Methyl mercury	0.089	0.23	mg/kg	22/22	0.17	mg/kg	95% Student's t

Key
mg/kg: milligram per kilogram
95% UCL: 95% Upper Confidence Limit on the arithmetic mean
MAX: Maximum Concentration
MIN: Minimum Concentration

Table 5
Selection of Exposure Pathways

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/ Future	Biota Tissue	Fish Tissue	Fish from the lower 8.3 miles of the Passaic River	Angler	Child (1 to 6 years old)	Ingestion	Quantitative	COCs have been detected in fish. Studies have found that despite prohibition on fish consumption, individuals do fish and eat their catch in the lower 8.3 miles. Assumes receptor will consume fish caught from lower 8.3 miles and share it with family members, including young children.
					Adolescent (7 to 18 years old)	Ingestion	Quantitative	
					Adult (>18 years old)	Ingestion	Quantitative	
		Crab Tissue	Crab from the lower 8.3 miles of the Passaic River	Angler	Child (1 to 6 years old)	Ingestion	Quantitative	COCs have been detected in crabs. Studies have found that despite prohibition on crab consumption, individuals do collect and eat crab from the lower 8.3 miles. Assumes receptor will consume crabs/shellfish gathered from lower 8.3 miles and share them with family members, including young children.
					Adolescent (7 to 18 years old)	Ingestion	Quantitative	
					Adult (>18 years old)	Ingestion	Quantitative	

Table 6
Cancer Toxicity Data Summary

Pathway: Consumption of Biota					
Contaminant of Concern	**Oral Cancer Slope Factor**	**Slope Factor Units**	**Weight of Evidence/Cancer Guideline Description**	**Source**	**Date (MM/DD/YYYY)**
TCDD TEQ (D/F)	1.50×10^5	$(mg/kg\text{-}day)^{-1}$	B2	HEAST	07/31/97 (1)
TCDD TEQ (PCBs)	1.50×10^5	$(mg/kg\text{-}day)^{-1}$	B2	HEAST	07/31/97 (1)
Total PCBs	2.00×10^0	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	10/28/2013 (accessed IRIS)
Methyl mercury	--	--	C	IRIS	10/28/2013 (accessed IRIS)

Key
— : No information available
EPA Group: B2 – Probable human carcinogen – Indicates sufficient; C - Possible human carcinogen
(1) USEPA's HEAST (1997) value of 150,000 $(mg/kg\text{-}day)^{-1}$ was developed based on the USEPA's 1985, "Health Assessment Document for Polychlorinated Dibenzo-p-Dioxin."

IRIS: Integrated Risk Information System, U.S. EPA HEAST - Health Effects Assessment Summary Tables

Table 7
Noncancer Toxicity Data Summary

Pathway: Consumption of Biota							
Contaminant of Concern	**Chronic/ Subchronic**	**Oral RfD Value**	**Oral RfD Units**	**Primary Target Organ**	**Combined Uncertainty/ Modifying Factors**	**Sources of RfD: Target Organ**	**Dates of RfD: (MM/DD/YYYY)**
TCDD TEQ (D/F)	Chronic	7.0×10^{-10}	mg/kg-day	Dermal, Developmental, Immunological, Reproductive	30	IRIS	2/17/2012 (IRIS accessed)
TCDD TEQ (PCBs)	Chronic	2.0×10^{-5}	mg/kg-day	Immune System, Eye	300	IRIS	2/28/2011 (IRIS accessed)
Total PCBs(1)	Chronic	2.0×10^{-5}	mg/kg-day	Immune System, Eye	300	IRIS	2/28/2011 (IRIS accessed)
Methyl mercury	Chronic	1.0×10^{-4}	mg/kg-day	Central Nervous System	10	IRIS	2/28/2011 (IRIS accessed)

Key
(1) Based on the noncancer toxicity value for Aroclor 1254.
—: No information available
IRIS: Integrated Risk Information System, U.S. EPA
RfD – reference dose

Table 8
Summary of Cancer Risks for the Adult + Child Receptor (RME)

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Adult + Child

Medium	Exposure Medium	Exposure Point	Contaminant of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Tissue	Fish	Ingestion	TCDD TEQ (D/F)	3×10^{-3}	N/A	N/A	3×10^{-3}
		Ingestion	TCDD TEQ (PCBs)	5×10^{-4}	N/A	N/A	5×10^{-4}
		Ingestion	Total PCBs	6×10^{-4}	N/A	N/A	6×10^{-4}
		Ingestion	Methyl mercury	—	N/A	N/A	—
						Risk Sum =	4×10^{-3}
	Blue Crab	Ingestion	TCDD TEQ (D/F)	1×10^{-3}	N/A	N/A	1×10^{-3}
		Ingestion	TCDD TEQ (PCBs)	2×10^{-4}	N/A	N/A	2×10^{-4}
		Ingestion	Total PCBs	8×10^{-5}	N/A	N/A	8×10^{-5}
		Ingestion	Methyl mercury	—	N/A	N/A	—
						Risk Sum =	1×10^{-3}

Key
— : Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

Table 9
Summary of Cancer Risks for the Adolescent Receptor (RME)

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Contaminant of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Tissue	Fish	Ingestion	TCDD TEQ (D/F)	1×10^{-3}	N/A	N/A	1×10^{-3}
		Ingestion	TCDD TEQ (PCBs)	2×10^{-4}	N/A	N/A	2×10^{-4}
		Ingestion	Total PCBs	3×10^{-4}	N/A	N/A	3×10^{-4}
		Ingestion	Methyl mercury	—	N/A	N/A	—
						Risk Sum =	2×10^{-3}
	Blue Crab	Ingestion	TCDD TEQ (D/F)	5×10^{-4}	N/A	N/A	5×10^{-4}
		Ingestion	TCDD TEQ (PCBs)	8×10^{-5}	N/A	N/A	8×10^{-5}
		Ingestion	Total PCBs	3×10^{-5}	N/A	N/A	3×10^{-5}
		Ingestion	Methyl mercury	—	N/A	N/A	—
						Risk Sum =	6×10^{-4}

Key
— : Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

Table 10
Summary of Cancer Risks for the Adult + Child Receptor (CTE)

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Adult + Child

Medium	Exposure Medium	Exposure Point	Contaminant of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Tissue	Fish	Ingestion	TCDD TEQ (D/F)	8×10^{-5}	N/A	N/A	8×10^{-5}
		Ingestion	TCDD TEQ (PCBs)	2×10^{-5}	N/A	N/A	2×10^{-5}
		Ingestion	Total PCBs	1×10^{-5}	N/A	N/A	1×10^{-5}
		Ingestion	Methyl mercury	—	N/A	N/A	—
						Risk Sum =	1×10^{-4}
	Blue Crab	Ingestion	TCDD TEQ (D/F)	9×10^{-5}	N/A	N/A	9×10^{-5}
		Ingestion	TCDD TEQ (PCBs)	1×10^{-5}	N/A	N/A	1×10^{-5}
		Ingestion	Total PCBs	2×10^{-6}	N/A	N/A	2×10^{-6}
		Ingestion	Methyl mercury	—	N/A	N/A	—
						Risk Sum =	1×10^{-4}

Key
— : Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

Table 11
Summary of Cancer Risks for the Adolescent Receptor (CTE)

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Contaminant of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Tissue	Fish	Ingestion	TCDD TEQ (D/F)	3×10^{-5}	N/A	N/A	3×10^{-5}
		Ingestion	TCDD TEQ (PCBs)	7×10^{-6}	N/A	N/A	7×10^{-6}
		Ingestion	Total PCBs	5×10^{-6}	N/A	N/A	5×10^{-6}
		Ingestion	Methyl mercury	—	N/A	N/A	—
						Risk Sum =	4×10^{-5}
	Blue Crab	Ingestion	TCDD TEQ (D/F)	4×10^{-5}	N/A	N/A	4×10^{-5}
		Ingestion	TCDD TEQ (PCBs)	4×10^{-6}	N/A	N/A	4×10^{-6}
		Ingestion	Total PCBs	1×10^{-6}	N/A	N/A	1×10^{-6}
		Ingestion	Methyl mercury	—	N/A	N/A	—
						Risk Sum =	4×10^{-5}

Key
— : Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

Table 12
Summary of Noncancer Health Hazards for the Child Receptor (RME)

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Contaminant of Concern	Primary Target Organ	Noncancer Health Hazards			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Tissue	Fish	Ingestion	TCDD TEQ (D/F)	Dermal, Developmental, Immunological, Reproductive	110	N/A	N/A	110
		Ingestion	TCDD TEQ (PCBs)	Immune System, Eye	18	N/A	N/A	18
		Ingestion	Total PCBs	Immune System, Eye	65	N/A	N/A	65
		Ingestion	Methyl mercury	Central Nervous System	3	N/A	N/A	3
					Receptor Hazard Index =			196
	Hazard Index by Target Organ				Dermal, Developmental, Immunological, Reproductive			110
					Immune System, Eye			83
					Central Nervous System			3
	Blue Crab	Ingestion	TCDD TEQ (D/F)	Dermal, Developmental, Immunological, Reproductive	50	N/A	N/A	50
		Ingestion	TCDD TEQ (PCBs)	Immune System, Eye	7	N/A	N/A	7
		Ingestion	Total PCBs	Immune System, Eye	9	N/A	N/A	9
		Ingestion	Methyl mercury	Central Nervous System	0.8	N/A	N/A	0.8
					Receptor Hazard Index =			67
	Hazard Index by Target Organ				Dermal, Developmental, Immunological, Reproductive			50
					Immune System, Eye			16
					Central Nervous System			0.8

Key
— : Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

Table 13
Summary of Noncancer Health Hazards for the Adult Receptor (RME)

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Contaminant of Concern	Primary Target Organ	Noncancer Health Hazards			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Tissue	Fish	Ingestion	TCDD TEQ (D/F)	Dermal, Developmental, Immunological, Reproductive	62	N/A	N/A	62
		Ingestion	TCDD TEQ (PCBs)	Immune System, Eye	10	N/A	N/A	10
		Ingestion	Total PCBs	Immune System, Eye	37	N/A	N/A	37
		Ingestion	Methyl mercury	Central Nervous System	2	N/A	N/A	2
					Receptor Hazard Index =			111
	Hazard Index by Target Organ				Dermal, Developmental, Immunological, Reproductive			62
					Immune System, Eye			47
					Central Nervous System			2
	Blue Crab	Ingestion	TCDD TEQ (D/F)	Dermal, Developmental, Immunological, Reproductive	28	N/A	N/A	28
		Ingestion	TCDD TEQ (PCBs)	Immune System, Eye	4	N/A	N/A	4
		Ingestion	Total PCBs	Immune System, Eye	5	N/A	N/A	5
		Ingestion	Methyl mercury	Central Nervous System	0.4	N/A	N/A	0.4
					Receptor Hazard Index =			37
	Hazard Index by Target Organ				Dermal, Developmental, Immunological, Reproductive			28
					Immune System, Eye			9
					Central Nervous System			0.4

Key
— : Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

Table 14
Summary of Noncancer Health Hazards for the Adolescent Receptor (RME)

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Contaminant of Concern	Primary Target Organ	Noncancer Health Hazards			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Tissue	Fish	Ingestion	TCDD TEQ (D/F)	Dermal, Developmental, Immunological, Reproductive	63	N/A	N/A	63
		Ingestion	TCDD TEQ (PCBs)	Immune System, Eye	10	N/A	N/A	10
		Ingestion	Total PCBs	Immune System, Eye	38	N/A	N/A	38
		Ingestion	Methyl mercury	Central Nervous System	2	N/A	N/A	2
					Receptor Hazard Index =			113
	Hazard Index by Target Organ				Dermal, Developmental, Immunological, Reproductive			63
					Immune System, Eye			48
					Central Nervous System			2
	Blue Crab	Ingestion	TCDD TEQ (D/F)	Dermal, Developmental, Immunological, Reproductive	29	N/A	N/A	29
		Ingestion	TCDD TEQ (PCBs)	Immune System, Eye	4	N/A	N/A	4
		Ingestion	Total PCBs	Immune System, Eye	5	N/A	N/A	5
		Ingestion	Methyl mercury	Central Nervous System	0.5	N/A	N/A	0.5
					Receptor Hazard Index =			39
	Hazard Index by Target Organ				Dermal, Developmental, Immunological, Reproductive			29
					Immune System, Eye			9
					Central Nervous System			0.5

Key
— : Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

Table 15
Summary of Noncancer Health Hazards for the Child Receptor (CTE)

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Contaminant of Concern	Primary Target Organ	Noncancer Health Hazards			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Tissue	Fish	Ingestion	TCDD TEQ (D/F)	Dermal, Developmental, Immunological, Reproductive	6	N/A	N/A	6
		Ingestion	TCDD TEQ (PCBs)	Immune System, Eye	1	N/A	N/A	1
		Ingestion	Total PCBs	Immune System, Eye	5	N/A	N/A	5
		Ingestion	Methyl mercury	Central Nervous System	0.3	N/A	N/A	0.3
					Receptor Hazard Index =			12
	Hazard Index by Target Organ				Dermal, Developmental, Immunological, Reproductive			6
					Immune System, Eye			6
					Central Nervous System			0.3
	Blue Crab	Ingestion	TCDD TEQ (D/F)	Dermal, Developmental, Immunological, Reproductive	7	N/A	N/A	7
		Ingestion	TCDD TEQ (PCBs)	Immune System, Eye	0.8	N/A	N/A	0.8
		Ingestion	Total PCBs	Immune System, Eye	1	N/A	N/A	1
		Ingestion	Methyl mercury	Central Nervous System	0.1	N/A	N/A	0.1
					Receptor Hazard Index =			9
	Hazard Index by Target Organ				Dermal, Developmental, Immunological, Reproductive			7
					Immune System, Eye			2
					Central Nervous System			0.1

Key
— : Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

Table 16
Summary of Noncancer Health Hazards for the Adult Receptor (CTE)

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Contaminant of Concern	Primary Target Organ	Noncancer Health Hazards			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Tissue	Fish	Ingestion	TCDD TEQ (D/F)	Dermal, Developmental, Immunological, Reproductive	4	N/A	N/A	4
		Ingestion	TCDD TEQ (PCBs)	Immune System, Eye	0.8	N/A	N/A	0.8
		Ingestion	Total PCBs	Immune System, Eye	3	N/A	N/A	3
		Ingestion	Methyl mercury	Central Nervous System	0.2	N/A	N/A	0.2
					Receptor Hazard Index =			8
	Hazard Index by Target Organ				Dermal, Developmental, Immunological, Reproductive			4
					Immune System, Eye			4
					Central Nervous System			0.2
	Blue Crab	Ingestion	TCDD TEQ (D/F)	Dermal, Developmental, Immunological, Reproductive	4	N/A	N/A	4
		Ingestion	TCDD TEQ (PCBs)	Immune System, Eye	0.5	N/A	N/A	0.5
		Ingestion	Total PCBs	Immune System, Eye	0.6	N/A	N/A	0.6
		Ingestion	Methyl mercury	Central Nervous System	0.06	N/A	N/A	0.06
					Receptor Hazard Index =			5
	Hazard Index by Target Organ				Dermal, Developmental, Immunological, Reproductive			4
					Immune System, Eye			1
					Central Nervous System			0.06

Key
— : Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

Table 17
Summary of Noncancer Health Hazards for the Adolescent Receptor (CTE)

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Contaminant of Concern	Primary Target Organ	Noncancer Health Hazards: Ingestion	Inhalation	Dermal	Exposure Routes Total
Tissue	Fish	Ingestion	TCDD TEQ (D/F)	Dermal, Developmental, Immunological, Reproductive	4	N/A	N/A	4
		Ingestion	TCDD TEQ (PCBs)	Immune System, Eye	0.8	N/A	N/A	0.8
		Ingestion	Total PCBs	Immune System, Eye	3	N/A	N/A	3
		Ingestion	Methyl mercury	Central Nervous System	0.2	N/A	N/A	0.2
					Receptor Hazard Index =			8
	Hazard Index by Target Organ				Dermal, Developmental, Immunological, Reproductive			4
					Immune System, Eye			4
					Central Nervous System			0.2
	Blue Crab	Ingestion	TCDD TEQ (D/F)	Dermal, Developmental, Immunological, Reproductive	4	N/A	N/A	4
		Ingestion	TCDD TEQ (PCBs)	Immune System, Eye	0.5	N/A	N/A	0.5
		Ingestion	Total PCBs	Immune System, Eye	0.6	N/A	N/A	0.6
		Ingestion	Methyl mercury	Central Nervous System	0.07	N/A	N/A	0.07
					Receptor Hazard Index =			5
	Hazard Index by Target Organ				Dermal, Developmental, Immunological, Reproductive			4
					Immune System, Eye			1
					Central Nervous System			0.07

Key
— : Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

Table 18a
Occurrence, Distribution and Selection of Contaminants of Concern (COCs)
For Lower Passaic River Lower 8.3 Miles

Exposure Medium: Sediment - Entire

Ecological Receptor: Benthic Macroinvertebrates

Contaminant of Potential Concern	Minimum Conc. (ppm)	Maximum Conc. (ppm)	Mean Conc. (ppm)	95% UCL of the Mean (ppm)	Background Conc. (ppm)	Screening Toxicity Value -Lower Bound (ppm)	Screening Toxicity Value –Upper Bound (ppm)	Screening Toxicity Value Source[1]	HQ Value[2] – Lower Bound	HQ Value[2] – Upper Bound	COC Flag (Y or N)
Copper	23	580	150	160	63	32	94	(a)	5	2	Y
Lead	37	760	220	240	130	30	94	(a)	8	3	Y
Mercury	0.039	13	2.0	2.6	0.72	0.14	0.48	(a)	20	5	Y
LMW PAHs	0.37	340	11	24	7.9	0.55	3.2	(b)	40	8	Y
HMW PAHs	0	290	33	45	53	1.7	9.6	(b)	30	5	Y
Total DDx	0.0033	3.0	0.14	0.26	0.030	0.0016	0.046	(b)	200	6	Y
Dieldrin	0.000015	0.15	0.0074	0.015	0.005	0.00083	0.0029	(a)	20	5	Y
Total PCBs	0.012	19	1.3	2.0	0.46	0.035	0.37	(a)	60	5	Y
2,3,7,8-TCDD	0.0000068	0.014	0.00052	0.0011	0.000002	0.0000032	N/A	(c)	300	-	Y

Notes

1. Screening toxicity values were selected to bracket toxicological thresholds concentrations. The following specific sources were used:
   - (a) Logistic model point estimates for T20 and T50 (concentrations corresponding to a 20% and 50% probability of observing sediment toxicity, respectively) estimates based on laboratory toxicity testing using two species of marine amphipod (USEPA, 2005).
   - (b) Lower and upper bound benchmark estimates based on ER-L = Effects Range-Low and ER-M =Effects Range-Median values from Long *et al*. (1995), respectively (as summarized in Buchman, 2008).
   - (c) Value for 2,3,7,8-TCDD derived by U.S. Fish and Wildlife Service (Kubiak *et al*., 2007) using sediment chemistry for Arthur Kill and oyster effect data
2. Hazard Quotients (HQ) are defined as the 95% UCL of the mean divided by either the lower or upper bound screening toxicity value.

Key

Conc. = Concentration

N/A = Not Available

Table 18b
Occurrence, Distribution and Selection of Contaminants of Concern (COCs)
For Lower Passaic River Lower 8.3 Miles

Exposure Medium: Sediment - Mudflat

Ecological Receptor: Benthic Macroinvertebrates

Contaminant of Potential Concern	Minimum Conc. (ppm)	Maximum Conc. (ppm)	Mean Conc. (ppm)	95% UCL of the Mean (ppm)	Background Conc. (ppm)	Screening Toxicity Value -Lower Bound (ppm)	Screening Toxicity Value –Upper Bound (ppm)	Screening Toxicity Value Source[1]	HQ Value[2] – Lower Bound	HQ Value[2] – Upper Bound	COC Flag (Y or N)
Copper	37	580	190	240	63	32	94	(a)	7	2	Y
Lead	110	760	250	320	130	30	94	(a)	10	3	Y
Mercury	0.65	13	2.8	5.8	0.72	0.14	0.48	(a)	40	10	Y
LMW PAHs	0.87	13	4.8	6.4	7.9	0.55	3.2	(b)	10	2	Y
HMW PAHs	5.8	52	26	31	53	1.7	9.6	(b)	20	3	Y
Total DDx	0.031	0.82	0.11	0.31	0.030	0.0016	0.046	(b)	200	7	Y
Dieldrin	0.00075	0.13	0.011	0.044	0.005	0.00083	0.0029	(a)	50	20	Y
Total PCBs	0.36	19	1.9	6.6	0.46	0.035	0.37	(a)	200	20	Y
2,3,7,8-TCDD	0.000061	0.014	0.0011	0.0045	0.000002	0.0000032	N/A	(c)	1000	-	Y

Notes

1. Screening toxicity values were selected to bracket toxicological thresholds concentrations. The following specific sources were used:
   (a) Logistic model point estimates for T20 and T50 (concentrations corresponding to a 20% and 50% probability of observing sediment toxicity, respectively) estimates based on laboratory toxicity testing using two species of marine amphipod (USEPA, 2005).
   (b) Lower and upper bound benchmark estimates based on ER-L = Effects Range-Low and ER-M =Effects Range-Median values from Long *et al*. (1995), respectively (as summarized in Buchman, 2008).
   (c) Value for 2,3,7,8-TCDD derived by U.S. Fish and Wildlife Service (Kubiak *et al*., 2007) using sediment chemistry for Arthur Kill and oyster effect data.
2. Hazard Quotients (HQ) are defined as the 95% UCL of the mean divided by either the lower or upper bound screening toxicity value.

Key
Conc. = Concentration
N/A = Not Available

Table 18c
Occurrence, Distribution and Selection of Contaminants of Concern (COCs)
For Lower Passaic River Lower 8.3 Miles

Exposure Medium: Sediment – Crab Tissue

Ecological Receptor: Macroinvertebrates and Their Predators(i.e., Fish and Wildlife)

Contaminant of Potential Concern	Minimum Conc. (ppm)	Maximum Conc. (ppm)	Mean Conc. (ppm)	95% UCL of the Mean (ppm)	Background Conc. (ppm)	Screening Toxicity Value - Lower Bound (ppm)	Screening Toxicity Value –Upper Bound (ppm)	Screening Toxicity Value Source[1]	HQ Value[2] – Lower Bound	HQ Value[2] – Upper Bound	COC Flag (Y or N)
Copper	16	31	22	24	7.5	5	12	(a)	5	2	Y
Lead	0.20	0.66	0.33	0.37	0.12	0.52	2.6	(b)	0.7	0.1	N
Mercury	0.086	0.19	0.14	0.15	0.07	0.048	0.095	(c)	3	2	Y
LMW PAHs	0.020	0.29	0.080	0.11	0.017	0.078	0.78	(d)	1	0.1	N
HMW PAHs	0.021	0.35	0.089	0.12	0.024	0.022	0.22	(e)	6	0.6	Y
Total DDx	0.030	0.10	0.065	0.071	0.022	0.060	0.13	(f)	1	0.5	N
Dieldrin	0.0024	0.014	0.0063	0.0073	0.0046	0.0016	0.0080	(g)	5	0.9	Y
Total PCBs	0.15	0.58	0.32	0.36	0.21	0.0080	0.026	(h)	40	10	Y
2,3,7,8-TCDD	0.000024	0.000086	0.000052	0.000058	2.7×10^{-7}	0.00000015	0.0000013	(i)	400	40	Y

Notes

1. Screening toxicity values were selected to bracket toxicological thresholds concentrations. The following specific sources were used: (a) Absil et al., 1996; (b) Borgmann & Norwood, 1999; (c) Hook & Fisher, 2002; (d) Emery & Dillon, 1996; (e) Eertman et al ., 1995; (f) Parrish et al., 1973; (g) Nimmo et al. , 1970; (h) Chu et al., 2000, 2003; (i) Wintermyer & Cooper, 2003.
2. Hazard Quotients (HQ) are defined as the 95% UCL of the mean divided by either the lower or upper bound screening toxicity value.

Key
Conc. = Concentration
N/A = Not Available

Table 18d
Occurrence, Distribution and Selection of Contaminants of Concern (COCs) For Lower Passaic River Lower 8.3 Miles

Exposure Medium: Sediment – Mummichog Tissue

Ecological Receptor: Forage Fish and Their Predators (i.e., Piscivorous Fish and Wildlife)

Contaminant of Potential Concern	Minimum Conc. (ppm)	Maximum Conc. (ppm)	Mean Conc. (ppm)	95% UCL of the Mean (ppm)	Background Conc. (ppm)	Screening Toxicity Value -Lower Bound (ppm)	Screening Toxicity Value –Upper Bound (ppm)	Screening Toxicity Value Source[1]	HQ Value[2] – Lower Bound	HQ Value[2] – Upper Bound	COC Flag (Y or N)
Copper	2.0	4.3	2.8	3.1	1.3	0.32	1.5	(a)	10	2	**Y**
Lead	0.38	3.9	1.0	2.2	0.5	0.40	4.0	(b)	6	0.6	**Y**
Mercury	0.036	0.071	0.059	0.065	0.028	0.052	0.26	(c)	1	0.3	N
LMW PAHs	0.044	0.18	0.076	0.093	0.058	0.26	2.6	(d)	0.4	0.04	N
HMW PAHs	0.035	0.50	0.12	0.19	0.078	0.21	2.1	(e)	0.9	0.09	N
Total DDx	0.025	0.097	0.054	0.063	0.023	0.078	0.39	(f)	0.8	0.2	N
Dieldrin	0.0035	0.013	0.0067	0.0084	0.0066	0.0080	0.040	(g)	1	0.2	N
Total PCBs	0.24	0.93	0.51	0.62	0.16	0.17	0.53	(h)	4	1	**Y**
TCDD TEQ (D/F)	0.000012	0.000081	0.000035	0.000046	0.00000048	0.00000089	0.0000018	(i)	50	30	**Y**
TCDD TEQ (PCBs)	0.00000027	0.00000090	0.00000054	0.00000063	N/A	0.00000089	0.0000018	(i)	0.7	0.3	N

Notes

1. Background tissue concentrations estimated using the sediment tissue bioaccumulation models presented in Appendix A of the FFS (Data Evaluation Report No. 6), concentrations represent the average of the estimated values for white perch and American eel (Table 3-3 in Appendix E of the FFS). Background value for the TEQ COCs is the estimated value for 2,3,7,8-TCDD.
2. Screening toxicity values were selected to bracket toxicological thresholds concentrations. The following specific sources were used: (a) Zyadah & Abdel-Baky, 2000; (b) Holcombe *et al*., 1976; (c) Beckvar *et al*., 2005; (d) Hall & Oris, 1991; (e) Hose *et al*., 1982; (f) Shubat & Curtis, 1986; (g) Beckvar *et al*., 2005; (h) Lerner *et al*., 2007; (i) Couillard *et al*., 2011.
3. Hazard Quotients (HQ) are defined as the 95% UCL of the mean divided by either the lower or upper bound screening toxicity value.

Key
Conc. = Concentration
N/A = Not Available

Table 18e
Occurrence, Distribution and Selection of Contaminants of Concern (COCs)
For Lower Passaic River Lower 8.3 Miles

Exposure Medium: Generic Fish Tissue

Ecological Receptor: Demersal and Pelagic Fish and Their Predators (i.e., Piscivorous Fish and Wildlife)

Contaminant of Potential Concern	Minimum Conc. (ppm)	Maximum Conc. (ppm)	Mean Conc. (ppm)	95% UCL of the Mean (ppm)	Background[1] Conc. (ppm)	Screening Toxicity Value -Lower Bound (ppm)	Screening Toxicity Value –Upper Bound (ppm)	Screening Toxicity Value Source[2]	HQ Value[3] – Lower Bound	HQ Value[3] – Upper Bound	COC Flag (Y or N)
Copper	0.40	51	4.6	12	2.0	0.32	1.5	(a)	40	8	Y
Lead	0.052	2.2	0.41	0.5	0.22	0.40	4.0	(b)	1	0.1	N
Mercury	0.046	0.63	0.19	0.24	0.15	0.052	0.26	(c)	5	0.9	Y
LMW PAHs	0.042	0.37	0.20	0.23	0.19	0.26	2.6	(d)	0.9	0.09	N
HMW PAHs	0.0075	0.45	0.10	0.13	0.10	0.21	2.1	(d)	0.6	0.06	N
Total DDx	0.13	0.92	0.28	0.32	0.33	0.078	0.39	(c)	4	0.8	Y
Dieldrin	0.0072	0.088	0.032	0.038	0.034	0.0080	0.040	(c)	5	0.9	Y
Total PCBs	0.63	7.9	2.6	3.0	1.2	0.17	0.53	(e)	20	6	Y
TCDD TEQ (D/F)	0.0000059	0.0014	0.00019	0.00025	0.0000014	0.00000089	0.0000018	(f)	300	100	Y
TCDD TEQ (PCBs)	0.00000038	0.0000065	0.0000022	0.0000026	N/A	0.00000089	0.0000018	(f)	3	1	Y

Notes

1. Background tissue concentrations estimated using the sediment tissue bioaccumulation models presented in Appendix A of the FFS (Data Evaluation Report No. 6), concentrations represent the average of the estimated values for white perch and American eel (Table 3-3 in Appendix E of the FFS). Background value for the TEQ COCs is the estimated value for 2,3,7,8-TCDD.
2. Screening toxicity values were selected to bracket toxicological thresholds concentrations. The following specific sources were used: (a) Zyadah & Abdel-Baky, 2000; (b) Holcombe *et al*., 1976; (c) Beckvar *et al*., 2005; (d) Hall & Oris, 1991; (e) Shubat & Curtis, 1986; (f) Couillard *et al*., 2011.
3. Hazard Quotients (HQ) are defined as the 95% UCL of the mean divided by either the lower or upper bound screening toxicity value.

Key
Conc. = Concentration
N/A = Not Available

Table 19
Ecological Exposure Pathways of Concern

Exposure Medium	Endangered/ Threatened Species Flag (Y or N)	Receptor	Endangered/ Threatened Species Flag (Y or N)	Exposure Routes	Assessment Endpoints	Measurement Endpoints
Sediment (Invertebrate Tissue)	N	Benthic Macroinvertebrates	N	Incidental ingestion and dermal contact with sediment	Survival, growth and reproduction of benthic and epibenthic invertebrates	- Comparison of sediment benchmarks to sediment EPCs - Comparison of invertebrate CBRs to crab tissue EPCs
Sediment (Fish Tissue)	N	Fish (general)	N	Ingestion of contaminated prey tissue/Incidental ingestion and dermal contact with sediment	Survival, growth and reproduction of generic fish	- Comparison of fish CBRs to fish tissue EPCs - Comparison of fish egg CBRs to estimated fish egg tissue EPCs
Sediment (Fish Tissue)	N	Fish (forage)	N	Ingestion of contaminated prey tissue/Incidental ingestion and dermal contact with sediment	Survival, growth and reproduction of forage fish	- Comparison of fish CBRs to mummichog tissue EPCs - Comparison of fish egg CBRs to estimated mummichog egg tissue EPCs
Prey Tissue (Sediment)	N	Aquatic-dependent Birds	N	Ingestion of contaminated prey tissue/Incidental ingestion and dermal contact with sediment	Survival, growth and reproduction of birds	- Comparison of modeled daily dose estimates to avian TRVs - Comparison of avian egg CBRs to estimated herring gull egg tissue EPCs
Prey Tissue (Sediment)	N	Aquatic-dependent Mammals	N	Ingestion of contaminated prey tissue/Incidental ingestion and dermal contact with sediment	Survival, growth and reproduction of mammals	- Comparison of modeled daily dose estimates to mammalian TRVs

Table 20
COC Concentrations Expected to Provide Adequate Protection of Ecological Receptors[1]

Habitat Type/ Name	Exposure Medium	COC	Protective Level	Units	Basis	Assessment Endpoint
Lower 8.3 Miles of Lower Passaic River	Sediment	Mercury	0.074	mg/kg	Bioaccumulation factor modeling - dietary exposures to contaminated prey	Survival, growth and reproduction of mammals
		DDT	0.0003	mg/kg	Bioaccumulation factor modeling –bird embryo tissue residues	Survival, growth and reproduction of birds
		PCBs	0.0078	mg/kg	Bioaccumulation factor modeling –adult crab tissue residues	Survival, growth and reproduction of benthic and epibenthic invertebrates
		TCDD	0.0000011	mg/kg	Bioaccumulation factor modeling - dietary exposures to contaminated prey	Survival, growth and reproduction of fish and mammals

Notes

1. Development of ecologically-protective media concentrations is described in Appendix E of the FFS.

Table 21
Summary of Ecological Hazard Estimates (HQs) for Benthic Macroinvertebrates

Contaminant of Concern	HQs for Worms		HQs for Crab	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Copper	2	5	2	5
Lead	3	8	0.1	0.7
Mercury	5	20	2	3
LMW PAHs	8	40	0.1	1
HMW PAHs	5	30	0.6	6
Dieldrin	5	20	0.9	5
Total DDx	6	200	0.5	1
Total PCBs	6	60	10	40
2,3,7,8-TCDD	300	300	40	400

Table 22
Summary of Ecological Hazard Estimates (HQs) for Fish

Contaminant of Concern	HQs for Fish				HQs for Fish Embryo			
	Piscivorous Fish		Forage Fish		Piscivorous Fish		Forage Fish	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Copper	8	40	2	10	---*	---	---	---
Lead	0.1	1	0.6	6	---	---	---	---
Mercury	0.9	5	0.3	1	---	---	---	---
LMW PAHs	0.09	0.9	0.04	0.4	---	---	---	---
HMW PAHs	0.06	0.6	0.09	0.9	---	---	---	---
Dieldrin	0.9	5	0.2	1	---	---	---	---
Total DDx	0.8	4	0.2	0.8	---	---	---	---
Total PCBs	6	20	1	4	---	---	---	---
TCDD TEQ (D/F)	100	300	30	50	3	30	2	20
TCDD TEQ (PCBs)	1	3	0.3	0.7	0.3	3	2	20

Notes

* = Not evaluated (i.e., no CBR was developed), because embryonic exposures could not be reliably estimated

Table 23a
Summary of Ecological Hazard Estimates (HQs) for Wildlife Receptors

Contaminant of Concern	HQs for Heron				HQs for Mink	
	Piscivorous Fish Diet		Forage Fish Diet			
	Lower Bound	Upper Bound	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Copper	0.8	2	0.6	1	0.8	2
Lead	1	10	2	20	0.2	2
Mercury	1	3	0.5	1	2	4
LMW PAHs	0.04	0.4	0.01	0.1	0.001	0.004
HMW PAHs	0.9	9	0.6	6	0.1	0.5
Dieldrin	0.03	0.1	0.01	0.03	0.3	0.6
Total DDx	2	6	0.5	2	0.02	0.1
Total PCBs	1	1	0.3	0.4	9	10
TCDD TEQ (D/F)	2	20	2	20	30	900
TCDD TEQ (PCBs)	1	10	0.8	8	4	100

Table 23b
Summary of Ecological Hazard Estimates (HQs) for Bird Embryos

Contaminant of Concern	HQ	
	NOAEL	LOAEL
Dieldrin	0.7	0.02
Total DDx	10	2
Total PCBs	70	40
TCDD TEQ (D/F)	40	15

Table 24
Fish and Crab Tissue Concentrations Protective of the Angler

Contaminant [All Units in ug/kg or ppb]	Cancer Risk-Based Tissue Concentrations									Noncancer Hazard-Based Tissue Concentrations		
	56 fish meals per year			34 crab meals per year			12 fish/crab meals per year[1]					
	10^{-6}	10^{-5}	10^{-4}	10^{-6}	10^{-5}	10^{-4}	10^{-6}	10^{-5}	10^{-4}	56 fish meals per year	34 crab meals per year	12 fish/ crab meals per year[1]
Mercury	Classification — C; possible human carcinogen; There is no quantitative estimate of carcinogenic risk from oral exposure									230	380	1072
Total PCBs	4.0	40	400	6.6	66	660	18.8	188	1880	46	76	214
2,3,7,8-TCDD	0.000054	0.00054	0.0054	0.000088	0.00088	0.0088	.00025	.0025	.025	0.0016	0.0026	0.0075

Notes
1. Used to calculate interim remediation milestones.

Table 25
Human Health and Ecological Risk-Based Sediment PRGs and Remediation Goals

Contaminant [All Units in ug/kg or ppb]	Overall Eco Sediment PRG	Cancer Sediment PRG									Noncancer Sediment PRG		
		56 fish meals per year			34 crab meals per year			12 fish/crab meals per year[1]					
		10^{-6}	10^{-5}	10^{-4}	10^{-6}	10^{-5}	10^{-4}	10^{-6}	10^{-5}	10^{-4}	56 fish meals per year	34 crab meals per year	12 fish/ crab meals per year[1]
Mercury	**74**	Classification — C; possible human carcinogen; There is no quantitative estimate of carcinogenic risk from oral exposure									800	65,000	95,000
Total PCBs	7.8	4.4	44	435	2.5	81	2600	18	240	2700	**50**	100	270
Total DDT	**0.30**	-	-	-	-	-	-	-	-	-	-	-	-
2,3,7,8-TCDD	0.0011	0.000146	0.0024	0.032	0.00059	0.0069	0.081	0.0012	0.016	0.19	**0.0083**	0.022	0.052

Notes
Bolded numbers are remediation goals.
1. Interim remediation milestones.

Table 26
Background

Contaminant of Concern (COC)	Background Concentration[ug/kg or ppb]
Dioxin	0.002
PCBs	460
DDT	30
Dieldrin	5
Copper	63,000
Lead	130,000
Mercury	720
LMW PAHs	7,900
HMW PAHs	53,000

Table 27
Navigation Channel Dredging Depths Under Alternative 2 (Deep Dredging with Backfill)

River Mile Section	Dredging Depth [feet MLW]	Resulting Channel Depth [feet MLW]	Width
RM 0 to RM 2.6	33	30	300 feet
RM 2.6 to RM 4.6	23	20	300 feet
RM 4.6 to RM 7.1	19	16	300 feet
RM 7.1 to RM 8.1	19	16	200 feet
RM 8.1 to RM 8.3	13	10	150 feet

Table 28
Navigation Channel Dredging Depths
Under Alternative 3 (Capping with Dredging for Flooding and Navigation)

River Mile Section	Dredging Depth [feet MLW]	Resulting Channel Depth [feet MLW]	Width
RM 0 to RM 0.6	33	30	300 feet
RM 0.6 to RM 1.7	25.5	20	300 feet

Table 29
Applicable or Relevant and Appropriate Requirements (ARARs)

Authority/Source	General Description	ARAR or TBC
Location-Specific ARARs or TBCs		
Federal		
Coastal Zone Management Act (CZMA), 16 U.S.C. §1451 *et seq.*, CZMA § 307(a)(1) Coordination and cooperation Coastal Zone Management Act Federal Consistency Regulations, 15 CFR Part 930: 15 CFR 930.30	The CZMA Federal Consistency Determination provisions require that any Federal agency undertaking a project in the coastal zone of a state shall insure that the project is, to the maximum extent practicable, consistent with the enforceable policies of approved state management programs. Applicable to dredging. Implemented through compliance with substantive requirements of New Jersey Waterfront Development Law and Coastal Zone Management Rules, N.J.A.C. 7:7.	ARAR Applicable
Section 10, Rivers & Harbors Act of 1899, 33 U.S.C. § 403 33 CFR Parts 322, 323, 329	Governs coordination of activities occurring in navigable waters. Congressional approval required for any obstruction of the navigable capacity of the waters of the United States. Construction of bridges, wharfs, piers, and other structures across navigable waters must be authorized by U.S. Army Corps of Engineers (USACE). The creation of any obstruction not affirmatively authorized by Congress, to the navigable capacity of any of the waters of the United States is prohibited; and it shall not be lawful to build or commence the building of any wharf, pier, dolphin, boom, weir, breakwater, bulkhead, jetty, or other structures in any port, roadstead, haven, harbor, canal, navigable river, or other water of the United States, outside established harbor lines. Placement of pilings, or discharge of dredged material where the flow or circulation of waters of the United States may be impaired or the reach of such waters reduced must comply with Section 10. **33 CFR 322.2.(b)** addresses the alteration of any navigable water of the United States, including "the excavating from or depositing of material in such waters, or the accomplishment of any other work affecting the course, location, condition, or capacity of such waters." **33 CFR 322(e)** provides that placing aids to navigation in navigable waters is under the purview of Section 10, and must meet requirements of the U.S. Coast Guard (33 CFR 330.5(a)(1)). **33 CFR 323.3** contains requirements for discharges of dredged or fill material into water of the United States, as those terms are defined in 33 CFR 323.2. **33 CFR Section 323.4(b)** provides that If any discharge of dredged or fill material contains any toxic pollutant listed under section 307 of the CWA such discharge shall require compliance with Section 404 of the CWA. **33 CFR 329.4** defines the term "navigable water of the United States" for purposes of the USACE regulations, including those addressing the discharge of dredged or fill material.	ARAR Applicable

Authority/Source	General Description	ARAR or TBC
Endangered Species Act, 16 U.S.C. §1531 *et seq.* 50 CFR Part 17, Subpart I, Part 402 including 50 CFR Part 17.21(c) 50 CFR Part 17.31(a)	The Endangered Species Act provides broad protection for species of fish, wildlife and plants that are listed as threatened or endangered in the U.S. or elsewhere. Applicable if any action may have an impact on an endangered species listed in 50 CFR Part 17.11(h). The federally endangered peregrine falcon has been observed in the lower 8.3 mile area. The shortnose sturgeon and Atlantic sturgeon are federally listed as endangered. The shortnose sturgeon was not collected in any of the studies conducted in Newark Bay or adjacent waters. The Atlantic sturgeon formerly inhabited the Passaic River. National Marine Fisheries Services (NMFS) collected an Atlantic sturgeon in Newark Bay in 1993/94 but has not been collected in any of the Passaic River studies.	ARAR Potentially Applicable
National Historic Preservation Act (NHPA), 16 U.S.C. §470 *et seq.* Protection of Historic Properties, 36 CFR. Part 800	The NHPA requires federal agencies to take into account the effects of any federally assisted undertaking on any district, site, building, structure or object included in, or eligible for inclusion in, the National Register of Historic Places. If the undertaking results in adverse effects, the agency must consult with the New Jersey Historic Preservation Office and other parties to develop ways to avoid, reduce, minimize, or mitigate any adverse impacts to those identified properties. A side-scan sonar survey performed in the Lower Passaic River in 2004 identified large objects including automobiles and a shipwreck. EPA expects to conduct a cultural survey (Phase I and II) during remedial design that would comply with the NHPA and aid in consultations with the New Jersey Historic Preservation Office.	ARAR Applicable
Floodplain Management: Executive Order 11988 as amended by Executive Order 13690	Directs federal agencies to evaluate the potential effects of actions that may be taken in a floodplain and to avoid, to the extent possible, long-term and short-term adverse effects associated with the occupancy and modification of floodplains, and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative. The selected remedy includes enough dredging so that the engineered cap can be placed without increasing the potential for flooding. EPA does not expect the elevation of the river bottom or the mudflats to be increased above current conditions.	TBC
Protection of Wetlands, Executive Order 11990	Directs that activities conducted by federal agencies avoid, to the extent possible, long- term and short-term adverse effects associated with the modification or destruction of wetlands. Federal agencies are to avoid direct or indirect support of new construction in wetlands when there are practical alternatives; harm to wetlands must be minimized when there is no practical alternative available. These considerations are applicable to any remedial work in wetlands. The aquatic habitat affected by the selected remedy will be replaced with habitat of similar size and location, but significantly improved quality.	TBC
Fish and Wildlife Coordination Act, 16 U.S.C. § 662, 40 CFR 6.302(g).	Requires consideration of the effects of a proposed action on wetlands and areas affecting streams (including floodplains), as well as other protected habitats. Federal agencies must consult with the United States Fish and Wildlife Service (USFWS) and the appropriate state agency with jurisdiction over wildlife resources prior to issuing permits or undertaking actions involving the modification of any body of water (including impoundment, diversion, deepening, or otherwise controlled or modified for any purpose). Consultation with USFWS will occur during remedial design.	ARAR Applicable
Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. 1801, as amended through October 11, 1996	Requires that federal agencies consult with NMFS on actions that may adversely affect essential fish habitat (EFH), defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NMFS has designated the Lower Passaic River as EFH for a number of fish species and life stages. A fish migration study will be conducted during remedial design and consultation will occur with NMFS and the New Jersey Department of Environmental Protection (NJDEP) regarding fish windows.	ARAR Applicable

Authority/Source	General Description	ARAR or TBC
Migratory Bird Treaty Act, 16 U.S.C. §703	Requires that federal agencies consult with USFWS during remedial design and remedial construction to ensure that the cleanup of the site does not unnecessarily impact migratory birds. Consultation with USFWS will occur during remedial design.	ARAR Applicable
	State	
New Jersey Soil Erosion and Sediment Control Act , N.J.S.A. 4:24-39, N.J.A.C. 2:90	Regulates construction that will potentially result in erosion of soils and sediment, such as at an upland processing facility, requires preparation of stormwater pollution prevention plan, designation of construction waste collection site, site plan for construction related erosion. Applicable to land disturbance activities involving greater than 5,000 square feet.	ARAR Potentially Applicable
New Jersey Freshwater Wetlands Protection Act, N.J.S.A. 13:9B-1,N.J.A.C. 7:7A	Regulates construction or other activities (including remedial action) that will have an impact on wetlands, including working and transporting across coastal zone to upland processing facility. As described in the Remedial Investigation/Focused Feasibility Study Appendix F, Best Management Practices will be used during implementation of the selected remedy to avoid or minimize adverse impact to aquatic habitat, consistent with substantive requirements of N.J.A.C. 7:7A.	ARAR Applicable
New Jersey Flood Hazard Area Control Act, N.J.S.A. 58:16A-50, N.J.A.C. 7:13	Regulates activities (including remedial action) within flood hazard areas that will impact stream carrying capacity or flow velocity to avoid increasing impacts of flood waters, to minimize degradation of water quality, protect wildlife and fisheries, and protect and enhance public health and welfare. Consistent with N.J.A.C. 7:13-10 and 7:13-11, EPA does not expect the elevation of the river bottom or the mudflats to be increased above current conditions. Potentially applicable to construction of upland processing facility depending on location.	ARAR Potentially Applicable
New Jersey Tidelands Act, N.J.S.A. 12:3 (Riparian Lands, Leases, Grants and Conveyances Act)	Requires a tidelands lease, grant or conveyance for use of State-owned riparian lands, including sediment removal and backfill. Tidelands, also known as riparian lands, are all those lands now or formerly flowed by the mean high tide of a natural waterway, except for those lands for which the State has already conveyed its interest in the form of a riparian grant. Applicable to dredging and capping. Substantive requirements include preparation of plans by professional engineer, depicting the limits of the tidelands instrument, notice to upland property owners.	ARAR Applicable
New Jersey Waterfront Development Law, N.J.S.A. 12:5-3, New Jersey Coastal Zone Management Rules, N.J.A.C. 7:7	Regulates any waterfront development, including sediment removal and fill, at or below mean high water and up to 500 feet from mean high water in the coastal zone and tidal waters of the State. Implemented through Coastal Zone Management Rules (N.J.A.C. 7:7), which provide rules and standards for use and development of resources in New Jersey's coastal zone. The rules are used in the review of water quality certificates subject to Section 401 of the Federal Clean Water Act, and Federal consistency determinations under Section 307 of the Federal Coastal Zone Management Act, 16 U.S.C. § 1456. The rules also provide a basis for riparian grants, leases, and licenses. Potentially applicable to construction of upland processing facility.	ARAR Applicable
New Jersey Register of Historic Places Act N.J.S.A. 13:1B-15.128 *et seq.*	If federally assisted undertaking on any district, site, building, structure or object included in, or eligible for inclusion in, the National Register of Historic Places results in adverse effects, the agency must consult with the New Jersey Historic Preservation Office and other parties to develop ways to avoid, reduce, minimize, or mitigate any adverse impacts to those identified properties. EPA expects to conduct a cultural survey (Phase I and II) during remedial design that would comply with the NHPA and aid in consultations with the New Jersey Historic Preservation Office.	ARAR Potentially Applicable

Authority/Source	General Description	ARAR or TBC
Action-Specific ARARs		
Federal		
Clean Water Act (CWA), 33 U.S.C. §1251, *et seq.*	Provides authority for EPA to establish water quality criteria for the protection of aquatic life and human health. New Jersey has promulgated surface water quality criteria. Federally recommended water quality criteria established under Section 304(a) of the CWA that are more stringent than state criteria may be relevant and appropriate. Note that the selected remedy is not a final action for the water column.	ARAR Relevant and Appropriate
CWA §§ 303, 304(a)		
40 CFR Parts 129, 131	Specific toxic pollution effluent standards that may apply: Aldrin/Dieldrin 129.4(a), DDT 129.4(b), PCBs 129.4(f)	
Clean Water Act, §401 40 CFR §121.2	Requires that an applicant for a federal license or permit provide a certification that any discharges (e.g., dredged material dewatering effluent, placement of fill, discharges of decants water) will comply with the Act, including water quality standard requirements (water quality certification). Dredging and capping must comply with substantive requirements in N.J.A.C. 7:7 (discussed above) which is basis for issuance of water quality certification in New Jersey.	ARAR Applicable
Clean Water Act, §404 40 CFR Part 230 (Guidelines for Specification of Disposal Sites for Dredged or Fill Material) 40 CFR 320-330 (discussed above under location-specific ARARs)	Regulates the discharge of dredged and fill material into waters of the United States including wetlands and including return flows from such activity. This program is implemented through regulations set forth in the 404(b)(1) guidelines, 40 CFR Part 230. The guidelines specify the types of information and environmental conditions that need to be evaluated for impacts on the aquatic ecosystem and provide for compensatory mitigation when there will be unavoidable impacts to waters of the United States. **40 CFR Part 230.10(a)** Restrictions on Discharge (approach minimizes adverse environmental consequences). **40 CFR Part 230.10(b)** (approach does not causes or contributes, after consideration of disposal site dilution and dispersion, to violations of any applicable s tate water quality standard). **40 CFR Part 230.10(c)** (discharge will not cause or contribute to significant degradation of the waters of the United States). **40 CFR Part 230.10(d)** (take appropriate and practicable steps in accordance with 40 CFR 230.70 to minimize potential adverse impacts of the discharge on the aquatic ecosystem); **40 CFR 230.11** (determine potential short-term or long-term effects of the discharge of dredged or fill material on the physical, chemical, and biological components of the aquatic environment). Consistent with CWA § 404(b)(1) and Part 230, an evaluation prepared as part of the RI/FFS and provided in Appendix F describes the Best Management Practices and engineering practices that will be used during implementation of the selected remedy to avoid or minimize adverse impacts to aquatic habitat The aquatic habitat affected by the remedy will be replaced with habitat of similar size and location, but significantly improved quality, so no additional mitigation is anticipated.	ARAR Applicable

Authority/Source	General Description	ARAR or TBC
Clean Air Act, 42 U.S.C. § 7401 *et seq*. Section 112, 40 CFR Parts 61, 63 (National Emission Standards for Hazardous Air Pollutants)	Provides emissions standards for specific contaminants and for categories of operating equipment. Relevant and appropriate to the construction and operation of the uplands processing facility. EPA does not anticipate emission of air pollutants in concentrations that would trigger these regulations or adversely affect the surrounding population but an air monitoring program will be designed as part of the Community Health and Safety Plan to document no adverse effect.	ARAR Potentially Applicable
Resource Conservation and Recovery Act (RCRA), 42 U.S.C. § 6921 *et seq.* 40 CFR Parts 239 – 299	RCRA establishes requirements for generators, transporters and facilities that manage non- hazardous solid waste, and hazardous wastes, applicable to dredged material management: **40 CFR 262.11** provides requirements for determining if a solid waste is excluded from regulation under 40 CFR 261.4 and if not, whether waste is a listed as a hazardous waste, or characteristic under 40 CFR Part 261, subpart C, which provides for evaluation and control of materials that display a hazardous waste characteristic under 40 CFR 261.21 – 261.24. EPA has determined and documented for the record that the dredged material does not contain a listed hazardous waste. Dredged material will be characterized for disposal consistent with 40 CFR 261, subpart C, and to the extent material is identified as characteristic, will be managed as hazardous waste. Refer to Parts 261, 262, 264, 265, 266, and 273 of chapter 40 for possible exclusions or restrictions. **40 CFR 262** provides general requirements for generators of hazardous waste including registration, manifesting, packaging, recordkeeping and accumulation time, e.g.: 1) **262.30 –** pre-transportation packaging requirements; 2) **262.31** – pre-transportation labeling requirements; 3) **262.32 –**pre-transportation marking requirements; 4) **262.33** – pre-transportation placarding requirements. **40 CFR 264 and 265** regulate storage of hazardous waste in containers, e.g.: 1) **264/265.171** – use container in good condition; 2) **264/265.172** – container must be lined with material compatible with contents; 3) **264/265.173** – keep containers closed and handle properly to avoid rupture; 4) **264.175(a)** to **264.175 (c)**-- regulate the storage of RCRA hazardous waste in containers with free liquid and no free liquid; includes design expectations for storage units. **40 CFR 264.178** regulates closure of RCRA container storage area. At closure, hazardous waste and hazardous waste residue must be removed from the containment system. Remaining containers, liners, bases, and soil containing or contaminated with hazardous waste must be decontaminated or removed. **40 CFR 268** contains land disposal restrictions: under 268.48 and 268.49, dredged material must be managed as a hazardous waste if the material exhibits a RCRA hazardous characteristic. In that case, it will be disposed of at a RCRA subtitle C landfill, in compliance with RCRA land disposal restrictions for characteristic hazardous wastes, after evaluation for underlying hazardous constituents and potentially, treatment prior to disposal. Non-hazardous materials may be eligible for direct landfill disposal at a RCRA Subtitle D facility, depending on the facility's permit, or may qualify for beneficial reuse depending on the results of testing and the applicable state requirements.	ARAR Applicable for sediment that is managed as hazardous waste, and relevant and appropriate for sediment managed as non-hazardous waste.

Authority/Source	General Description	ARAR or TBC
Toxic Substances Control Act of 1976 (TSCA), 15 U.S.C. §§ 2601 *et seq*. 40 CFR Part 761 Subpart D	Regulates PCBs from manufacture to disposal. Subpart D regulates storage and disposal of PCB waste. Establishes requirements for handling, storage, and disposal of PCB-containing materials, including PCB remediation wastes, and sets performance standards for disposal technologies for materials/wastes with concentrations in excess of 50 milligrams per kilogram (mg/kg). Establishes decontamination standards for PCB contaminated debris. Because the remedy requires removal of sediment to specific depths, and the maximum PCB concentrations detected in the areas of the river to be dredged do not exceed 50 mg/kg, no substantive requirements are triggered. If additional testing during remedial design identifies sediments subject to dredging with concentrations of PCBs exceeding 50 mg/kg, TSCA regulations may be applicable for managing dredged material for off-site disposal, as discussed below.	ARAR
	40 CFR 761.1(b)(5) prohibits dilution in order to avoid TSCA requirements.	Potentially Applicable
	40 CFR 761.3. Environmental media containing PCBs may be considered remediation waste if concentrations exceed 50 mg/kg.	Potentially Applicable
	40 CFR 761.50(a) provides that any person storing or disposing of PCB waste must do so in accordance with 40 CFR 761, Subpart D.	Potentially Relevant and Appropriate
	40 CFR 761.50(b)(3) provides that any person cleaning up and disposing of PCBs with concentrations exceeding 50 mg/kg shall do so based on the "as found" concentration consistent with 40 CFR 761.61.	Potentially Relevant and Appropriate
	40 CFR 761.61(a)(5) provides requirements for off-site disposal of "bulk PCB remediation waste" including sediment, as well as liquid remediation waste, non-liquid cleaning material and personal protective waste (self-implementing option).	Potentially Relevant and Appropriate
	40 CFR 761.61(b) provides for performance-based disposal of PCB remediation waste.	Potentially Relevant and Appropriate
	40 CFR 761.65(c)(9)(i) – (iii) provide for storage for disposal of PCB remediation waste. **40 CFR 761.79(c)(1)-(2)** – provide decontamination standards for containers and movable equipment.	Potentially Relevant and Appropriate

Authority/Source	General Description	ARAR or TBC
Hazardous Material Transportation Act, 49 U.S.C. §§ 1801-1819 Hazardous Waste Transportation: 49 CFR Parts 171-177	Applicable to the transportation of dredged material that is being managed as hazardous wastes, and include the procedures for the packaging, labeling, manifesting and transporting of hazardous materials to a licensed off- site disposal facility. General operating and handling requirements are outlined in 49 CFR 174, including documentation, placarding rail car/trucks, absence of leaking packages.	ARAR Applicable
State		
New Jersey Water Pollution Control Act, N.J.S.A. 58:10A, *et seq*., New Jersey Water Quality Planning Act, N.J.S.A 58:11 A, *et seq*. New Jersey Surface Water Quality Standards, N.J.A.C. 7:9B	Establishes the designated uses and antidegradation categories of New Jersey's surface waters, classifies surface waters based on those uses (i.e., stream classifications), and specifies the water quality criteria and other policies and provisions necessary to attain those designated uses. Used by New Jersey in setting discharge limits, for upland processing facility. For dredging, N.J.A.C. 7:9B is applicable to evaluate impacts to surface water quality, for issuance of Water Quality Certificate. Will likely result in best management practices and monitoring to evaluate impact on surface water quality and downstream locations.	ARAR Applicable
New Jersey Pollutant Discharge Elimination System N.J.A.C. 7:14A	Establishes effluent discharge standards to protect water quality. Applicable to establish substantive compliance with discharge limitations for discharges from upland processing facility. N.J.A.C. 7:14, Subchapter 12, Appendix B identifies effluent standards (for specified constituents) for remediation projects.	ARAR Applicable
Stormwater Management Rules, N.J.A.C. 7:8	Applicable for establishing the design and performance standards for stormwater management measures at the upland processing facility.	ARAR Applicable
Noise Control, N.J.S.A., §13:1g-1 *et seq*., N.J.A.C. 7:20	Regulates noise levels for certain types of activities and facilities such as commercial, industrial, community service and public service facilities. Relevant and appropriate for establishing allowable noise levels. A noise monitoring program will be designed as part of the Community Health and Safety Plan.	ARAR Relevant and Appropriate
New Jersey Air Pollution Control Act, N.J.S.A. § 26:2C *et seq*., N.J.A.C. 7:27	Governs emissions that introduce contaminants into the ambient atmosphere for a variety of substances and from a variety of sources; controls and prohibits air pollution, particle emissions and toxic VOC emissions. EPA does not anticipate emission of air pollutants in concentrations that would trigger these regulations or adversely affect the surrounding population but an air monitoring program will be designed as part of the Community Health and Safety Plan to document no adverse effect.	ARAR Potentially Applicable

Authority/Source	General Description	ARAR or TBC
New Jersey Solid Waste Management Act (NJSWMA), N.J.S.A. §13:1E-1, *et seq*., New Jersey Solid and Hazardous Waste Rules, N.J.A.C. 7:26 and 7:26G	New Jersey program for solid waste management and disposal pursuant to NJSWMA with regulations codified at N.J.A.C. 7:26 providing the requirements for solid waste disposal facilities. On September 14, 1998, EPA granted New Jersey full program determination of adequacy for all areas of its municipal solid waste landfill program. **N.J.A.C. 7:26-2.11(b)(9**), facilities must comply with their operating permits, including acceptance criteria for waste. Non-hazardous material must meet the acceptance criteria of the receiving facility. **N.J.A.C. 7:26-1.6(a)(5)**, dredged material from New Jersey's coastal or tidal waters, which is regulated under the New Jersey Water Pollution Control Act, New Jersey Waterfront Development Law, New Jersey Tidelands Act, Federal Clean Water Act and Federal Coastal Zone Management Act, is excluded from the definition of solid waste and thus not subject to disposal as solid waste in New Jersey. Dredged material, therefore, will not be disposed of as solid waste in New Jersey. New Jersey hazardous waste management rules incorporate RCRA regulations by reference, with few significant differences. There are no disposal facilities located in New Jersey licensed to accept hazardous waste (RCRA Subtitle C).	ARAR Applicable
New Jersey Technical Requirements for Site Remediation, May 2012, N.J.A.C. 7:26E	Establish technical requirements for investigation and remediation processes under New Jersey cleanup programs. Substantive requirements for remedial action potentially relevant and appropriate to upland facility.	ARAR Potentially Relevant and Appropriate

Notes:

ARAR - applicable or relevant and appropriate requirements
CFR - Code of Federal Regulations;
N.J.A.C. - New Jersey Administrative Code
N.J.S.A. – New Jersey Statutes Annotated
TBC - to-be-considered
U.S.C. – United States Code

Table 30
Dredged Material Incinerated or Landfilled Under DMM Scenario B (Off-Site Disposal)

Alternative	Dredged Material Incinerated (CY)	Dredged Material Landfilled (CY)
2	490,000	6,540,000
3	130,000	2,400,000
4	20,000	740,000

Notes
Numbers are in-situ cubic yards and exclude volume of reclaimed materials (sand) and some debris separated in the mechanical dewatering process.

Table 31
Dredged Material Undergoing Thermal Treatment, Sediment Washing or Stabilization Under DMM Scenario C (Local Decontamination and Beneficial Use)

Alternative	Thermal Treatment (CY)	Sediment Washing (CY)	Stabilization (CY)
2	490,000	6,400,000	194,000
3	130,000	2,380,000	35,000
4	20,000	720,000	21,000

Notes
Numbers are in-situ cubic yards and exclude volume of reclaimed materials (sand) and some debris separated in the mechanical dewatering process.

Table 32
Present Value Cost Estimates[1]

Alternative	Disposal Scenario	Capital Costs	Average Annual Long-term O&M Costs[2]	Total[3]
1) No Action	--	$0	$0	$0
2) Deep Dredging with Backfill	with CAD	$1,190,000,000	$571,000	$1,207,000,000
	with Off-Site	$2,830,000,000	$399,000	$2,842,000,000
	with Decontamination	$2,554,000,000	$399,000	$2,566,000,000
3) Capping with Dredging for Flooding and Navigation	with CAD	$805,000,000	$1,596,000	$853,000,000
	with Off-Site	$1,338,000,000	$1,468,000	$1,382,000,000
	with Decontamination	$1,319,000,000	$1,468,000	$1,363,000,000
4) Focused Capping with Dredging for Flooding	with CAD	$313,000,000	$1,450,000	$356,000,000
	with Off-Site	$522,000,000	$1,405,000	$564,000,000
	with Decontamination	$547,000,000	$1,405,000	$589,000,000

Notes

1. Present Value costs calculated using 7% discount rate. Values are rounded to the nearest million (capital costs) and nearest ten-thousand (annual average O&M costs).

2. Capital costs include capital costs, DMM capital costs, and DMM O&M costs.

3. Discounted annual and periodic O&M costs averaged over the 30-years post-construction monitoring period.

4. Total costs may not add due to rounding.

Table 33
Dredging and Engineered Capping Expectations for the Selected Remedy

<table>
<tr><th colspan="6">For RM 0 to RM 1.7
Extent of Federally-Authorized Navigation Channel</th></tr>
<tr><th rowspan="2">River Mile Section</th><th colspan="4">In the Navigation Channel</th><th rowspan="2">Outside of the Navigation Channel (in the Shoals)*</th></tr>
<tr><th>Channel Width</th><th>Dredging Depth (MLW)</th><th>Engineered Cap Thickness*</th><th>Resulting Channel Depth (MLW)</th></tr>
<tr><td>RM 0 to RM 0.6</td><td>300 feet</td><td>33 feet</td><td>generally 2 feet</td><td>30 feet</td><td>~2.5 feet of dredging and ~2-foot cap</td></tr>
<tr><td>RM 0.6 to RM 1.7</td><td>300 feet</td><td>25.5 feet</td><td>generally 2 feet</td><td>20 feet</td><td>~2.5 feet of dredging and ~2-foot cap</td></tr>
<tr><th colspan="6">For RM 1.7 to RM 8.3
Dredging and Capping for Recreational Use</th></tr>
<tr><th rowspan="2">River Mile Section</th><th colspan="4">Areas Dredged for Recreational Use</th><th rowspan="2">In the Shoals*</th></tr>
<tr><th>Width</th><th>Dredging Depth** (MLW)</th><th>Engineered Cap Thickness*</th><th>Resulting Depth (MLW)</th></tr>
<tr><td>RM 1.7 to RM 8.1</td><td>200 feet</td><td>approximately 2.5 feet</td><td>generally 2 feet</td><td>10 feet</td><td>~2.5 feet of dredging and ~2-foot cap</td></tr>
<tr><td>RM 8.1 to RM 8.3</td><td>150 feet</td><td>approximately 2.5 feet</td><td>generally 2 feet</td><td>10 feet</td><td>~2.5 feet of dredging and ~2-foot cap</td></tr>
<tr><td colspan="6">Notes
* Engineered cap thickness is expected to be, on average, 2 feet, although it may be determined during design that the cap thickness can vary in segments of the lower 8.3 miles, as long as protectiveness is maintained.

** Approximately 2.5 feet of dredging is expected to prevent the engineered cap from causing additional flooding, some additional smoothing out of a few areas to achieve at least 10 feet below MLW for reasonably anticipated recreational future use.</td></tr>
</table>

Table 34
Cost Estimate Summary for the Selected Remedy

Component	Unit	Unit Cost	# of Units	Cost
CAPITAL COSTS				
A. Pre-Construction Activities				
Design	Percentage	6%		$29,110,000
Regulatory Requirements, Legal, and Community Outreach	Percentage	2%		$9,700,000
Contractor Work Plans and Submittals	LS	$355,000	1	$355,000
Pre-Construction Support Facility	Month	$10,000	12	$120,000
Pre-Construction Oversight	Month	$48,000	12	$576,000
General and Survey and Coring Vessels Mobilization	LS	$28,900	1	$28,900
Pre-Design Investigation - Chemical, Waste Characterization, Geological Sample Collection - RM 0 to RM 1.7 Channel	Core	$1,250	609	$761,250
Pre-Design Investigation - Chemical, Waste Characterization, Geological Sample Collection - RM 1.7 to RM 8.3 and RM 0 - RM 1.7 Shoals	Core	$250	4,869	$1,217,250
Pre-Design Investigation - Geotechnical Sample Collection	Boring	$9,750	77	$750,750
Pre-Design Investigation - Chemical Analysis	Sample	$1,560	19,479	$30,387,240
Pre-Design Investigation - Waste Characterization Analysis	Sample	$1,280	7,755	$9,926,400
Pre-Design Investigation - Geological Analysis	Sample	$280	7,106	$1,989,680
Pre-Design Investigation - Geotechnical Analysis	Sample	$1,240	231	$286,440
Biological Monitoring Baseline Studies	LS	$2,800,000	1	$2,800,000
Pore Water Evaluation	Sample	$1,040	548	$569,920
Sub-bottom Geophysics and Bathymetric Survey	Day	$8,200	9	$73,800
Video Survey for Debris Identification	Day	$8,200	9	$73,800
Habitat Survey (in river)	LS	$100,000	1	$100,000
Cultural Survey (in river)	LS	$540,000	1	$540,000
Fish Spawning Study	LS	$50,000	1	$50,000
Borrow Site Pre-Screening	Sample	$3,000	300	$900,000
Borrow Material Characterization	Sample	$2,620	354	$927,480
Cap Erosion Modeling for Armor Placement Design	LS	$18,000	1	$18,000
Total Pre-Construction Activities				*$91,261,910*
B. Mobilization and Demobilization				
Dredge Equipment Mobilization/Demobilization	EA	$237,000	3	$711,000
Capping Equipment Mobilization/Demobilization	EA	$237,000	3	$711,000
Monitoring Equipment Mobilization/Demobilization	LS	$13,800	1	$13,800
Debris Removal Equipment Mobilization/Demobilization	EA	$60,000	1	$60,000
Shoreline Protection Equipment Mobilization/Demobilization	EA	$237,000	1	$237,000
New Season Restart	Year	$480,000	5	$2,160,000
Total Mobilization and Demobilization				*$3,892,800*

Component	Unit	Unit Cost	# of Units	Cost
C. Testing and Monitoring During Dredging and Capping				
Bathymetric Survey	Year	$635,200	6	$3,493,600
Water Quality Monitoring	Year	$1,195,860	6	$6,577,230
Sediment Monitoring	Year	$486,640	6	$2,676,520
Biological Monitoring	Year	$900,000	6	$4,950,000
Air Monitoring	Year	$120,000	6	$660,000
Monitoring Reports (including Laboratory Reporting)	Year	$355,000	6	$1,952,500
Total Testing and Monitoring During Dredging and Backfilling/Capping				*$20,309,850*
D. Dredging				
Mechanical Dredging	CY	$25	3,541,588	$88,539,700
Large Debris Removal, Off-loading, Transport, and Disposal	Ton	$200	6,000	$1,200,000
Sediment Screening for Bypass Pumping	CY	$9	650,000	$5,850,000
Bypass Pumping (RM 6.1 to RM 5.7)	CY	$12	1,330,000	$15,960,000
Offloading and Transport	CY	$15	720,000	$10,800,000
Barge Transport of Dredged Material	CY	$10	5,494,000	$54,940,000
Shallow Water Sediments - Double Handling	CY	$5	203,500	$1,017,500
Hydraulic Off-loading of Dredged Material	CY	$10	5,494,000	$54,940,000
Controls for Quality of Life Impacts	Percentage	1%		$4,800,000
Total Dredging				*$238,047,200*
E. Backfill and/or Engineered Cap				
Backfill/Engineered Cap Material Purchase and Delivery	CY	$30	2,723,000	$81,690,000
Backfill Material Placement	CY	$20	141,000	$2,820,000
Engineered Cap Material Placement	CY	$30	2,582,000	$77,460,000
Armor Material Purchase and Delivery	CY	$30	192,000	$5,760,000
Armor Material Placement	CY	$30	192,000	$5,760,000
Confirmation Coring	Core	$210	465	$97,650
Sediment Recontamination Monitoring	Sample	$1,560	1,395	$2,176,200
Mudflat Engineered Cap	CY	$80	203,500	$16,280,000
Mudflat Reconstruction	CY	$150	203,500	$30,525,000
Riprapped Shoreline Repairs and Replacement	SY	$75	5,000	$375,000
Total Backfill and/or Engineered Cap				*$222,943,850*
Subtotal Capital Costs				**$576,455,610**
Construction and Program Management	Percentage	10%		$48,520,000
Scope and Bid Contingency	Percentage	25%		$144,110,000
TOTAL CAPITAL COSTS				**$769,085,610**

Component	Unit	Unit Cost	# of Units	Cost
DREDGED MATERIAL MANAGEMENT CAPITAL COSTS				
F2. Pre-Construction Activities for DMM				
Design	Percentage	6%		$52,400,000
Regulatory Requirements, Legal, and Community Outreach	Percentage	2%		$17,470,000
Land Acquisition	Acre	$510,000	32	$16,065,000
Contractor Work Plans and Submittals	LS	$119,000	1	$119,000
Pre-Construction Oversight	Month	$48,000	3	$144,000
Upland Sediment Processing Facility Site Investigation - Geotechnical	Boring	$3,220	63	$202,860
Upland Sediment Processing Facility Site Investigation - Chemical	Core	$2,560	32	$80,640
Topographic Survey - Upland Sediment Processing Facility Site	Acre	$870	34.5	$30,015
Habitat Survey (upland sediment processing facility site)	LS	$42,000	1	$42,000
Cultural Survey (upland sediment processing facility site)	LS	$42,000	1	$42,000
Miscellaneous Tests for DMM Design	LS	$106,130	1	$106,130
Total Pre-Construction Activities for DMM				*$86,701,645*
G2. Upland Sediment Processing Facility				
Mobilization and Demobilization	Percentage	10%		$5,930,000
Mechanical and Electrical	Percentage	10%		$5,930,000
Layout and Documentation Surveys	Day	$4,000	104	$416,000
Fencing	LF	$60	9,400	$564,000
Exterior Lighting	Acre	$50,000	32	$1,600,000
Security	LS	$100,000	1	$100,000
Buildings	LS	$25,340,000	1	$25,340,000
Utilities	LS	$1,250,000	1	$1,250,000
Earthwork	CY	$12	169,000	$2,028,000
Stormwater Management	LS	$154,000	1	$154,000
Paving	SY	$30	105,000	$3,150,000
Pier/Dock Structure	SF	$160	50,000	$8,000,000
Prefabricated Building (Sprung Structure) for Dewatered Sediment Storage	SF	$40	138,000	$5,520,000
Storage Area - Concrete Slab and Push Walls	CY	$600	6,000	$3,600,000
Storage Area - Subgrade Material	CY	$40	2,600	$104,000
Storage Area - Filter Fabric	SY	$2	15,400	$30,800
Storage Area - Vapor Emissions Control	Unit	$5,000	12	$60,000
Piping	LF	$30	33,600	$1,008,000
Upfront Storage and Recycle Water Tanks	LS	$707,000	1	$707,000
Loadout Facility	LS	$500,000	1	$500,000

Component	Unit	Unit Cost	# of Units	Cost
Rail Line Spur/Railcar Storage	Mile	$1,000,000	5	$5,000,000
Temporary Bunkers for Loadout Facility	Unit	$10,000	2	$20,000
Hazardous Material Storage Area	LS	$93,000	1	$93,000
Air Monitoring During Construction	Month	$5,000	12	$60,000
Total Upland Sediment Processing Facility				*$71,164,800*
H2. Equipment Costs				
Operating Equipment	LS	$1,067,000	1	$1,067,000
Wastewater Treatment Plant	LS	$6,701,000	1	$6,701,000
Total Equipment Costs				*$7,768,000*
I2. Processing and Disposal				
Mechanical Dewatering Using Filter Presses	CY	$50	3,541,588	$177,079,400
Dredged Material Testing for Disposal	5000 CY	$1,088	440	$478,720
Transport Off-site Thermal Treatment	Ton	$240	100,000	$24,000,000
Thermal Treatment and Disposal (Off-site Facility)	Ton	$400	100,000	$40,000,000
Transport to Subtitle C Landfill (Off-site Facility)	Ton	$130	2,070,000	$269,100,000
Off-site Disposal in Subtitle C Landfill	Ton	$100	2,070,000	$207,000,000
Decontamination and Disposal of Medium-sized Debris	Ton	$200	231,000	$46,200,000
Debris Transport and Disposal (Small Organic Fraction) in Subtitle C Landfill	Ton	$230	20,000	$4,600,000
Reclaimed Sand Processing, Transport, and Beneficial Use	Ton	$50	500,000	$25,000,000
Total Processing and Disposal				*$793,458,120*
J2. Site Decommissioning/Restoration	Acre	$30,000	32	$945,000
Total Decommissioning/Restoration				*$945,000*
Subtotal Dredged Material Management Capital Costs				**$960,037,565**
Construction and Program Management	Percentage	10%		$87,330,000
Scope and Bid Contingency	Percentage	25%		$240,010,000
TOTAL DREDGED MATERIAL MANAGEMENT CAPITAL COSTS				**$1,287,377,565**

Component	Unit	Unit Cost	# of Units	Cost
DREDGED MATERIAL MANAGEMENT O&M COSTS				
K. DMM Site O&M				
Wastewater Treatment Plant O&M	Year	$670,100	1	$670,100
Sediment Processing Site O&M	Year	$2,738,000	1	$2,738,000
Operations Management/Coordination	Year	$939,000	1	$939,000
Wastewater Testing	Month	$5,430	12	$65,160
Air Monitoring	Month	$5,000	12	$60,000
Subtotal DMM Site O&M				**$4,472,260**
Construction and Program Management	Percentage	10%		$450,000
Scope and Bid Contingency	Percentage	25%		$1,120,000
TOTAL DREDGED MATERIAL MANAGEMENT O&M COSTS				**$6,042,260**
LONG-TERM O&M COSTS				
L. Annual Monitoring Activities				
Community Outreach	LS	$95,000	1	$95,000
Mobilization and Demobilization of Monitoring Equipment	EA	$26,900	1	$26,900
Bathymetric Survey	Day	$8,200	9	$73,800
Water Column Sampling and Analysis	Sample	$1,000	37	$37,000
Sediment Sampling and Analysis	Sample	$830	1,826	$1,515,580
Biological Monitoring	LS	$1,400,000	1	$1,400,000
Habitat Recolonization using SPI	Location	$2,300	17	$39,100
Annual Monitoring Reports	EA	$105,000	1	$105,000
Total Annual Monitoring Activities				*$3,292,380*
M. Annual Maintenance Activities				
Mobilization and Demobilization of Cap Maintenance Equipment	EA	$54,000	1	$54,000
Ice Scour Evaluation of Cap along Shoreline	LS	$21,000	1	$21,000
Annual Cap Maintenance	CY	$50	5,200	$260,000
Total Annual Maintenance Activities				*$335,000*
Subtotal Annual O&M				**$3,627,380**
Construction and Program Management	Percentage	10%		$360,000
Scope and Bid Contingency	Percentage	25%		$910,000
TOTAL ANNUAL O&M				**$4,897,380**

Component	Unit	Unit Cost	# of Units	Cost
N. Periodic Monitoring Activities				
Supplemental Biological Monitoring	Year	$1,400,000	1	$1,400,000
Supplemental Habitat Recolonization using SPI	Location	$2,400	66	$158,400
Performance Review Report	Year	$365,000	1	$365,000
Total Periodical Monitoring Activities				*$1,923,400*
O. Periodic Maintenance Activitites				
Periodic Cap Maintenance	CY	$50	130,000	$6,500,000
Natural Shoreline Maintenance	LF	$200	2,300	$460,000
Total Periodic Maintenance Activitites				*$6,960,000*
Subtotal Periodic O&M				**$8,883,400**
Construction and Program Management	Percentage	10%		$890,000
Scope and Bid Contingency	Percentage	25%		$2,220,000
TOTAL PERIODIC O&M				**$11,993,400**

Notes: CAD = Confined Aquatic Disposal; CY = Cubic Yard; DMM = Dredged Material Management; EA = Each; HARS = Historic Area Remediation Site; LF = Linear Feet; LS = Lump Sum; O&M = Operation and Maintenance; SPI = Sediment Profile Imaging; SF = Square Feet; SY = Square Yard.

Table 35
Summary of Present Value Analysis for Cost Estimate of the Selected Remedy

YEAR	TOTAL PV	CONTINGENCY	CM	COST PV	2015	2016	2017	2018	2019	2020	2021	2022	2023
Alternative 3 with DMM Scenario B: Capping with Dredging for Flooding and Navigation, Off-Site Disposal													
TOTAL PRESENT VALUE	**$ 1,382,073,200**	**$ 258,630,300**	**$ 88,922,600**	**$ 1,034,520,300**									
Capital Costs	**$ 493,844,000**	**$ 92,831,100**	**$ 29,688,500**	**$ 371,324,400**	**$ -**	**$ -**	**$ 30,350,637**	**$ 30,350,637**	**$ 32,083,437**	**$ 87,009,255**	**$ 87,489,255**	**$ 87,489,255**	**$ 87,489,255**
Pre-construction Activities	$ 93,048,600	$ 18,609,700	$ -	$ 74,438,900	$ -	$ -	$ 30,350,637	$ 30,350,637	$ 30,350,637				
Mobilization and Demobilization	$ 3,514,300	$ 650,800	$ 260,300	$ 2,603,200	$ -	$ -	$ -	$ -	$ 1,732,800	$ -	$ 480,000	$ 480,000	$ 480,000
Testing and Monitoring During Dredging and Capping	$ 16,860,700	$ 3,122,400	$ 1,248,900	$ 12,489,400	$ -	$ -	$ -	$ -	$ -	$ 3,692,700	$ 3,692,700	$ 3,692,700	$ 3,692,700
Dredging	$ 195,338,000	$ 36,173,700	$ 14,469,500	$ 144,694,800	$ -	$ -	$ -	$ -	$ -	$ 42,781,309	$ 42,781,309	$ 42,781,309	$ 42,781,309
Backfilling and/or Engineered Cap	$ 185,082,400	$ 34,274,500	$ 13,709,800	$ 137,098,100	$ -	$ -	$ -	$ -	$ -	$ 40,535,245	$ 40,535,245	$ 40,535,245	$ 40,535,245
Dredged Material Management Capital Costs	**$ 822,228,800**	**$ 153,576,900**	**$ 54,345,200**	**$ 614,306,700**	**$ -**	**$ -**	**$ 21,675,411**	**$ 78,933,223**	**$ 65,025,811**	**$ 132,243,020**	**$ 132,243,020**	**$ 132,243,020**	**$ 132,243,020**
Pre-construction Activities for DMM	$ 88,569,300	$ 17,713,900	$ -	$ 70,855,400	$ -	$ -	$ 21,675,411	$ 43,350,823	$ 21,675,411				
Upland Sediment Processing Facility	$ 75,858,600	$ 14,047,900	$ 5,619,200	$ 56,191,500	$ -	$ -	$ -	$ 35,582,400	$ 35,582,400				
Equipment Costs	$ 8,000,400	$ 1,481,600	$ 592,600	$ 5,926,200	$ -	$ -	$ -	$ -	$ 7,768,000				
Processing and Disposal	$ 649,194,300	$ 120,221,200	$ 48,088,500	$ 480,884,600	$ -	$ -	$ -	$ -	$ -	$ 132,243,020	$ 132,243,020	$ 132,243,020	$ 132,243,020
Site Decommissioning/Restoration	$ 606,200	$ 112,300	$ 44,900	$ 449,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Dredged Material Management O&M Costs	**$ 21,954,800**	**$ 4,065,700**	**$ 1,626,300**	**$ 16,262,800**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 4,472,260**	**$ 4,472,260**	**$ 4,472,260**	**$ 4,472,260**
Long-Term Operation and Maintenance Costs	**$ 44,045,600**	**$ 8,156,600**	**$ 3,262,600**	**$ 32,626,400**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Annual O&M	$ 30,890,700	$ 5,720,500	$ 2,288,200	$ 22,882,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Periodic O&M	$ 13,154,900	$ 2,436,100	$ 974,400	$ 9,744,400	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

YEAR	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Alternative 3 with DMM Scenario B: Capping with Dredging for Flooding and Navigation, Off-Site Disposal													
TOTAL PRESENT VALUE													
Capital Costs	**$ 87,489,255**	**$ 43,744,627**											
Pre-construction Activities													
Mobilization and Demobilization	$ 480,000	$ 240,000											
Testing and Monitoring During Dredging and Capping	$ 3,692,700	$ 1,846,350											
Dredging	$ 42,781,309	$ 21,390,655											
Backfilling and/or Engineered Cap	$ 40,535,245	$ 20,267,623											
Dredged Material Management Capital Costs	**$ 132,243,020**	**$ 132,243,020**	**$ 945,000**										
Pre-construction Activities for DMM													
Upland Sediment Processing Facility													
Equipment Costs													
Processing and Disposal	$ 132,243,020	$ 132,243,020											
Site Decommissioning/Restoration	$ -	$ -	$ 945,000										
Dredged Material Management O&M Costs	**$ 4,472,260**	**$ 4,472,260**											
Long-Term Operation and Maintenance Costs	**$ -**	**$ -**	**$ 3,627,380**	**$ 3,627,380**	**$ 3,627,380**	**$ 3,627,380**	**$ 12,510,780**	**$ 3,627,380**	**$ 3,627,380**	**$ 3,627,380**	**$ 3,627,380**	**$ 12,510,780**	**$ 3,627,380**
Annual O&M	$ -	$ -	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380
Periodic O&M	$ -	$ -	$ -	$ -	$ -	$ -	$ 8,883,400	$ -	$ -	$ -	$ -	$ 8,883,400	$ -

YEAR	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Alternative 3 with DMM Scenario B: Capping with Dredging for Flooding and Navigation, Off-Site Disposal														
TOTAL PRESENT VALUE														
Capital Costs														
Pre-construction Activities														
Mobilization and Demobilization														
Testing and Monitoring During Dredging and Capping														
Dredging														
Backfilling and/or Engineered Cap														
Dredged Material Management Capital Costs														
Pre-construction Activities for DMM														
Upland Sediment Processing Facility														
Equipment Costs														
Processing and Disposal														
Site Decommissioning/Restoration														
Dredged Material Management O&M Costs														
Long-Term Operation and Maintenance Costs	**$ 3,627,380**	**$ 3,627,380**	**$ 3,627,380**	**$ 12,510,780**	**$ 3,627,380**	**$ 3,627,380**	**$ 3,627,380**	**$ 3,627,380**	**$ 12,510,780**	**$ 3,627,380**	**$ 3,627,380**	**$ 3,627,380**	**$ 3,627,380**	**$ 12,510,780**
Annual O&M	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380
Periodic O&M	$ -	$ -	$ -	$ 8,883,400	$ -	$ -	$ -	$ -	$ 8,883,400	$ -	$ -	$ -	$ -	$ 8,883,400

YEAR	2051	2052	2053	2054	2055	2056
Alternative 3 with DMM Scenario B: Capping with Dredging for Flooding and Navigation, Off-Site Disposal						
TOTAL PRESENT VALUE						
Capital Costs						
Pre-construction Activities						
Mobilization and Demobilization						
Testing and Monitoring During Dredging and Capping						
Dredging						
Backfilling and/or Engineered Cap						
Dredged Material Management Capital Costs						
Pre-construction Activities for DMM						
Upland Sediment Processing Facility						
Equipment Costs						
Processing and Disposal						
Site Decommissioning/Restoration						
Dredged Material Management O&M Costs						
Long-Term Operation and Maintenance Costs	**$ 3,627,380**	**$ 3,627,380**	**$ 3,627,380**	**$ 3,627,380**	**$ 12,510,780**	
Annual O&M	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	$ 3,627,380	
Periodic O&M	$ -	$ -	$ -	$ -	$ 8,883,400	

APPENDIX III

ADMINISTRATIVE RECORD INDEX

ADMINISTRATIVE RECORD INDEX OF DOCUMENTS

FINAL

03/03/2016

REGION ID: 02

Site Name: DIAMOND ALKALI CO.
CERCLIS ID: NJD980528996
OUID:
SSID: 0296
Action: LOWER 8 MILES OF LOWER PASSAIC RIVER

DocID:	Doc Date:	Title:	Image Count:	Doc Type:	Beginning Bates:	Ending Bates:	Addressee Name/Organization:	Author Name/Organization:
697621	03/03/201	ADMINISTRATIVE RECORD INDEX FOR THE LOWER 8 MILES OF THE LOWER PASSAIC RIVER	62	ARI / Administrative Record Index				R02: (US ENVIRONMENTAL PROTECTION AGENCY)
205856	10/30/1985	A STUDY OF DIOXIN IN AQUATIC ANIMALS AND SEDIMENTS	107	RPT / Report	R2-0000001	R2-0000107		R02: Belton, Thomas, J (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF THE COMMISSIONER), R02: Hazen, Robert (NONE)
85198	4/20/1994	ADMINISTRATIVE ORDER ON CONSENT. IN THE MATTER OF THE DIAMOND ALKALI SUPERFUND SITE, PASSAIC RIVER STUDY AREA. OCCIDENTAL CHEMICAL CORPORATION, RESPONDENT.	49	LGL / Legal Instrument	R2-0000108	R2-0000156	R02: (Occidental Chemical Corporation)	R02: (US ENVIRONMENTAL PROTECTION AGENCY)
246728	1/1/1995	NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION FINAL REPORT ON COMMUNITY OUTREACH TO AT RISK URBAN ANGLERS - APPENDIX URBAN ANGLER SURVEY	26	RPT / Report	R2-0000157	R2-0000182		R02: (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION)
703087	1/1/1995	NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION FINAL REPORT ON COMMUNITY OUTREACH TO AT RISK URBAN ANGLERS	13	RPT / Report	R2-0000183	R2-0000195		R02: (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION)
82747	7/6/1995	DRAFT SCREENING-LEVEL HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT - VOLUME I OF II FOR THE PASSAIC RIVER STUDY AREA	243	RPT / Report	R2-0000196	R2-0000438		R02: (CHEMRISK)
82749	7/6/1995	DRAFT SCREENING-LEVEL HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT - VOLUME IIA OF II FOR THE PASSAIC RIVER STUDY AREA	228	RPT / Report	R2-0000439	R2-0000666		R02: (CHEMRISK)
82750	7/6/1995	DRAFT SCREENING-LEVEL HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT - VOLUME IIB FOR THE PASSAIC RIVER STUDY AREA	288	RPT / Report	R2-0000667	R2-0000954		R02: (CHEMRISK)
213236	1/1/1996	JOURNAL ARTICLE - SOCIETY FOR RISK ANALYSIS: FISHING IN A POLLUTED ESTUARY FISHING BEHAVIOR FISH CONSUMPTION AND POTENTIAL RISK	13	PUB / Publication	R2-0000955	R2-0000967		R02: May, Helen (RUTGERS UNIVERSITY), R02: Burger, Joanna (RUTGERS UNIVERSITY)
213233	1/1/1999	JOURNAL ARTICLE - SOCIETY FOR RISK ANALYSIS: FISHING IN URBAN NEW JERSEY ETHNICITY AFFECTS INFORMATION SOURCES PERCEPTION AND COMPLIANCE	13	PUB / Publication	R2-0000968	R2-0000980		R02: Burger, Joanna (RUTGERS UNIVERSITY), R02: Pflugh, Kerry Kirk (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION), R02: Lurig, Lynette (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION)

ADMINISTRATIVE RECORD INDEX OF DOCUMENTS

FINAL

03/03/2016

REGION ID: 02

Site Name: DIAMOND ALKALI CO.
CERCLIS ID: NJD980528996
OUID:
SSID: 0296
Action: LOWER 8 MILES OF LOWER PASSAIC RIVER

DocID:	Doc Date:	Title:	Image Count:	Doc Type:	Beginning Bates:	Ending Bates:	Addressee Name/Organization:	Author Name/Organization:
213234	1/1/1999	JOURNAL ARTICLE - THE SCIENCE OF THE TOTAL ENVIRONMENT: URBAN ANGLERS PERCEPTION OF RISK FROM CONTAMINATED FISH	16	PUB / Publication	R2-0000981	R2-0000996		R02: Burger, Joanna (RUTGERS UNIVERSITY), R02: Pflugh, Kerry Kirk (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION), R02: Lurig, Lynette (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION)
703089	1/1/1999	NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION FINAL REPORT TO US EPA REGION 2 - COMMUNITY OUTREACH TO AT RISK URBAN ANGLERS	21	RPT / Report	R2-0000997	R2-0001017		R02: (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION)
83731	1/24/2000	PASSAIC RIVERFRONT REVITALIZATION, FACT SHEET, JANUARY 24, 2000 (WITH ATTACHMENTS)	59	LST / List/Index	R2-0001018	R2-0001076		R02: (EHRENKRANTZ ECKSTUT & KUHN ARCHITECTS PC)
205857	11/16/2001	CONSUMPTION PATTERNS AND WHY PEOPLE FISH	11	PUB / Publication	R2-0001077	R2-0001087		R02: Burger, Joanna (NONE)
213385	1/1/2002	PASSAIC RIVER STUDY AREA AVIAN SURVEY	58	RPT / Report	R2-0001088	R2-0001145		R02: (BLASLAND, BOUCK & LEE, INCORPORATED)
212961	4/25/2002	ESTIMATE OF CANCER RISK TO CONSUMERS OF CRABS CAUGHT IN THE AREA	10	RPT / Report	R2-0001146	R2-0001155		R02: (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION)
241160	7/1/2002	MASTER PLAN REEXAMINATION REPORT, TOWN OF KEARNY	31	RPT / Report	R2-0001156	R2-0001186		R02: (HEYER, GRUEL & ASSOCIATES)
213239	1/1/2003	JOURNAL ARTICLE - JOURNAL OF SHELLFISH RESEARCH: DIOXIN/FURAN AND POLYCHLORINATED BIPHENYL CONCENTRATIONS IN EASTERN OYSTER TISSUES AND THE EFFECTS ON EGG FERTILIZATION AND DEVELOPMENT	10	PUB / Publication	R2-0001187	R2-0001196		R02: Cooper, K.r. (RUTGERS UNIVERSITY), R02: Wintermyer, M.l. (RUTGERS UNIVERSITY)
206877	8/25/2003	EVALUATION OF THE HEP / CARP MODELING FRAMEWORK FOR APPLICATION TO THE PASSAIC RIVER ESTUARY STUDY	18	RPT / Report	R2-0001197	R2-0001214	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (HYDROQUAL INCORPORATED)
241159	10/1/2003	HARRISON WATERFRONT REDEVELOPMENT PLAN	78	WP / Work Plan	R2-0001215	R2-0001292		R02: (HEYER, GRUEL & ASSOCIATES)
241158	1/22/2004	PASSAIC RIVERFRONT REDEVELOPMENT PLAN (PRESENTATION 1/22/2004)	55	WP / Work Plan	R2-0001293	R2-0001347	R02: (CITY OF NEWARK)	R02: (EHRENKRANTZ ECKSTUT & KUHN ARCHITECTS PC), R02: (CLARKE CATON HINTZ)

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99861	4/6/2004	SETTLEMENT AGREEMENT AND RESPONSE COSTS FOR SETTLING PARTIES, LOWER PASSAIC RIVER STUDY AREA	54	AGMT / Agreement	R2-0001348	R2-0001401		R02: Sansonetti, Thomas, L (U.S. DEPARTMENT OF JUSTICE), R02: Kenny, Jane, M (US ENVIRONMENTAL PROTECTION AGENCY)
212826	5/25/2004	ENVIRONMENTAL DREDGING AND SEDIMENT DECONTAMINATION TECHNOLOGY DEMONSTRATION PILOT STUDY, HYDROGRAPHIC SURVEY, SIDE SCAN SONAR SURVEY FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	39	RPT / Report	R2-0001402	R2-0001440		R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION), R02: (TAMS CONSULTANTS INCORPORATED)
206864	6/1/2004	APPENDICES TO THE FINAL DREDGING TECHNOLOGY REVIEW REPORT	497	RPT / Report	R2-0001441	R2-0001937	R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: (MALCOLM PIRNIE, INCORPORATED), R02: (TAMS CONSULTANTS)
206865	6/1/2004	FINAL DREDGING TECHNOLOGY REVIEW REPORT	66	RPT / Report	R2-0001938	R2-0002003	R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: (MALCOLM PIRNIE, INCORPORATED), R02: (TAMS CONSULTANTS)
212827	6/1/2004	PROJECT PLANS FOR GEOPHYSICAL SURVEYS AND SEDIMENT CORING FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	336	WP / Work Plan	R2-0002004	R2-0002339	R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: (MALCOLM PIRNIE, INCORPORATED), R02: (TAMS CONSULTANTS INCORPORATED)
212839	6/15/2004	DRAFT SAMPLING PLAN FOR SUMMER / FALL 2004 FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	76	WP / Work Plan	R2-0002340	R2-0002415	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED), R02: (HYDROQUAL INCORPORATED)
234923	8/9/2004	CORRESPONDENCE AND COMMENTS ON DRAFT DOCUMENTS FOR THE PASSAIC RIVER PILOT SCALE DEMONSTRATION PROJECT	13	LTR / Letter	R2-0002416	R2-0002428	R02: Baron, Lisa (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: Potter, Willard (DE MAXIMIS INCORPORATED)
205807	10/11/2004	CORRESPONDENCE REGARDING STANDARDS OF THE COORDINATE SYSTEM AND RIVER MILES	3	MEMO / Memorandum	R2-0002429	R2-0002431	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: Cedro, Stephanie (MALCOLM PIRNIE, INCORPORATED)
234924	11/17/2004	CORRESPONDENCE REGARDING DRAFT MODELING WORK PLAN FOR THE LOWER PASSAIC RIVER RESTORATION STUDY	2	LTR / Letter	R2-0002432	R2-0002433	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Potter, Willard (DE MAXIMIS INCORPORATED)
234922	12/6/2004	LAND USE ELEMENT OF THE MASTER PLAN FOR THE CITY OF NEWARK	257	RPT / Report	R2-0002434	R2-0002690	R02: (CENTRAL PLANNING BOARD, CITY OF NEWARK)	R02: (CITY OF NEWARK)
207246	2/1/2005	PROJECT DELIVERY TEAM MEETING ON 02/02/2005 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT	1	MTG / Meeting Document	R2-0002691	R2-0002691		

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206843	2/2/2005	PROJECT DELIVERY TEAM (PDT) MEETING 02/02/2005 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0002692	R2-0002693		
207252	3/1/2005	PROJECT DELIVERY TEAM MEETING ON 03/09/2005 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT	1	MTG / Meeting Document	R2-0002694	R2-0002694		
206848	3/9/2005	PROJECT DELIVERY TEAM (PDT) MEETING 03/09/2005 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0002695	R2-0002696		
212845	3/9/2005	PRESENTATION - PROJECT DELIVERY TEAM - INTEGRATING RISK AND DECISION ANALYSIS TO GUIDE RESTORATION AND MANAGEMENT OF CONTAMINATED SEDIMENTS	29	OTH / Other	R2-0002697	R2-0002725		R02: Kiker, Gregory (US ARMY CORPS OF ENGINEERS), R02: Bridges, Todd (US ARMY CORPS OF ENGINEERS)
207254	3/23/2005	PROJECT DELIVERY TEAM MEETING ON 04/06/2005 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT	1	MTG / Meeting Document	R2-0002726	R2-0002726		
206849	4/6/2005	PROJECT DELIVERY TEAM (PDT) MEETING 04/06/2005 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0002727	R2-0002728		
212846	4/6/2005	PRESENTATION - PROJECT DELIVERY TEAM - COMMUNITY INVOLVEMENT PLAN UPDATE FOR THE LOWER PASSAIC RIVER AND NEWARK BAY	9	OTH / Other	R2-0002729	R2-0002737		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
212847	4/6/2005	PRESENTATION - PROJECT DELIVERY TEAM - WELCOME TO THE SEDIMENT REMEDIATION TECHNOLOGY DATABASE, DREDGING, CAPPING, IN-SITU REMEDIATION AND MONITORED NATURAL RECOVERY	125	LST / List/Index	R2-0002738	R2-0002862		R02: (MALCOLM PIRNIE, INCORPORATED)
212848	4/6/2005	PRESENTATION - PROJECT DELIVERY TEAM - CERCLA / WRDA: INTEGRATED FEASIBILITY PLANNING PROCESS	22	LST / List/Index	R2-0002863	R2-0002884		R02: (MALCOLM PIRNIE, INCORPORATED)
207255	4/15/2005	PROJECT DELIVERY TEAM MEETING ON 05/04/2005 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT	1	MTG / Meeting Document	R2-0002885	R2-0002885		

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240925	4/25/2005	TIERRA SOLUTIONS INCORPORATED'S COMMENTS ON PRESENTATION GIVEN ON 03/23/2005 AND THE LOWER PASSAIC RIVER RESTORATION PROJECT DRAFT DATA SUMMARY AND EVALUATION REPORT	7	LTR / Letter	R2-0002886	R2-0002892	R02: Baron, Lisa (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: Mcnutt, Richard (TIERRA SOLUTIONS, INCORPORATED)
206866	5/1/2005	FINAL DATA SUMMARY AND EVALUATION REPORT	285	RPT / Report	R2-0002893	R2-0003177	R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: (MALCOLM PIRNIE, INCORPORATED), R02: (TAMS CONSULTANTS)
206828	5/4/2005	LOWER PASSAIC RIVER RESTORATION PROJECT SUMMARY OF UPCOMING ACTIVITIES AND MEETINGS FOR 05/01/2005	2	LST / List/Index	R2-0003178	R2-0003179		
212849	5/4/2005	PRESENTATION - PROJECT DELIVERY TEAM - PRELIMINARY DRAFT, CONCEPTUAL SITE MODEL ISOTOPE AND BATHYMETRY BASED SEDIMENTATION RATES APRIL 2005	1	FIG / Figure/Map/ Drawing	R2-0003180	R2-0003180		R02: (MALCOLM PIRNIE, INCORPORATED)
212850	5/4/2005	PRESENTATION - PROJECT DELIVERY TEAM - PRELIMINARY DRAFT, CONCEPTUAL SITE MODEL ISOTOPE AND BATHYMETRY BASED SEDIMENTATION RATES MARCH 2005	1	FIG / Figure/Map/ Drawing	R2-0003181	R2-0003181		R02: (MALCOLM PIRNIE, INCORPORATED)
212851	5/4/2005	PRESENTATION TO THE PROJECT DELIVERY TEAM - GEOCHEMICAL EVALUATION OF HISTORICAL SEDIMENT DATA FOR THE LOWER PASSAIC RIVER	44	OTH / Other	R2-0003182	R2-0003225		R02: Garvey, Ed (MALCOLM PIRNIE, INCORPORATED)
240926	5/5/2005	CORRESPONDENCE REGARDING THE PRESENTATION ON LOWER PASSAIC RIVER: GEOCHEMICAL EVALUATION OF HISTORICAL SEDIMENT DATA	1	LTR / Letter	R2-0003226	R2-0003226	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Firstenberg, Clifford E. (TIERRA SOLUTIONS, INCORPORATED)
234925	5/12/2005	CORRESPONDENCE AND COMMENTS ON DRAFT DOCUMENTS FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT - DRAFT WORK PLAN FIELD SAMPLING PLAN VOLUME 1 AND QUALITY ASSURANCE PROJECT PLAN	44	LTR / Letter	R2-0003227	R2-0003270	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Potter, Willard (DE MAXIMIS INCORPORATED)
240927	5/12/2005	TIERRA SOLUTIONS INCORPORATED'S COMMENTS ON THE LOWER PASSAIC RIVER RESTORATION PROJECT PLAN, FIELD SAMPLING PLAN VOLUME 1, AND QUALITY ASSURANCE PROJECT PLAN	52	LTR / Letter	R2-0003271	R2-0003322	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Mcnutt, Richard (TIERRA SOLUTIONS, INCORPORATED)

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212820	5/31/2005	CORRESPONDENCE REGARDING DE MAXIMIS, INC. ON BEHALF OF THE COOPERATIVE PARTIES GROUP'S COMMENTS ON THE DRAFT MODELING WORK PLAN FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	24	LTR / Letter	R2-0003323	R2-0003346	R02: Nicholson, Scott (US ARMY CORPS OF ENGINEERS), R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Potter, Willard (DE MAXIMIS INCORPORATED)
212821	5/31/2005	CORRESPONDENCE REGARDING TIERRA SOLUTIONS, INC. COMMENTS ON DRAFT MODELING WORK PLAN FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	5	LTR / Letter	R2-0003347	R2-0003351	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Mcnutt, Richard (TIERRA SOLUTIONS, INCORPORATED)
212822	5/31/2005	CORRESPONDENCE REGARDING GENERAL COMMENTS ON DRAFT MODELING WORK PLAN, APRIL 2005 FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	18	LTR / Letter	R2-0003352	R2-0003369	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Mcnutt, Richard (TIERRA SOLUTIONS, INCORPORATED)
212867	6/1/2005	PROJECT DELIVERY TEAM - PROGRESS REPORT JUNE 2005 LOWER PASSAIC RIVER RESTORATION PROJECT	2	RPT / Report	R2-0003370	R2-0003371		
206824	6/14/2005	LOWER PASSAIC RIVER RESTORATION PROJECT SUMMARY OF UPCOMING ACTIVITIES AND MEETINGS FOR 06/01/2005	2	LST / List/Index	R2-0003372	R2-0003373		
234927	6/17/2005	CORRESPONDENCE AND COMMENTS ON THE LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP - LOWER PASSAIC RIVER RESTORATION PROJECT - DRAFT MODELING WORK PLAN ADDENDUM	11	LTR / Letter	R2-0003374	R2-0003384	R02: Butler, Elizabeth (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Potter, Willard (DE MAXIMIS INCORPORATED)
240928	7/5/2005	TIERRA SOLUTIONS INCORPORATED'S COMMENTS ON THE LOWER PASSAIC RIVER RESTORATION PROJECT - DRAFT ENVIRONMENTAL DREDGING PILOT STUDY - HYDRODYNAMIC MODELING REPORT	15	LTR / Letter	R2-0003385	R2-0003399	R02: Baron, Lisa (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: Mcnutt, Richard (TIERRA SOLUTIONS, INCORPORATED)
207260	7/27/2005	PROJECT DELIVERY TEAM MEETING ON 08/03/2005 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT	1	MTG / Meeting Document	R2-0003400	R2-0003400		
213231	7/27/2005	PATHWAYS ANALYSIS REPORT FOR LOWER PASSAIC RIVER RESTORATION PROJECT	155	RPT / Report	R2-0003401	R2-0003555	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED), R02: (BATTELLE)
207280	8/1/2005	TECHNICAL MEMORANDUM: PRELIMINARY GEOCHEMICAL EVALUATION - LOWER PASSAIC RIVER RESTORATION PROJECT	198	RPT / Report	R2-0003556	R2-0003753	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)

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213384	8/1/2005	FINAL REPORT OF SEDIMENT PROFILE IMAGING SURVEY OF SEDIMENT AND BENTHIC HABITAT CHARACTERISTICS FOR LOWER PASSAIC RIVER	129	RPT / Report	R2-0003754	R2-0003882	R02: (AQUA SURVEY INCORPORATED)	R02: (GERMANO & ASSOCIATES INCORPORATED)
206867	8/2/2005	ATTACHMENT B - GEOCHEMICAL DATA EVALUATION OF THE LOWER PASSAIC RIVER WORK PLAN	198	RPT / Report	R2-0003883	R2-0004080	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
206868	8/2/2005	PLATE 1 OF SURFICIAL SEDIMENT SAMPLE LOCATIONS FOR LOWER PASSAIC RIVER RESTORATION PROJECT	49	FIG / Figure/Map/ Drawing	R2-0004081	R2-0004129		R02: (MALCOLM PIRNIE, INCORPORATED)
206855	8/3/2005	PROJECT DELIVERY TEAM (PDT) MEETING 08/03/2005 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0004130	R2-0004131		
240929	8/9/2005	TIERRA SOLUTIONS INCORPORATED'S COMMENTS ON THE DRAFT PROJECT PLANS FOR ENVIRONMENTAL DREDGING PILOT STUDY - JUNE 2005	52	LTR / Letter	R2-0004132	R2-0004183	R02: Baron, Lisa (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: Mcnutt, Richard (TIERRA SOLUTIONS, INCORPORATED)
234928	8/10/2005	CORRESPONDENCE AND COMMENTS ON THE LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP - LOWER PASSAIC RIVER RESTORATION PROJECT - DRAFT ENVIRONMENTAL DREDGING PILOT STUDY PROJECT PLAN	21	LTR / Letter	R2-0004184	R2-0004204	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Potter, Willard (DE MAXIMIS INCORPORATED)
212828	8/26/2005	QUALITY ASSURANCE PROJECT PLAN FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	232	WP / Work Plan	R2-0004205	R2-0004436	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
206821	8/29/2005	LOWER PASSAIC RIVER RESTORATION PROJECT SUMMARY OF UPCOMING ACTIVITIES AND MEETINGS FOR 08/01/2005	2	LST / List/Index	R2-0004437	R2-0004438		
207263	8/29/2005	PROJECT DELIVERY TEAM MEETING ON 09/07/2005 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT	1	MTG / Meeting Document	R2-0004439	R2-0004439		
212868	9/1/2005	PROJECT DELIVERY TEAM - PROGRESS REPORT SEPTEMBER 2006 LOWER PASSAIC RIVER RESTORATION PROJECT	2	RPT / Report	R2-0004440	R2-0004441		

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206857	9/7/2005	PROJECT DELIVERY TEAM (PDT) MEETING 09/07/2005 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0004442	R2-0004443		
212853	9/7/2005	PRESENTATION - PROJECT DELIVERY TEAM MEETING - LOWER PASSAIC RIVER RESTORATION PROJECT	21	OTH / Other	R2-0004444	R2-0004464		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
92084	9/16/2005	SETTLEMENT AGREEMENT AND RESPONSE COSTS FOR SETTLING PARTIES, AMENDMENT NO. 1, LOWER PASSAIC RIVER STUDY AREA	21	AGMT / Agreement	R2-0004465	R2-0004485		
207266	9/19/2005	PROJECT DELIVERY TEAM MEETING ON 10/05/2005 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT	1	MTG / Meeting Document	R2-0004486	R2-0004486		
234929	9/19/2005	CORRESPONDENCE REGARDING QUESTIONS ARISING FROM REVIEW OF PASSAIC RIVER ESTUARY MANAGEMENT INFORMATION SYSTEM DATABASE	25	LTR / Letter	R2-0004487	R2-0004511	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Potter, Willard (DE MAXIMIS INCORPORATED)
240930	9/22/2005	TIERRA SOLUTIONS INCORPORATED'S COMMENTS ON THE DRAFT LOWER PASSAIC RIVER RESTORATION PROJECT PATHWAYS ANALYSIS REPORT - JULY 2005	42	LTR / Letter	R2-0004512	R2-0004553	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Mcnutt, Richard (TIERRA SOLUTIONS, INCORPORATED)
206831	9/27/2005	LOWER PASSAIC RIVER RESTORATION PROJECT SUMMARY OF UPCOMING ACTIVITIES AND MEETINGS FOR 09/01/2005	1	LST / List/Index	R2-0004554	R2-0004554		
206869	10/1/2005	FINAL PILOT STUDY FOR HYDRODYNAMIC MODELING FOR PASSAIC RIVER ENVIRONMENTAL DREDGING	107	RPT / Report	R2-0004555	R2-0004661	R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: (MALCOLM PIRNIE, INCORPORATED), R02: (TAMS CONSULTANTS)
212972	10/1/2005	FINAL REPORT SOLIDIFICATION / STABILIZATION OF SOFT RIVER SEDIMENTS USING DEEP SOIL MIXING	44	RPT / Report	R2-0004662	R2-0004705		R02: Maher, Dr., Ali (CENTER FOR ADVANCED INFRASTRUCTURE & TRANSPORTATION (CAIT)), R02: Najm, Dr., Husam (CENTER FOR ADVANCED INFRASTRUCTURE & TRANSPORTATION (CAIT)), R02: Boile, Dr., Maria (CENTER FOR ADVANCED INFRASTRUCTURE & TRANSPORTATION (CAIT))

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246814	10/3/2005	COMMENTS OF TIERRA SOLUTIONS, INC. ON LOWER PASSAIC RIVER RESTORATION PROJECT AND NEWARK BAY STUDY DRAFT COMMUNITY INVOLVEMENT PLAN	24	LTR / Letter	R2-0004706	R2-0004729	R02: Vadino, Carolyn, J (US ARMY CORPS OF ENGINEERS), R02: Kluesner, Dave (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Mcnutt, Richard (TIERRA SOLUTIONS, INCORPORATED)
212829	10/10/2005	FIELD MODIFICATION FORM, FINAL QAPP, AUGUST 2005 FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	1	FRM / Form	R2-0004730	R2-0004730	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
207267	10/17/2005	PROJECT DELIVERY TEAM MEETING ON 11/02/2005 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT	1	MTG / Meeting Document	R2-0004731	R2-0004731		
240931	10/19/2005	TIERRA SOLUTIONS INCORPORATED'S COMMENTS ON THE LOWER PASSAIC RIVER RESTORATION PROJECT PRELIMINARY DRAFT RESTORATION OPPORTUNITIES REPORT - AUGUST 2005	12	LTR / Letter	R2-0004732	R2-0004743	R02: Baron, Lisa (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: Mcnutt, Richard (TIERRA SOLUTIONS, INCORPORATED)
212823	10/21/2005	FINAL PASSAIC RIVER ENVIRONMENTAL DREDGING PILOT STUDY - HYDRODYNAMIC MODELING FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	107	RPT / Report	R2-0004744	R2-0004850	R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: (MALCOLM PIRNIE, INCORPORATED), R02: (TAMS, AN EARTH TECH COMPANY)
206859	11/2/2005	PROJECT DELIVERY TEAM (PDT) MEETING 11/02/2005 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0004851	R2-0004852		
212855	11/2/2005	PRESENTATION - PROJECT DELIVERY TEAM - CONCEPTUAL SITE MODEL ISOTOPE SEDIMENTATION RATES AND BATHYMETRY BASED DEPTH CHANGE MARCH 2005	1	FIG / Figure/Map/ Drawing	R2-0004853	R2-0004853		R02: (MALCOLM PIRNIE, INCORPORATED)
212856	11/2/2005	PRESENTATION - PROJECT DELIVERY TEAM BRIEFING - PASSAIC RIVER INVESTIGATION UPDATE	45	OTH / Other	R2-0004854	R2-0004898		R02: Garvey, Ed (MALCOLM PIRNIE, INCORPORATED)
212857	11/2/2005	PRESENTATION - PROJECT DELIVERY TEAM - SEDIMENT TEXTURE MAP LOWER PASSAIC RIVER RESTORATION PROJECT MILE 1 TO 2 PORTRAIT	1	FIG / Figure/Map/ Drawing	R2-0004899	R2-0004899		R02: (MALCOLM PIRNIE, INCORPORATED)
212858	11/2/2005	PRESENTATION - PROJECT DELIVERY TEAM - SEDIMENT TEXTURE MAP LOWER PASSAIC RIVER RESTORATION PROJECT MILE 3 TO 4 LANDSCAPE	1	FIG / Figure/Map/ Drawing	R2-0004900	R2-0004900		R02: (MALCOLM PIRNIE, INCORPORATED)

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212859	11/2/2005	PRESENTATION - PROJECT DELIVERY TEAM - SEDIMENT TEXTURE MAP LOWER PASSAIC RIVER RESTORATION PROJECT MILE 7 TO 8 LANDSCAPE	1	FIG / Figure/Map/ Drawing	R2-0004901	R2-0004901		R02: (MALCOLM PIRNIE, INCORPORATED)
212860	11/2/2005	PRESENTATION - PROJECT DELIVERY TEAM MEETING - THE SCREENER AT BAYSHORE IS IN PLACE	4	OTH / Other	R2-0004902	R2-0004905		R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION)
212861	11/2/2005	PRESENTATION - PROJECT DELIVERY TEAM - SEDIMENTATION RATE (1989 - 2004) LOWER PASSAIC RIVER RESTORATION PROJECT MILE 0 TO 1	17	FIG / Figure/Map/ Drawing	R2-0004906	R2-0004922		R02: (MALCOLM PIRNIE, INCORPORATED)
212862	11/2/2005	PRESENTATION - PROJECT DELIVERY TEAM - SEDIMENTATION TEXTURE MAP LOWER PASSAIC RIVER RESTORATION PROJECT MILE 1 TO 2	1	FIG / Figure/Map/ Drawing	R2-0004923	R2-0004923		R02: (MALCOLM PIRNIE, INCORPORATED)
212863	11/2/2005	PRESENTATION - PROJECT DELIVERY TEAM - SEDIMENTATION TEXTURE MAP LOWER PASSAIC RIVER RESTORATION PROJECT MILE 2 TO 3	1	FIG / Figure/Map/ Drawing	R2-0004924	R2-0004924		R02: (MALCOLM PIRNIE, INCORPORATED)
212864	11/2/2005	PRESENTATION - PROJECT DELIVERY TEAM - SEDIMENTATION TEXTURE MAP LOWER PASSAIC RIVER RESTORATION PROJECT MILE 4 TO 5	1	FIG / Figure/Map/ Drawing	R2-0004925	R2-0004925		R02: (MALCOLM PIRNIE, INCORPORATED)
212865	11/2/2005	PRESENTATION - PROJECT DELIVERY TEAM - SEDIMENTATION TEXTURE MAP LOWER PASSAIC RIVER RESTORATION PROJECT MILE 8 TO 9	1	FIG / Figure/Map/ Drawing	R2-0004926	R2-0004926		R02: (MALCOLM PIRNIE, INCORPORATED)
212866	11/2/2005	PRESENTATION - PROJECT DELIVERY TEAM - SEDIMENTATION TEXTURE MAP LOWER PASSAIC RIVER RESTORATION PROJECT MILE 12 TO 13	1	FIG / Figure/Map/ Drawing	R2-0004927	R2-0004927		R02: (MALCOLM PIRNIE, INCORPORATED)
234930	11/7/2005	CORRESPONDENCE AND COMMENTS ON LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP - LOWER PASSAIC RIVER RESTORATION PROJECT - PATHWAY ANALYSIS REPORT	11	LTR / Letter	R2-0004928	R2-0004938	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Potter, Willard (DE MAXIMIS INCORPORATED)
212830	11/21/2005	FINAL ENVIRONMENTAL DREDGING PILOT STUDY, QUALITY ASSURANCE PROJECT PLAN, REVISION 2 FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	178	WP / Work Plan	R2-0004939	R2-0005116	R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: (TAMS, AN EARTH TECH COMPANY)
206870	11/22/2005	FINAL WORK PLAN FOR LOWER PASSAIC RIVER DREDGING	21	WP / Work Plan	R2-0005117	R2-0005137	R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: (JAY CASHMAN INCORPORATED)

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212831	11/22/2005	FINAL PROJECT PLANS FOR ENVIRONMENTAL DREDGING PILOT STUDY FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	103	WP / Work Plan	R2-0005138	R2-0005240	R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: (MALCOLM PIRNIE, INCORPORATED), R02: (TAMS, AN EARTH TECH COMPANY)
246809	12/13/2005	SIGN-IN LIST FOR BASELINE ECOLOGICAL RISK ASSESSMENT WORKSHOP	2	LST / List/Index	R2-0005241	R2-0005242		
246808	12/14/2005	BASELINE ECOLOGICAL RISK ASSESSMENT WORKSHOP FOR LOWER PASSAIC RIVER RESTORATION PROJECT	66	MTG / Meeting Document	R2-0005243	R2-0005308		
207245	12/20/2005	PROJECT DELIVERY TEAM MEETING ON 02/01/2006 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT	1	MTG / Meeting Document	R2-0005309	R2-0005309		
234931	12/22/2005	CORRESPONDENCE REGARDING QUESTIONS ON LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP - LOWER PASSAIC RIVER RESTORATION PROJECT - ENVIRONMENTAL DREDGING PILOT STUDY	3	LTR / Letter	R2-0005310	R2-0005312	R02: Baron, Lisa (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: Potter, Willard (DE MAXIMIS INCORPORATED)
205089	1/11/2006	FIELD SAMPLING PLAN - VOLUME 1 - VERSION 2006-01-11 FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	282	WP / Work Plan	R2-0005313	R2-0005594	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
246807	1/12/2006	BASELINE ECOLOGICAL RISK ASSESSMENT MEETING MINUTES	42	MTG / Meeting Document	R2-0005595	R2-0005636		
206842	2/1/2006	PROJECT DELIVERY TEAM (PDT) MEETING 02/01/2006 ATTENDEES SIGN IN SHEET	3	OTH / Other	R2-0005637	R2-0005639		
207284	2/1/2006	REMEDIAL OPTIONS WORK GROUP MEETING ON 02/01/2006 - AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT	1	MTG / Meeting Document	R2-0005640	R2-0005640		
207285	2/1/2006	REMEDIAL OPTIONS WORK GROUP MEETING ON 02/01/2006 - ATTENDEES LIST - LOWER PASSAIC RIVER RESTORATION PROJECT	2	LST / List/Index	R2-0005641	R2-0005642		

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207287	2/1/2006	REMEDIAL OPTIONS WORK GROUP FEBRUARY 2006 PRESENTATION: EVALUATION OF INTERIM REMEDIAL MEASURES - LOWER PASSAIC RIVER RESTORATION PROJECT	17	LST / List/Index	R2-0005643	R2-0005659		
207286	2/23/2006	REMEDIAL OPTIONS WORK GROUP MEETING ON 02/01/2006 - MEETING MINUTES - LOWER PASSAIC RIVER RESTORATION PROJECT	5	MTG / Meeting Document	R2-0005660	R2-0005664		
212974	3/3/2006	TECHNICAL MEMORANDUM - REFINEMENT OF TOXICITY VALUES AND DEVELOPMENT OF CRITICAL BIOTA RESIDUES AND BIOMAGNIFICATION FACTORS (BMFs) CONCEPTUAL SITE MODULE/PROBLEM FORMULATION LOWER PASSAIC RIVER RESTORATION PROJECT	253	MEMO / Memorandum	R2-0005665	R2-0005917	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (BATTELLE)
207278	3/6/2006	DRAFT GEOCHEMICAL EVALUATION (STEP 2) - LOWER PASSAIC RIVER RESTORATION PROJECT	421	RPT / Report	R2-0005918	R2-0006338	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
206820	3/14/2006	LOWER PASSAIC RIVER RESTORATION PROJECT SUMMARY OF UPCOMING ACTIVITIES AND MEETINGS FOR 04/01/2006	2	LST / List/Index	R2-0006339	R2-0006340		
213240	3/21/2006	FINAL FIELD REPORT AND DATA SUMMARY - PASSAIC RIVER EROSION TESTING AND CORE COLLECTION	19	RPT / Report	R2-0006341	R2-0006359	R02: (MALCOLM PIRNIE, INCORPORATED)	R02: Cornwell, Jeffrey, C (CHESAPEAKE BIOGEOCHEMICAL ASSOCIATES), R02: Suttles, Steven, E (CHESAPEAKE BIOGEOCHEMICAL ASSOCIATES), R02: Owens, Michael (CHESAPEAKE BIOGEOCHEMICAL ASSOCIATES)
206826	3/27/2006	LOWER PASSAIC RIVER RESTORATION PROJECT STAKEHOLDER SUMMARY OF UPCOMING ACTIVITIES AND MEETINGS FOR 03/01/2006	2	LST / List/Index	R2-0006360	R2-0006361		
207253	4/5/2006	PROJECT DELIVERY TEAM MEETING ON 04/05/2006 - AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT	1	MTG / Meeting Document	R2-0006362	R2-0006362		

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207293	5/24/2006	REMEDIAL OPTIONS WORK GROUP MAY 2006 PRESENTATION: INTERIM ACTION EVALUATION PRELIMINARY DETAILED ANALYSIS - LOWER PASSAIC RIVER RESTORATION PROJECT	39	LST / List/Index	R2-0006363	R2-0006401		R02: (MALCOLM PIRNIE, INCORPORATED)
246812	5/30/2006	COMMENTS OF TIERRA SOLUTIONS, INC. ON LOWER PASSAIC RIVER RESTORATION PROJECT DRAFT HYDRODYNAMIC MODELING REPORT	31	LTR / Letter	R2-0006402	R2-0006432	R02: Taccone, Thomas (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Mcnutt, Richard (TIERRA SOLUTIONS, INCORPORATED)
207079	6/1/2006	COMMUNITY INVOLVEMENT PLAN FOR LOWER PASSAIC RIVER RESTORATION PROJECT AND NEWARK BAY STUDY	131	WP / Work Plan	R2-0006433	R2-0006563	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
234932	6/2/2006	CORRESPONDENCE AND COMMENTS ON THE LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP - LOWER PASSAIC RIVER RESTORATION PROJECT - DRAFT HYDRODYNAMIC MODELING REPORT	17	LTR / Letter	R2-0006564	R2-0006580	R02: Taccone, Tom (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Potter, Willard (DE MAXIMIS INCORPORATED)
205091	6/16/2006	DRAFT FIELD SAMPLING PLAN - VOLUME 2 FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	306	WP / Work Plan	R2-0006581	R2-0006886	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED), R02: (EARTH TECH INCORPORATED)
213247	6/16/2006	FINAL AQUA SURVEY GEOPHYSICAL SURVEY TECHNICAL REPORT FOR LOWER PASSAIC RIVER RESTORATION PROJECT	364	RPT / Report	R2-0006887	R2-0007250	R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: (AQUA SURVEY INCORPORATED)
233614	6/16/2006	TECHNICAL REPORT, GEOPHYSICAL SURVEY, LOWER PASSAIC RIVER RESTORATION PROJECT	364	RPT / Report	R2-0007251	R2-0007614	R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: (AQUA SURVEY INCORPORATED)
213241	7/1/2006	ERODIBILITY STUDY OF PASSAIC RIVER SEDIMENTS USING US ARMY CORPS OF ENGINEERS SEDFLUME	81	RPT / Report	R2-0007615	R2-0007695	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: Borrowman, Thomas, D (US ARMY ENGINEER RESEARCH AND DEVELOPMENT CENTER), R02: Smith, Ernest, R (US ARMY ENGINEER RESEARCH AND DEVELOPMENT CENTER), R02: Gailani, Joseph, Z (US ARMY ENGINEER RESEARCH AND DEVELOPMENT CENTER)

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206823	7/27/2006	LOWER PASSAIC RIVER RESTORATION PROJECT STAKEHOLDER SUMMARY OF UPCOMING ACTIVITIES AND MEETINGS FOR 07/01/2006	1	LST / List/Index	R2-0007696	R2-0007696		
207235	7/28/2006	DRAFT FINAL RESTORATION OPPORTUNITIES REPORT	55	RPT / Report	R2-0007697	R2-0007751	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION), R02: (US ARMY CORPS OF ENGINEERS)	R02: (EARTH TECH INCORPORATED)
246810	8/2/2006	COMMENTS OF COOPERATING PARTIES GROUP ON LOWER PASSAIC RIVER RESTORATION PROJECT DRAFT FIELD SAMPLING PLAN VOLUME 2	20	LTR / Letter	R2-0007752	R2-0007771	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Potter, Willard (DE MAXIMIS INCORPORATED)
246813	8/2/2006	COMMENTS OF TIERRA SOLUTIONS, INC. ON LOWER PASSAIC RIVER RESTORATION PROJECT DRAFT FIELD SAMPLING PLAN VOLUME 2	30	LTR / Letter	R2-0007772	R2-0007801	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY), R02: Taccone, Thomas (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Mcnutt, Richard (TIERRA SOLUTIONS, INCORPORATED)
206871	8/23/2006	FINAL ADDENDUM TO THE MODELING WORK PLAN FOR NEWARK BAY STUDY AREA	66	WP / Work Plan	R2-0007802	R2-0007867	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (HYDROQUAL INCORPORATED)
206822	8/30/2006	LOWER PASSAIC RIVER RESTORATION PROJECT STAKEHOLDER SUMMARY OF UPCOMING ACTIVITIES AND MEETINGS FOR 08/01/2006	1	LST / List/Index	R2-0007868	R2-0007868		
212824	9/13/2006	FINAL MODELING WORK PLAN FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	252	WP / Work Plan	R2-0007869	R2-0008120	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (MALCOLM PIRNIE, INCORPORATED), R02: (HYDROQUAL INCORPORATED)
206832	9/21/2006	LOWER PASSAIC RIVER RESTORATION PROJECT STAKEHOLDER SUMMARY OF UPCOMING ACTIVITIES AND MEETINGS FOR 09/01/2006	1	LST / List/Index	R2-0008121	R2-0008121		
206830	10/24/2006	LOWER PASSAIC RIVER RESTORATION PROJECT STAKEHOLDER SUMMARY OF UPCOMING ACTIVITIES AND MEETINGS FOR 10/01/2006	1	LST / List/Index	R2-0008122	R2-0008122		
206829	11/15/2006	LOWER PASSAIC RIVER RESTORATION PROJECT STAKEHOLDER SUMMARY OF UPCOMING ACTIVITIES AND MEETINGS FOR 11/01/2006	1	LST / List/Index	R2-0008123	R2-0008123		

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206862	12/6/2006	PROJECT DELIVERY TEAM (PDT) MEETING 12/06/2006 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0008124	R2-0008125		
207270	12/6/2006	PROJECT DELIVERY TEAM MEETING ON 12/06/2006 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT	1	MTG / Meeting Document	R2-0008126	R2-0008126		
212834	1/8/2007	FIELD MODIFICATION FORM, FINAL QAPP AUGUST 2005, ANALYSIS OF HIGH RESOLUTION SEDIMENT CORE SAMPLES COLLECTED FROM DUNDEE LAKE FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	115	FRM / Form	R2-0008127	R2-0008241	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
207251	2/15/2007	PROJECT DELIVERY TEAM MEETING ON 03/07/2007 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT	1	MTG / Meeting Document	R2-0008242	R2-0008242		
206827	2/27/2007	LOWER PASSAIC RIVER RESTORATION PROJECT STAKEHOLDER SUMMARY OF UPCOMING ACTIVITIES AND MEETINGS FOR 03/01/2007	1	LST / List/Index	R2-0008243	R2-0008243		
212835	3/6/2007	FIELD MODIFICATION FORM, FINAL QAPP AUGUST 2005, RADIOCHEMISTRY DATING OF DUNDEE LAKE HIGH RESOLUTION SEDIMENT CORE SAMPLES FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	9	FRM / Form	R2-0008244	R2-0008252	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
206847	3/7/2007	PROJECT DELIVERY TEAM (PDT) MEETING 03/07/2007 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0008253	R2-0008254		
212844	3/7/2007	PRESENTATION - PROJECT DELIVERY TEAM MEETING FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	9	OTH / Other	R2-0008255	R2-0008263		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
246811	3/9/2007	COMMENTS OF TIERRA SOLUTIONS, INC. ON LOWER PASSAIC RIVER RESTORATION PROJECT PRELIMINARY GEOTECHNICAL EVALUATION AND DRAFT GEOCHEMICAL EVALUATION STEP 2	50	LTR / Letter	R2-0008264	R2-0008313	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Firstenberg, Clifford E. (TIERRA SOLUTIONS, INCORPORATED)
205855	3/29/2007	NEW JERSEY'S POSITION ON THE FUTURE NAVIGATIONAL USE ON THE LOWER PASSAIC RIVER - RIVER MILES 0 - 8	109	MEMO / Memorandum	R2-0008314	R2-0008422		R02: (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION), R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION)

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213220	4/1/2007	STAGING AND PROCESSING AREAS - TREATMENT TECHNOLOGIES AND TRANSPORTATION LOGISTICS REVIEW	27	RPT / Report	R2-0008423	R2-0008449		R02: (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION)
213390	4/12/2007	TECHNICAL MEMORANDUM FOR CEMENT LOCK TECHNOLOGY FOR DECONTAMINATING DREDGED ESTUARINE SEDIMENTS - PHASE 2 DEMONSTRATION SCALE PROJECT FOR 11/2006 - 03/2007	76	MEMO / Memorandum	R2-0008450	R2-0008525		R02: Mensinger, Michael, C (GAS TECHNOLOGY INSTITUTE), R02: (ENDESCO CLEAN HARBORS LLC)
99864	5/8/2007	ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY, LOWER PASSAIC RIVER STUDY AREA	156	LGL / Legal Instrument	R2-0008526	R2-0008681		
99862	5/31/2007	SETTLEMENT AGREEMENT AND RESPONSE COSTS FOR SETTLING PARTIES, AMENDMENT NO. 2, LOWER PASSAIC RIVER STUDY AREA	42	AGMT / Agreement	R2-0008682	R2-0008723		
698636	6/8/2007	DRAFT SOURCE CONTROL EARLY ACTION FOCUSED FEASIBILITY STUDY - TEXT, TABLES, FIGURES	230	RPT / Report	R2-0008724	R2-0008953	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED), R02: (HYDROQUAL INCORPORATED), R02: (BATTELLE)
698637	6/8/2007	DRAFT SOURCE CONTROL EARLY ACTION FOCUSED FEASIBILITY STUDY - APPENDICES A THROUGH J	2031	RPT / Report	R2-0008954	R2-0010984	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED), R02: (HYDROQUAL INCORPORATED), R02: (BATTELLE)
207071	6/14/2007	FACT SHEET: SOURCE CONTROL EARLY ACTION FOR LOWER PASSAIC RIVER RESTORATION PROJECT	2	LST / List/Index	R2-0010985	R2-0010986		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
207072	6/14/2007	PRESS RELEASE: EPA WEIGHTS SIX OPTIONS TO ACCELERATE THE CLEANUP OF POLLUTION IN THE LOWER PASSAIC RIVER	3	LST / List/Index	R2-0010987	R2-0010989		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
207259	6/14/2007	PROJECT DELIVERY TEAM MEETING ON 06/27/2007 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT	1	MTG / Meeting Document	R2-0010990	R2-0010990		
698635	6/14/2007	TRANSMITTAL OF THE DRAFT SOURCE CONTROL EARLY ACTION FOCUSED FEASIBILITY STUDY	1	LTR / Letter	R2-0010991	R2-0010991	R02: Buckrucker, Elizabeth, A (US ARMY CORPS OF ENGINEERS)	R02: Thompson, Scott, E (MALCOLM PIRNIE, INCORPORATED)

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212918	6/18/2007	THE FRIENDS OF THE PASSAIC RIVER, INCORPORATED'S COMMENTS ON DRAFT SOURCE CONTROL EARLY ACTION FOCUSED FEASIBILITY STUDY	2	LTR / Letter	R2-0010992	R2-0010993	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Urrutia, Margaret (FRIENDS OF THE PASSAIC RIVER)
206825	6/21/2007	LOWER PASSAIC RIVER RESTORATION PROJECT STAKEHOLDER SUMMARY OF UPCOMING ACTIVITIES AND MEETINGS FOR 06/01/2007	1	LST / List/Index	R2-0010994	R2-0010994		
206854	6/27/2007	PROJECT DELIVERY TEAM (PDT) MEETING 06/27/2007 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0010995	R2-0010996		
207288	6/27/2007	REMEDIAL OPTIONS WORK GROUP MEETING ON 06/27/2007 - AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT	1	MTG / Meeting Document	R2-0010997	R2-0010997		
207289	6/27/2007	REMEDIAL OPTIONS WORK GROUP MEETING ON 06/27/2007 - ATTENDEES LIST - LOWER PASSAIC RIVER RESTORATION PROJECT	3	LST / List/Index	R2-0010998	R2-0011000		R02: (MALCOLM PIRNIE, INCORPORATED)
207290	6/27/2007	REMEDIAL OPTIONS WORK GROUP MEETING - ENGINEERING PRESENTATION: SOURCE CONTROL EARLY ACTION FOCUSED FEASIBILITY STUDY - LOWER PASSAIC RIVER RESTORATION PROJECT	27	LST / List/Index	R2-0011001	R2-0011027		R02: Thompson, Scott, E (MALCOLM PIRNIE, INCORPORATED)
207291	6/27/2007	REMEDIAL OPTIONS WORK GROUP MEETING - INTRODUCTORY PRESENTATION: SOURCE CONTROL EARLY ACTION FOCUSED FEASIBILITY STUDY - LOWER PASSAIC RIVER RESTORATION PROJECT	12	LST / List/Index	R2-0011028	R2-0011039		R02: Thompson, Scott, E (MALCOLM PIRNIE, INCORPORATED)
207292	6/27/2007	REMEDIAL OPTIONS WORK GROUP MEETING - EMPIRICAL MASS BALANCE MODEL RESULTS: SOURCE CONTROL EARLY ACTION FOCUSED FEASIBILITY STUDY - LOWER PASSAIC RIVER RESTORATION PROJECT	37	LST / List/Index	R2-0011040	R2-0011076		R02: Garvey, Edward, A (MALCOLM PIRNIE, INCORPORATED)
212926	6/29/2007	CORRESPONDENCE REQUESTING EXTENSION TO SUBMIT FORMAL WRITTEN COMMENTS REQUEST SOURCE CONTROL EARLY ACTION FOCUSED FEASIBILITY STUDY LOWER PASSAIC RIVER RESTORATION PROJECT	1	LTR / Letter	R2-0011077	R2-0011077	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Law, Robert (DE MAXIMIS INCORPORATED)

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207281	7/1/2007	A MODEL FOR THE EVALUATION AND MANAGEMENT OF CONTAMINANTS OF CONCERN IN WATER, SEDIMENT, AND BIOTA IN THE NEW YORK / NEW JERSEY HARBOR ESTUARY	374	RPT / Report	R2-0011078	R2-0011451		R02: (HYDROQUAL INCORPORATED)
207073	7/12/2007	LOWER PASSAIC RIVER CLEANUP OPTIONS MEETING: FINAL SUMMARY OF DISCUSSION AND INPUT FROM MUNICIPALITIES ON THE STUDY OF CLEANUP OPTIONS	39	MTG / Meeting Document	R2-0011452	R2-0011490	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (SRA INTERNATIONAL INCORPORATION)
205854	8/1/2007	SITE EVALUATION FOR A DREDGED MATERIAL PUBLIC PROCESSING AND STORAGE FACILITY	121	RPT / Report	R2-0011491	R2-0011611		R02: (US ARMY CORPS OF ENGINEERS - NEW YORK DISTRICT)
212919	8/14/2007	THE IRONBOUND COMMUNITY CORPORATION'S RESPONSE TO THE FOCUSED FEASIBILITY STUDY FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	3	RPT / Report	R2-0011612	R2-0011614		R02: (IRONBOUND COMMUNITY CORPORATION)
212920	8/15/2007	THE IRONBOUND COMMUNITY CORPORATION'S COMMENTS TO THE EARLY ACTION PLAN FOR ALTERNATIVE REMEDIES FOR THE PASSAIC RIVER	1	LTR / Letter	R2-0011615	R2-0011615	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Johnston, Carol (IRONBOUND COMMUNITY CORPORATION)
212922	8/15/2007	PASSAIC RIVER COALITION TECHNICAL COMMENTS REGARDING LOWER PASSAIC RIVER RESTORATION PROJECT (LPRRP) DRAFT SOURCE CONTROL EARLY ACTION FOCUSED FEASIBILITY STUDY, JUNE 2007	14	LTR / Letter	R2-0011616	R2-0011629		R02: Filippone, Ella, F (PASSAIC RIVER COALITION), R02: Kruger, Anne (PASSAIC RIVER COALITION)
212923	8/15/2007	PASSAIC RIVER COALITION COMMENTS REGARDING LOWER PASSAIC RIVER RESTORATION PROJECT (LPRRP) DRAFT SOURCE CONTROL EARLY ACTION FEASIBILITY STUDY, JUNE 2007	1	LTR / Letter	R2-0011630	R2-0011630	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Filippone, Ella, F (PASSAIC RIVER COALITION)
212915	8/16/2007	BIOGENESIS COMMENTS ON DRAFT SOURCE CONTROL EARLY ACTION FOCUSED FEASIBILITY STUDY, LOWER PASSAIC RIVER RESTORATION PROJECT, VERSION 2007/06/08	5	LTR / Letter	R2-0011631	R2-0011635	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Wilde, Charles (BIOGENESIS ENTERPRISES INCORPORATED)
212916	8/16/2007	COOPERATING PARTIES GROUP COMMENTS ON DRAFT SOURCE CONTROL EARLY ACTION FOCUSED FEASIBILITY STUDY FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	1	LTR / Letter	R2-0011636	R2-0011636	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Potter, Willard (COOPERATING PARTIES GROUP), R02: Hyatt, William (COOPERATING PARTIES GROUP)

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212917	8/16/2007	LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP COMMENTS ON THE DRAFT SOURCE CONTROL EARLY ACTION FOCUSED FEASIBILITY STUDY	15	LTR / Letter	R2-0011637	R2-0011651		R02: (COOPERATING PARTIES GROUP)
212921	8/16/2007	GREENFAITH, NATURAL RESOURCES DEFENSE COUNCIL, NY/NJ BAYKEEPER COMMENTS ON THE DRAFT SOURCE CONTROL EARLY ACTION FOCUSED FEASIBILITY STUDY, LOWER PASSAIC RIVER RESTORATION PROJECT	2	LTR / Letter	R2-0011652	R2-0011653	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Levine, Lawrence, M (NATURAL RESOURCES DEFENSE COUNCIL), R02: Willner, Andy (BAYKEEPER PROGRAM), R02: Harper, Reverend Fletcher (GREENFAITH)
212927	9/20/2007	CORRESPONDENCE THANKING BIOGENESIS FOR COMMENTS REGARDING THE DRAFT FOCUSED FEASIBILITY STUDY ON THE PASSAIC RIVER SOURCE CONTROL EARLY ACTION	1	LTR / Letter	R2-0011654	R2-0011654	R02: Wilde, Charles (BIOGENESIS ENTERPRISES INCORPORATED)	R02: Steinberg, Alan, J (US ENVIRONMENTAL PROTECTION AGENCY)
212928	9/20/2007	CORRESPONDENCE THANKING LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP FOR COMMENTS REGARDING THE DRAFT FOCUSED FEASIBILITY STUDY ON THE PASSAIC RIVER SOURCE CONTROL EARLY ACTION	1	LTR / Letter	R2-0011655	R2-0011655	R02: Potter, Willard (COOPERATING PARTIES GROUP), R02: Hyatt, William (COOPERATING PARTIES GROUP)	R02: Steinberg, Alan, J (US ENVIRONMENTAL PROTECTION AGENCY)
212929	9/20/2007	CORRESPONDENCE THANKING THE FRIENDS OF THE PASSAIC RIVER, INCORPORATED FOR COMMENTS REGARDING THE DRAFT FOCUSED FEASIBILITY STUDY ON THE PASSAIC RIVER SOURCE CONTROL EARLY ACTION	1	LTR / Letter	R2-0011656	R2-0011656	R02: Urrutia, Margaret (FRIENDS OF THE PASSAIC RIVER)	R02: Steinberg, Alan, J (US ENVIRONMENTAL PROTECTION AGENCY)
212930	9/20/2007	CORRESPONDENCE THANKING THE IRONBOUND COMMUNITY CORPORATION FOR COMMENTS REGARDING THE DRAFT FOCUSED FEASIBILITY STUDY ON THE PASSAIC RIVER SOURCE CONTROL EARLY ACTION	1	LTR / Letter	R2-0011657	R2-0011657	R02: Johnston, Carol (IRONBOUND COMMUNITY CORPORATION)	R02: Steinberg, Alan, J (US ENVIRONMENTAL PROTECTION AGENCY)
212933	9/20/2007	CORRESPONDENCE THANKING THE NATIONAL RESOURCE DEFENSE COUNCIL FOR COMMENTS REGARDING THE DRAFT FOCUSED FEASIBILITY STUDY ON THE PASSAIC RIVER SOURCE CONTROL EARLY ACTION	1	LTR / Letter	R2-0011658	R2-0011658	R02: Levine, Lawrence, M (NATURAL RESOURCES DEFENSE COUNCIL), R02: Willner, Andy (BAYKEEPER PROGRAM), R02: Harper, Reverend Fletcher (GREENFAITH)	R02: Steinberg, Alan, J (US ENVIRONMENTAL PROTECTION AGENCY)
212934	9/20/2007	CORRESPONDENCE THANKING THE PASSAIC RIVER COALITION FOR COMMENTS REGARDING THE DRAFT FOCUSED FEASIBILITY STUDY ON THE PASSAIC RIVER SOURCE CONTROL EARLY ACTION	1	LTR / Letter	R2-0011659	R2-0011659	R02: Filippone, Ella, F (PASSAIC RIVER COALITION)	R02: Steinberg, Alan, J (US ENVIRONMENTAL PROTECTION AGENCY)

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212924	10/5/2007	SEDIMENT MANAGEMENT WORK GROUP COMMENTS ON DRAFT PASSAIC RIVER SOURCE CONTROL EARLY ACTION FOCUSED FEASIBILITY STUDY	2	LTR / Letter	R2-0011660	R2-0011661	R02: Steinberg, Alan, J (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Nadeau, Steven (SEDIMENT MANAGEMENT WORK GROUP)
212925	10/5/2007	SEDIMENT MANAGEMENT WORK GROUP COMMENTS ON THE LOWER PASSAIC RIVER RESTORATION PROJECT DRAFT SOURCE CONTROL EARLY ACTION FOCUSED FEASIBILITY STUDY	17	RPT / Report	R2-0011662	R2-0011678		R02: Nadeau, Steven (SEDIMENT MANAGEMENT WORK GROUP)
212959	11/15/2007	PRESENTATION - DEVELOPMENT OF A PRELIMINARY REMEDIATION GOAL (PRG) FOR DIOXIN IN SEDIMENT FOR THE PASSAIC RIVER/NEWARK BAY AND RARITAN BAY COMPLEX, USING A REPRODUCTIVE END-POINT IN THE EASTER OYSTER	23	LST / List/Index	R2-0011679	R2-0011701		R02: Stern, Clay (US FISH & WILDLIFE SERVICE), R02: Foster, Melissa (US FISH & WILDLIFE SERVICE), R02: Kubiak, Timothy (U.S. FISH AND WILDLIFE SERVICE)
213242	11/30/2007	LOW RESOLUTION NARRATIVE - LOWER PASSAIC RIVER RESTORATION PROJECT	23	RPT / Report	R2-0011702	R2-0011724	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
207273	12/4/2007	PROJECT DELIVERY TEAM MEETING ON 12/13/2007 - AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT	1	MTG / Meeting Document	R2-0011725	R2-0011725		
206571	12/13/2007	PROJECT DELIVERY TEAM (PDT) MEETING 12/13/2007 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0011726	R2-0011727		
207274	12/13/2007	PRESENTATION - PROJECT DELIVERY TEAM MEETING ON 12/13/2007 FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	7	LST / List/Index	R2-0011728	R2-0011734		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
212836	12/17/2007	QAPP / FSP ADDENDUM FOR LOWER PASSAIC RIVER RESTORATION PROJECT EMPIRICAL MASS BALANCE EVALUATION, NOVEMBER 2007, REVISION 2	353	RPT / Report	R2-0011735	R2-0012087	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
212837	12/19/2007	FIELD MODIFICATION FORM, AMENDMENT TO THE 2007-12-17 QAPP / FSP ADDENDUM, USING SEDIMENT TRAPS TO DETERMINE CONTAINMENT CONCENTRATION ON PARTICULATE MATTER IN TRIBUTARIES FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	6	FRM / Form	R2-0012088	R2-0012093	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)

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213243	1/4/2008	DUNDEE LAKE NARRATIVE - LOWER PASSAIC RIVER RESTORATION PROJECT	10	RPT / Report	R2-0012094	R2-0012103	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
212906	1/14/2008	CORRESPONDENCE INVITING THE PASSAIC RIVER COALITION TO PARTICIPATE IN CONTAMINATED SEDIMENTS TECHNICAL ADVISORY GROUP (CSTAG) MEETING ON 2/13/2008 FOR LOWER PASSAIC RIVER RESTORATION PROJECT	3	LTR / Letter	R2-0012104	R2-0012106	R02: Filippone, Ella, F (PASSAIC RIVER COALITION)	R02: Tomchuk, Douglas (US ENVIRONMENTAL PROTECTION AGENCY)
212907	1/14/2008	CORRESPONDENCE INVITING THE IRONBOUND COMMUNITY CORPORATION TO PARTICIPATE IN CONTAMINATED SEDIMENTS TECHNICAL ADVISORY GROUP (CSTAG) MEETING ON 2/13/2008 FOR LOWER PASSAIC RIVER RESTORATION PROJECT	3	LTR / Letter	R2-0012107	R2-0012109	R02: Johnston, Carol (IRONBOUND COMMUNITY CORPORATION)	R02: Tomchuk, Douglas (US ENVIRONMENTAL PROTECTION AGENCY)
212908	1/14/2008	CORRESPONDENCE INVITING THE NATURAL RESOURCE DEFENSE COUNCIL TO PARTICIPATE IN CONTAMINATED SEDIMENTS TECHNICAL ADVISORY GROUP (CSTAG) MEETING ON 2/13/2008 FOR LOWER PASSAIC RIVER RESTORATION PROJECT	3	LTR / Letter	R2-0012110	R2-0012112	R02: Levine, Lawrence, M (NATURAL RESOURCES DEFENSE COUNCIL)	R02: Tomchuk, Douglas (US ENVIRONMENTAL PROTECTION AGENCY)
212909	1/14/2008	CORRESPONDENCE INVITING THE PASSAIC VALLEY SEWERAGE COMMISSION TO PARTICIPATE IN CONTAMINATED SEDIMENTS TECHNICAL ADVISORY GROUP (CSTAG) MEETING ON 2/13/2008 FOR LOWER PASSAIC RIVER RESTORATION PROJECT	3	LTR / Letter	R2-0012113	R2-0012115	R02: Lipke, Sheldon (PASSAIC VALLEY SEWERAGE COMMISSION)	R02: Tomchuk, Douglas (US ENVIRONMENTAL PROTECTION AGENCY)
212910	1/14/2008	CORRESPONDENCE INVITING THE COOPERATING PARTIES GROUP PROJECT COORDINATOR TO PARTICIPATE IN CONTAMINATED SEDIMENTS TECHNICAL ADVISORY GROUP (CSTAG) MEETING ON 2/13/2008 FOR LOWER PASSAIC RIVER RESTORATION PROJECT	3	LTR / Letter	R2-0012116	R2-0012118	R02: Potter, Willard (DE MAXIMIS INCORPORATED)	R02: Tomchuk, Douglas (US ENVIRONMENTAL PROTECTION AGENCY)
212911	1/14/2008	CORRESPONDENCE INVITING THE NY/NJ BAYKEEPER TO PARTICIPATE IN CONTAMINATED SEDIMENTS TECHNICAL ADVISORY GROUP (CSTAG) MEETING ON 2/13/2008 FOR LOWER PASSAIC RIVER RESTORATION PROJECT	3	LTR / Letter	R2-0012119	R2-0012121	R02: Willner, Andy (BAYKEEPER PROGRAM)	R02: Tomchuk, Douglas (US ENVIRONMENTAL PROTECTION AGENCY)

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212912	1/14/2008	CORRESPONDENCE INVITING THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY TO PARTICIPATE IN CONTAMINATED SEDIMENTS TECHNICAL ADVISORY GROUP (CSTAG) MEETING ON 2/13/2008 FOR LOWER PASSAIC RIVER RESTORATION PROJECT	3	LTR / Letter	R2-0012122	R2-0012124	R02: Zeppie, Christopher (Port Authority of NY and NJ)	R02: Tomchuk, Douglas (US ENVIRONMENTAL PROTECTION AGENCY)
213221	1/25/2008	FINAL HYDRODYNAMIC MODELING REPORT FOR LOWER PASSAIC RIVER RESTORATION PROJECT AND NEWARK BAY STUDY	345	RPT / Report	R2-0012125	R2-0012469	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED), R02: (HYDROQUAL INCORPORATED)
212902	1/29/2008	PASSAIC RIVER COALITION COMMENTS REGARDING LOWER PASSAIC RIVER RESTORATION PROJECT (LPRRP) FOR US EPA CONTAMINATED SEDIMENTS TECHNICAL ADVISORY GROUP (CSTAG)	4	LTR / Letter	R2-0012470	R2-0012473		R02: Filippone, Ella, F (PASSAIC RIVER COALITION), R02: Kruger, Anne (PASSAIC RIVER COALITION)
212903	2/6/2008	CORRESPONDENCE REGARDING PROJECT OVERVIEW - LOWER PASSAIC RIVER RESTORATION PROJECT	14	LTR / Letter	R2-0012474	R2-0012487	R02: Ells, Stephen, J (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Potter, Willard (DE MAXIMIS INCORPORATED)
212901	2/8/2008	NATURAL RESOURCE DEFENSE COUNCIL COMMENTS RELEVANT TO CONTAMINATED SEDIMENTS TECHNICAL ADVISORY GROUP (CSTAG) STAKEHOLDER PRESENTATION FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	3	LTR / Letter	R2-0012488	R2-0012490	R02: Tomchuk, Douglas (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Levine, Lawrence, M (NATURAL RESOURCES DEFENSE COUNCIL), R02: Willner, Andy (BAYKEEPER PROGRAM)
212900	2/11/2008	THE IRONBOUND COMMUNITY CORPORATION'S REVISED RESPONSE TO THE FOCUSED FEASIBILITY STUDY FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	3	RPT / Report	R2-0012491	R2-0012493		R02: (IRONBOUND COMMUNITY CORPORATION)
212905	2/20/2008	PASSAIC RIVER COALITION COMMENTS REGARDING PERSPECTIVES OF COOPERATING PARTIES GROUP (CPG) ON LOWER PASSAIC RIVER RESTORATION PROJECT (LPRRP) PRESENTED TO US EPA CSTAG ON 2/13/2008	4	LTR / Letter	R2-0012494	R2-0012497		R02: Filippone, Ella, F (PASSAIC RIVER COALITION), R02: Kruger, Anne (PASSAIC RIVER COALITION)
212904	2/25/2008	CORRESPONDENCE REGARDING COOPERATING PARTIES GROUP (CPG) FOLLOW-UP RESPONSE, LOWER PASSAIC RIVER RESTORATION PROJECT CSTAG REVIEW	16	LTR / Letter	R2-0012498	R2-0012513	R02: Ells, Stephen, J (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Potter, Willard (DE MAXIMIS INCORPORATED)
234907	2/28/2008	MEMORANDUM ON MATERIALS FOR EPA ON FUTURE USE DEPTH OF PASSAIC RIVER	104	RPT / Report	R2-0012514	R2-0012617	R02: Pryor, Stefan (CITY OF NEWARK)	R02: Rich, Damon (CITY OF NEWARK)

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207250	3/5/2008	PROJECT DELIVERY TEAM MEETING ON 03/05/2008 - AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT / NEWARK BAY STUDY	1	MTG / Meeting Document	R2-0012618	R2-0012618		
213391	3/27/2008	ADDENDUM TO THE TECHNICAL MEMORANDUM FOR CEMENT LOCK TECHNOLOGY FOR DECONTAMINATING DREDGED ESTUARINE SEDIMENTS - PHASE 2 DEMONSTRATION SCALE PROJECT FOR 11/2006 - 03/2007	11	MEMO / Memorandum	R2-0012619	R2-0012629	R02: Thompson, Scott, E (MALCOLM PIRNIE, INCORPORATED), R02: Navon, Daria (MALCOLM PIRNIE, INCORPORATED)	R02: Mensinger, Michael, C (GAS TECHNOLOGY INSTITUTE)
212913	4/1/2008	CORRESPONDENCE REGARDING CONTAMINATED SEDIMENTS TECHNICAL ADVISORY GROUP (CSTAG) RECOMMENDATIONS FOR THE LOWER PASSAIC RIVER PROJECT	12	MEMO / Memorandum	R2-0012630	R2-0012641	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Ells, Stephen, J (US ENVIRONMENTAL PROTECTION AGENCY)
213389	4/1/2008	TOPICAL REPORT ON BENEFICIAL USE OF ECOMELT FROM PASSAIC RIVER SEDIMENT AT MONTCLAIR STATE UNIVERSITY NEW JERSEY	16	RPT / Report	R2-0012642	R2-0012657	R02: (BROOKHAVEN SCIENCE ASSOCIATES)	R02: Mensinger, Michael, C (GAS TECHNOLOGY INSTITUTE)
213244	4/11/2008	LARGE VOLUME WATER COLUMN NARRATIVE - LOWER PASSAIC RIVER RESTORATION PROJECT	10	RPT / Report	R2-0012658	R2-0012667	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
212914	5/6/2008	US EPA RESPONSE TO CONTAMINATED SEDIMENTS TECHNICAL ADVISORY GROUP (CSTAG) ON THE LOWER PASSAIC RIVER PROJECT EARLY ACTION EVALUATION	22	LTR / Letter	R2-0012668	R2-0012689	R02: Ells, Stephen, J (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)
207282	5/7/2008	FINAL REMEDIAL OPTIONS WORK GROUP PRESENTATION: ALTERNATIVE DEVELOPMENT - SOURCE CONTROL EARLY ACTION - LOWER PASSAIC RIVER RESTORATION PROJECT	28	LST / List/Index	R2-0012690	R2-0012717		R02: (MALCOLM PIRNIE, INCORPORATED)
207283	5/7/2008	REMEDIAL OPTIONS WORK GROUP MEETING ON 05/07/2008 - ATTENDESS LIST - LOWER PASSAIC RIVER RESTORATION PROJECT	2	LST / List/Index	R2-0012718	R2-0012719		
207258	6/3/2008	PROJECT DELIVERY TEAM MEETING ON 06/11/2008 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT / NEWARK BAY STUDY	1	MTG / Meeting Document	R2-0012720	R2-0012720		
212838	6/5/2008	FIELD MODIFICATION FORM, QAPP / FSP ADDENDUM, DECEMBER 2007 AND FINAL QAPP, AUGUST 2005 SAMPLING AND ANALYSES OF SURFACE SEDIMENT SAMPLES FROM THE LOWER PASSAIC RIVER (RIVER MILE 0.0 TO 1.0)	21	FRM / Form	R2-0012721	R2-0012741	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)

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206853	6/11/2008	PROJECT DELIVERY TEAM (PDT) MEETING 06/11/2008 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0012742	R2-0012743		
212852	6/11/2008	PRESENTATION - PROJECT DELIVERY TEAM MEETING, PASSAIC RIVER - NEWARK BAY	12	OTH / Other	R2-0012744	R2-0012755		
107570	6/23/2008	ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT FOR LOWER PASSAIC RIVER STUDY AREA REMOVAL ACTION	69	AGMT / Agreement	R2-0012756	R2-0012824		
213392	7/1/2008	FINAL REPORT OF PHASE 2 DEMONSTRATION TESTS WITH STRATUS PETROLEUM AND PASSAIC RIVER SEDIMENTS	134	RPT / Report	R2-0012825	R2-0012958	R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION), R02: (BROOKHAVEN SCIENCE ASSOCIATES)	R02: Mensinger, Michael, C (GAS TECHNOLOGY INSTITUTE)
207265	8/20/2008	PROJECT DELIVERY TEAM MEETING ON 09/10/2008 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT / NEWARK BAY STUDY	1	MTG / Meeting Document	R2-0012959	R2-0012959		
239611	8/29/2008	FINAL PHASE 1 ENGINEERING EVALUATION / COST ANALYSIS WORK PLAN - REVISION 1 FOR CERCLA NON-TIME CRITICAL REMOVAL ACTION FOR THE LOWER PASSAIC RIVER STUDY AREA	62	WP / Work Plan	R2-0012960	R2-0013021	R02: Cosentino, Joseph (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Bluestein, Paul (TIERRA SOLUTIONS, INCORPORATED)
239619	8/29/2008	TRANSMITTAL OF THE FINAL PHASE 1 ENGINEERING EVALUATION / COST ANALYSIS WORK PLAN - REVISION 1 FOR CERCLA NON-TIME CRITICAL REMOVAL ACTION FOR THE LOWER PASSAIC RIVER STUDY AREA	2	LTR / Letter	R2-0013022	R2-0013023	R02: Cosentino, Joseph (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Bluestein, Paul (TIERRA SOLUTIONS, INCORPORATED)
206858	9/10/2008	PROJECT DELIVERY TEAM (PDT) MEETING 09/10/2008 ATTENDEES SIGN IN SHEET	4	OTH / Other	R2-0013024	R2-0013027		
213380	9/23/2008	PHASE 1 AND PHASE 2 SEDIMENT INVESTIGATION FIELD AND DATA REPORT	2518	RPT / Report	R2-0013028	R2-0015545		R02: (TIERRA SOLUTIONS, INCORPORATED)
212975	9/29/2008	TRANSMITTAL OF THE ESTIMATION OF THE BIOLOGICALLY ACTIVE ZONE, NEWARK BAY, NEW JERSEY, REVISION 2	2	LTR / Letter	R2-0015546	R2-0015547	R02: Butler, Elizabeth (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Bluestein, Paul (TIERRA SOLUTIONS, INCORPORATED)
212976	9/29/2008	ESTIMATION OF THE BIOLOGICALLY ACTIVE ZONE, NEWARK BAY, NEW JERSEY, REVISION 2	67	RPT / Report	R2-0015548	R2-0015614	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Diaz, Robert (R.J. DIAZ AND DAUGHTERS), R02: (ARCADIS)

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212843	10/30/2008	FIELD MODIFICATION FORM, QAPP / FSP ADDENDUM, DECEMBER 2007 AND FINAL QAPP, AUGUST 2005 SEDFLUME CONSOLIDATION ANALYSIS FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	20	FRM / Form	R2-0015615	R2-0015634	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
213381	11/5/2008	RAIN EVENT PROGRAM NARRATIVE - LOWER PASSAIC RIVER RESTORATION PROJECT	20	RPT / Report	R2-0015635	R2-0015654	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
213382	11/5/2008	RM0 TO RM1 SEDIMENT PROGRAM NARRATIVE - LOWER PASSAIC RIVER RESTORATION PROJECT	6	RPT / Report	R2-0015655	R2-0015660	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
213383	11/5/2008	SUPPLEMENTAL SEDIMENT PROGRAM NARRATIVE - LOWER PASSAIC RIVER RESTORATION PROJECT	36	RPT / Report	R2-0015661	R2-0015696	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
205853	11/12/2008	CORRESPONDENCE REGARDING CONSIDERATION OF PASSAIC RIVER SEDIMENTS PERSUANT TO RESOURCE CONSERVATION RECOVERY ACT REGULATIONS	1	MEMO / Memorandum	R2-0015697	R2-0015697	R02: Loor, Thalia, A (LOUIS BERGER GROUP INCORPORATED)	R02: Hendricks, Al (VOLCANO PARTNERS LLC)
206834	11/12/2008	CONSIDERATION OF PASSAIC RIVER SEDIMENTS	1	MEMO / Memorandum	R2-0015698	R2-0015698	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Mugdan, Walter, E (US ENVIRONMENTAL PROTECTION AGENCY), R02: Schaaf, Eric (US ENVIRONMENTAL PROTECTION AGENCY)
207269	11/20/2008	PROJECT DELIVERY TEAM MEETING ON 12/03/2008 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT / NEWARK BAY STUDY	1	MTG / Meeting Document	R2-0015699	R2-0015699		
206873	12/1/2008	VEGETATION SAMPLING - WETLAND DELINEATION AND BIO-BENCHMARK REPORT	180	RPT / Report	R2-0015700	R2-0015879	R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
206861	12/3/2008	PROJECT DELIVERY TEAM (PDT) MEETING 12/03/2008 ATTENDEES SIGN IN SHEET	3	OTH / Other	R2-0015880	R2-0015882		

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212973	12/16/2008	DRAFT SEDFLUME CONSOLIDATION ANALYSIS PASSAIC RIVER, NEW JERSEY	19	RPT / Report	R2-0015883	R2-0015901	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (HYDROQUAL INCORPORATED)	R02: (SEA ENGINEERING INCORPORATED)
239617	1/8/2009	ACTION MEMORANDUM - REQUEST FOR AUTHORIZATION TO CONDUCT A CERCLA NON-TIME CRITICAL REMOVAL ACTION AT THE DIAMOND ALKALI SITE	55	MEMO / Memorandum	R2-0015902	R2-0015956	R02: Mugdan, Walter, E (US ENVIRONMENTAL PROTECTION AGENCY), R02: Steinberg, Alan, J (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Wilson, Eric, J (US ENVIRONMENTAL PROTECTION AGENCY)
213245	2/18/2009	SMALL VOLUME WATER COLUMN NARRATIVE - LOWER PASSAIC RIVER RESTORATION PROJECT	17	RPT / Report	R2-0015957	R2-0015973	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
213246	2/18/2009	HIGH RESOLUTION CORING PROGRAM NARRATIVE - LOWER PASSAIC RIVER RESTORATION PROJECT	43	RPT / Report	R2-0015974	R2-0016016	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (MALCOLM PIRNIE, INCORPORATED)
207249	2/25/2009	PROJECT DELIVERY TEAM MEETING ON 03/04/2009 - AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT / NEWARK BAY STUDY	1	MTG / Meeting Document	R2-0016017	R2-0016017		
206874	2/27/2009	FINAL PILOT STUDY WORK GROUP BINDER MATERIAL FOR ENVIRONMENTAL DREDGING	259	RPT / Report	R2-0016018	R2-0016276		R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)
213227	3/1/2009	DRAFT HUDSON - RARITAN ESTUARY COMPREHENSIVE RESTORATION PLAN	169	WP / Work Plan	R2-0016277	R2-0016445		R02: (PORT AUTHORITY (NY & NJ)), R02: (US ARMY CORPS OF ENGINEERS), R02: (HARBOR ESTUARY PROGRAM OF NEW YORK AND NEW JERSEY)
206846	3/4/2009	PROJECT DELIVERY TEAM (PDT) MEETING 03/04/2009 ATTENDEES SIGN IN SHEET	3	OTH / Other	R2-0016446	R2-0016448		
206875	3/4/2009	PRESENTATION MATERIAL FOR REVISION AND UPDATES TO THE ENVIRONMENTAL DREDGING PILOT STUDY	29	LST / List/Index	R2-0016449	R2-0016477		R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)
205810	3/5/2009	ASSESSMENT OF HUMAN HEALTH RISKS POSED BY CONSUMPTION OF FISH FROM THE LOWER PASSAIC RIVER, NEW JERSEY	16	PUB / Publication	R2-0016478	R2-0016493		R02: Urban, J, D (SCIENCE OF TOTAL ENVIRONMENT)

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213224	4/10/2009	LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP REQUEST THAT US EPA SUBJECT ALL INFLUENTIAL SCIENTIFIC AND TECHNICAL WORK PRODUCTS INCORPORATED IN THE FOCUSED FEASIBILITY STUDY TO EXTERNAL PEER REVIEW	2	LTR / Letter	R2-0016494	R2-0016495	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Potter, Willard (DE MAXIMIS INCORPORATED)
207257	5/21/2009	PROJECT DELIVERY TEAM MEETING ON 06/03/2009 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT / NEWARK BAY STUDY	1	MTG / Meeting Document	R2-0016496	R2-0016496		
206852	6/3/2009	PROJECT DELIVERY TEAM (PDT) MEETING 06/03/2009 ATTENDEES SIGN IN SHEET	3	OTH / Other	R2-0016497	R2-0016499		
213225	6/17/2009	US EPA RESPONSE TO LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP REQUEST THAT US EPA SUBJECT ALL INFLUENTIAL SCIENTIFIC AND TECHNICAL WORK PRODUCTS INCORPORATED IN THE FFS TO EXTERNAL PEER REVIEW	2	LTR / Letter	R2-0016500	R2-0016501	R02: Potter, Willard (DE MAXIMIS INCORPORATED)	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)
206835	6/30/2009	REMEDIAL OPTIONS WORK GROUP 06/30/2009 ATTENDANCE SIGN IN SHEET	2	OTH / Other	R2-0016502	R2-0016503		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
207074	6/30/2009	REMEDIAL OPTIONS WORK GROUP MEETING: PRESENTATION OF ALTERNATIVE DEVELOPMENT OF SOURCE CONTROL ACTION FOR LOWER PASSAIC RIVER RESTORATION PROJECT	38	LST / List/Index	R2-0016504	R2-0016541		R02: (MALCOLM PIRNIE, INCORPORATED)
207078	8/5/2009	CORRESPONDENCE REGARDING THE AGENDA OF COMMERCIAL USERS MEETING TO DISCUSS THE FUTURE OF THE PASSAIC RIVER'S NAVIGATION CHANNEL	2	LTR / Letter	R2-0016542	R2-0016543	R02: Bernhard, Gene (MOTIVA ENTERPRISES LLC), R02: Pace, Jeoffrey (MOTIVA ENTERPRISES LLC)	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)
207262	8/25/2009	PROJECT DELIVERY TEAM MEETING ON 09/02/2009 - AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT / NEWARK BAY STUDY	1	MTG / Meeting Document	R2-0016544	R2-0016544		
206838	8/27/2009	COMMERCIAL USERS OF PASSAIC RIVER NAVIGATION CHANNEL MEETING 08/27/2009 SIGN IN SHEET	2	OTH / Other	R2-0016545	R2-0016546		

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207244	8/27/2009	COMMERCIAL USERS MEETING ON 08/27/2009 - AGENDA - AGENCIES' MEETING WITH COMMERCIAL USERS OF PASSAIC RIVER NAVIGATIONAL CHANNEL	1	MTG / Meeting Document	R2-0016547	R2-0016547		
206856	9/2/2009	US ENVIRONMENTAL PROTECTION AGENCY-COOPERATING PARTIES GROUP FOCUSED FEASIBILITY STUDY MEETING OF 09/11/2009 ATTENDANCE SIGN IN SHEET	2	OTH / Other	R2-0016548	R2-0016549		
206839	9/11/2009	MEETING OF 09/11/2009 ATTENDANCE LPRSA SIGN IN SHEET	2	OTH / Other	R2-0016550	R2-0016551		
207080	9/11/2009	PRESENTATION TO LOWER PASSAIC RIVER COOPERATING PARTIES GROUP MEETING: ALTERNATIVE DEVELOPMENT OF SOURCE CONTROL ACTION FOR LOWER PASSAIC RIVER RESTORATION PROJECT	11	LST / List/Index	R2-0016552	R2-0016562		R02: (MALCOLM PIRNIE, INCORPORATED)
207081	9/11/2009	PRESENTATION TO LOWER PASSAIC RIVER COOPERATING PARTIES GROUP MEETING: REVIEW OF CARP MODEL AND COMPUTED TRAJECTORIES	21	LST / List/Index	R2-0016563	R2-0016583		R02: (HYDROQUAL INCORPORATED)
207082	9/11/2009	FINAL AGENDA FOR US ENVIRONMENTAL PROTECTION AGENCY-COOPERATING PARTIES GROUP FOCUSED FEASIBILITY STUDY MEETING	1	MTG / Meeting Document	R2-0016584	R2-0016584		
207083	9/11/2009	PRESENTATION TO LOWER PASSAIC RIVER COOPERATING PARTIES GROUP MEETING: FIGURES FOR LOWER PASSAIC RIVER RESTORATION PROJECT	5	FIG / Figure/Map/ Drawing	R2-0016585	R2-0016589		R02: (MALCOLM PIRNIE, INCORPORATED)
207084	9/11/2009	PRESENTATION TO LOWER PASSAIC RIVER COOPERATING PARTIES GROUP MEETING: EXAMINATION OF SEDIMENT STABILITY FROM 1989 THROUGH 2007	25	LST / List/Index	R2-0016590	R2-0016614		R02: (MALCOLM PIRNIE, INCORPORATED)
207085	9/11/2009	PRESENTATION TO LOWER PASSAIC RIVER COOPERATING PARTIES GROUP MEETING: SEDIMENT TRANSPORT OVERVIEW	9	LST / List/Index	R2-0016615	R2-0016623		R02: (HYDROQUAL INCORPORATED)
207086	9/11/2009	PRESENTATION TO LOWER PASSAIC RIVER COOPERATING PARTIES GROUP MEETING: CONCEPTUAL SITE MODEL - RISK ASSESSMENT	17	LST / List/Index	R2-0016624	R2-0016640		R02: (BATTELLE)

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207096	9/21/2009	PASSAIC RIVER COMMUNITY ADVISORY GROUP PLANNING MEETING	1	MTG / Meeting Document	R2-0016641	R2-0016641		
213272	9/23/2009	QUALITY REVIEW OF COOPERATING PARTIES GROUP 2008 LOW RESOLUTION SEDIMENT CORING DATA FOR LOWER PASSAIC RIVER RESTORATION PROJECT	32	MEMO / Memorandum	R2-0016642	R2-0016673	R02: Buckrucker, Elizabeth, A (US ARMY CORPS OF ENGINEERS), R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY), R02: Vaughn, Stephanie (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Accardi-dey, Amymarie (MALCOLM PIRNIE, INCORPORATED), R02: Mccann, Jim (MALCOLM PIRNIE, INCORPORATED)
207098	9/24/2009	PRELIMINARY OUTLINE OF MEETINGS AND TOPICS FOR PASSAIC RIVER COMMUNITY ADVISORY GROUP	2	LST / List/Index	R2-0016674	R2-0016675		
213273	10/5/2009	STATISTICAL COMPARISON OF 2008 LOW RESOLUTION SPLIT SAMPLE SEDIMENT DATA FOR LOWER PASSAIC RIVER RESTORATION PROJECT	67	MEMO / Memorandum	R2-0016676	R2-0016742	R02: Buckrucker, Elizabeth, A (US ARMY CORPS OF ENGINEERS), R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (MALCOLM PIRNIE, INCORPORATED)
205820	10/6/2009	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION OVERVIEW	43	OTH / Other	R2-0016743	R2-0016785		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
205811	11/9/2009	RESPONSE TO MUGDAN ET AL.'S COMMENT ON URBAN ET AL. "ASSESSMENT OF HUMAN HEALTH RISKS POSED BY CONSUMPTION OF FISH FROM THE LOWER PASSAIC RIVER (LPR), NEW JERSEY"	3	LTR / Letter	R2-0016786	R2-0016788		R02: Urban, J, D (SCIENCE OF TOTAL ENVIRONMENT)
205812	11/9/2009	COMMENT ON URBAN ET AL. "ASSESSMENT OF HUMAN HEALTH RISKS POSED BY CONSUMPTION OF FISH FROM THE LOWER PASSAIC RIVER (LPR), NEW JERSEY"	3	LTR / Letter	R2-0016789	R2-0016791		R02: Mugdan, Walter (US ENVIRONMENTAL PROTECTION AGENCY)
207268	11/30/2009	PROJECT DELIVERY TEAM MEETING ON 12/02/2009 - AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT / NEWARK BAY STUDY	1	MTG / Meeting Document	R2-0016792	R2-0016792		
206860	12/2/2009	PROJECT DELIVERY TEAM (PDT) MEETING 12/02/2009 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0016793	R2-0016794		
205821	12/9/2009	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION ON ENVIRONMENTAL DREDGING AND DECONTAMINATION PILOT STUDY	24	LST / List/Index	R2-0016795	R2-0016818		R02: Baron, Lisa (US ARMY CORPS OF ENGINEERS)

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213387	12/17/2009	FINAL REPORT - DEMONSTRATION TESTING AND FULL-SCALE OPERATION OF THE BIOGENESIS SEDIMENT DECONTAMINATION PROCESS	1005	RPT / Report	R2-0016819	R2-0017823		R02: (BIOGENESIS WASHING BGW, LLC), R02: (MWH AMERICAS INCORPORATED)
213237	1/1/2010	TECHNICAL MEMORANDUM FOR EXPOSURE PARAMETER ASSUMPTIONS FOR THE LPRSA HUMAN HEALTH RISK ASSESSMENT	17	MEMO / Memorandum	R2-0017824	R2-0017840		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
205825	1/14/2010	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION	47	LST / List/Index	R2-0017841	R2-0017887		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
207275	2/2/2010	US ENVIRONMENTAL PROTECION AGENCY AND COOPERATING PARTIES GROUP MEETING ON 02/04/2010 FOR SEDIMENT STABILITY - DRAFT AGENDA	1	MTG / Meeting Document	R2-0017888	R2-0017888		
206572	2/4/2010	SEDIMENT STABILITY MEETING 02/04/2010 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0017889	R2-0017890		
213226	2/4/2010	PRESENTATION MATERIAL ON THE SEDIMENT TRANSPORT AND MORPHODYNAMICS IN LPR	31	LST / List/Index	R2-0017891	R2-0017921		R02: (DELTARES)
207238	2/9/2010	SCHEDULE OF UPCOMING PUBLIC PRODUCTS FOR FEBRUARY 2010 - LOWER PASSAIC RIVER - NEWARK BAY	1	LST / List/Index	R2-0017922	R2-0017922		
207248	2/18/2010	PROJECT DELIVERY TEAM MEETING ON 03/03/2010 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT / NEWARK BAY STUDY	1	MTG / Meeting Document	R2-0017923	R2-0017923		
206845	3/3/2010	PROJECT DELIVERY TEAM (PDT) MEETING 03/03/2010 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0017924	R2-0017925		
213278	3/16/2010	REPORT ON SUSPECTED CAUSES OF DISPARITIES BETWEEN THE RESULTS PRODUCED BY COLUMBIA ANALYTICAL SERVICES AND AXYS ANALYTICAL SERVICES IN ANALYSIS OF LOWER PASSAIC RIVER SEDIMENT SPLIT SAMPLES	12	RPT / Report	R2-0017926	R2-0017937	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (COMPUTER SCIENCES CORPORATION), R02: (INTERFACE INCORPORATED)

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207279	3/20/2010	THE SHAPING OF AN ESTUARINE SUPERFUND SITE: ROLES OF EVOLVING DYNAMICS AND GEOMORPHOLOGY	16	PUB / Publication	R2-0017938	R2-0017953		R02: Chant, R, J (RUTGERS UNIVERSITY), R02: Garvey, Edward, A (MALCOLM PIRNIE, INCORPORATED), R02: Fugate, David (FLORIDA GULF COAST UNIVERSITY)
205836	4/8/2010	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION	56	LST / List/Index	R2-0017954	R2-0018009		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
213223	5/5/2010	CORRESPONDENCE REGARDING MAINTENANCE DREDGING	3	LTR / Letter	R2-0018010	R2-0018012	R02: Payne, Donald, M (HOUSE OF REPRESENTATIVES)	R02: Boule, John, R (US ARMY CORPS OF ENGINEERS)
207240	5/21/2010	SCHEDULE OF UPCOMING PUBLIC PRODUCTS FOR MAY 2010 - LOWER PASSAIC RIVER - NEWARK BAY	1	LST / List/Index	R2-0018013	R2-0018013		
212958	6/1/2010	THE RIVERFRONT THAT NEWARK WANTS PROGRESS REPORT: 2009-2010	59	RPT / Report	R2-0018014	R2-0018072		R02: (CITY OF NEWARK)
206851	6/2/2010	PROJECT DELIVERY TEAM (PDT) MEETING 06/02/2010 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0018073	R2-0018074		
207097	6/20/2010	PASSAIC RIVER SYMPOSIUM: OVERVIEW OF PARTNER AGENCY EFFORTS TO CLEAN UP THE LOWER PASSAIC RIVER WITH FOCUS ON ALTERNATIVES FOR THE LOWER EIGHT MILES	16	LST / List/Index	R2-0018075	R2-0018090		R02: Buckrucker, Elizabeth, A (US ARMY CORPS OF ENGINEERS), R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY), R02: Butler, Elizabeth (US ENVIRONMENTAL PROTECTION AGENCY), R02: Vaughn, Stephanie (US ENVIRONMENTAL PROTECTION AGENCY), R02: Thompson, Scott (THE LOUIS BERGER
207075	7/1/2010	LOWER PASSAIC RIVER COMMERCIAL NAVIGATION ANALYSIS, REVISION 2	77	RPT / Report	R2-0018091	R2-0018167		R02: (US ARMY CORPS OF ENGINEERS - NEW YORK DISTRICT)
213386	7/1/2010	FINAL REPORT TO THE HUDSON RIVER FOUNDATION - MECHANISMS OF SEDIMENT TRAPPING AND ACCUMULATION IN NEWARK BAY - AN ENGINEERED ESTUARINE BASIN	40	RPT / Report	R2-0018168	R2-0018207		R02: Chant, R, J (RUTGERS UNIVERSITY), R02: Sommerfield, Christopher, K (UNIVERSITY OF DELAWARE)

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207261	8/4/2010	PROJECT DELIVERY TEAM MEETING ON 09/01/2010 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT / NEWARK BAY STUDY	1	MTG / Meeting Document	R2-0018208	R2-0018208		
207236	8/19/2010	SCHEDULE OF UPCOMING PUBLIC PRODUCTS FOR AUGUST 2010 - LOWER PASSAIC RIVER - NEWARK BAY	1	LST / List/Index	R2-0018209	R2-0018209		
205833	10/14/2010	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION	43	LST / List/Index	R2-0018210	R2-0018252		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
207242	11/23/2010	SCHEDULE OF UPCOMING PUBLIC PRODUCTS FOR NOVEMBER 2010 - LOWER PASSAIC RIVER - NEWARK BAY	1	LST / List/Index	R2-0018253	R2-0018253		
207272	11/23/2010	PROJECT DELIVERY TEAM MEETING ON 12/08/2010 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT / NEWARK BAY STUDY	1	MTG / Meeting Document	R2-0018254	R2-0018254		
205815	12/1/2010	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP: BAYSHORE RECYCLING INFORMATION	21	LST / List/Index	R2-0018255	R2-0018275		R02: (BAYSHORE)
205837	12/1/2010	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION ON HUDSON RIVER PCBS SUPERFUND SITE: PROJECT OVERVIEW	49	LST / List/Index	R2-0018276	R2-0018324		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
206837	12/2/2010	CEMENT LOCK PRESENTATION TO US EPA 12/02/2010 PASSAIC RIVER DECONTAMINATION TECHNOLOGY MEETING ATTENDANCE SIGN IN SHEET	2	OTH / Other	R2-0018325	R2-0018326		R02: (VOLCANO PARTNERS LLC)
207077	12/2/2010	PRESENTATION: CEMENT-LOCK - A 21ST CENTURY TECHNOLOGY SOLUTION TO CLEAN THE PASSAIC RIVER	29	LST / List/Index	R2-0018327	R2-0018355	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (VOLCANO PARTNERS LLC)
205816	12/6/2010	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP SCHEDULE FOR LOWER 8 MILE EARLY ACTION	2	OTH / Other	R2-0018356	R2-0018357		
206570	12/8/2010	PROJECT DELIVERY TEAM (PDT) MEETING 12/08/2010 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0018358	R2-0018359		
205838	12/9/2010	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION ON ENVIRONMENTAL DREDGING PRIMER	11	OTH / Other	R2-0018360	R2-0018370		R02: Pabst, Douglas (US ENVIRONMENTAL PROTECTION AGENCY)

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206880	12/10/2010	TECHNICAL MEMORANDUM FOR ESTIMATION OF THE PERCENT CONTRIBUTION FROM DIOXIN WHO CONGENERS AND DIOXIN-LIKE PCB CONGENERS TO ECOLOGICAL RISK ASSOCIATED WITH THE TISSUE RESIDUE AND WILDLIFE DOSE ENDPOINTS	31	MEMO / Memorandum	R2-0018371	R2-0018401	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (BATTELLE)
206836	12/16/2010	BIOGENESIS MEETING 12/16/2010 ATTENDANCE SIGN IN SHEET	1	OTH / Other	R2-0018402	R2-0018402		
207076	12/16/2010	PRESENTATION: STATE OF THE ART SEDIMENT DECONTAMINATION BIOGENESIS SEDIMENT TECHNOLOGY FOR LOWER PASSAIC RIVER PROJECT	64	LST / List/Index	R2-0018403	R2-0018466	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (BIOGENESIS ENTERPRISES INCORPORATED)
213228	1/1/2011	DRAFT LOWER PASSAIC RIVER RESTORATION PLANNING - SUMMARY OF RESTORATION OPPORTUNITIES	65	RPT / Report	R2-0018467	R2-0018531		R02: (US ARMY CORPS OF ENGINEERS)
213235	1/1/2011	JOURNAL ARTICLE - SCIENCE OF THE TOTAL ENVIRONMENT: CONSUMPTION PATTERNS AND RISK ASSESSMENT OF CRAB CONSUMERS FROM THE NEWARK BAY COMPLEX NEW JERSEY USA	9	PUB / Publication	R2-0018532	R2-0018540		R02: Stern, Alan, H (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION), R02: Pflugh, Kerry Kirk (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION), R02: Lurig, Lynette (NEW JERSEY DEPARTMENT OF
213276	1/5/2011	DIOXIN CORRECTION FACTOR ASSESSMENT - THE EFFECT OF APPLICATION OF A CORRECTION FACTOR ON CHLORINATED DIBENZO-P-DIOXINS AND DIBENZOFURAN RESULTS FOR LOWER PASSAIC RIVER SEDIMENT SAMPLES	14	RPT / Report	R2-0018541	R2-0018554	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (COMPUTER SCIENCES CORPORATION), R02: (INTERFACE INCORPORATED)
205826	1/20/2011	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION ON FOX RIVER	61	OTH / Other	R2-0018555	R2-0018615		R02: Hannenberg, James (US ENVIRONMENTAL PROTECTION AGENCY)
205852	2/7/2011	CORRESPONDENCE REGARDING INFORMATION ON CEMENT-LOCK THERMAL-CHEMICAL PROCESS	7	EML / Email	R2-0018616	R2-0018622	R02: Loor, Thalia, A (LOUIS BERGER GROUP INCORPORATED)	R02: Hendricks, Al (VOLCANO PARTNERS LLC)
206840	2/8/2011	FOCUSED FEASIBILITY STUDY ALTERNATIVES 02/08/2011 MEETING SIGN IN SHEET	3	OTH / Other	R2-0018623	R2-0018625		

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207091	2/8/2011	AGENDA FOR THE PASSAIC RIVER LOWER EIGHT MILES FOCUSED FEASIBILITY STUDY ALTERNATIVES MEETING WITH STAKEHOLDERS	1	MTG / Meeting Document	R2-0018626	R2-0018626		
207092	2/8/2011	PRESENTATION DOCUMENTS FOR PASSAIC RIVER LOWER EIGHT MILES FOCUSED FEASIBILITY STUDY ALTERNATIVES MEETING WITH STAKEHOLDERS	19	LST / List/Index	R2-0018627	R2-0018645		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
207093	2/8/2011	DRAFT TABLE OF COMPARING ALTERNATIVES FOR THE PASSAIC RIVER LOWER EIGHT MILES FOCUSED FEASIBILITY STUDY AS OF 2/08/2011 FOR MEETING WITH STAKEHOLDERS	1	CHT / Chart/Table	R2-0018646	R2-0018646		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
213238	2/11/2011	TECHNICAL MEMORANDUM FOR REVISIONS TO EXPOSURE PARAMETER ASSUMPTIONS FOR THE LPRSA HUMAN HEALTH RISK ASSESSMENT	3	MEMO / Memorandum	R2-0018647	R2-0018649		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
213396	2/14/2011	CORRESPONDENCE REGARDING THE PASSAIC RIVER SUPERFUND CLEANUP STAKEHOLDER MEETING	2	LTR / Letter	R2-0018650	R2-0018651	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Mans, Deborah (NY/NJ BAYKEEPER)
205824	2/16/2011	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION OF CONFINED AQUATIC DISPOSAL CELLS (CADS)	34	OTH / Other	R2-0018652	R2-0018685		R02: Fredette, Thomas, J (US ARMY CORPS OF ENGINEERS)
207090	2/17/2011	DRAFT TABLE OF COMPARING ALTERNATIVES FOR THE PASSAIC RIVER LOWER EIGHT MILES FOCUSED FEASIBILITY STUDY AS OF 2/17/2011 FOR MEETING WITH STAKEHOLDERS	1	CHT / Chart/Table	R2-0018686	R2-0018686		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
207247	2/22/2011	PROJECT DELIVERY TEAM MEETING ON 03/02/2011 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT / NEWARK BAY STUDY	1	MTG / Meeting Document	R2-0018687	R2-0018687		
207087	2/23/2011	UPDATE ON THE PROGRESS ON ACTION ITEMS AND QUESTIONS REGARDING THE PASSAIC RIVER LOWER EIGHT MILES FOCUSED FEASIBILITY STUDY FOR MEETING WITH STAKEHOLDERS	1	EML / Email	R2-0018688	R2-0018688	R02: Cozzi, Thomas (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION), R02: Brzozowski, Paul (TIERRA SOLUTIONS, INCORPORATED), R02: Baptista, Ana (IRONBOUND COMMUNITY CORPORATION)	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)

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207088	2/24/2011	SUMMARY OF THE PROGRESS ON ACTION ITEMS AND QUESTIONS REGARDING THE PASSAIC RIVER LOWER EIGHT MILES FOCUSED FEASIBILITY STUDY ALTERNATIVES FOR MEETING WITH STAKEHOLDERS	3	LST / List/Index	R2-0018689	R2-0018691		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
207089	2/24/2011	LIST OF POTENTIAL DISPOSAL FACILITIES FOR THE PASSAIC RIVER LOWER EIGHT MILES FOCUSED FEASIBILITY STUDY FOR MEETING WITH STAKEHOLDERS	1	CHT / Chart/Table	R2-0018692	R2-0018692		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
207239	2/28/2011	SCHEDULE OF UPCOMING PUBLIC PRODUCTS FOR FEBRUARY 2011 - LOWER PASSAIC RIVER - NEWARK BAY	1	LST / List/Index	R2-0018693	R2-0018693		
206833	3/1/2011	FINAL REPORT MASS BALANCE BENEFICIAL USE PRODUCTS AND COST COMPARISONS OF FOUR SEDIMENT TREATMENT TECHNOLOGIES NEAR COMMERCIALIZATION	286	RPT / Report	R2-0018694	R2-0018979	R02: (US ARMY CORPS OF ENGINEERS)	R02: Averett, Daniel, E (US ARMY CORPS OF ENGINEERS), R02: Myers, Tommy, E (US ARMY CORPS OF ENGINEERS), R02: Estes, Trudy, J (US ARMY CORPS OF ENGINEERS)
206844	3/2/2011	PROJECT DELIVERY TEAM (PDT) MEETING 03/02/2011 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0018980	R2-0018981		
213164	3/7/2011	CORRESPONDENCE IN APPRECIATION OF HOSTING AND ATTENDING STAKEHOLDER MEETING OF FEBRUARY 8, 2011	6	LTR / Letter	R2-0018982	R2-0018987	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Sheehan, Bill (HACKENSACK RIVERKEEPER INCORPORATED)
205829	3/10/2011	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION ON BIOGENESIS SEDIMENT TECHNOLOGY	38	LST / List/Index	R2-0018988	R2-0019025		R02: (BIOGENESIS)
205830	3/10/2011	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION ON CEMENT-LOCK THERMO CHEMICAL PROCESS	24	OTH / Other	R2-0019026	R2-0019049		R02: (VOLCANO PARTNERS LLC)
205851	3/22/2011	CORRESPONDENCE REGARDING COMPARAISON BETWEEN CEMENT-LOCK THERMAL-CHEMICAL PROCESS AND INCINERATION	2	EML / Email	R2-0019050	R2-0019051		R02: Hendricks, Al (VOLCANO PARTNERS LLC)
212825	5/13/2011	SYSTEM UNDERSTANDING OF SEDIMENT TRANSPORT FOR THE LOWER PASSAIC RIVER	66	RPT / Report	R2-0019052	R2-0019117	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (HYDROQUAL INCORPORATED), R02: (SEA ENGINEERING INCORPORATED)

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207256	5/24/2011	PROJECT DELIVERY TEAM MEETING ON 06/01/2011 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT / NEWARK BAY STUDY	1	MTG / Meeting Document	R2-0019118	R2-0019118		
207241	5/25/2011	SCHEDULE OF UPCOMING PUBLIC PRODUCTS FOR MAY 2011 - LOWER PASSAIC RIVER - NEWARK BAY	1	LST / List/Index	R2-0019119	R2-0019119		
205828	6/1/2011	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION ON SEDIMENT DECONTAMINATION TECHNOLOGIES	44	OTH / Other	R2-0019120	R2-0019163		R02: Averett, Daniel, E (US ARMY CORPS OF ENGINEERS), R02: Estes, Trudy, J (US ARMY CORPS OF ENGINEERS)
206850	6/1/2011	PROJECT DELIVERY TEAM (PDT) MEETING 06/01/2011 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0019164	R2-0019165		
213277	6/6/2011	LOW RESOLUTION CORING - DATA VALIDATION REPORT AND PCDD / PCDF SPLIT SAMPLE DATA ISSUES FOR LOWER PASSAIC RIVER STUDY AREA	290	RPT / Report	R2-0019166	R2-0019455	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Law, Robert (DE MAXIMIS INCORPORATED)
207099	7/6/2011	TOPICS TIMELINE FOR PASSAIC RIVER COMMUNITY ADVISORY GROUP	2	CHT / Chart/Table	R2-0019456	R2-0019457		
205827	7/14/2011	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION ON DREDGING CAP	35	LST / List/Index	R2-0019458	R2-0019492		R02: (LOUIS BERGER GROUP INCORPORATED)
205849	7/15/2011	BIOGENESIS SEDIMENT DECONTAMINATION TECHNOLOGY PERTAINING TO THE LOWER PASSAIC RIVER FEASIBILITY STUDY	48	MEMO / Memorandum	R2-0019493	R2-0019540		R02: (BIOGENESIS ENTERPRISES INCORPORATED)
205850	7/15/2011	TRANMITTAL OF BIOGENESIS SEDIMENT DECONTAMINATION TECHNOLOGY PERTAINING TO THE LOWER PASSAIC RIVER FEASIBILITY STUDY	1	MEMO / Memorandum	R2-0019541	R2-0019541		R02: (BIOGENESIS ENTERPRISES INCORPORATED)
213275	7/20/2011	FINAL FISH COMMUNITY SURVEY AND TISSUE COLLECTION DATA REPORT FOR LOWER PASSAIC RIVER STUDY AREA - 2010 FIELD EFFORTS	743	RPT / Report	R2-0019542	R2-0020284	R02: (COOPERATING PARTIES GROUP)	R02: (WIND WARD ENVIRONMENTAL LLC)

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254384	7/26/2011	TRANSMITTAL OF THE REVISED LOW RESOLUTION CORING CHARACTERIZATION SUMMARY REPORT AND COOPERATING PARTIES GROUP'S POSITION WITH RESPECT TO ISSUES REGARDING LRC WORK FOR LOWER PASSAIC RIVER STUDY AREA	14	LTR / Letter	R2-0020285	R2-0020298	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY), R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY), R02: (COOPERATING PARTIES GROUP)	R02: Law, Robert (DE MAXIMIS INCORPORATED)
254385	7/26/2011	DEVELOPMENT OF CORRECTION FACTORS FOR SPLIT SAMPLES USING THE APPROACH DEVELOPED BY CSC ANALYTICAL POLYCHLORINATED BIPHENYLS AND POLYCYCLIC AROMATIC HYDROCARBONS - LOW RESOLUTION CORING PROGRAM SEDIMENT CHEMISTRY DATA	188	RPT / Report	R2-0020299	R2-0020486	R02: (TIERRA SOLUTIONS, INCORPORATED)	R02: (ARCADIS)
254386	7/27/2011	TIERRA SOLUTIONS INCORPORATED'S DISPUTE RESOLUTION FOR APPLICATION OF A CORRECTION FACTOR TO LOW RESOLUTION CORING PROGRAM DIOXIN DATA	4	LTR / Letter	R2-0020487	R2-0020490	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Dinkins, Carol, E (VINSON & ELKINS LLP)
207264	8/4/2011	PROJECT DELIVERY TEAM MEETING ON 09/07/2011 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT / NEWARK BAY STUDY	1	MTG / Meeting Document	R2-0020491	R2-0020491		
213274	8/8/2011	FINAL AVIAN COMMUNITY SURVEY DATA REPORT FOR LOWER PASSAIC RIVER STUDY AREA - SUMMER / FALL 2010	624	RPT / Report	R2-0020492	R2-0021115	R02: (COOPERATING PARTIES GROUP)	R02: (WIND WARD ENVIRONMENTAL LLC)
213395	8/9/2011	CORRESPONDENCE REGARDING THE FOCUSED FEASIBILITY STUDY	2	LTR / Letter	R2-0021116	R2-0021117	R02: Jackson, Lisa, P (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Payne, Donald, M (HOUSE OF REPRESENTATIVES)
239608	8/9/2011	[TRANSMITTAL OF THE REVISED RISK ANALYSIS AND RISK CHARACTERIZATION (RARC) PLAN FOR THE REMEDIAL INVESTIGATION / FEASIBILITY STUDY FOR THE LOWER PASSAIC RIVER STUDY AREA	4	LTR / Letter	R2-0021118	R2-0021121	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY), R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Law, Robert (DE MAXIMIS INCORPORATED)
254387	8/11/2011	CORRESPONDENCE REGARDING THE COOPERATING PARTIES GROUP NOTICE OF DISPUTE RESOLUTION DATED 07/26/2011	3	LTR / Letter	R2-0021122	R2-0021124	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Hyatt, William, H (K & L GATES LLP)

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239609	8/12/2011	COOPERATING PARTIES GROUP'S WRITTEN STATEMENT OF OBJECTIONS REGARDING THE RISK ANALYSIS AND RISK CHARACTERIZATION PLAN AND EPA'S TECHNICAL MEMORANDUM - FISH AND CRAB CONSUMPTION RATES FOR THE LOWER PASSAIC RIVER STUDY AREA HUMAN HEALTH RISK ASSESSMENT	10	LTR / Letter	R2-0021125	R2-0021134	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Hyatt, William, H (K & L GATES LLP)
207237	8/24/2011	SCHEDULE OF UPCOMING PUBLIC PRODUCTS FOR AUGUST 2011 - LOWER PASSAIC RIVER - NEWARK BAY	1	LST / List/Index	R2-0021135	R2-0021135		
239610	9/1/2011	POSITION PAPER - REVIEW OF US EPA REGION 2 JULY 11, 2011 COMMENTS ON REVISED RARC PLAN FOR THE LOWER PASSAIC RIVER STUDY AREA HUMAN HEALTH RISK ASSESSMENT - ISSUES FOR DISPUTE RESOLUTION	95	RPT / Report	R2-0021136	R2-0021230	R02: (COOPERATING PARTIES GROUP)	R02: (AECOM ENVIRONMENT)
212854	9/7/2011	PROJECT DELIVERY TEAM (PDT) MEETING 09/07/2011 ATTENDEES SIGN IN SHEET	2	LST / List/Index	R2-0021231	R2-0021232		
205834	9/8/2011	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION ON ENVIRONMENTAL DREDGING IN THE HUDSON RIVER	86	OTH / Other	R2-0021233	R2-0021318		R02: Conetta, Ben (US ENVIRONMENTAL PROTECTION AGENCY)
254388	9/9/2011	TRANSMITTAL OF THE LOW RESOLUTION CORING SPLIT SAMPLE PCB AND PAH RESULTS	1	LTR / Letter	R2-0021319	R2-0021319	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY), R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Hyatt, William, H (K & L GATES LLP)
254389	9/9/2011	LOW RESOLUTION CORING SPLIT SAMPLE PCB AND PAH RESULTS	65	RPT / Report	R2-0021320	R2-0021384		R02: (ANCHOR QEA, LLC)
233548	9/19/2011	CORRESPONDENCE REGARDING APPLICATION OF A "CORRECTION" FACTOR TO LOW RESOLUTION CORING PROGRAM DIOXIN DATA FOR THE LOWER PASSAIC RIVER STUDY	4	LTR / Letter	R2-0021385	R2-0021388	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY), R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Dinkins, Carol, E (VINSON & ELKINS LLP)

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233549	9/19/2011	RESPONSE TO ANCHOR QEA COMMENTS ON THE ARCADIS REPORT REGARDING ANALYSIS OF SPLIT SAMPLE RESULTS FROM THE LOWER PASSAIC RIVER SAMPLING PROGRAM	632	RPT / Report	R2-0021389	R2-0022020		R02: (ARCADIS)
239614	9/23/2011	CORRESPONDENCE REGARDING PLANS TO SAMPLE ATHLETIC FIELDS AT FOUR PARKS ALONG THE LOWER PASSAIC RIVER	2	LTR / Letter	R2-0022021	R2-0022022	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Hyatt, William, H (K & L GATES LLP)
239620	9/28/2011	US EPA RESPONSE TO THE LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP REGARDING THE US EPA SAMPLING IN RIVERSIDE PARK IN THE WAKE OF FLOODING EXPERIENCED FOLLOWING HURRICANE IRENE AND TROPICAL STORM LEE	1	LTR / Letter	R2-0022023	R2-0022023	R02: Hyatt, William, H (K & L GATES LLP)	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)
205831	10/13/2011	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION ON ECOLOGICAL RISK ASSESSMENT	17	LST / List/Index	R2-0022024	R2-0022040		R02: Nace, Charles (US ENVIRONMENTAL PROTECTION AGENCY)
205832	10/13/2011	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION ON HUMAN HEALTH RISK ASSESSMENT	23	OTH / Other	R2-0022041	R2-0022063		R02: Olsen, Marian (US ENVIRONMENTAL PROTECTION AGENCY)
239606	10/17/2011	CSC ASSESSMENT OF THE PROPOSED CORRECTION FACTOR FOR DIOXIN / FURAN RESULTS FROM LOWER PASSAIC RIVER SEDIMENT SPLIT SAMPLES IN LIGHT OF CPG COMMENTS	33	MEMO / Memorandum	R2-0022064	R2-0022096	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY), R02: Kelly, Marion (EAD)	R02: Rushneck, Dale (INTERFACE INCORPORATED), R02: Walters, Lynn (COMPUTER SCIENCES CORPORATION)
254383	11/14/2011	CORRESPONDENCE REGARDING THE PORTLAND HARBOR AREA CLEAN-UP	2	LTR / Letter	R2-0022097	R2-0022098	R02: Jackson, Lisa, P (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Blumenauer, Earl (US CONGRESS), R02: Merkley, Jeff (US CONGRESS), R02: Schrader, Kurt (US CONGRESS)
213279	11/17/2011	US EPA RESPONSE TO LETTER DATED 06/06/2011 REGARDING CONCERNS OVER SPLIT SAMPLE DATA COLLECTED DURING THE 2008 COOPERATING PARTIES GROUP LOW RESOLUTION CORING PROGRAM	2	LTR / Letter	R2-0022099	R2-0022100	R02: Law, Robert (DE MAXIMIS INCORPORATED)	R02: Mugdan, Walter, E (US ENVIRONMENTAL PROTECTION AGENCY)

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207068	11/20/2011	CORRESPONDENCE REGARDING PASSAIC RIVER CLEANUP REMEDIAL ALTERNATIVES	3	LTR / Letter	R2-0022101	R2-0022103	R02: Legare, Amy, R (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Baptista, Ana (IRONBOUND COMMUNITY CORPORATION)
207243	11/22/2011	SCHEDULE OF UPCOMING PUBLIC PRODUCTS FOR NOVEMBER 2011 - LOWER PASSAIC RIVER - NEWARK BAY	1	LST / List/Index	R2-0022104	R2-0022104		
207271	11/22/2011	PROJECT DELIVERY TEAM MEETING ON 12/07/2011 - DRAFT AGENDA - LOWER PASSAIC RIVER RESTORATION PROJECT / NEWARK BAY STUDY	1	MTG / Meeting Document	R2-0022105	R2-0022105		
254381	11/28/2011	FINAL CREEL/ANGLER SURVEY WORK PLAN - VOLUMES 1 AND 2 OF 2 - PEER REVIEW OF THE LOWER PASSAIC RIVER STUDY AREA	130	WP / Work Plan	R2-0022106	R2-0022235	R02: (LPRSA COOPERATING PARTIES GROUP), R02: (AECOM)	R02: (TOXICOLOGY EXCELLENCE FOR RISK ASSESSMENT)
254380	11/29/2011	TRANSMITTAL OF THE FINAL CREEL/ANGLER SURVEY WORK PLAN AND EXPERT REVIEW PANEL COMMENTS FOR LOWER PASSAIC RIVER STUDY AREA	4	LTR / Letter	R2-0022236	R2-0022239	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY), R02: Vaughn, Stephanie (US ENVIRONMENTAL PROTECTION AGENCY), R02: Mugdan, Walter (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Law, Robert (DE MAXIMIS INCORPORATED)
205808	11/30/2011	CORRESPONDENCE REGARDING SUMMARY OF PROJECT AND DESIGN UPDATES FOR CEMENT-LOCK TECHNOLOGY MANUFACTURING PLANT	14	MEMO / Memorandum	R2-0022240	R2-0022253	R02: Hendricks, Al (VOLCANO PARTNERS LLC)	R02: Mcgee, Steve (TETRA TECH EC INCORPORATED)
205809	11/30/2011	CORRESPONDENCE REGARDING ADDITIONAL INFORMATION ON THE CEMENT-LOCK MANUFACTURING PROCESS	3	LTR / Letter	R2-0022254	R2-0022256	R02: Thompson, Scott (THE LOUIS BERGER GROUP DOMESTIC INCORPORATED)	R02: Hendricks, Al (VOLCANO PARTNERS LLC)
205822	12/1/2011	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION ON LOWER PASSAIC RIVER, NEWARK BAY, NY/NJ HARBOR: DREDGED MATERIAL MANAGEMENT	32	LST / List/Index	R2-0022257	R2-0022288		R02: (PASSAIC RIVER COALITION)

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206863	12/7/2011	PROJECT DELIVERY TEAM (PDT) MEETING 12/07/2011 ATTENDEES SIGN IN SHEET	2	OTH / Other	R2-0022289	R2-0022290		
205823	12/19/2011	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION ON ST MODEL	28	OTH / Other	R2-0022291	R2-0022318		R02: Garland, Edward, J (HYDROQUAL INCORPORATED), R02: Naranjo, Eugenia (US ENVIRONMENTAL PROTECTION AGENCY)
205813	1/12/2012	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP ACTION ITEMS FROM THE THURSDAY JANUARY 12, 2012 MONTHLY MEETING	2	OTH / Other	R2-0022319	R2-0022320		
205819	1/12/2012	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP KEY REMEDY DECISIONS	4	OTH / Other	R2-0022321	R2-0022324		
212982	1/18/2012	RESPONSE TO LETTER DATED 12/23/2011 ON DREDGED MATERIAL MANAGEMENT FOR LOWER PASSAIC RIVER SEDIMENTS	1	LTR / Letter	R2-0022325	R2-0022325	R02: Filippone, Ella, F (PASSAIC RIVER COALITION)	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)
213232	2/2/2012	TECHNICAL MEMORANDUM FOR FISH AND CRAB CONSUMPTION RATES FOR THE LPRSA HUMAN HEALTH RISK ASSESSMENT	19	MEMO / Memorandum	R2-0022326	R2-0022344		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
233617	2/6/2012	RECORD OF DISPUTE RESOLUTION PROCEEDING PURSUANT TO ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT FOR REMEDIAL INVESTIGATION AND FEASIBILITY STUDY FOR THE LOWER PASSAIC RIVER PROJECT	1	LST / List/Index	R2-0022345	R2-0022345		

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202596	7/25/2011	NOTICE OF DISPUTE RESOLUTION PURSUANT TO THE DISPUTE RESOLUTION PROVISIONS OF THE ADMINISTRATIVE SETTLEMENT AND ORDER ON CONSENT - CERCLA DOCKET NO. 02-2007-2009 FOR THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY FOR THE LOWER PASSAIC RIVER PROJECT	1	LTR / Letter	R2-0022346	R2-0022346	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Hyatt, William, H (LPRSA COOPERATING PARTIES GROUP)
233528	8/2/2011	US EPA ACKNOWLEDGEMENT OF REQUEST FOR DISPUTE RESOLUTION FOR THE ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT - CERCLA DOCKET NO. 02-2007-2009 FOR REMEDIAL INVESTIGATION AND FEASIBILITY STUDY FOR THE LOWER PASSAIC RIVER PROJECT	1	LTR / Letter	R2-0022347	R2-0022347	R02: Hyatt, William, H (LPRSA COOPERATING PARTIES GROUP)	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)
233536	8/25/2011	EXTENSION OF NEGOTIATION PERIOD FOR DISPUTE RESOLUTION UNTIL 12/01/2011 REGARDING RISK ASSESSMENT AND RISK CHARACTERIZATION PLAN FOR THE LOWER PASSAIC RIVER PROJECT	1	LTR / Letter	R2-0022348	R2-0022348	R02: Hyatt, William, H (LPRSA COOPERATING PARTIES GROUP)	R02: Flanagan, Sarah, P (US ENVIRONMENTAL PROTECTION AGENCY)
233613	11/16/2011	CORRESPONDENCE REGARDING THE DISPUTE RESOLUTION MEETING PLANNED FOR 12/01/2011 AND SUBSEQUENT STEPS FOR REACHING RESOLUTION ON ALL ISSUES IN DISPUTE FOR THE LOWER PASSAIC RIVER PROJECT	2	LTR / Letter	R2-0022349	R2-0022350	R02: Hyatt, William, H (LPRSA COOPERATING PARTIES GROUP)	R02: Flanagan, Sarah, P (US ENVIRONMENTAL PROTECTION AGENCY)
233517	12/5/2011	CORRESPONDENCE REGARDING US EPA REGION 2 STAFF RECOMMENDED LANGUAGE TO ADDRESS CERTAIN ISSUES / OBJECTIONS RAISED BY SETTLING PARTIES AND MEETING ATTENDANCE LIST FOR THE 12/01/2011 MEETING FOR THE DISPUTE RESOLUTION FOR THE LOWER PASSAIC RIVER PROJECT	15	EML / Email	R2-0022351	R2-0022365	R02: Hyatt, William, H (LPRSA COOPERATING PARTIES GROUP)	R02: Flanagan, Sarah, P (US ENVIRONMENTAL PROTECTION AGENCY)
213229	1/3/2012	CORRESPONDENCE REGARDING RESOLUTION OF THE SEVEN DISPUTED ISSUES FOR THE DISPUTE RESOLUTION FOR THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY FOR THE LOWER PASSAIC RIVER PROJECT	43	LTR / Letter	R2-0022366	R2-0022408	R02: Hyatt, William, H (K & L GATES LLP)	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)

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232636	1/5/2012	CORRESPONDENCE REGARDING DISPUTE RESOLUTION PROCEEDING PURSUANT TO ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT - CERCLA DOCKET NO. 02-2007-2009 FOR THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY FOR THE LOWER PASSAIC RIVER PROJECT	5	LTR / Letter	R2-0022409	R2-0022413	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Hyatt, William, H (LPRSA COOPERATING PARTIES GROUP)
232634	1/5/2012	TRANSMITTAL OF EPA REGION 2 STAFF STATEMENT OF POSITION ON ISSUES THAT REMAIN IN DISPUTE REGARDING THE DISPUTE RESOLUTION PURSUANT TO ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT - DOCKET NO. 02-2007-2009 FOR THE LOWER PASSAIC RIVER PROJECT	1	LTR / Letter	R2-0022414	R2-0022414	R02: Hyatt, William, H (LPRSA COOPERATING PARTIES GROUP)	R02: Flanagan, Sarah, P (US ENVIRONMENTAL PROTECTION AGENCY)
232635	1/3/2012	EPA REGION 2 STAFF STATEMENT OF POSITION ON ISSUES THAT REMAIN IN DISPUTE REGARDING THE DISPUTE RESOLUTION PURSUANT TO ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT - CERCLA DOCKET NO. 02-2007-2009 FOR RI/FS FOR THE LOWER PASSAIC RIVER PROJECT	241	RPT / Report	R2-0022415	R2-0022655		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
238521	2/6/2012	SIGN-IN LIST FOR DISPUTE RESOLUTION MEETING ON 01/13/2012 CONCERNING ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT - DOCKET NO. 02-2007-2009 FOR REMEDIAL INVESTIGATION AND FEASIBILITY STUDY FOR THE LOWER PASSAIC RIVER PROJECT	1	LST / List/Index	R2-0022656	R2-0022656		
213230	2/6/2012	US EPA DECISION PURSUANT TO ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT - CERCLA DOCKET NO. 02-2007-2009 FOR REMEDIAL INVESTIGATION AND FEASIBILITY STUDY FOR THE LOWER PASSAIC RIVER PROJECT	30	LTR / Letter	R2-0022657	R2-0022686	R02: Hyatt, William, H (K & L GATES LLP)	R02: Mugdan, Walter, E (US ENVIRONMENTAL PROTECTION AGENCY)

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205814	2/9/2012	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP AGENDA	1	OTH / Other	R2-0022687	R2-0022687		
207065	2/17/2012	CORRESPONDENCE REGARDING CEMENT-LOCK TECHNOLOGY PROPOSAL FOR ALTERNATIVE PILOT PROGRAM	26	LTR / Letter	R2-0022688	R2-0022713	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Fabricant, Robert, E (VOLCANO PARTNERS LLC), R02: Hendricks, Al (VOLCANO PARTNERS LLC)
212956	2/27/2012	DRAFT, NEWARK'S RIVER A PUBLIC ACCESS AND REDEVELOPMENT PLAN FEBRUARY 2012	91	WP / Work Plan	R2-0022714	R2-0022804		R02: (CITY OF NEWARK)
205817	3/7/2012	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP HANDOUT CLEANUP STAGES	1	OTH / Other	R2-0022805	R2-0022805		R02: Sarno, Doug (FORUM FACILITATION GROUP)
205818	3/7/2012	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP HANDOUT ON SEDIMENT CHOICES	1	OTH / Other	R2-0022806	R2-0022806		R02: Sarno, Doug (FORUM FACILITATION GROUP)
212987	3/13/2012	RESPONSE TO LETTER DATED 02/17/2012 ON CEMENT LOCK'S PROPOSAL FOR AN ALTERNATIVE PILOT PROGRAM	1	LTR / Letter	R2-0022807	R2-0022807	R02: Fabricant, Robert, E (VOLCANO PARTNERS LLC), R02: Hendricks, Al (VOLCANO PARTNERS LLC)	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)
212869	4/27/2012	PASSAIC RIVER COALITION (PRC) - DREDGED MATERIAL MANAGEMENT (DMM) OF DIOXIN CONTAMINATED SEDIMENTS, LOWER PASSAIC RIVER, NEWARK BAY AND NY / NJ HARBOR	23	RPT / Report	R2-0022808	R2-0022830		R02: Filippone, Ella, F (PASSAIC RIVER COALITION), R02: Kruger, Anne (PASSAIC RIVER COALITION)

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239616	5/21/2012	ACTION MEMORANDUM - DETERMINATION OF NEED TO CONDUCT A CERCLA TIME-CRITICAL REMOVAL ACTION AT THE LOWER PASSAIC RIVER STUDY AREA - RIVER MILE 10.9 REMOVAL AREA	17	MEMO / Memorandum	R2-0022831	R2-0022847	R02: Mugdan, Walter, E (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)
212955	6/1/2012	MOBILITY ELEMENT, NEWARK MASTER PLAN	235	WP / Work Plan	R2-0022848	R2-0023082	R02: (CITY OF NEWARK), R02: (NORTH JERSEY TRANSPORTATION PLANNING AUTHORITY)	R02: (PB AMERICAS INCORPORATED), R02: (NEWARK CENTRAL PLANNING BOARD)
232657	6/18/2012	ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT FOR REMOVAL ACTION FOR DIAMOND ALKALI COMPANY SITE	144	AGMT / Agreement	R2-0023083	R2-0023226		
212841	7/31/2012	ENVIRONMENTAL DREDGING PILOT STUDY REPORT (PART 1 OF 2) FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	292	RPT / Report	R2-0023227	R2-0023518	R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: (TAMS, AN EARTH TECH COMPANY)
212842	7/31/2012	ENVIRONMENTAL DREDGING PILOT STUDY REPORT (PART 2 OF 2 - APPENDICES) FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	916	RPT / Report	R2-0023519	R2-0024435	R02: (NEW JERSEY DEPARTMENT OF TRANSPORTATION)	R02: (TAMS, AN EARTH TECH COMPANY)
205858	8/6/2012	CORRESPONDENCE REGARDING CONCERNS ABOUT REPEATED DELAYS IN EPA'S COMPLETION OF FOCUSED FEASIBILITY STUDY	3	LTR / Letter	R2-0024436	R2-0024438	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Martin, Bob (OFFICE OF THE GOVERNOR OF NEW JERSEY STATE)
213388	9/17/2012	SEDIMENT WASHING BENCH-SCALE TESTING REPORT FOR LOWER PASSAIC RIVER STUDY AREA	9	RPT / Report	R2-0024439	R2-0024447	R02: Vaughn, Stephanie (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Law, Robert (DE MAXIMIS INCORPORATED)

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205835	9/18/2012	PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP PRESENTATION ON FOCUSED FEASIBILITY STUDY ALTERNATIVES	11	LST / List/Index	R2-0024448	R2-0024458		R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)
212953	9/24/2012	NEWARK'S MASTER PLAN, OUR CITY OUR FUTURE, VOLUME 1 OF 2	270	WP / Work Plan	R2-0024459	R2-0024728		R02: (NEWARK CENTRAL PLANNING BOARD)
212954	9/24/2012	NEWARK'S MASTER PLAN, OUR CITY OUR FUTURE, VOLUME 2 OF 2	233	WP / Work Plan	R2-0024729	R2-0024961		R02: (NEWARK CENTRAL PLANNING BOARD)
212870	10/12/2012	SUMMARY FOR THE COMMUNITY ADVISORY GROUP - REMEDIAL INVESTIGATION AND FOCUSED FEASIBILITY STUDY - LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER	33	RPT / Report	R2-0024962	R2-0024994	R02: (COMMUNITY ADVISORY GROUP)	R02: (US ENVIRONMENTAL PROTECTION AGENCY)
207060	11/14/2012	PASSAIC RIVER COALITION RECOMMENDATIONS TO US ENVIRONMENTAL PROTECTION AGENCY AND NATIONAL REMEDY REVIEW BOARD REGARDING THE LOWER PASSAIC RIVER RESTORATION PROJECT	39	PUB / Publication	R2-0024995	R2-0025033		R02: Filippone, Ella, F (PASSAIC RIVER COALITION), R02: Kruger, Anne (PASSAIC RIVER COALITION), R02: Reinhart, Michael (PASSAIC RIVER COALITION)
207066	11/14/2012	VOLCANO PARTNERS NEW JERSEY LLC'S COMMENTS REGARDING THE NATIONAL REMEDY REVIEW BOARD'S PENDING REVIEW OF CEMENT-LOCK TECHNOLOGY PROPOSAL FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT	2	LTR / Letter	R2-0025034	R2-0025035	R02: Legare, Amy, R (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Fabricant, Robert, E (VOLCANO PARTNERS LLC), R02: Hendricks, Al (VOLCANO PARTNERS LLC)
207061	11/19/2012	TIERRA SOLUTIONS, INC.'S COMMENTS FOR CONSIDERATION BY THE NATIONAL REMEDY REVIEW BOARD REGARDING THE LOWER PASSAIC RIVER (LOWER EIGHT MILES) REMEDIAL INVESTIGATION AND FOCUSED FEASIBILITY STUDY	60	LTR / Letter	R2-0025036	R2-0025095	R02: Legare, Amy, R (US ENVIRONMENTAL PROTECTION AGENCY), R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Firstenberg, Clifford E. (TIERRA SOLUTIONS, INCORPORATED)

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207063	11/20/2012	CORRESPONDENCE REGARDING NY/NJ BAYKEEPER'S STRONG OPPOSITION TO ANY REMEDY THAT WOULD BURY CONTAMINATED PASSAIC RIVER SEDIMENST IN NEWARK BAY	2	LTR / Letter	R2-0025096	R2-0025097	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Mans, Deborah (NY/NJ BAYKEEPER)
207062	11/21/2012	LPRSA COOPERATING PARTIES GROUP'S COMMENTS FOR CONSIDERATION BY THE NATIONAL REMEDY REVIEW BOARD AND THE CONTAMINATED SEDIMENT TECHNICAL ADVISORY GROUP REGARDING THE DRAFT FOCUSED FEASIBILITY STUDY	78	LTR / Letter	R2-0025098	R2-0025175	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Hyatt, William, H (LPRSA COOPERATING PARTIES GROUP)
207064	11/23/2012	COMMUNITY ADVISORY GROUP COMMENTS TO NATIONAL REMEDY REVIEW BOARD	9	LTR / Letter	R2-0025176	R2-0025184	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Baptista, Ana (IRONBOUND COMMUNITY CORPORATION), R02: Johnston, Carol (IRONBOUND COMMUNITY CORPORATION), R02: Mans, Deborah (NY/NJ BAYKEEPER)
207067	11/28/2012	CORRESPONDENCE REGARDING STATE OF NEW JERSEY'S SUPPORT FOR A REMEDIAL ALTERNATIVE FOR THE LOWER EIGHT MILES OF THE PASSAIC RIVER	5	LTR / Letter	R2-0025185	R2-0025189	R02: Jackson, Lisa, P (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Christie, Chris (STATE OF NEW JERSEY OFFICE OF GOVERNOR)
207069	11/30/2012	US ARMY CORPS OF ENGINEERS' COMMENTS SENT TO NATIONAL REMEDY REVIEW BOARD - ATTACHMENT	3	PUB / Publication	R2-0025190	R2-0025192	R02: Legare, Amy, R (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (US ARMY CORPS OF ENGINEERS)
207070	11/30/2012	US ARMY CORPS OF ENGINEERS'S COMMENTS SENT TO NATIONAL REMEDY REVIEW BOARD REGARDING PREFERRED ALTERNATIVE FOR THE LOWER PASSAIC RIVER FOCUSED FEASIBILITY STUDY	4	LTR / Letter	R2-0025193	R2-0025196	R02: Legare, Amy, R (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Owen, Paul, E (US ARMY CORPS OF ENGINEERS)
213460	12/6/2012	DISCUSSION OF LOWER PASSAIC CLEANUP ALTERNATIVES - PRESENTATION TO THE PASSSAIC RIVER COMMUNITY ADVISORY GROUP	25	LST / List/Index	R2-0025197	R2-0025221		R02: (COOPERATING PARTIES GROUP)
213162	1/25/2013	CORRESPONDENCE IN OPPOSITION TO ENVIRONMENTAL PROTECTION AGENCY'S FOCUSED FEASIBILITY STUDY	2	LTR / Letter	R2-0025222	R2-0025223	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Degise, Thomas (HUDSON COUNTY, NJ)
205859	1/29/2013	CORRESPONDENCE REGARDING PREFERRED CLEANUP PLAN FOR THE LOWER 8 MILES OF THE PASSAIC RIVER	1	LTR / Letter	R2-0025224	R2-0025224	R02: Christie, Chris (STATE OF NEW JERSEY)	R02: Jackson, Lisa, P (US ENVIRONMENTAL PROTECTION AGENCY)

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254393	2/8/2013	LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP'S COMMENTS ON SUBMITTAL OF US EPA'S DRAFT FOCUSED FEASIBILITY STUDY TO A PEER REVIEW PANEL	1	LTR / Letter	R2-0025225	R2-0025225	R02: Flanagan, Sarah, P (US ENVIRONMENTAL PROTECTION AGENCY), R02: (COOPERATING PARTIES GROUP)	R02: Wyatt, Robert, J (BCM ENGINEERS INCORPORATED)
254391	2/12/2013	LOWER PASSAIC RIVER - LOWER EIGHT-MILE FOCUSED FEASIBILITY STUDY SEDIMENT TRANSPORT - ORGANIC CARBON AND CONTAMINANT FATE AND TRANSPORT MODEL CHARGE TO PEER REVIEWERS	12	OTH / Other	R2-0025226	R2-0025237		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
254390	2/13/2013	US EPA'S RESPONSE TO LETTER DATED 02/08/2013 CONFIRMING A LETTER PEER REVIEW FOR MODELS USED IN THE FOCUSED FEASIBILITY STUDY	2	LTR / Letter	R2-0025238	R2-0025239	R02: Hyatt, William, H (K & L GATES LLP)	R02: Flanagan, Sarah, P (US ENVIRONMENTAL PROTECTION AGENCY)
212983	2/14/2013	CORRESPONDENCE REGARDING FOCUSED FEASIBILITY STUDY	3	LTR / Letter	R2-0025240	R2-0025242	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Sarlo, Paul, A (SENATOR DISTRICT 36)
212988	2/20/2013	CORRESPONDENCE REGARDING U.S. EPA REGION 2 FOCUSED FEASIBILITY STUDY	2	LTR / Letter	R2-0025243	R2-0025244	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Wargacki, Walter, G (MAYOR BOROUGH OF WALLINGTON)
213165	2/21/2013	CORRESPONDENCE IN OPPOSITION TO ENVIRONMENTAL PROTECTION AGENCY'S FOCUSED FEASIBILITY STUDY	4	LTR / Letter	R2-0025245	R2-0025248	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Donovan, Kathleen, A (COUNTY OF BERGEN)
212980	3/1/2013	DRAFT PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP SUMMARY AND ACTION ITEMS FROM 03/14/2013 MONTHLY MEETING	3	MTG / Meeting Document	R2-0025249	R2-0025251		

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254394	3/4/2013	CORRESPONDENCE REGARDING FOCUSED FEASIBILITY STUDY MODELING PEER REVIEW	2	LTR / Letter	R2-0025252	R2-0025253	R02: Flanagan, Sarah, P (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Hyatt, William, H (K & L GATES LLP)
207296	3/6/2013	NEW JERSEY CHAMBER OF COMMERCE'S LETTER ON CLEANUP OPTIONS FOR THE REMEDIATION OF THE LOWER PASSAIC RIVER AND CONCERNS ON FOCUSED FEASIBILITY STUDY	3	LTR / Letter	R2-0025254	R2-0025256	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Egenton, Michael, A (NEW JERSEY CHAMBER OF COMMERCE)
212871	3/7/2013	COMPARISON OF EPA AND CPG REMEDIES - EPA'S UNDERSTANDING AS OF 03/07/2013	1	CHT / Chart/Table	R2-0025257	R2-0025257		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
212872	3/7/2013	COMPARISON OF "BANK TO BANK" AND "TARGETED" REMEDIAL APPROACHES FOR THE LOWER PASSAIC RIVER	2	LST / List/Index	R2-0025258	R2-0025259		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
212989	3/7/2013	RESPONSE TO LETTER DATED 02/20/2013 REGARDING U.S. EPA REGION 2 FOCUSED FEASIBILITY STUDY	2	LTR / Letter	R2-0025260	R2-0025261	R02: Wargacki, Walter, G (MAYOR BOROUGH OF WALLINGTON)	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)
213163	3/7/2013	CORRESPONDENCE RESPONDING TO LETTER OF JANUARY 25 2013 OPPOSING THE ENVIRONMENTAL PROTECTION AGENCY'S FOCUSED FEASIBILITY STUDY	2	LTR / Letter	R2-0025262	R2-0025263	R02: Degise, Thomas (HUDSON COUNTY, NJ)	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)
213399	3/7/2013	CORRESPONDENCE REGARDING THE FOCUSED FEASIBILITY STUDY	2	LTR / Letter	R2-0025264	R2-0025265	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Caride, Marlene (NJ GENERAL ASSEMBLY)
207094	3/8/2013	FACTSHEET FOR LOCAL COMMUNITY: LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER FOCUSED FEASIBILITY STUDY AS OF 03/08/2013	2	LST / List/Index	R2-0025266	R2-0025267		R02: (US ENVIRONMENTAL PROTECTION AGENCY)

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212985	3/14/2013	CORRESPONDENCE REGARDING THE LOWER PASSAIC RESTORATION PROJECT	2	LTR / Letter	R2-0025268	R2-0025269	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Van Der Tuin, John (NONE)
213166	3/15/2013	CORRESPONDENCE RESPONDING TO LETTER OF FEBRUARY 21 2013 OPPOSING THE ENVIRONMENTAL PROTECTION AGENCY'S FOCUSED FEASIBILITY STUDY	2	LTR / Letter	R2-0025270	R2-0025271	R02: Donovan, Kathleen, A (COUNTY OF BERGEN)	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)
207294	3/18/2013	MONTCLAIR STATE UNIVERSITY'S LETTER ADDRESSING A SCIENTIFIC APPROACH IN ASSESSMENT OF CLEANUP OPTIONS FOR THE REMEDIATION OF THE LOWER PASSAIC RIVER	3	LTR / Letter	R2-0025272	R2-0025274	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Wu, Meiyin (MONTCLAIR STATE UNIVERSITY)
206841	3/20/2013	US EPA PASSAIC RIVER MEETING 03/20/2013 ATTENDEE LIST	2	OTH / Other	R2-0025275	R2-0025276		
207095	3/20/2013	PRESENTATION FOR BRIEFING FOR LOCAL OFFICIALS: LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER FOCUSED FEASIBILITY STUDY	20	LST / List/Index	R2-0025277	R2-0025296		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
239618	3/20/2013	FINAL CONSTRUCTION REPORT - PHASE 1 REMOVAL ACTION - CERCLA NON-TIME CRITICAL REMOVAL ACTION FOR THE LOWER PASSAIC RIVER STUDY AREA	72	RPT / Report	R2-0025297	R2-0025368	R02: Butler, Elizabeth (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Bluestein, Paul (TIERRA SOLUTIONS, INCORPORATED)
239621	3/20/2013	TRANSMITTAL OF THE FINAL CONSTRUCTION REPORT - PHASE 1 REMOVAL ACTION - CERCLA NON-TIME CRITICAL REMOVAL ACTION FOR THE LOWER PASSAIC RIVER STUDY AREA	2	LTR / Letter	R2-0025369	R2-0025370	R02: Butler, Elizabeth (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Bluestein, Paul (TIERRA SOLUTIONS, INCORPORATED)
207297	3/28/2013	RESPONSE TO NEW JERSEY CHAMBER OF COMMERCE'S LETTER ON CLEANUP OPTIONS FOR THE REMEDIATION OF THE LOWER PASSAIC RIVER AND CONCERNS ON FOCUSED FEASIBILITY STUDY	2	LTR / Letter	R2-0025371	R2-0025372	R02: Egenton, Michael, A (NEW JERSEY CHAMBER OF COMMERCE)	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)
212984	3/29/2013	RESPONSE TO LETTER DATED 02/14/2013 REGARDING THE FOCUSED FEASIBILITY STUDY	2	LTR / Letter	R2-0025373	R2-0025374	R02: Sarlo, Paul, A (SENATOR DISTRICT 36)	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)

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207295	5/3/2013	RESPONSE TO MONTCLAIR STATE UNIVERSITY'S LETTER ADDRESSING A SCIENTIFIC APPROACH IN ASSESSMENT OF CLEANUP OPTIONS FOR THE REMEDIATION OF THE LOWER PASSAIC RIVER	2	LTR / Letter	R2-0025375	R2-0025376	R02: Wu, Meiyin (MONTCLAIR STATE UNIVERSITY)	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)
212873	5/23/2013	SUMMARY OF WHAT KIND OF INFORMATION WILL AND WILL NOT BE IN THE REMEDIAL INVESTIGATION AND FOCUSED FEASIBILITY REPORTS FOR THE LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER	2	LST / List/Index	R2-0025377	R2-0025378	R02: (COMMUNITY ADVISORY GROUP)	R02: (US ENVIRONMENTAL PROTECTION AGENCY)
212874	5/23/2013	DRAFT FINAL FOCUSED FEASIBILITY STUDY TABLE OF CONTENTS LIST OF APPENDICES FOR THE LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER	1	LST / List/Index	R2-0025379	R2-0025379	R02: (COMMUNITY ADVISORY GROUP)	R02: (US ENVIRONMENTAL PROTECTION AGENCY)
212875	5/23/2013	DRAFT FINAL FOCUSED FEASIBILITY STUDY TABLE OF CONTENTS FOR THE LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER	4	LST / List/Index	R2-0025380	R2-0025383	R02: (COMMUNITY ADVISORY GROUP)	R02: (US ENVIRONMENTAL PROTECTION AGENCY)
212876	5/23/2013	DRAFT FINAL REMEDIAL INVESTIGATION REPORT FOR THE FOCUSED FEASIBILITY STUDY TABLE OF CONTENTS FOR THE LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER	5	LST / List/Index	R2-0025384	R2-0025388	R02: (COMMUNITY ADVISORY GROUP)	R02: (US ENVIRONMENTAL PROTECTION AGENCY)
212962	6/1/2013	HEALTH ADVICE ON EATING SPORTFISH AND GAME	48	RPT / Report	R2-0025389	R2-0025436		R02: (NYS Department of Health)
213167	6/11/2013	CORRESPONDENCE IN SUPPORT OF THE ENVIRONMENTAL PROTECTION AGENCY'S FOCUSED FEASIBILITY STUDY	1	LTR / Letter	R2-0025437	R2-0025437	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Degise, Thomas (HUDSON COUNTY, NJ)
212957	8/17/2013	FINAL, NEWARK'S RIVER PUBLIC ACCESS AND REDEVELOPMENT PLAN APRIL 2013	94	WP / Work Plan	R2-0025438	R2-0025531		R02: (CITY OF NEWARK)

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212981	9/1/2013	DRAFT PASSAIC RIVER SUPERFUND COMMUNITY ADVISORY GROUP SUMMARY AND ACTION ITEMS FROM 09/12/2013 MONTHLY MEETING	4	MTG / Meeting Document	R2-0025532	R2-0025535		
213222	9/11/2013	REPORT OF THE PEER REVIEW OF SEDIMENT TRANSPORT - ORGANIC CARBON AND CONTAMINANT FATE AND TRANSPORT MODEL	123	RPT / Report	R2-0025536	R2-0025658	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (HYDROQUAL INCORPORATED)
207299	10/1/2013	PASSAIC RIVER COMMUNITY ADVISORY GROUP STRATEGIC PLAN FOR REVIEW AND COMMENT OF FOCUSED FEASIBILITY STUDY AND PROPOSED PLAN	3	LST / List/Index	R2-0025659	R2-0025661		
239622	10/23/2013	CORRESPONDENCE REGARDING MODELING CLARIFICATION TO THE COOPERATING PARTIES GROUP FOR THE REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES BEING CONDUCTED FOR THE LOWER PASSAIC RIVER STUDY AREA	2	LTR / Letter	R2-0025662	R2-0025663	R02: Law, Robert (DE MAXIMIS INCORPORATED)	R02: Vaughn, Stephanie (US ENVIRONMENTAL PROTECTION AGENCY)
213463	11/14/2013	SUSTAINABLE REMEDY UPDATE - PRESENTATION TO THE LOWER PASSSAIC RIVER COMMUNITY ADVISORY GROUP	20	LST / List/Index	R2-0025664	R2-0025683		R02: (COOPERATING PARTIES GROUP)
213464	11/14/2013	LOWER 8 MILES OF THE LOWER PASSAIC RIVER FOCUSED FEASIBILITY STUDY - PRESENTATION TO THE PASSSAIC RIVER COMMUNITY ADVISORY GROUP	10	LST / List/Index	R2-0025684	R2-0025693		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
239623	11/22/2013	COOPERATING PARTIES GROUP'S RESPONSE TO US EPA CORRESPONDENCE REGARDING MODELING CLARIFICATION FOR THE REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES BEING CONDUCTED FOR THE LOWER PASSAIC RIVER STUDY AREA	24	LTR / Letter	R2-0025694	R2-0025717	R02: Vaughn, Stephanie (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Law, Robert (DE MAXIMIS INCORPORATED)
254392	11/22/2013	COOPERATING PARTIES GROUP'S RESPONSE TO US EPA LETTER DATED 10/23/2013 REGARDING MODEL CLARIFICATIONS	24	LTR / Letter	R2-0025718	R2-0025741	R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY), R02: Vaughn, Stephanie (US ENVIRONMENTAL PROTECTION AGENCY), R02: Mugdan, Walter (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Law, Robert (DE MAXIMIS INCORPORATED)

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213401	12/20/2013	CORRESPONDENCE REGARDING COOPERATING PARTIES GROUP'S PROPOSAL TO CONDUCT A PILOT STUDY OF A FISH EXCHANGE PROGRAM FOR LOWER PASSAIC RIVER STUDY AREA	3	LTR / Letter	R2-0025742	R2-0025744	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Hyatt, William, H (K & L GATES LLP)
212960	12/31/2013	FISH SMART, EAT SMART A GUIDE TO HEALTH ADVISORIES FOR EATING FISH AND CRABS CAUGHT IN NEW JERSEY WATERS 2013	79	RPT / Report	R2-0025745	R2-0025823		R02: (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION), R02: (NEW JERSEY DEPARTMENT OF HEALTH)
207298	1/1/2014	PASSAIC RIVER COMMUNITY ADVISORY GROUP MEETING AND ACTIVITIES FOR REVIEW AND COMMENT OF FOCUSED FEASIBILITY STUDY AND PROPOSED PLAN AS OF 01/06/2013	4	LST / List/Index	R2-0025824	R2-0025827		
213461	1/9/2014	UPDATE ON FOCUSED FEASIBILITY STUDY MODELS PART 1 - PRESENTATION TO THE PASSSAIC RIVER COMMUNITY ADVISORY GROUP	18	LST / List/Index	R2-0025828	R2-0025845		R02: (HYDROQUAL INCORPORATED)
213462	1/9/2014	UPDATE ON FOCUSED FEASIBILITY STUDY MODELS PART 2 - PRESENTATION TO THE PASSSAIC RIVER COMMUNITY ADVISORY GROUP	15	LST / List/Index	R2-0025846	R2-0025860		R02: (HYDROQUAL INCORPORATED)
213402	1/16/2014	COOPERATING PARTIES GROUP MEETING REQUEST FOR DETAILED BRIEFING REGARDING WORK ON THE REMEDIAL INVESTIGATION / FEASIBILITY STUDY AND PROPOSED SUSTAINABLE REMEDY FOR LOWER PASSAIC RIVER STUDY AREA	1	LTR / Letter	R2-0025861	R2-0025861	R02: Stanislaus, Mathy (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Hyatt, William, H (K & L GATES LLP)
213398	1/20/2014	CORRESPONDENCE REGARDING RELEASE OF THE PROPOSED PLAN AND FOCUSED FEASIBILITY STUDY FOR PASSAIC RIVER SUPERFUND CLEANUP	2	EML / Email	R2-0025862	R2-0025863	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY), R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY), R02: Woolford, James (US ENVIRONMENTAL PROTECTION AGENCY), R02: Stanislaus, Mathy (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Mans, Deborah (NY/NJ BAYKEEPER)
213400	1/21/2014	COOPERATING PARTIES GROUP'S KEY ELEMENTS OF PRESENTATIONS REGARDING REMEDIAL INVESTIGATION / FEASIBILITY STUDY MEETING DATED 01/15/2014	2	LTR / Letter	R2-0025864	R2-0025865	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Hyatt, William, H (K & L GATES LLP)

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213394	1/22/2014	US EPA REQUEST FOR LETTER FROM US ARMY CORPS OF ENGINEERS CONFIRMING THE CURRENT AND PROJECTED FUTURE USE OF THE FEDERALLY-AUTHORIZED NAVIGATION CHANNEL	1	LTR / Letter	R2-0025866	R2-0025866	R02: Seebode, Joseph (US ARMY CORPS OF ENGINEERS)	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)
213403	1/30/2014	COOPERATING PARTIES GROUP PRESENTATION SLIDES FOR MEETING ON 01/31/2014 AND COMMUNITY AND LOCAL ELECTED OFFICIAL'S LETTERS REGARDING THE SUSTAINABLE REMEDY	52	LTR / Letter	R2-0025867	R2-0025918	R02: Stanislaus, Mathy (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Hyatt, William, H (K & L GATES LLP)
213168	2/4/2014	TRANSMITTAL OF CORRESPONDENCE REGARDING PASSAIC RIVER CLEANUP REMEDIAL ALTERNATIVES	2	EML / Email	R2-0025919	R2-0025920	R02: Mclendon, Wanda (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Bergman, Shawna (US ENVIRONMENTAL PROTECTION AGENCY)
703638	2/5/2014	REMEDIAL INVESTIGATION REPORT FOR THE FOCUSED FEASIBILITY STUDY OF THE LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER	531	RPT / Report	R2-0025921	R2-0026451	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (THE LOUIS BERGER GROUP INC), R02: (BATTELLE), R02: (HDR/HYDROQUAL)
703640	1/31/2014	APPENDIX A - DATA EVALUATION REPORTS FOR THE LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER	1313	RPT / Report	R2-0026452	R2-0027764	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (THE LOUIS BERGER GROUP INC), R02: (BATTELLE), R02: (HDR/HYDROQUAL)
703641	2/11/2014	APPENDIX B - MODELING FOR THE LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER	3834	RPT / Report	R2-0027765	R2-0031598	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (THE LOUIS BERGER GROUP INC), R02: (BATTELLE), R02: (HDR/HYDROQUAL)
703642	2/20/2014	APPENDIX C, D, E, F, G, AND H OF THE REMEDIAL INVESTIGATION REPORT AND FOCUSED FEASIBILITY STUDY REPORT FOR THE LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER	1781	RPT / Report	R2-0031599	R2-0033379	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (THE LOUIS BERGER GROUP INC), R02: (BATTELLE), R02: (HDR/HYDROQUAL)
213393	2/6/2014	US ARMY CORPS OF ENGINEERS RESPONSE TO US EPA LETTER DATED 01/22/2014 REGARDING THE FEDERAL AUTHORIZED NAVIGATION CHANNEL	1	LTR / Letter	R2-0033380	R2-0033380	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Seebode, Joseph (US ARMY CORPS OF ENGINEERS)
246748	2/6/2014	CORRESPONDENCE REGARDING DISCUSSIONS OF THE FOCUSED FEASBILITY STUDY	5	LTR / Letter	R2-0033381	R2-0033385	R02: Stanislaus, Mathy (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Hyatt, William (COOPERATING PARTIES GROUP)
213397	2/7/2014	PASSAIC RIVER COMMUNITY ADVISORY GROUP'S DEMAND FOR IMMEDIATE RELEASE OF THE FOCUSED FEASIBILITY STUDY AND THE PROPOSED PLAN	2	LTR / Letter	R2-0033386	R2-0033387	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Baptista, Ana (IRONBOUND COMMUNITY CORPORATION), R02: Mans, Deborah (NY/NJ BAYKEEPER)

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213197	2/12/2014	CORRESPONDENCE REGARDING US EPA'S STUDY OF OPTIONS FOR CLEANING UP THE LOWER EIGHT-MILES OF THE PASSAIC RIVER	1	LTR / Letter	R2-0033388	R2-0033388	R02: Mccarthy, Gina (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Payne, Donald, M (HOUSE OF REPRESENTATIVES)
213404	2/12/2014	CORRESPONDENCE REGARDING SUSTAINABLE REMEDY PROTECTIVENESS	5	LTR / Letter	R2-0033389	R2-0033393	R02: Stanislaus, Mathy (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Hyatt, William, H (K & L GATES LLP)
213196	2/19/2014	TRANSMITTAL OF CORRESPONDENCE REGARDING US EPA'S STUDY OF OPTIONS FOR CLEANING UP THE LOWER EIGHT-MILES OF THE PASSAIC RIVER	1	CORR / Correspondence	R2-0033394	R2-0033394	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Payne, Donald, M (HOUSE OF REPRESENTATIVES)
213201	2/22/2014	CORRESPONDENCE REGARDING RESTORATION OF POWER BOATING - BUILDING OF PUBLIC DOCKS AND BOAT RAMPS TO THE PASSAIC RIVER	2	LTR / Letter	R2-0033395	R2-0033396	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Morginstin, Harvey (PASSAIC RIVER BOAT CLUB)
700800	2/24/2014	REPORT OF PEER REVIEW OF CONCEPTUAL SITE MODEL FOR THE LOWER PASSAIC RIVER RESTORATION PROJECT FORMATTED FOR PUBLICATION	176	RPT / Report	R2-0033397	R2-0033572	R02: (US ENVIRONMENTAL PROTECTION AGENCY), R02: (US ARMY CORPS OF ENGINEERS)	R02: (THE LOUIS BERGER GROUP INC)
213198	2/25/2014	HACKENSACK RIVERKEEPER INCORPORATED'S REQUEST FOR IMMEDIATE RELEASE OF US EPA PROPOSED PLAN AND FOCUSED FEASIBILITY STUDY FOR THE LOWER EIGHT MILES OF THE PASSAIC RIVER	1	LTR / Letter	R2-0033573	R2-0033573	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Sheehan, Bill (HACKENSACK RIVERKEEPER INCORPORATED)
213181	2/26/2014	US EPA'S RESPONSE TO LETTER DATED 02/07/2014 REGARDING CLEANUP OF THE PASSAIC RIVER	1	LTR / Letter	R2-0033574	R2-0033574	R02: Baptista, Ana (IRONBOUND COMMUNITY CORPORATION), R02: Mans, Deborah (NY/NJ BAYKEEPER)	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)
213186	2/28/2014	US EPA'S RESPONSE TO EMAIL DATED 01/29/2014 ADDRESSED TO MATHY STANISLAUS REGARDING CLEANUP OF THE LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER	1	LTR / Letter	R2-0033575	R2-0033575	R02: Baptista, Ana (IRONBOUND COMMUNITY CORPORATION)	R02: Mugdan, Walter (US ENVIRONMENTAL PROTECTION AGENCY)
213200	2/28/2014	PASSAIC RIVER COMMUNITY ADVISORY GROUP REQUEST FOR RELEASE OF US EPA'S PROPOSED PLAN AND FOCUSED FEASIBILITY STUDY	1	EML / Email	R2-0033576	R2-0033576	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Yennior, David (SIERRA CLUB)
213180	3/2/2014	COMMUNITY ADVISORY COMMITTEE REQUEST FOR IMMEDIATE RELEASE OF THE FOCUSED FEASIBILITY STUDY AND THE PROPOSED PLAN FOR THE LOWER PASSAIC RIVER CLEANUP	1	LTR / Letter	R2-0033577	R2-0033577	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Barrett, Kirk, R (NONE)

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213183	3/3/2014	US EPA'S RESPONSE TO LETTER DATED 02/25/2014 REGARDING RELEASE OF THE PROPOSED PLAN AND FOCUSED FEASIBILITY STUDY	1	EML / Email	R2-0033578	R2-0033578	R02: Baptista, Ana (IRONBOUND COMMUNITY CORPORATION), R02: Mans, Deborah (NY/NJ BAYKEEPER), R02: Sheehan, Bill (HACKENSACK RIVERKEEPER INCORPORATED)	R02: Kluesner, Dave (US ENVIRONMENTAL PROTECTION AGENCY)
213184	3/3/2014	US EPA'S RESPONSE TO LETTER DATED 03/02/2014 REGARDING RELEASE OF THE PROPOSED PLAN AND FOCUSED FEASIBILITY STUDY	1	EML / Email	R2-0033579	R2-0033579	R02: Barrett, Kirk, R (NONE)	R02: Kluesner, Dave (US ENVIRONMENTAL PROTECTION AGENCY)
213185	3/3/2014	US EPA'S RESPONSE TO LETTER DATED 02/28/2014 REGARDING RELEASE OF THE PROPOSED PLAN AND FOCUSED FEASIBILITY STUDY	1	EML / Email	R2-0033580	R2-0033580	R02: Yennior, David (SIERRA CLUB), R02: Baptista, Ana (IRONBOUND COMMUNITY CORPORATION), R02: Mans, Deborah (NY/NJ BAYKEEPER)	R02: Kluesner, Dave (US ENVIRONMENTAL PROTECTION AGENCY)
239615	3/3/2014	CORRESPONDENCE REGARDING THE COOPERATING PARTIES GROUP REQUEST FOR EPA TO ALLOW THE REMEDIAL INVESTIGATION / FEASIBILITY STUDY PROCESS TO BE COMPLETED WITHOUT ISSUANCE OF THE FOCUSED FEASIBILITY STUDY FOR THE LOWER PASSAIC RIVER STUDY AREA	4	LTR / Letter	R2-0033581	R2-0033584	R02: Stanislaus, Mathy (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Hyatt, William, H (K & L GATES LLP)
213189	3/10/2014	NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION AND US FISH AND WILDLIFE SERVICE CONCERNS REGARDING IN-WATER DISPOSAL ALTERNATIVES AND IMPACTS OF A CONFINED AQUATIC DISPOSAL CELL	10	LTR / Letter	R2-0033585	R2-0033594	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY), R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY), R02: Mugdan, Walter (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Kubiak, Timothy (U.S. FISH AND WILDLIFE SERVICE), R02: Mehran, Reyhan (NOAA-NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION)
703639	3/10/2014	FOCUSED FEASIBILITY STUDY REPORT FOR THE LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER	348	RPT / Report	R2-0033595	R2-0033942	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (THE LOUIS BERGER GROUP INC), R02: (BATTELLE), R02: (HDR/HYDROQUAL)
213187	3/12/2014	NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION'S REQUEST FOR RELEASE OF US EPA'S FOCUSED FEASIBILITY STUDY AND PROPOSED PLAN FOR THE LOWER EIGHT MILES OF THE PASSAIC RIVER	9	LTR / Letter	R2-0033943	R2-0033951	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY), R02: Mccarthy, Gina (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Martin, Bob (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION)
213195	3/13/2014	US EPA'S RESPONSE TO LETTER DATED 02/12/2014 ADDRESSED TO GINA MCCARTHY REGARDING US EPA STUDY OF OPTIONS FOR CLEANING UP THE LOWER EIGHT-MILES OF THE PASSAIC RIVER	2	LTR / Letter	R2-0033952	R2-0033953	R02: Payne, Donald, M (HOUSE OF REPRESENTATIVES)	R02: Enck, Judith, A (US ENVIRONMENTAL PROTECTION AGENCY)
213193	3/18/2014	PRESENTATION MATERIAL - LOWER PASSAIC RIVER FOCUSED FEASIBILITY STUDY / PROPOSED PLAN	11	LST / List/Index	R2-0033954	R2-0033964	R02: Woolford, James (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (VINSON & ELKINS LLP), R02: (Occidental Chemical Corporation)
213190	3/20/2014	CORRESPONDENCE REGARDING THE LOWER PASSAIC RIVER FOCUSED FEASIBILITY STUDY	4	LTR / Letter	R2-0033965	R2-0033968	R02: Woolford, James (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Dinkins, Carol, E (VINSON & ELKINS LLP)

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213191	3/20/2014	POLICY ISSUES RAISED BY THE PROSPECT OF AN FOCUSED FEASIBILITY STUDY FOR THE LOWER PASSAIC	5	LST / List/Index	R2-0033969	R2-0033973		R02: Voltaggio, Thomas, C (VOLTAGGIO CONSULTING LLC)
213192	3/20/2014	BRIEFING ON FISH AND CRAB TISSUE DATA IN THE LOWER PASSAIC RIVER STUDY AREA RELATIVE TO DECISION-MAKING IN THE US EPA'S REVISED FOCUSED FEASIBILITY STUDY	5	OTH / Other	R2-0033974	R2-0033978		R02: (ARCADIS)
213194	3/20/2014	US EPA'S RESPONSE TO LETTER DATED 02/22/2014 REGARDING CLEANUP OF THE LOWER PASSAIC RIVER	1	LTR / Letter	R2-0033979	R2-0033979	R02: Morginstin, Harvey (PASSAIC RIVER BOAT CLUB)	R02: Kluesner, Dave (US ENVIRONMENTAL PROTECTION AGENCY)
213199	3/20/2014	US EPA'S RESPONSE TO LETTER DATED 03/05/2014 REGARDING CLEANUP OF THE LOWER PASSAIC RIVER	1	EML / Email	R2-0033980	R2-0033980	R02: Sollohub, Louisa (NONE)	R02: Kluesner, Dave (US ENVIRONMENTAL PROTECTION AGENCY)
213188	3/21/2014	CORRESPONDENCE REGARDING THE 03/18/2014 LOWER PASSAIC RIVER FOCUSED FEASIBILITY STUDY MEETING	1	LTR / Letter	R2-0033981	R2-0033981	R02: Woolford, James (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Jalfin, Guillermo (MAXUS ENERGY CORPORATION)
213182	3/24/2014	CORRESPONDENCE REGARDING COOPERATING PARTIES GROUP SUSTAINABLE REMEDY FOR THE ENTIRE 17 MILES OF THE LOWER PASSAIC RIVER STUDY AREA	3	LTR / Letter	R2-0033982	R2-0033984	R02: Perciasepe, Robert (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Hyatt, William, H (K & L GATES LLP)
239612	3/26/2014	TECHNICAL MEMORANDUM - CONCEPTUAL FISH AND CRAB SAMPLING PLAN FOR THE LOWER PASSAIC RIVER STUDY AREA	18	MEMO / Memorandum	R2-0033985	R2-0034002	R02: Vallance, Derrick (MAXUS ENERGY CORPORATION), R02: Rabbe, Dave (TIERRA SOLUTIONS, INCORPORATED)	R02: Iannuzzi, Tim (ARCADIS U.S. INCORPORATED)
239613	3/31/2014	TRANSMITTAL OF TECHNICAL MEMORANDUM - CONCEPTUAL FISH AND CRAB SAMPLING PLAN FOR THE LOWER PASSAIC RIVER STUDY AREA	1	LTR / Letter	R2-0034003	R2-0034003	R02: Woolford, James (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Dinkins, Carol, E (VINSON & ELKINS LLP)
239624	4/1/2014	US EPA RESPONSE TO THE COOPERATING PARTIES GROUP'S CORRESPONDENCE REGARDING EPA'S MODEL CLARIFICATION FOR THE REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES FOR THE LOWER PASSAIC RIVER STUDY AREA	4	LTR / Letter	R2-0034004	R2-0034007	R02: Law, Robert (DE MAXIMIS INCORPORATED)	R02: Basso, Raymond (US ENVIRONMENTAL PROTECTION AGENCY)
239604	4/11/2014	NATIONAL REMEDY REVIEW BOARD AND CONTAMINATED SEDIMENTS TECHNICAL ADVISORY GROUP RECOMMENDATIONS FOR THE LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER	8	MEMO / Memorandum	R2-0034008	R2-0034015	R02: Mugdan, Walter, E (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Legare, Amy, R (US ENVIRONMENTAL PROTECTION AGENCY), R02: Ellis, Stephen (US ENVIRONMENTAL PROTECTION AGENCY)

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239605	4/11/2014	US EPA RESPONSES TO NATIONAL REMEDY REVIEW BOARD AND CONTAMINATED SEDIMENTS TECHNICAL ADVISORY GROUP RECOMMENDATIONS FOR THE LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER	30	MEMO / Memorandum	R2-0034016	R2-0034045	R02: Legare, Amy, R (US ENVIRONMENTAL PROTECTION AGENCY), R02: Ellis, Stephen (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Mugdan, Walter, E (US ENVIRONMENTAL PROTECTION AGENCY)
239625	4/11/2014	FACTSHEET: CLEANING UP THE LOWER PASSAIC RIVER - AN OVERVIEW OF US EPA'S PROPOSAL FOR THE LOWER EIGHT MILES	4	LST / List/Index	R2-0034046	R2-0034049		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
239626	4/11/2014	FACTSHEET: THE PASSAIC RIVER'S POLLUTED PAST	4	LST / List/Index	R2-0034050	R2-0034053		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
239627	4/11/2014	PROPOSED PLAN FOR THE LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER	46	WP / Work Plan	R2-0034054	R2-0034099		R02: (US ENVIRONMENTAL PROTECTION AGENCY)
227576	4/16/2014	TRANSMITTAL OF THE ADMINISTRATIVE RECORD FILE FOR THE LOWER 8 MILES OF LOWER PASSAIC RIVER OF THE DIAMOND ALKALI COMPANY SUPERFUND SITE	1	LTR / Letter			R02: Chmiel, Mary, F (ELIZABETH PUBLIC LIBRARY)	R02: Keating, Robert (US ENVIRONMENTAL PROTECTION AGENCY)
227577	4/16/2014	TRANSMITTAL OF THE ADMINISTRATIVE RECORD FILE FOR THE LOWER 8 MILES OF LOWER PASSAIC RIVER OF THE DIAMOND ALKALI COMPANY SUPERFUND SITE	1	LTR / Letter			R02: Grey, Wilma, J (NEWARK PUBLIC LIBRARY)	R02: Keating, Robert (US ENVIRONMENTAL PROTECTION AGENCY)
392623	5/16/2000	RESPONSE TO THE CHEMICAL LAND HOLDINGS INCORPORATED'S INQUIRY REGARDING THE VARIETY OF MATERIALS CONCERNING FISH CONSUMPTION STUDIES FOR THE DIAMOND ALKALI COMPANY SITE	2	LTR / Letter			R02: Firstenberg, Clifford (CHEMICAL LAND HOLDINGS, INC.)	R02: Jaffess, Sharon (US ENVIRONMENTAL PROTECTION AGENCY)
393274	5/26/2000	CORRESPONDENCE REGARDING CREEL/ANGLER SURVEY DISAPPROVAL MEETING 5/23/2000 FOR THE DIAMOND ALKALI SITE	48	LTR / Letter			R02: Jaffess, Sharon (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Firstenberg, Clifford (CHEMICAL LAND HOLDINGS, INC.)
392624	6/16/2000	CHEMICAL LAND HOLDINGS INCORPORATED REQUESTS EPA TO RECONSIDER THE DECISION TO FOREGO THE CREEL/ANGLER SURVEY AS A COMPONENT OF THE ECOLOGICAL SAMPLING PLAN FOR THE DIAMOND ALKALI COMPANY SITE	54	LTR / Letter			R02: Hick, Patricia (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Dinkins, Carol, E (VINSON & ELKINS L.L.P. ATTORNEYS AT LAW)
392625	6/23/2000	CHEMICAL LAND HOLDINGS INCORPORATED RESPONSE TO 1996 EPA'S COMMENTS ON THE CREEL/ANGLER SURVEY PORTION OF THE DRAFT ECOLOGICAL SAMPLING PLAN FOR THE DIAMOND ALKALI COMPANY SITE	14	LTR / Letter			R02: Conetta, Janet (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Firstenberg, Clifford (CHEMICAL LAND HOLDINGS, INC.)

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392626	8/22/2000	CHEMICAL LAND HOLDINGS INCORPORATED 'S CONCERNS REGARDING EPA'S DECISION TO FOREGO THE CREEL/ANGEL SURVEY FOR THE DIAMOND ALKALI COMPANY SITE	2	LTR / Letter			R02: Fox, Jeanne (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Rabbe, Dave (CHEMICAL LAND HOLDINGS, INC.)
377124	10/24/2000	RESPONSE TO US EPA REQUEST FOR CREEL ANGLER SURVEY WORK PLAN AND OTHER INFORMATION FOR THE PASSAIC RIVER STUDY AREA	149	LTR / Letter			R02: Hick, Patricia (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Dinkins, Carol, E (VINSON & ELKINS LLP)
392627	11/17/2000	EPA RESPONDS TO 10/26/2000 LETTER TRANSMITTING CHEMICAL LAND HOLDING INCORPORATED'S MEETING NOTES FOR THE DIAMOND ALKALI COMPANY SITE	5	LTR / Letter			R02: Firstenberg, Clifford (CHEMICAL LAND HOLDINGS, INC.)	R02: Jaffess, Sharon (US ENVIRONMENTAL PROTECTION AGENCY)
392628	4/20/2001	EPA'S COMMENTS ON CHEMICAL LAND HOLDING INCORPORATED MODIFICATIONS TO THE CREEL/ANGLER SURVEY WORK PLAN FOR THE DIAMOND ALKALI COMPANY SITE	12	LTR / Letter			R02: Firstenberg, Clifford (CHEMICAL LAND HOLDINGS, INC.)	R02: Jaffess, Sharon (US ENVIRONMENTAL PROTECTION AGENCY)
392629	5/3/2001	RESPONSE TO THE EPA'S COMMENTS ON CHEMICAL LAND HOLDING INCORPORATED MODIFICATIONS TO THE CREEL/ANGLER SURVEY WORK PLAN FOR THE DIAMOND ALKALI COMPANY SITE	3	LTR / Letter			R02: Jaffess, Sharon (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Firstenberg, Clifford (CHEMICAL LAND HOLDINGS, INC.)
392630	5/3/2001	RESPONSE TO THE CHEMICAL HOLDING INCORPORATED REQUEST FOR A MEETING REGARDING THE CREEL/ANGEL SURVEY WORK PLAN FOR THE DIAMOND ALKALI COMPANY SITE	2	LTR / Letter			R02: Firstenberg, Clifford (CHEMICAL LAND HOLDINGS, INC.)	R02: Jaffess, Sharon (US ENVIRONMENTAL PROTECTION AGENCY)
392631	5/15/2001	CHEMICAL LAND HOLDING INCORPORATED RESPONSE TO EPA'S COMMENTS ON THE CREEL/ANGLER SURVEY WORK PLAN FOR THE DIAMOND ALKALI COMPANY SITE	60	LTR / Letter			R02: Jaffess, Sharon (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Firstenberg, Clifford (CHEMICAL LAND HOLDINGS, INC.)
392632	6/19/2001	CORRESPONDENCE REGARDING THE PROPOSED MEETING FOR THE CREEL/ANGLER SURVEY WORK PLAN FOR THE DIAMOND ALKALI COMPANY SITE	3	LTR / Letter			R02: Firstenberg, Clifford (CHEMICAL LAND HOLDINGS, INC.)	R02: Jaffess, Sharon (US ENVIRONMENTAL PROTECTION AGENCY)
392633	7/13/2001	RESPONSE TO EPA'S CORRESPONDENCE REGARDING THE PROPOSED MEETING FOR THE CREEL/ANGLER SURVEY WORK PLAN FOR THE DIAMOND ALKALI COMPANY SITE	8	LTR / Letter			R02: Jaffess, Sharon (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Firstenberg, Clifford (CHEMICAL LAND HOLDINGS, INC.)

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392622	4/27/2003	EPA'S REVIEW AND DISAPPROVAL OF THE 06/1999 CREEL/ANGLER SURVEY WORK PLAN FOR THE DIAMOND ALKALI COMPANY SITE	3	LTR / Letter			R02: Firstenberg, Clifford (CHEMICAL LAND HOLDINGS, INC.)	R02: Jaffess, Sharon (US ENVIRONMENTAL PROTECTION AGENCY)
377148	11/12/2009	US EPA RESPONSE TO THE COOPERATING PARTIES GROUP'S PROPOSAL FOR A NEW CREEL ANGLER SURVEY FOR THE LOWER PASSAIC RIVER	1	EML / Email			R02: Grubbs, Geoff (COOPERATING PARTIES GROUP)	R02: Mugdan, Walter, E (US ENVIRONMENTAL PROTECTION AGENCY)
377149	2/28/2011	CORRESPONDENCE REGARDING A PEER REVIEW OF THE WORK PLAN FOR POTENTIAL CREEL ANGLER SURVEY REMEDIAL INVESTIGATION / FEASIBILITY STUDY FOR THE LOWER PASSAIC RIVER STUDY AREA	1	LTR / Letter			R02: Vaughn, Stephanie (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Law, Robert (DE MAXIMIS INCORPORATED)
377150	4/14/2011	US EPA RESPONSE TO CPG'S INVITATION TO PROVIDE INPUT TO THE PEER REVIEW FOR A CREEL ANGLER SURVEY FOR THE LOWER PASSAIC RIVER STUDY AREA	1	LTR / Letter			R02: Law, Robert (DE MAXIMIS INCORPORATED)	R02: Mugdan, Walter, E (US ENVIRONMENTAL PROTECTION AGENCY)
377151	9/28/2012	CORRESPONDENCE SENT TO CAROL DINKINS REGARDING THE OPPORTUNITY TO SUBMIT COMMENTS TO NATIONAL REMEDY REVIEW BOARD REGARDING THE LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER STUDY AREA	2	LTR / Letter			R02: Dinkins, Carol, E (VINSON & ELKINS LLP)	R02: Flanagan, Sarah, P (US ENVIRONMENTAL PROTECTION AGENCY)
377152	9/28/2012	CORRESPONDENCE SENT TO WILLIAM HYATT REGARDING THE OPPORTUNITY TO SUBMIT COMMENTS TO NATIONAL REMEDY REVIEW BOARD REGARDING THE LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER STUDY AREA	2	LTR / Letter			R02: Hyatt, William, H (K & L GATES LLP)	R02: Flanagan, Sarah, P (US ENVIRONMENTAL PROTECTION AGENCY)
377100	3/25/2014	PRESENTATION FOR THE PUBLIC INFORMATION SESSION REGARDING THE PASSAIC RIVER MAIN STEM FLOOD RISK MANAGEMENT PROJECT PRELIMINARY ALTERNATIVE ANALYSIS REPORT	22	MTG / Meeting Document				R02: (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION), R02: (US ARMY CORPS OF ENGINEERS)
377052	6/1/2015	PHASE 2 YEAR 4 ANNUAL PROGRESS REPORT - APPENDIX D - DATA ON PCB MASS REMOVED AND IN-RIVER PCB LOADS FOR THE HUDSON RIVER PCBS SITE	12				R02: (GENERAL ELECTRIC COMPANY (GE))	R02: (PARSONS)
377126	12/11/2015	MEETING SUMMARY AND LATE COMMENTS SUBMITTED AT THE MEETING ON 12/11/2015 REGARDING THE LOWER PASSAIC RIVER STUDY AREA	66	MTG / Meeting Document				R02: Michaud, John (US ENVIRONMENTAL PROTECTION AGENCY)

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377045	12/29/2015	LATE COMMENTS ON THE PROPOSED PLAN FOR LOWER 8.3 MILES OF THE LOWER PASSAIC RIVER - PART 1 OF 13	1329	LTR / Letter			R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP), R02: (NEREID BOAT CLUB)
395740	12/29/2015	LATE COMMENTS ON THE PROPOSED PLAN FOR LOWER 8.3 MILES OF THE LOWER PASSAIC RIVER - PART 2 OF 13	829	LTR / Letter			R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP), R02: (NEREID BOAT CLUB)
395741	12/29/2015	LATE COMMENTS ON THE PROPOSED PLAN FOR LOWER 8.3 MILES OF THE LOWER PASSAIC RIVER - PART 3 OF 13	681	LTR / Letter			R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP), R02: (NEREID BOAT CLUB)
395742	12/29/2015	LATE COMMENTS ON THE PROPOSED PLAN FOR LOWER 8.3 MILES OF THE LOWER PASSAIC RIVER - PART 4 OF 13	689	LTR / Letter			R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP), R02: (NEREID BOAT CLUB)
395743	12/29/2015	LATE COMMENTS ON THE PROPOSED PLAN FOR LOWER 8.3 MILES OF THE LOWER PASSAIC RIVER - PART 5 OF 13	486	LTR / Letter			R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP), R02: (NEREID BOAT CLUB)
395744	12/29/2015	LATE COMMENTS ON THE PROPOSED PLAN FOR LOWER 8.3 MILES OF THE LOWER PASSAIC RIVER - PART 6 OF 13	1123	LTR / Letter			R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP), R02: (NEREID BOAT CLUB)
395745	12/29/2015	LATE COMMENTS ON THE PROPOSED PLAN FOR LOWER 8.3 MILES OF THE LOWER PASSAIC RIVER - PART 7 OF 13	1606	LTR / Letter			R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP), R02: (NEREID BOAT CLUB)
395746	12/29/2015	LATE COMMENTS ON THE PROPOSED PLAN FOR LOWER 8.3 MILES OF THE LOWER PASSAIC RIVER - PART 8 OF 13	1227	LTR / Letter			R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP), R02: (NEREID BOAT CLUB)

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395747	12/29/2015	LATE COMMENTS ON THE PROPOSED PLAN FOR LOWER 8.3 MILES OF THE LOWER PASSAIC RIVER - PART 9 OF 13	1089	LTR / Letter			R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP), R02: (NEREID BOAT CLUB)
395748	12/29/2015	LATE COMMENTS ON THE PROPOSED PLAN FOR LOWER 8.3 MILES OF THE LOWER PASSAIC RIVER - PART 10 OF 13	1562	LTR / Letter			R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP), R02: (NEREID BOAT CLUB)
395749	12/29/2015	LATE COMMENTS ON THE PROPOSED PLAN FOR LOWER 8.3 MILES OF THE LOWER PASSAIC RIVER - PART 11 OF 13	1215	LTR / Letter			R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP), R02: (NEREID BOAT CLUB)
395750	12/29/2015	LATE COMMENTS ON THE PROPOSED PLAN FOR LOWER 8.3 MILES OF THE LOWER PASSAIC RIVER - PART 12 OF 13	1914	LTR / Letter			R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP), R02: (NEREID BOAT CLUB)
395751	12/29/2015	LATE COMMENTS ON THE PROPOSED PLAN FOR LOWER 8.3 MILES OF THE LOWER PASSAIC RIVER - PART 13 OF 13	1632	LTR / Letter			R02: Yeh, Alice (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (LOWER PASSAIC RIVER STUDY AREA COOPERATING PARTIES GROUP), R02: (NEREID BOAT CLUB)
377054	1/21/2016	CORRESPONDENCE TO THE WATER PROGRAM REGARDING PCBS IN THE LOWER PASSAIC RIVER AREA FOR THE DIAMOND ALKALI COMPANY SITE	4	MEMO / Memorandum			R02: Matthews, Joan (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Mugdan, Walter, E (US ENVIRONMENTAL PROTECTION AGENCY)
377030	2/12/2016	WATER PROGRAM RESPONSE TO CORRESPONDENCE TO THE WATER PROGRAM REGARDING PCBS IN THE LOWER PASSAIC RIVER AREA FOR THE DIAMOND ALKALI COMPANY SITE	1	EML / Email			R02: Mugdan, Walter, E (US ENVIRONMENTAL PROTECTION AGENCY)	R02: Matthews, Joan (US ENVIRONMENTAL PROTECTION AGENCY)
377125	2/29/2016	MEMORANDUM TO ADMINISTRATIVE RECORD FILE REGARDING THE DIAMOND ALKALI - LOWER 8.3 MILES OF LOWER PASSAIC RIVER STUDY AREA - LATE COMMENTS	4	MEMO / Memorandum				R02: Flanagan, Sarah, P (US ENVIRONMENTAL PROTECTION AGENCY)

APPENDIX IV

STATE LETTER OF CONCURRENCE

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
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CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

February 26, 2016

The Honorable Judith Enck
Region 2 Administrator
U.S. Environmental Protection Agency
290 Broadway
New York, New York 10007-1866

Re: Concurrence with the Selected Remedy for the Lower 8.3 Miles of the Lower Passaic River

The purpose of this letter is to convey the concurrence of the New Jersey Department of Environmental Protection (NJDEP) with the remedy and dredged material management options selected for the Lower 8.3 Miles of the Lower Passaic River. To be clear, the selected remedy is Alternative 3: Capping with Dredging for Flooding and Navigation, and the selected dredged material management option is Scenario B: Off-Site Disposal. The remedy appears in the Declaration Statement of the Record of Decision as follows:

- An engineered cap will be constructed over the river bottom of the lower 8.3 miles, except in areas where backfill may be placed because all contaminated fine-grained sediments have been removed. The engineered cap will generally consist of two feet of sand and may be armored where necessary to prevent erosion of the sand.

- Before the engineered cap is installed, the river will be dredged bank to bank (approximately 3.5 million cubic yards) so that the cap can be placed without increasing the potential for flooding. Depth of dredging is estimated to be 2.5 feet, except in the 1.7 miles of the federally authorized navigation channel closest to Newark Bay.

- The remedy will include sufficient dredging and capping to allow for the continued commercial use of a federally authorized navigation channel in the 1.7 miles of the river closest to Newark Bay and to accommodate reasonably anticipated future recreational use above RM 1.7.

- Dredged materials will be barged or pumped to a sediment processing facility in the vicinity of the Lower Passaic River/Newark Bay shoreline for dewatering. Dewatered materials will be transported to permitted treatment facilities and landfills in the United States or Canada for disposal.

- Mudflats dredged during implementation of the remedy will be covered with an engineered cap consisting of one foot of sand and one foot of mudflat reconstruction (habitat) substrate.

- Institutional controls will be implemented to protect the engineered cap. In addition, New Jersey's existing prohibitions on fish and crab consumption will remain in place and will be enhanced with additional community outreach to encourage greater awareness of the prohibitions until the concentrations of contaminants of concern (COCs) in fish and crab tissue reach protective concentrations corresponding to remediation goals. EPA will share the data and consult with NJDEP about whether the prohibitions on fish and crab consumption can be lifted or adjusted to allow for increased consumption as contaminant levels decline.

- Long-term monitoring and maintenance of the engineered cap will be required to ensure its stability and integrity. Long-term monitoring of fish, crab and sediment will also be performed to determine when interim remediation milestones, remediation goals and remedial action objectives are reached. Other monitoring, such as water column sampling, will also be performed.

As you know, remediation of the Passaic River is a priority for Governor Christie and for NJDEP, and I know you share my belief that this remediation must occur as soon as possible in order to stop the major source of contamination, and especially dioxin contamination, to the Passaic River and Newark Bay Complex. Over the course of the last several years and in particular this past year, our agencies have discussed several issues of concern that could impact New Jersey's ability to concur with the remedy. I am pleased to have had the opportunity to convey those concerns to you and to have reached mutual understanding on nearly all of them.

New Jersey's key concern was that the ROD ensures that the dredged materials, which will contain high levels of dioxin and other contaminants, are disposed of in the most protective manner possible, outside the state. I appreciate you working with us so that the ROD clearly articulates the prohibition of disposing dredged material in a New Jersey solid waste landfill. In fact, the ROD states specifically in the Applicable or Relevant and Appropriate Requirements (ARAR) Table that "Dredged material, therefore, will not be disposed of as solid waste in New Jersey." The contamination of the dredged material warrants disposal in a RCRA Subtitle C hazardous waste landfill, even if that material can be characterized as non-hazardous.

The ROD also memorializes the fact that no dredged material will be disposed of in a Confined Aquatic Disposal (CAD) facility in New Jersey, in its discussion of the inability of such disposal to meet the criteria of implementability and State acceptance.

The sole issue that we have brought to your attention that remains unclear in the ROD is enforcement of ARARs. New Jersey's position is that we will enforce the provisions of any applicable permit, permit equivalencies, or other documents embodying the substantive requirements of State regulations.

I would like to close by emphasizing my appreciation for the opportunity for EPA and NJDEP to work cooperatively to advance the cleanup of the Passaic River. Addressing one of the major environmental challenges of our time will be sure to leave a lasting, positive legacy for future generations. I look forward to our continued partnership.

Sincerely,

Bob Martin
Commissioner

APPENDIX V

RESPONSIVENESS SUMMARY

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I. Introduction

This Responsiveness Summary provides a summary of the public's comments submitted to EPA regarding the Proposed Plan (Attachment A) for the lower 8.3 miles of the Lower Passaic River (LPR), part of the Diamond Alkali Superfund Site, and EPA's responses to those comments. A responsiveness summary is required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) at 40 C.F.R. 300.430(f)(3)(F). All comments summarized in this document have been considered in EPA's final decision for the selection of the remedy for the sediments of the lower 8.3 miles of the LPR.

A. Overview and Background on Community Involvement

From the discovery of dioxin at 80 Lister Avenue in Newark, New Jersey, in 1983, community interest in what would become the Diamond Alkali Superfund Site has been high. A more detailed history of community involvement at the Site is provided in the Lower Passaic River Restoration Project and Newark Bay Study Community Involvement Plan (EPA, 2006b).

Since 2004, soon after EPA began the Remedial Investigation and Feasibility Study (RI/FS) for the Lower Passaic River Study Area (LPRSA) (the 17-mile tidal portion of the river), EPA has used a number of community involvement tools to keep the public informed about project issues and maintain a meaningful public dialogue. Examples of community involvement activities include:

- From 2004 to 2011, EPA convened quarterly Project Delivery Team (PDT) meetings, open to the public, to report on progress on various aspects of the Lower Passaic River remediation, including the focused study of the lower 8.3-mile portion of the LPRSA after that began in 2006. Special meetings were held to discuss specific issues, such as developing sampling programs, formulating remedial alternatives and evaluating a dredging pilot. In 2011, PDT meetings were replaced by Community Advisory Group (CAG) meetings, described below.
- From 2009 to the present, EPA attended monthly public CAG meetings. The CAG consists of approximately 20 members representing local citizens and businesses, environmental and recreational groups, municipalities and educators, and other stakeholders with a broad range of interests. EPA and its Partner Agencies[1] attend in an *ex officio* capacity. The CAG was first convened to provide for community input with respect to the implementation of the removal action in the river near the former Diamond Alkali facility (Tierra Removal, Phase 1). Subsequently, the CAG broadened its mission to develop consensus values and provide a forum to discuss other aspects of the investigation and remediation of the Lower Passaic River. Between 2010 and 2014, EPA has provided extensive information to the CAG during the development of the lower 8.3-mile Remedial Investigation and Focused Feasibility Study (RI/FFS), including making presentations on topics such as risk assessments, modeling and

[1] EPA is one of a group of Partner Agencies (including the U.S. Army Corps of Engineers [USACE], New Jersey Department of Environmental Protection [NJDEP], National Oceanic and Atmospheric Administration [NOAA] and U.S. Fish and Wildlife Service [USFWS]) that are working cooperatively to remediate and restore the Lower Passaic River under separate authorities.

remedial alternatives. The Cooperating Parties Group (CPG), a group of PRPs, has also presented information to the CAG, including a presentation on its "Sustainable Remedy".

- In January 2011, EPA convened a meeting of a broad range of stakeholders, from potentially responsible parties (PRPs), to municipal officials, to environmental and community groups, to share views about remedial alternatives for the lower 8.3 miles of the river.
- In 2013-2014, EPA briefed local government officials on the lower 8.3-mile RI/FFS, making presentations to mayors, county executives, environmental commissioners and their staffs, from the City of Newark, towns of Clifton, Kearny and Harrison, Passaic and Bergen counties, and others.
- EPA has maintained a listserv, an electronic information distribution system, to quickly provide the public with timely information on project developments and news. EPA created the project website www.ourPassaic.org containing project background information, frequently asked questions, project updates and news, and a digital library of project documents.
- From 2004 to 2013, EPA awarded a Technical Assistance Grant (TAG) to the Passaic River Coalition to assist the community in the interpretation of technical documents generated by the study of the Lower Passaic River, including the lower 8.3-mile RI/FFS. From 2013 to the present, the TAG has been held by the New York/New Jersey Baykeeper. In 2014, EPA provided the CAG with a Technical Assistance Services for Communities (TASC) contractor to respond to technical questions the CAG had related to the lower 8.3-mile RI/FFS.

EPA's Proposed Plan for the lower 8.3 miles of the Passaic River was released to the public in April 2014. During the approximately four month public comment period, EPA went beyond the prescribed CERCLA public outreach process by organizing three public meetings (in Newark, Kearny and Belleville) to present information and receive public comments about the RI/FFS and Proposed Plan. Although not part of the formal public comment process, EPA also participated in three public forums, as follows: a "Morning Dialogue" on June 2, 2014 sponsored by Montclair State University to present information and answer questions about the RI/FFS and Proposed Plan from local government representatives; a "Restoring Our River" forum on June 10, 2014 sponsored by the Ironbound Community Corporation to present information about the Proposed Plan to the local community; and a forum sponsored by the New Jersey Institute of Technology on July 22, 2014 focused on dredged material disposal and navigation channel issues in the Proposed Plan. EPA also attended two Passaic River CAG meetings and a New York-New Jersey Harbor and Estuary Program Citizens Advisory Committee meeting, all open to the public, to present information and answer questions about the RI/FFS and Proposed Plan. A copy of the Proposed Plan, RI/FFS reports and other documents which comprise the administrative record file were made available to the public in the information repositories located at the Newark and Elizabeth Public Libraries and the EPA Region 2 Superfund Records Center. Public notices about the release of the Proposed Plan were published in the Star Ledger on April 21, 2014 and Luso Americano, a Portuguese publication, on April 25, 2014 (Attachment B). EPA extended the end of the public comment period from June 20, 2014 to August 20, 2014, publishing a public notice of the extension in the Star Ledger on June 13, 2014. Throughout the public comment period, EPA sent numerous news advisories by e-mail, listserv and regional social media accounts announcing the release of the Proposed Plan, reminding the public about EPA's public meetings and the public forums organized by other entities, announcing the extension of the comment period, and reminding the public about the end of the comment period. All of these activities resulted in numerous articles in local and online newspapers, including the Star Ledger, The Record, NJ.com, South Bergenite, Wall Street Journal, Belleville Times, and Jersey Journal.

B. Summary of Comments and Responses

Comments received by EPA showed overwhelming support for a cleanup of the Lower Passaic River. Opinions on how that cleanup should take place were more diverse. Several paper petitions sponsored by environmental, labor, university and local community groups generated over two thousand signatures in favor of the preferred alternative in the Proposed Plan (Capping with Dredging for Flooding and Navigation and Off-Site Disposal). EPA also received almost two hundred form e-mails and pre-printed post cards supporting the CPG's "Sustainable Remedy," an option that the CPG had not presented in sufficient detail when EPA was completing the RI/FFS, and thus was not evaluated by EPA in the Proposed Plan. An additional 30-40 post cards expressed concern over the construction impacts of a bank-to-bank remedy.

Elected officials on the federal, state and local levels expressed both support for and opposition to the preferred alternative. The CAG supported the preferred alternative, with two minority opinions supporting Alternative 2 (Deep Dredging with Backfill) with off-site disposal or confined aquatic disposal (CAD). Some environmental groups supported the preferred alternative, while others supported Alternative 2 with off-site disposal or local decontamination. Groups representing businesses and economic development generally supported the CPG's "Sustainable Remedy." Many local boating and rowing clubs expressed concern over the construction impacts of a bank-to-bank remedy. Those PRPs that submitted comments all opposed a bank-to-bank remedy, and most supported the CPG's "Sustainable Remedy." Each of the active alternatives (i.e., alternatives other than "No Action") received support from various individual stakeholders, and many local residents expressed concern over the construction impacts of any remediation, even if they wrote to support some form of cleanup.

While requesting comments on all aspects of the Proposed Plan, EPA provided focused public outreach on two aspects of the preferred alternative: the choice of off-site disposal versus a CAD site in Newark Bay; and the proposed depths in the navigation channel in River Mile (RM) 0 to RM 2.2. Of the commenters who specifically commented on off-site disposal versus CAD, more expressed support for than opposition to off-site disposal and conversely, more expressed opposition to than support for CAD, for reasons that are described in Section II below. Of those who specifically commented on the navigation channel, some supported dredging the navigation channel to the maximum extent while others expressed the opinion that deeper dredging in the navigation channel should not have been included in any of the alternatives. Business entities that identified themselves as operating within the lower 0.6 miles of the Passaic River supported dredging and maintaining the navigation channel as critical to their businesses or operations. Commenters' reasons for supporting or opposing deeper dredging in the navigation channel are described in Section II below.

Transcripts from the three public meetings are included in Attachment C and written comments submitted during the public comment period are included in Attachment D.

C. Late Comments

EPA received a number of submissions months after the close of the comment period, including: (1) a letter dated March 18, 2015 from the Nereid Boat Club; (2) a pre-printed post card dated April 22, 2015 from a resident of Newark; (3) a letter dated May 20, 2015 from the Hudson County Chamber of Commerce; (4) a letter dated August 7, 2015 from Senator Cory Booker and Congressman Albio Sires; (4) four letters dated April 17, July 14, September 29 and December 29, 2015, from William H. Hyatt, Jr., Coordinating Counsel for the CPG, enclosing numerous documents; and (5) documents and a presentation submitted by members of the CPG in a meeting with EPA Deputy Administrator on December 11, 2015, which was documented in a summary prepared by EPA.

Consistent with EPA's guidance (EPA, 2010a) on compiling administrative records for CERCLA responses, the comments have been labelled as "Late Comments" and added to the administrative record file. EPA has reviewed the late comments, including the documents enclosed with them. Consistent with 40 C.F.R. § 300.825(c), the comments are included in the administrative record file as Late Comments, as opposed to being incorporated into the administrative record for the selection of the remedy, because none of the comments, or other information submitted with the comments, substantially support the need to significantly alter EPA's selected remedy. Moreover, much of the information is somewhat or entirely duplicative of information already contained in the administrative record file.

II. Comments from the Public and Responses

This section contains summaries of the oral and written comments received by EPA during the public comment period, including at the three public meetings, and EPA's responses to these comments. The last section of this Responsiveness Summary includes attachments which document public participation in the remedy selection process for the lower 8.3 miles of the Passaic River. They are as follows:

Attachment A contains the Proposed Plan that was distributed to the public for review and comment.
Attachment B contains the public notices that appeared in prominent local newspapers, the Star Ledger and Luso Americano.
Attachment C contains the transcripts of the public meetings; and
Attachment D contains the public comments received during the public comment period.

A. Consistency with Laws and Guidance

A.1. Compliance with CERCLA & NCP, EPA Policies and Guidance

A.1.1 Comment: Proposed Plan is premature and inconsistent with NCP, CERCLA, and EPA policies and guidance

Commenters stated that the Proposed Plan was premature and inconsistent with the NCP's nine criteria remedy selection process, deviated from the basic tenets of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the NCP, and failed to follow EPA policies and sediment guidance, rendering the Proposed Plan arbitrary, capricious, and not in accordance with law. Some commenters cited to 40 C.F.R. § 300.430(a)(1)(ii)(B) to argue that an early action should not interfere with, nor preclude the implementation of the expected final remedy; they contended that the action for the lower 8.3 miles will do just that. Commenters asserted that although the RI report for the lower 8.3 mile FFS was labeled a remedial investigation, EPA had circumvented the remedial investigation requirements under the NCP. Commenters stated that the FFS was inconsistent with the requirements of the NCP and EPA's guidance for remediating sediment sites, that it was technically deficient, and that it did not support the legitimate selection of a preferred remedial alternative.

Response:

The NCP, at 40 C.F.R. § 300.430(a)(1)(ii)(A), states that EPA should conduct early actions when necessary or appropriate to achieve significant risk reductions quickly; when phased analysis and response is necessary or appropriate given the size or complexity of the site; or to expedite the completion of total site cleanup. In 2006, the 17-mile LPRSA RI/FS was underway, but still many years away from completion. In reviewing the data available at that time, EPA had begun to conclude that the great majority of the contaminated sediment was located in the lower portion of the 17-mile study area. At that time, within the context of the 17-mile LPRSA RI/FS, EPA began developing an FFS to look at that lower portion of the river, to assess whether taking a response action there first would be warranted. EPA contemporaneously shared information about its evaluation of options for an interim or early action in the LPR with PDT members, beginning in 2006.

In mid-2007, EPA released its initial draft FFS evaluating the FFS Study Area, which is the lower 8.3 miles of the Lower Passaic River. EPA received extensive feedback from its Partner Agencies, the Contaminated Sediments Technical Advisory Group (CSTAG), a group of Agency experts on sediment sites, and the Remedial Options Work Group, a work group of stakeholders convened under the auspices of the PDT. This feedback included the need to develop a mechanistic model, to collect more data on contamination in the sediments of the Lower Passaic River and extensive comments on all aspects of the draft FFS, some of which are discussed in detail in the response to comment II.A.2.1. Acting on this advice, EPA carried out modeling, collected additional data and made substantial changes to the FFS. Based on this work, EPA conducted an RI and prepared the RI/FFS that is the basis for selection of the remedy for the sediments of the lower 8.3 miles of the Lower Passaic River. While EPA continues to refer to the resulting study as a “Focused” FS, the RI/FFS fully meets the NCP and guidance for decision making in the lower 8.3 miles of the Lower Passaic River. The RI/FFS and the administrative record fully support the selected remedy, the implementation of which will lead to appropriate risk reduction.

In contrast, the timing for the CPG’s completion of the 17-mile LPRSA RI/FS is highly uncertain. As of February 2016, EPA has commented on many of the draft RI/FS documents received from the CPG and awaits submission of revised drafts, and is reviewing others. While progress continues, deferring issuance of the Record of Decision (ROD) for the lower 8.3 miles until a remedy can be selected for the entire 17-mile study area would result in an unnecessary delay of EPA’s effort to comprehensively address the unacceptable risks that exist in the Lower Passaic River.

The argument that a bank-to-bank remedy for the lower 8.3 miles will interfere with a subsequent remedy for the 17 miles rests upon the proposition that remediation of a limited number of discrete areas will achieve the same level of risk reduction that EPA concludes will result from bank-to-bank remediation. However, with elevated concentrations of contaminants of concern (COCs) found bank to bank throughout the surface sediments of the lower 8.3 miles, only a bank-to-bank remedy will achieve EPA’s risk-based goals. The prediction by the CPG that the approximately 150 parts per trillion (ppt) dioxin in surface sediment remaining after focused remediation would achieve the same level of protectiveness that EPA has concluded requires a protective goal of 8 ppt for dioxin is not supported by the record (see RI/FFS, Proposed Plan, ROD and responses to comments II.H.1.10, II.H.5.1 and II.I.1.1). Because the remedy for the lower 8.3 miles of the Passaic River will necessarily include bank-to-bank remediation to achieve protectiveness, EPA’s selected remedy will not interfere with a subsequent, final remedy for the entire 17-mile Lower Passaic River. By taking action in the near term in the lower 8.3 miles, EPA will expedite the completion of the total site remediation. By sequestering the contaminated sediments under an engineered cap, thus eliminating the largest ongoing source of contaminated sediment in this tidal system, the action will have a beneficial impact on the entire 17-mile LPRSA.

A.1.2 Comment: Lower 8.3-mile action should be deferred in favor of 17-mile RI/FS that is nearly complete

Commenters asserted that the lower 8.3 mile RI/FFS was duplicative of the 17-mile LPRSA RI/FS that is being performed by the CPG under EPA oversight. Commenters stated that the Proposed Plan should have been deferred in favor of the CPG's 17-mile RI/FS that was nearly complete.

Response:

EPA's approach is supported by the preamble of the NCP, which provides: "Although EPA agrees that total site remediation is the ultimate objective, often it is necessary and appropriate, particularly for complex sites, to divide the site or site problems for effective site management and early action. Operable units may be actions that completely address a geographical portion of a site …" 55 FR 8666, 8705. Further, "EPA allows the ROD for the operable unit to use data and analyses collected from any RI/FS performed for the site." 55 FR at 8705.

EPA's RI/FFS does not duplicate the 17-mile RI/FS that the CPG is performing under EPA oversight. The RI/FS has been underway since 2004. EPA began the FFS to evaluate the potential for an early action in the lower portion of the LPRSA in 2006. The RI/FFS for the lower 8.3 miles does incorporate and rely on data collected by the CPG, as appropriate. These data are not duplicative. Rather, they enhance the RI/FFS, and are part of the record for selection of a final remedy for sediment in the lower 8.3 miles of the 17-mile study area. The final remedy for the 17-mile study area will address sediments above RM 8.3, and will also address surface water for the entire 17 miles. It will not provide for a separate, duplicative remedy addressing sediment below RM 8.3.

While EPA and the CPG continue to work together on the RI/FS, and an analysis of the CPG's performance is beyond the scope of this Responsiveness Summary, as of February 2016, several critical technical issues are still under discussion. These issues will eventually be resolved to allow for the completion of a 17-mile RI/FS and for EPA to issue a Proposed Plan and select a remedy. However, this process will take several years. In the meantime, selection of this remedy for the lower 8.3 miles will allow for remedial design to proceed for the lower 8.3 miles, with the opportunity to incorporate data from the 17-mile study in a process that is fully in keeping with the NCP.

During the remedial design and implementation of the remedy for sediments of the lower 8.3 miles, as part of EPA's ongoing adaptive management approach for the project, EPA will review additional data and information that is produced in the 17-mile RI/FS and consider whether the data suggest adjustments are appropriate to ensure efficient and effective remediation. Similarly, during remedial design and implementation, there will be opportunities to update and re-run models and, if appropriate, make adjustments to the remedial action. In contrast, suspending the remedy selection process for the lower 8.3 miles pending completion of the 17-mile RI/FS would unnecessarily delay work in the river, potentially for many years.

A.1.3 Comment: Lower 8.3-mile action is an interim remedy

Commenters stated that the lower 8.3-mile action was described in the Proposed Plan as an interim remedy and that, as such, the Proposed Plan is inconsistent with EPA's guidance for interim remedies.

Response:

The Proposed Plan for the lower 8.3 miles of the Passaic River described the lower 8.3-mile remedy as "the final action for the sediments of the FFS Study Area and an interim action for the water column." The lower 8.3-mile action focuses on the sediments of that segment of the river, because they are a major source of the COCs to the rest of the 17-mile LPR and Newark Bay. Addressing these sediments will reduce COC concentrations in biota, including fish and crab tissue, thereby significantly reducing potential human health risks and hazards, and ecological risks, while the longer-duration 17-mile RI/FS is on-going. The lower 8.3-mile action is an interim action for the water column because, although remediation of contaminated sediment will contribute to improved water quality, implementation of any one of the alternatives evaluated in the RI/FFS by itself would be unlikely to achieve compliance with applicable or relevant and appropriate requirements (ARARs) in the water column. The lower 8.3-mile action is only part of the remedial activities under consideration for the 17-mile LPR and Newark Bay. Compliance with surface water ARARs would more likely be achieved after additional response actions have been implemented.

As discussed in the responses to comments II.A.1.1 and II.A.1.2, EPA's approach for the lower 8.3 miles of the Passaic River is supported by and consistent with the NCP. As discussed in responses to comments II.B.1.1 and II.B.1.2, it would not be protective to postpone remedy selection for the lower 8.3 miles, given the clear technical basis for taking an action and the uncertain timing of remedy selection for the rest of the LPRSA.

A.1.4 Comment: Administrative Record

Commenters stated that the administrative record was not complete, because, as of the closing date of the public comment period, EPA had not finished responding to numerous Freedom of Information Act (FOIA) requests relating to data the commenters maintain was necessary to evaluate the Proposed Plan; and because the Newark Public Library document repository did not contain the full administrative record file. Commenters further stated that since EPA had not fulfilled the FOIA request for the data set used to estimate bioaccumulation, it was impossible to conduct a comprehensive review.

Response:

The Proposed Plan and administrative record file provided the information necessary for any interested stakeholder to comment on the alternatives, including the preferred alternative, developed for remediating the lower 8.3 miles of the Lower Passaic River. Whether or not EPA had responded to FOIA requests (which generally are not included in the administrative record) is not relevant to the completeness of the administrative record file. Neither the NCP, nor EPA's guidance, suggest any intersection between EPA's compiling of the administrative record file, and its response to FOIA requests.

The administrative record file was delivered to the Newark Public Library document repository on April 17, 2014 with signatures confirming its receipt. Consistent with EPA's 2010 "Revised Guidance on Compiling Administrative Records for CERCLA Response Actions," EPA has continued updating the administrative record file during the preparation of the Responsiveness Summary.

A.1.5 Comment: Differences between 2007 draft FFS and 2014 RI/FFS

Commenters provided examples of differences between the 2007 draft FFS and 2014 RI/FFS in the categories of remedial action objectives (RAOs), general response actions, screening of technologies, development of remedial alternatives, supporting appendices, cost estimates, numerical modeling, remedial investigation, sediment threshold values, toxicity reference values, generic fish tissue data, biota-sediment accumulation factor and data sources.

Response:

Substantive points included in this comment are responded to elsewhere in the Responsiveness Summary (see responses to comments II.A.1.1, II.B.1.4, II.D.4.2, II.E.1, II.E.2, II.F.2.2, II.F.2.8, II.H.1.2,II.H.1.9, II.H.1.12, II.H.3.3 and II.H.7.2). Overall, the differences between the draft FFS and final RI/FFS show the development between 2007 and 2014 of a more detailed and comprehensive investigation and analysis, and a more robust set of documents to support the Proposed Plan. The 2007 draft FFS was released to the public and provided to the Remedial Option Work Group stakeholders to allow for their input to the process and to improve the final FFS.

A.2. CSTAG and External Peer Review

A.2.1 Comment: Adequacy of responses to CSTAG comments

Commenters stated that EPA had not addressed issues identified more than 6 years ago by CSTAG under Principles #1, 2, 3, 4, 5, 7, 8 and 9 of EPA's 2002 Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites (OSWER Directive 9285.6-08). There were no comments on how EPA addressed issues under Principle #6, 10, or 11.

Response:

In a May 6, 2008 memorandum, "Region 2 Response to CSTAG's Recommendations on the Lower Passaic River Early Action," EPA Region 2 responded to each of the recommendations in CSTAG's memorandum dated April 1, 2008, by describing in detail how the Region would develop the next draft of the FFS. CSTAG's recommendations were addressed as follows in the final RI/FFS, Proposed Plan and ROD:

Principle #1. CSTAG recommended that the Region evaluate more quantitatively the relative contribution of risks from dioxin and polychlorinated biphenyls (PCBs) entering the lower 8.3 miles from over Dundee Dam, from tributaries, from combined sewer overflows-stormwater outfalls (CSOs-SWOs) and from instream sediments above RM 8 and Newark Bay.

Response: In 2008, EPA Region 2 completed a sampling program targeting those sources into the lower 8.3 miles of the Lower Passaic River, including all of the COCs, not just dioxins and PCBs. The Region used these data, as well as data subsequently collected by the CPG as part of the 17-mile RI/FS, to quantify the relative contribution of contaminants from sources entering the lower 8.3 miles. Those evaluations, documented in the RI/FFS, showed that, when compared to the resuspension of the major COCs (dioxins, PCBs, mercury and DDT[2]) in the main stem of the Lower Passaic River (>75 percent), the tributaries and CSOs-SWOs are minor contributors of those contaminants (<4 percent each), and the Upper Passaic River and Newark Bay are small contributors of those contaminants (<14 percent each).

[2] Dichlorodiphenyltrichloroethane (DDT)

The remedy selection process for the lower 8.3 miles correctly focuses on remediating the contaminated sediments in the main stem of the lower 8.3 miles of the Lower Passaic River as a major on-going source of COCs in the system. In addition, the mechanistic model for the Lower Passaic River incorporated all of the data characterizing the sources of COCs entering the lower 8.3 miles into its predictions of surface sediment concentrations post-remediation.

Principle #2. CSTAG recommended that the Region consider sharing information earlier and provide more frequent updates as new data become available; hosting public information and input sessions when developing and refining treatment and disposal options for contaminated sediments; if the proposed remedy is expected to include a confined disposal facility (CDF), discuss potential locations with the communities and stakeholders as early as possible. CSTAG also recommended that the Region communicate to stakeholders that this site presents several challenges for effective dredging and capping and that it may take many years, if not decades, to reach remediation goals for this site.

Response: As described in Section I.A, EPA convened quarterly PDT meetings from 2004 to 2011 and attended CAG meetings from 2009 to the present to share information as it was developed and provide frequent updates as new data became available. Special PDT workgroup meetings were held to discuss specific issues, such as formulating alternatives for the lower 8.3 miles (including developing and refining treatment and disposal options for contaminated sediments) among others. Additional presentations were made to the CAG as EPA developed alternatives and disposal options (such as a CAD site in Newark Bay) for addressing the contaminated sediments in the lower 8.3 miles of the Passaic River. Section I.A also describes other community involvement tools that EPA used during the development of the RI/FFS and Proposed Plan to keep the public informed about project issues and maintain a meaningful public dialogue.

The FFS, Proposed Plan and ROD clearly present the challenges for effective dredging and capping in the lower 8.3 miles of the Passaic River in their discussions of the implementability criterion. The implementability section discusses the substantial challenges involved in the handling of large volumes of dredged materials and the large amount of backfill and cap material that would be needed under Alternatives 2 (Deep Dredging with Backfill) and 3 (Capping with Dredging for Flooding and Navigation); the utilities in the sediment bed that would have to be located and protected; the challenge that opening the bridges would present (and engineering options to minimize the need to open them); and the great degree of uncertainty that would be encountered in attempting to reliably identify discrete areas to dredge and cap in Alternative 4 (Focused Capping with Dredging for Flooding). In addition, the FFS included plots of surface sediment concentrations extending into the future that clearly showed that natural recovery would have to take place over the 30-year period after construction in order for interim and final remediation goals to be met. Transcripts of the three official public meetings held by EPA during the public comment period show that EPA emphasized that fish and crab consumption advisories would remain in place for years after the construction and that levels of contamination in the river would only go down slowly over time, even after a cleanup plan is implemented.

Principle #3. CSTAG recommended that the Region consider developing an alternative that addresses additional dredging for flood control but not for navigational purposes in the lower two miles. CSTAG also recommended that the Region coordinate with local and state governments to understand what the realistic and reasonably anticipated future land uses will be for the Lower Passaic River.

Response: Earlier in the development of the RI/FFS, EPA considered the possibility of bank-to-bank capping with dredging for flood control, but without accounting for navigational use of the authorized channel. Around that same time, the U.S. Army Corps of Engineering (USACE) released a 2010 Lower Passaic River Commercial Navigation Analysis report that included 1) a berth-by-berth analysis for 1997-2006 documenting that the lower 1.7 miles of the navigation channel are still in use for commercial navigation by a number of companies; and 2) a 2009 USACE survey of commercial users showing potential future commercial use of the channel up to RM 2.2. In the RI/FFS and Proposed Plan, based on USACE's 2010 report and extensive consultation with USACE and the New Jersey Department of Environmental Protection (NJDEP), EPA determined that dredging to address the use of the navigation channel in the lower 2.2 miles of the river would be necessary in order for the remedial action to comply with Section 10 of the Rivers and Harbors Act of 1899, a location-specific ARAR, and the navigation channel depths authorized by Congress, and to accommodate reasonably anticipated future land and waterway uses in accordance with EPA policy. Therefore, a bank-to-bank capping alternative with dredging for flood control but not for navigation was not included in the final FFS or Proposed Plan. The volume and cost differential between the selected remedy and a bank-to-bank capping alternative without a navigation channel are discussed in the response to comment II.H.3.3.

EPA worked with USACE, NJDEP, and local governments to understand the reasonably anticipated future use of the lower 8.3 miles of the Lower Passaic River. As discussed above, EPA looked to a 2010 Lower Passaic River Commercial Navigation Analysis report to describe current waterway use and to delineate future waterway use objectives. EPA also evaluated a 2007 State of New Jersey study that showed that the communities above RM 2.5 have included future increases in recreational access to the river in their master plans. According to that study, between RM 2.5 and RM 8.3, reasonably-anticipated future uses include recreational (rowing and boating) and light commercial (water taxis) uses, supporting a water depth of about 10 feet. The results of these studies were taken into account in the development of Alternative 3 (Capping with Dredging for Flooding and Navigation) in the RI/FFS and Proposed Plan.

EPA convened meetings with representatives of municipalities in the lower 8.3 miles of the Lower Passaic River to discuss reasonably anticipated future use of the waterway. In 2013-2014, EPA briefed local government officials (as described in Section I.A) on the lower 8.3 mile RI/FFS, discussing with them the proposed extent and depth of dredging to accommodate reasonably-anticipated future commercial and recreational use included in Alternative 3. As documented in the administrative record, EPA also reviewed a number of municipal Master Plans during the development of the RI/FFS. As discussed in the responses to comments II.C.4.7 and II.H.3.3, EPA reexamined available information pertaining to current and future commercial uses of the Lower Passaic River navigation channel submitted and obtained during the public comment period, and, in further consultation with USACE and NJDEP, adjusted the extent and depths of the navigation channel included in the selected remedy in the ROD.

Principle #4. CSTAG recommended that the Region collect additional data to support the main premise of the conceptual site model (CSM) that the entire lower 8.3 miles is a "well mixed box;" use a sediment transport model to supplement the empirical mass balance model (EMBM); and produce maps or other graphics presenting dioxin sediment chemistry data by location and depth in the FFS.

Response: As documented in the Region's May 6, 2008, response to CSTAG, EPA conducted an extensive sampling program in 2007-2008 that provided sediment data to update the CSM. EPA developed a sediment transport model and contaminant fate and transport model as an additional line of evidence for updating the CSM and to supplement the EMBM. The data and models served to further support and refine the concept of a "well-mixed box" to explain that the movement of the tides causes surface sediments in the river to resuspend and redeposit, resulting in longitudinal mixing of surface sediments. This results in little or no trend in COC median surface sediment concentrations with river mile from RM

2 to RM 12. In addition, in the lower 8.3 miles, surface sediments in the navigation channel are as highly contaminated as those in the shoals. In other words, data show that elevated concentrations of COCs are everywhere in surface sediments of the lower 8.3 miles, bank-to-bank. The final lower 8.3 mile RI contains numerous maps and other graphics presenting sediment and water chemistry for all COCs, further illustrating how the data support the RI/FFS CSM.

Principle #5. CSTAG recommended that the Region add one or more alternatives that address highly contaminated erosional areas within the lower 8.3 miles; perform additional analyses or collect additional sediment contaminant and stability data; collect information beyond the EMBM to support the conclusion that any action addressing only a portion of the lower 8.3 miles of the river would not be effective in reducing dioxin risks within the Lower Passaic River and Newark Bay; use the information being collected as part of the 17-mile RI/FS to update the CSM; and consider conducting pilot studies to evaluate the effectiveness of developing technologies such as reactive caps and sediment amendments.

Response: The final FFS included a newly developed alternative (Alternative 4) that addressed the highly contaminated erosional areas within the lower 8.3 miles, as recommended by CSTAG. EPA conducted field and laboratory studies to measure sediment stability (or erodibility) using Sedflume, Gust Microcosm and consolidation tests in 2005-2008. EPA spent over eight years developing linked hydrodynamic, sediment transport, organic carbon and contaminant fate and transport models. The results supported the EMBM's conclusion that a focused or less-than bank-to-bank alternative would not be effective in reducing risks to reach RAOs for the lower 8.3 miles of the Passaic River. Part of the model development included an independent peer review of the models in 2013. All of the sediment contaminant and stability data that were available during the development of the RI/FFS were incorporated into the RI/FFS CSM and mechanistic model. The RM 10.9 Removal included an active cap membrane and the Region is evaluating the effectiveness of that technology.

Principle #7. CSTAG recommended that the Region reevaluate the level of post-remediation residual risk by incorporating more reasonable estimates of recontamination resulting from dredging and capping the lower 8.3 miles; conduct a more robust assessment of the potential for post-cleanup recontamination from upstream, lateral and downstream sources; and conduct additional analysis of background levels in the lower 8.3 miles.

Response: EPA developed a contaminant fate and transport model that included mechanistic simulation of recontamination resulting from dredging the lower 8.3 miles and incorporated all available data from the 17-mile RI/FS to provide a more robust assessment of the potential for recontamination from upstream within the LPR, Newark Bay, above Dundee Dam, tributaries and CSOs-SWOs. See responses to comments II.E.2.6 and E.2.8 for further discussion. More data were collected in 2008 to characterize the area above Dundee Dam as background to the lower 8.3 miles. The data collected above Dundee Dam for the 17-mile LPRSA RI/FS in 2012 were not available in time to be used in the RI/FFS, but have been evaluated during the development of this Responsiveness Summary (see response to comment II.G.2.2).

Principle #8. CSTAG recommended that both long-term and short-term or interim remediation goals should be developed for fish and crab tissue (including crab muscle-only), and that the time to achieve these goals should be estimated for each alternative. CSTAG recommended that the risk assessment also estimate risks from direct contact exposure scenarios and that remediation goals be developed for these exposures. CSTAG suggested that the Region consider placing more emphasis on the potential benefits from reducing dioxin loading to Newark Bay than on achieving significant risk reduction in the

LPR itself. CSTAG said it would be helpful to explain the anticipated benefits of the proposed action to ecological resources in the river and bay.

Response: The Proposed Plan established both long-term and interim sediment remediation milestones that corresponded to protective fish and crab tissue concentrations (see response to comment II.G.1.5 for more on interim remediation milestones). The Proposed Plan discussed the time to achieve these milestones, based on the RI/FFS modeling results. In response to comments, EPA updated the sediment transport, organic carbon and contaminant fate and transport components of the model, as discussed in Attachment E. EPA's updated modeling predicts that, under the selected remedy, for dioxin and PCBs, shortly after construction completion, lower 8.3-mile surface sediment concentrations will reach the interim remediation milestones that correspond to interim protective fish and crab tissue concentrations, sufficiently protective to potentially allow NJDEP to consider lifting or relaxing the stringency of prohibitions on fish and crab consumption (e.g., allowing one fish meal per month, as opposed to the current prohibitions on consumption of fish or shellfish from the Lower Passaic River).

EPA has found no credible evidence since the publication of the Proposed Plan to contradict the information presented in the RI/FFS (Appendix D) that up to 15 percent of crabbers in the Newark Bay Complex, which includes tidal portions of the Passaic River, eat the whole crab, including the hepatopancreas. There is also no evidence to contradict NJDEP reports showing that even those consumers who do not deliberately eat the hepatopancreas are likely to be exposed to all or part of its content due to its fluid nature and its dispersion in the cooking liquid. NJDEP's crab consumption advisories are still calculated based on consumption of the whole crab. Therefore, as discussed in response to comment II.G.1.3, it would not be appropriate to establish remediation goals based on ingestion of only crab muscle, since EPA guidance states that remediation goals must be protective of the Reasonably Maximally Exposed (RME) individual. In the lower 8.3 miles of the Passaic River, the RME individual must be assumed to be exposed to the hepatopancreas.

As discussed in the RI/FFS, Proposed Plan and ROD, the lower 8.3 mile action is the final action for the sediments of that stretch of the river, but it is an interim action for the water column. After the completion of the on-going 17-mile RI/FS, EPA expects to select a remedy that addresses the entire Lower Passaic River, including the water column. As such, the RI/FFS, Proposed Plan and ROD focused on evaluating risks from consumption of fish and shellfish (crab) that have become contaminated through exposure to contaminated sediment. Based on a review of risk assessments at other sediment sites, Region 2 found fish and shellfish consumption is associated with the highest cancer risks and noncancer health hazards compared to ingestion, dermal contact or inhalation of chemicals in surface water or sediment during recreational exposures. EPA did not evaluate risk associated with direct human exposure to surface water and/or sediment, but those other exposure pathways are being evaluated in the 17-mile RI/FS.

The RI/FFS and Proposed Plan describe how modeling results predict post-construction sediment concentrations that will lead to substantial risk reductions in the lower 8.3 miles of the Passaic River as a result of bank-to-bank remediation. In response to CSTAG's recommendation, EPA undertook additional analyses as a part of the RI/FFS, which showed that fluxes of COCs to Newark Bay would be reduced under each of the active alternatives (more for Alternatives 2 and 3, less for Alternative 4). However, the greatest benefit of the lower 8.3 mile action will be to reduce COC concentrations and, therefore, risks in that stretch of the river, consistent with the statutory requirement (CERCLA Section 121(d)(1)) that remedial actions attain a degree of cleanup of hazardous substances that assures protection of human health and the environment.

The RI/FFS (Appendix D) explained the anticipated benefits of the lower 8.3-mile action to ecological resources in the Lower Passaic River and Newark Bay. In response to CSTAG's recommendation, EPA substantially expanded the baseline ecological risk assessment (BERA) to explain the ecological effects of the COCs, to discuss the reasoning behind the selection of species representative of each category of receptors evaluated in the risk assessment, and to describe assessment endpoints and measures of effect for those receptors. As described in the Proposed Plan and ROD, under overall protection of human health and the environment, EPA calculated future ecological risks under Alternative 1 (No Action) and compared those risks to future ecological risks that would be achieved after implementation of each active alternative, showing the anticipated benefit of Alternative 3 to ecological resources in the river.

Principle #9. CSTAG recommended an evaluation of institutional controls that would be needed to protect the integrity of a cap, if selected as a remedy, in light of any planned future navigational uses and construction activities in the river. CSTAG recommended identifying who would be responsible for ensuring that the institutional controls remain in place over the long-term.

Response: The RI/FFS and Proposed Plan identify the kinds of institutional controls that EPA anticipates will be needed to protect an engineered cap in perpetuity. The ROD also describes the federal and state agencies responsible for ensuring that the institutional controls remain in place over the long-term. (The RI/FFS, Proposed Plan and ROD also describe how New Jersey's fish and crab consumption prohibitions and advisories could be enhanced with additional outreach efforts to ensure protectiveness of human health until RAOs are reached.) The ROD describes that such controls might include: restrictions on construction and dredging in the lower 8.3 miles except in the federally authorized navigation channel; restrictions on construction and dredging below the depths of the federally authorized navigation channel; and restrictions on bulkhead maintenance. These kinds of controls to protect the cap have been proposed or implemented at other Superfund sites. The exact mix of controls that would be appropriate in the lower 8.3 miles of the Passaic River will be determined during remedial design. EPA has begun discussions with NJDEP about implementing restrictions on capped areas within the river, other than within the authorized navigation channel.

In the Proposed Plan, EPA identified the potential institutional controls so that interested stakeholders could evaluate the remedial alternatives that included capping and provide meaningful comments about their preferences. During remedial design, EPA will consider community preferences expressed during the public comment period for the Proposed Plan and input gathered during additional public outreach in the design of the cap. See response to comment II.C.4.6.

A.2.2 Comment: Adequacy of responses to CSM peer review comments

Commenters stated that EPA had not addressed issues related to potential sources of recontamination and potential for targeted remediation identified by EPA's external peer reviewers for the 2008 CSM.

Response:

In a February 2013 peer review report, developed in accordance with EPA's 2006 Peer Review Handbook (Third Edition), EPA responded to each of the peer reviewers' comments on the 2008 Comprehensive CSM and described how their recommendations had been incorporated in the RI/FFS. The report is part of the administrative record for the lower 8.3 miles of the Lower Passaic River. The following summarizes how the peer reviewers' issues highlighted by the commenters were addressed in the final RI/FFS:

<u>Potential Sources of Recontamination</u>: In accordance with the peer reviewers' recommendation, a mechanistic model consisting of linked hydrodynamic, sediment transport, organic carbon and contaminant fate and transport models was developed to predict post-remedial surface sediment concentrations under the various remedial alternatives for comparison to those derived using the EMBM. Based on the results of the mechanistic model, EPA concluded that remediating the lower 8.3 miles first would result in less recontamination of the remediated portion of the river from the unremediated upper nine miles than remediating the upper nine miles first. EPA also incorporated data characterizing all of the significant sources of contamination entering the lower 8.3 miles (including from the upper nine miles, above Dundee Dam, major tributaries, CSOs-SWOs and Newark Bay) into the mechanistic model, so that the model's projections of future sediment concentrations under the alternatives evaluated in the FFS included the potential for recontamination from those sources. With those sources of recontamination, as well as contamination from resuspension of sediments during remedy implementation, incorporated into the mechanistic model, model results showed significant risk reduction from implementation of the selected remedy, as discussed in the RI/FFS, Proposed Plan and ROD.

<u>Potential for Targeted Remediation</u>: To evaluate the peer reviewers' recommendation that a remedial action should be focused on erosional areas with high contaminant concentrations close to the current sediment surface (and to respond to CSTAG comments, as discussed in response to comment II.A.2.1), Alternative 4 (Focused Capping with Dredging for Flooding) was developed in the FFS. It included dredging and capping of contaminated fine-grained sediments in the discrete areas of the lower 8.3 miles with the highest gross and net fluxes of COCs. The ability of Alternative 4 and the other alternatives in the FFS to achieve reductions in contaminant concentrations in the surface sediment was evaluated using the mechanistic model. EPA did not select Alternative 4, because it would not be protective of human health and the environment; would not be effective in meeting all of the RAOs; would achieve the smallest reduction of mobility, toxicity and volume through treatment compared to the other active alternatives; would face implementation challenges; and would not satisfy the modifying criteria of state and community acceptance (see response to comment II.C.4.9).

A.2.3 Comment: Peer review requirement

Commenters stated that EPA had failed to use peer-reviewed sediment and fate and transport models, and had relied only on the EMBM, which also had not undergone peer review. Commenters asserted that EPA had described the RI/FFS mechanistic models as "state-of-the-art," because they were based on previously-developed models with domains covering the New York-New Jersey Harbor and beyond that had been peer reviewed. The commenters contended that a detailed peer review of the RI/FFS models as applied to the lower 8.3 miles of the Passaic River must be completed to improve confidence in the models.

Response:

EPA relied on both the EMBM and the mechanistic model that consisted of linked hydrodynamic, sediment transport, organic carbon, and contaminant fate and transport models to support the Proposed Plan. In response to an April 2008 EPA CSTAG recommendation, EPA Region 2 submitted the EMBM to peer review in May 2008. In response to a December 2012 EPA National Remedy Review

Board (NRRB) and CSTAG recommendation, EPA Region 2 submitted the mechanistic model to peer review in February-March 2013. Both reviews were structured as "letter peer reviews," in accordance with the EPA 2006 *Peer Review Handbook Third Edition* (EPA/100/B-06/002). None of the peer reviewers had substantially contributed to the development of the models undergoing review, or provided significant consultation during the development of the models, consistent with the Peer Review Handbook's definition of an independent peer reviewer. The charge questions developed for the EMBM and mechanistic model peer reviews were sent to CSTAG and NRRB/CSTAG for review, respectively. Peer review reports, dated February 2013 (EMBM) and September 2013 (mechanistic model), were developed by EPA as required by the *2006 Peer Review Handbook*. The reports described the peer review process, provided the charge questions, listed the peer reviewers with brief biographies outlining their experience, summarized the key issues identified by the reviewers, described how the Region undertook a number of tasks to strengthen the models based on the peer reviewers' comments, and provided the peer reviewers' comments and detailed responses to each comment. The peer review reports are part of the administrative record for the lower 8.3 miles of the Lower Passaic River. The changes to the models made as a result of the peer review comments improved EPA's confidence in the models, and both were used to support EPA's development and analysis of alternatives as described in the FFS and the Proposed Plan.

A.3. Adaptive Management

A.3.1 Comment: Failure to use adaptive management

Commenters supported use of adaptive management to provide for additional work to be implemented, to ensure that cleanup goals are met and to allow for reconsideration of a chosen remedy where new information warrants it. Commenters stated that EPA failed to, but should have, developed an alternative that encompasses a phased or adaptive management approach. Other commenters stated that proposing or selecting a bank-to-bank remedy would be contrary to EPA guidance requiring application of adaptive management principles during the decision-making process.

Response:

EPA has engaged in an adaptive management approach to assessing, phasing and implementing response actions in the 17-mile LPRSA throughout the development of the lower 8.3 mile RI/FFS. EPA's 2005 *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (EPA 540-R-05-012, OSWER Directive 9355.0-85, also termed "the Sediment Guidance") explains that an adaptive management approach, in general, involves the testing of hypotheses and conclusions and reevaluating site assumptions as new information is gathered, as an important component of updating the CSM. An adaptive management approach might also include gathering and evaluating multiple data sets or pilot testing to determine the effectiveness of various remedial technologies at a site. The guidance specifically notes that the extent to which adaptation is cost-effective is "of course" a site-specific decision. In short, a phased or adaptive management approach can be incorporated as appropriate during the investigation, remedy selection and remediation.

EPA has already taken a phased, or adaptive management approach on the Lower Passaic River, where possible. Several years after beginning the RI/FS for the 17-mile LPRSA, EPA concluded that data showed that the majority of COCs were present in the lower 8.3 miles of the river. Based on this knowledge, EPA began an FFS for the lower 8.3 miles, while at the same time continuing the larger 17-mile RI/FS through the work of the CPG. This is consistent with the Sediment Guidance at p.2-21: "Phasing site characterization can be especially useful when risks are high, yet some important site-specific factors are unknown."

As discussed in the response to comment II.A.2.1, in 2008, not long after the CPG took over the 17-mile RI/FS, EPA submitted the FFS for review to EPA's CSTAG. CSTAG recommended that the Region develop a mechanistic model to support and guide decision-making. EPA's decision to develop and use a full mechanistic model was significant, leading to a longer, more full-scale remedial investigation.

While continuing to develop the model, in 2008, EPA entered into an agreement with Occidental Chemical Corporation to perform a removal action in the river adjacent to the former Diamond Alkali facility, thereby undertaking another phase, consistent with the Sediment Guidance at p.2-22: "Phasing can also be used at large, multi-source, multi-PRP sites with primarily historic contamination where contaminated sediment is still near the sources. At these types of sites, working with a single responsible party to address sediment with higher contaminant concentrations near a specific source may be an effective risk reduction measure, while the more complex decision making for the rest of the site is ongoing."

In 2011, EPA identified an area of elevated concentrations in a mudflat at RM 10.9, worked with the CPG to characterize it and, in 2012, entered into an agreement with the then-members of the CPG to conduct a removal action to address those sediments. That removal yielded lessons about implementation that will be taken into account during the design of the lower 8.3 mile action, and also allowed for a pilot study of the use of certain decontamination techniques, supplementing work that was performed years earlier by the USACE. This is consistent with the Sediment Guidance at p.2-22: "For example, an adaptive management approach might include gathering and evaluating multiple data sets or pilot testing to determine the effectiveness of various remedial technologies at a site."

As a result of EPA's efforts since 2008, the mechanistic model has been fully developed and peer reviewed, the data from the 17-mile RI/FS have been incorporated, and a focused remedial alternative (Alternative 4) was evaluated in the FFS. EPA prepared a full RI report to support the FFS. Completion of the RI/FFS process resulted in greatly reduced uncertainty regarding new site information and the ability to predict remedy effectiveness.

Given the extensive work performed since 2008 and the conclusions that EPA has reached at the end of its evaluation of the lower 8.3 miles, the record shows that incremental remediation would not be an effective approach for the lower 8.3 miles. The most recent data from the 17-mile RI/FS confirm that median contaminant concentrations in the surface sediment are not declining and remain far in excess of the risk-based remediation goals established in the RI/FFS. Under the threshold criterion of overall protection of human health and the environment, EPA concluded that Alternative 4 (Focused Capping with Dredging for Flooding), which would dredge and cap discrete highly contaminated erosional areas in the lower 8.3 miles, would not be protective of human health and the environment, even with monitored natural recovery (MNR), remediation of the Lower Passaic River above RM 8.3 and Newark Bay, and implementation of Clean Water Act programs to address sources of COCs above Dundee Dam. Rather than the incremental steps proposed in Alternative 4 or any other partial remedy such as the CPG's "Sustainable Remedy" (as presented in the CPG comments to the Proposed Plan), a bank-to-bank remediation approach is necessary to approach remediation goals as closely as possible. Taking an incremental remedial approach followed by monitoring to see if it works would not be protective, as it would cause an unnecessary delay in remediating the Lower Passaic. Adaptive management in the lower

8.3 miles, moving forward, will be related to incorporating appropriate adjustments during remedial design and remedial action to ensure efficient and effective remediation.

In summary, while the lower 8.3 mile RI/FFS and removal actions have been integral to the adaptive management approach to addressing the Lower Passaic River, an incremental approach is not appropriate for the remedial action for the lower 8.3 miles of the river. The RI/FFS is based on a very strong, complete data set, and a mechanistic model that provides the ability to predict future sediment concentrations for each alternative. While uncertainty cannot be completely eliminated, the RI/FFS has clearly demonstrated that a less than bank-to-bank remedy will not meet EPA's RAOs for the lower 8.3 miles.

A.3.2 Comment: Adaptive management does not apply to Lower Passaic River remedy selection process

Commenters stated that the use of adaptive management does not necessarily apply to the Lower Passaic River, because, while adaptive management operates on the basis that restoration decisions would be modified over time in response to how the ecosystem was responding, in the case of the Passaic, it is already clear that the condition of the ecosystem will not improve unless all contaminants are removed.

Response:

EPA agrees that while adaptive management is useful as a means of testing hypotheses and reevaluating site assumptions as new information is gathered, given the extensive work performed by EPA since 2008 and the conclusions that EPA has reached at the end of its evaluation of the lower 8.3 miles, the record shows that incremental remediation would not be an effective approach for the lower 8.3 miles. See response to comment II.A.3.1. As discussed in the responses to comments II.B.1.2 and II.C.4.2, the selected remedy does not include removal of all contaminants in the 17-mile LPRSA or in the lower 8.3 miles.

A.3.3 Comment: Proposed Plan needs to be altered to accommodate adaptive management

Commenters noted that the Proposed Plan indicates the intention to use an adaptive management approach with the preferred remedy, but stated that significant alterations to the Proposed Plan would be needed to achieve the goal of using an adaptive management framework. Commenters specifically mentioned the need to collect all relevant information (e.g., a fish migration study) before finalizing a plan for remediation, to define criteria that must be met for the preferred alternative to be modified or dismissed, to provide for the failure of the cap to contain contamination, to identify indicators against which post-remedial monitoring data will be evaluated, and to explain how the management plan can be modified without modifying the ROD (which is not a flexible enough process). Commenters sought to understand how adaptive management would be applied in the cleanup process.

Response:

EPA's 2005 *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* explains that an adaptive management approach, in general, means testing of hypotheses and conclusions, and reevaluating site assumptions as new information is gathered. EPA expects to employ an adaptive management approach during the remedial design and implementation of the selected remedy for the lower 8.3 miles of the Lower Passaic River. This will allow for appropriate adjustments to ensure efficient and effective remediation. Information critical to the successful implementation of the remedy can be evaluated; for example, models may be reviewed and updated and new projections made which may provide the opportunity for modifications to the remedial action to be considered, if appropriate. Any remedy modifications will be made and documented in accordance with the CERCLA process, through an Explanation of Significant Differences or an Amendment to the ROD, which are the administrative procedures provided by the NCP and EPA guidance. However, adaptive management will not necessarily lead to significant changes to the remedy. See response to comment II.A.3.1 for more discussion on adaptive management.

EPA does expect to collect additional data for the remedial design phase, which will occur after remedy selection, such as information on fish migration to develop a construction schedule for the implementation of the selected remedy. However, that information is not necessary to evaluate alternatives and select a remedy in a ROD. EPA's Proposed Plan includes a full evaluation of each remedial alternative using the criteria established in the NCP, which is the requirement for selecting a final remedy. The Proposed Plan and RI/FFS were based on a very strong, complete data set, and a mechanistic model that provides the ability to predict future sediment concentrations for each alternative. While uncertainty cannot be completely eliminated, just as all information cannot be completely collected, the RI/FFS data set and analyses have resulted in greatly reduced uncertainty regarding new site information and the ability to predict remedy effectiveness, which supports EPA's issuance of a ROD for the lower 8.3 miles of the Lower Passaic River.

Criteria to determine the success of the selected remedy and indicators against which post-remedial monitoring data will be evaluated were identified in the Proposed Plan, and are established in the ROD in the form of RAOs and remediation goals. Remediation goals for the lower 8.3 miles of the Passaic River are surface sediment concentrations of COCs corresponding to fish and crab tissue concentrations that are protective of human and ecological health. For human health, risk-based sediment remediation goals were developed based on fish or crab tissue levels that would allow the RME adult angler to eat self-caught fish or crab from the lower 8.3 miles without incurring a cancer risk above the acceptable risk range identified in the NCP of 10^{-4} to 10^{-6} and above EPA's goal of protection of a noncancer health hazard index (HI) equal to 1. Interim remediation milestones were developed based on a lower consumption rate than that of the RME individual, for use during monitoring after remedy implementation to evaluate if contaminant concentrations in sediment, fish and crab tissue are decreasing as expected. As part of the remedial design, EPA will develop a plan for monitoring sediment, and fish and crab tissue to evaluate when interim remediation milestones and remediation goals are reached.

EPA's 2005 *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* shows that, as of 2004, *in-situ* capping had been selected as a component of the remedy for contaminated sediment at approximately 15 Superfund sites. A survey of contaminated sediment capping projects conducted for the Lower Fox River and Green Bay, Wisconsin RI/FS (WDNR, 2002a,b) shows caps installed as early as 1978 had no chemical migration through them detected in subsequent monitoring programs. This history of capping use shows that capping, with proper monitoring and maintenance, is a permanent solution that can provide long-term protectiveness for human and environmental health by sequestering contaminated sediments. The remedy selected for the lower 8.3 miles includes monitoring and maintenance of the engineered cap to evaluate its long-term protectiveness. The cost estimate provided in the Proposed Plan included costs for replacing cap material on a regular basis and following storm events, if necessary. During five-year reviews, the remedy will be reviewed and alternate remedial plans developed should the remedy be found not to be effectively protecting human and ecological health (i.e., if cap failure were occurring or surface sediment concentrations were not reaching interim milestones, among other evaluation criteria to be determined during remedial design).

B. Relationship to 17-mile RI/FS and Tierra Removal

B.1. 17-Mile RI/FS

B.1.1 Comment: Selecting a final remedy for the lower 8.3 miles while a 17-mile RI/FS is on-going

Commenters asked whether deciding on a final cleanup plan for the lower 8.3 miles while the 17-mile LPRSA RI/FS is on-going is consistent with the NCP and has been done at other Superfund sites. Commenters wondered why EPA would have released the lower 8.3 mile FFS in early 2014 when the 17-mile RI/FS was scheduled to be completed by the end of 2014.

Response:

EPA's approach for the lower 8.3 miles of the Lower Passaic River is supported by the NCP, as discussed in the responses to comments II.A.1.1 and II.A.1.2. Undertaking remedial action at one operable unit of a site while investigation work is underway for another operable unit is not an uncommon occurrence. Several examples include the Cornell-Dubilier Electronics site (Region 2) and Commencement Bay/ Nearshore Tideflats site (Region 10). In fact, one of the benefits of managing a large, complex site in operable units is that it will be possible to proceed with one or more portions of the cleanup instead of waiting for the completion of all aspects of the investigation.

While some commenters have stated in their comments that the 17-mile RI/FS is almost complete, that is not the case. As discussed in response to comment II.A.1.2, EPA has received draft submittals, but extensive work is needed before the 17-mile RI/FS is complete, and EPA can prepare a Proposed Plan for the 17-mile LPRSA. In the meantime, selection of this remedy for the sediments of the lower 8.3 miles will allow for parallel design and investigation phases that are fully in keeping with the NCP. As discussed in the response to comment II.A.3.1, EPA expects to employ an adaptive management approach, consistent with guidance, during the remedial design and implementation of the selected remedy. This will allow for appropriate adjustments to enable efficient and effective remediation, providing a means to address uncertainties, inform specific design decisions and address concerns about how this action will be integrated with the ongoing 17-mile LPRSA RI/FS.

B.1.2 Comment: When will EPA address the rest of the 17-mile Lower Passaic River?

Commenters asked about plans for cleaning up the stretch of the river above RM 8.3 and wondered why EPA is waiting to address the upper nine miles of the river. Other commenters urged EPA to address the full 17 miles of the Lower Passaic River in one cleanup plan. Commenters asserted that EPA's original plan was to dredge all 17 miles of the river from Dundee Dam to Newark Bay and urged EPA to return to that original plan. Commenters stated that implementation of Alternative 2 in the lower 8.3 miles would set a precedent for the remediation of the rest of the Lower Passaic River.

Response:

EPA will propose a remedial action to address the sediments of the upper nine miles of the Lower Passaic River and the water column of the entire 17-miles when the 17-mile LPRSA RI/FS has been completed. EPA completed its lower 8.3 mile RI/FFS reports and issued the Proposed Plan for the sediments of the lower 8.3 miles of the river in April 2014, relying on the data collected and analyses performed for the RI/FFS and also for the 17-mile RI/FS, to the extent those were available. The Proposed Plan set forth EPA's preferred approach on how to remediate the sediments of the lower 8.3 miles. The RI/FFS reports show that the sediments of the lower 8.3 miles of the Lower Passaic River are a major source of contamination to the rest of the river and Newark Bay. Because of this, EPA has chosen to go forward with the remediation of this portion of the river, rather than waiting for completion of the 17-mile RI/FS. As explained in the RI/FFS, Proposed Plan and responses to comments II.A.1.1 and II.B.1.3, such a delay is not defensible or protective of human health and the environment based on the information that EPA has developed. Further, as discussed in response to comments II.B.1.4, II.D.1.1, II.D.1.2 and II.D.1.7, EPA evaluated the data sets submitted to EPA after the completion of the RI/FFS and determined they do not change the conclusions reached in the RI/FFS or lead to a change in the selected remedy.

The idea that EPA had planned, at one time, to dredge all 17 miles of the Lower Passaic River is not accurate. EPA has never developed any plans to dredge all 17 miles of the Lower Passaic River. Nor does EPA anticipate that selection of the remedy for the sediments of the lower 8.3 miles necessarily will set a precedent for the rest of the Lower Passaic River. While the ROD for the 17-mile Lower Passaic River will use data and analyses for the lower 8.3 miles, the decision for the 17-mile LPRSA will be based on the specific considerations raised by that larger study area.

B.1.3 Comment: Lower Passaic River should be remediated from upstream to downstream

Commenters indicated that the order in which the remediation projects are being undertaken is inconsistent with standard procedures of remediating upstream areas first and working downstream so that remediated downstream locations would not be recontaminated as a result of later remediation of upstream areas. Commenters asserted that EPA implemented the RM 10.9 Removal first on the assumption that remediation should proceed upstream to downstream. Commenters stated that, as proposed, the likelihood for recontamination of the lower 8.3 miles of the Lower Passaic River seemed high. Commenters stated that the remediation of the lower 8.3 miles of the Lower Passaic River should be delayed until upstream locations had been remediated by completing the 17-mile RI/FS and determining the needed remedial action for the full 17 miles of the Lower Passaic River. Commenters stated that the Proposed Plan did not present the rationale for addressing the FFS area first.

Response:

Because the Lower Passaic River is tidal, water and contaminated sediments that are transported in the water move back and forth twice a day. So, while rivers that flow in one direction are typically remediated from upstream to downstream to minimize the potential for recontamination, there is no such flow-based starting point for the Lower Passaic River. EPA used its computer model to simulate the effects of starting the remediation above RM 8.3 versus starting it below RM 8.3. The model results, documented in the RI/FFS, show that remediating the river above RM 8.3 first would lead to more recontamination than starting the remediation below RM 8.3. In addition to these model results, several other lines of evidence support the conclusion that the lower 8.3 miles should be remediated first, while the 17-mile RI/FS is on-going, as follows:

- The river bed below RM 8.3, from bank to bank, is dominated by fine-grained sediments (primarily silts) with pockets of coarser sediments (sand and gravel). Above RM 8.3, the bed is dominated by coarser sediments with smaller areas of fine-grained sediments, often located outside the channel. About 85 to90 percent of fine-grained sediments in the Lower Passaic River (by surface area or by volume) are located below RM 8.3. Since most of the COCs tend to bind tightly to the organic carbon on fine-grained sediment particles, elevated concentrations of COCs are found bank to bank in the lower 8.3 miles. Starting the remediation of the Lower Passaic River in the lower 8.3 miles minimizes the potential for recontamination, because it addresses the area where the majority of the contamination is located.

- Sampling from 1995 through 2013 confirms that the lower 8.3 mile surface sediment median contaminant concentrations have remained well above remediation goals and almost unchanged over that 18-year period. This means that the river is highly contaminated and is not recovering naturally.
- Based on analyses discussed in the RI/FFS, direct atmospheric deposition, groundwater discharge and industrial point sources currently are not significant contributors of COC mass (i.e., sediment particles and the COCs bound to them) to the lower 8.3 miles of the Lower Passaic River. Sampling data collected between 2005 and 2011 showed that the tributaries, CSOs and SWOs are minor contributors of COCs, since they are minor contributors of sediment particles compared to the Upper Passaic River and Newark Bay, and the mass of contaminants delivered by those particles is low compared to the sediments of the Lower Passaic River main stem. For COCs such as 2,3,7,8-TCDD, Total PCBs and mercury, concentrations on sediment particles from the tributaries, CSOs and SWOs are clearly lower than those on Lower Passaic River surface sediments. Resuspension of Lower Passaic River sediments contributes well over 90 percent of the dioxin in recently deposited sediments of the Lower Passaic River, followed by Newark Bay (approximately 5 percent) and the Upper Passaic River (3 percent or less). Resuspension of Lower Passaic River sediments contributes approximately 80 percent of PCBs and DDE in recently deposited sediments, followed by the Upper Passaic River (approximately 10 percent) and Newark Bay (less than 10 percent). Similar trends are shown for copper, mercury and lead. These findings, coupled with the fact that 85 to90 percent of the fine-grained sediments in the Lower Passaic River are located below RM 8.3, further support the conclusion that resuspension of highly contaminated surface sediments already in the lower 8.3 miles of the river is the predominant contributor to COC mass in the water column, and thus to COC concentrations in fish and crab tissue.

Removal actions are carried out under different provisions of CERCLA and the NCP than remedial actions. The RM 10.9 Removal was implemented as a “time critical” removal to address highly-contaminated sediments discovered at the surface of the mudflat in Lyndhurst. Because contaminants were present in the top six inches of the mudflat and potentially subject to disturbance by weather conditions or water movement, EPA determined it was necessary to act expeditiously. Therefore, the planning and design of the RM 10.9 Removal were completed while the lower 8.3 mile RI/FFS was still underway. However, it should be recognized that the level of contamination and degree of erodibility of sediments at RM 10.9 are not generally representative of the river above RM 8.3.

B.1.4 Comment: Lower 8.3 mile RI/FFS did not incorporate all of the data from the 17-mile RI/FS

Commenters stated that the RI and FFS were prepared based on data from 2007 and did not incorporate all of the data collected for the 17-mile RI/FS. Commenters asserted that EPA used older data sets that are likely to include outdated analytical methods and different data quality objectives (DQOs), and would not be consistent with the Uniform Federal Policy for Quality Assurance Project Plans that was used to develop and implement data collection for the 17-mile RI.

Response:

Use of Data Collected Since 2012: The RI/FFS incorporated and relied on all of the data that were available up to the time that EPA prepared the near-final draft of the RI/FFS, in early summer 2013. Most of the data sets that commenters claimed were not used in the RI/FFS were submitted to EPA after that time, as follows:

- 2013 Supplemental Sediment Sampling Program 2 (SSP2) data were submitted in May 2014 (after the Proposed Plan was issued).
- 2013 High Volume Chemical Water Column Sampling data were submitted in September 2013.
- 2012 Background Tissue and Sediment Data were submitted in August 2013.
- 2012 Background Sediment Toxicity data were submitted in October 2013.

Two of the data sets that commenters asserted were not used in the FFS were actually used in the mechanistic model: 2013 Low Volume Chemical Water Column Sampling data and 2011-2012 River Mile 10.9 Characterization data.

All of the data sets submitted to EPA after the completion of the RI/FFS were evaluated during the development of this response. EPA determined that they do not change any of the conclusions reached in the RI/FFS (see responses to comments II.D.1.1, II.D.1.2 and II.D.1.7), nor do they lead to a change in the selected remedy. These data sets refine, but are substantially consistent with, previously collected data.

Use of 17-Mile RI/FS Data Collected in 2004-2012. Sediment data collected through 2012 were included in the CSM, as shown in figures used throughout Appendix A (Data Evaluation Reports) of the RI/FFS, including maps of surface sediment concentrations of COCs and plots of sediment concentrations at depth. Fish and crab tissue data through 2009 (the last tissue data available for EPA to incorporate before finalizing the RI/FFS) were included in the CSM, as shown in the plots of fish and crab tissue concentrations of COCs versus river mile (Appendix A of RI/FFS).

Use of Data Collected before 2004. EPA used older data sets to evaluate trends in surface sediment concentrations of COCs over time, as a line of evidence to evaluate MNR as a remedial option in the RI/FFS. As explained in the ROD, the investigation of the Lower Passaic River began in 1994, when Occidental Chemical Corporation agreed to investigate a 6-mile stretch of the Lower Passaic River (RM 1 to RM 7, termed “Passaic River Study Area”), pursuant to an administrative order on consent (AOC) with EPA. The scope of the investigation was expanded in 2002 to include the entire 17-mile LPRSA. Data sets used in trend analyses were all collected under EPA-approved quality assurance project plans (QAPPs), including data collected: in 1995 during the 6-mile Passaic River Study Area RI conducted by Tierra Solutions, Inc. (on behalf of respondent Occidental Chemical Corporation, also known as Tierra/Maxus/Occidental or TMO), under EPA oversight; in 2007-2008 as part of the expanded 17-mile LPRSA RI initiated by EPA with CPG funding; and in 2008-2012, after the CPG assumed the lead role for the 17-mile RI under EPA oversight. The tissue data sets used to evaluate trends over time were also collected under EPA-approved QAPPs developed during the 6-mile RI and the 17-mile RI.

B.1.5 Comment: Lower 8.3 mile remediation goals are inconsistent with 17-mile RI/FS risk assessments

Commenters stated that EPA’s proposed remediation goals were inconsistent with the baseline human health and ecological risk assessments being developed for the 17-mile LPRSA RI/FS by the CPG under

EPA oversight, were unattainable and sidestep EPA policy and guidance requiring that remediation goals take background concentrations into account.

Response:

As of February 2016, the 17-mile LPRSA RI/FS is still under development and EPA has not approved the human health and ecological risk assessments supporting it. The human health remediation goals for the lower 8.3 mile response action were developed based on the lower 8.3 mile RI/FFS human health risk assessment (HHRA), which evaluated risks and hazards from consumption of fish and crab using the same exposure parameters as have been established to date for the 17-mile RI/FS. The ecological remediation goals were developed based on the lower 8.3 mile RI/FFS BERA and recommendations by the NRRB and CSTAG dated April 11, 2014. The remediation goals for the 17 mile LPRSA will be developed upon completion of the 17-mile RI/FS. EPA is overseeing this process and will ensure that the approach used for the lower 8.3 miles and the 17 miles are consistent where appropriate, considering area-specific characteristics and issues.

In the RI/FFS, Proposed Plan and ROD, EPA fully explained the selection of remediation goals and described how it evaluated the effect that background contaminant concentrations will have on post-remedy conditions in the lower 8.3 miles, in accordance with both OSWER Directive No. 9285.6-07P, May 2002, *Role of Background in the CERCLA Cleanup Program* and OSWER Directive No. 9355.0-85, December 2005, *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*. See response to comment II.G.2.3.

B.1.6 Comment: Request for presentation on CPG data and model

The CAG requested a presentation discussing the status and results of the CPG's sampling and modeling of the upper nine miles of the river. Commenters stated that the CPG river model should be made available for evaluation, particularly if it contained additional data.

Response:

The purpose of the Responsiveness Summary is to respond to public comments on the alternatives evaluated in the RI/FFS and Proposed Plan, not to address on-going work being conducted for the 17-mile LPRSA RI/FS by the CPG, under EPA oversight. The 17-mile RI/FS will be the subject of a subsequent decision-making process. EPA will respond directly to the CAG's requests for information related to the 17-mile RI/FS.

B.1.7 Comment: Request for database

A commenter requested that, in addition to the data available on the web site ourPassaic.org, a searchable, relational database containing the results of the Lower Passaic River sampling programs be made publicly available.

Response:

As part of EPA's efforts to inform the public about the investigation and cleanup of the Diamond Alkali Superfund Site, including the Lower Passaic River and Newark Bay study areas, EPA has compiled all of the data generated for and used in these studies into a database and made the results available on ourPassaic.org (Digital Library, Passaic River/Newark Bay Datasets) in the form of user-friendly Excel spreadsheets. EPA currently does not have the resources to make a searchable database of the sort suggested by the commenter available to members of the public.

B.2. Tierra Removal

B.2.1 Comment: Tierra Removal, Phase 2

Commenters asked that planning for Phase 2 of the Tierra Removal action be accelerated. Commenters requested information regarding Phase 2 of the Tierra Removal action and wanted to see it completed with the lower 8.3 mile cleanup.

Response:

Planning for Phase 2 of the Tierra Removal has progressed with the collection of sediment cores in the Phase 2 area to better define the area of contamination. Cores were collected in March 2015 and a report on results submitted in August 2015. As of February 2016, EPA is evaluating next steps for this area. If the approach for addressing the Phase 2 sediments has not been determined by the time the lower 8.3-mile remedial design is underway, EPA expects that this work will be integrated with the lower 8.3-mile remedy in a coordinated and consistent manner.

C. Local Community and Local Business Concerns

C.1. Overall Project Length

C.1.1 Comment: Cleanup is taking too long

Commenters urged EPA to expedite the evaluation process, begin the cleanup immediately and clean the river up quickly. Commenters asked why the cleanup is taking so long, why EPA is doing one study after another over so many years and when the cleanup would stop being a proposal and become a reality.

Response:

The Lower Passaic River is a complex, tidal estuary, polluted by multiple contaminants since the 1800s. It has taken many years of study to understand the nature and extent of contaminants in the system, and to quantify the risks they pose to human health and the environment. EPA has overseen several projects that have started the cleanup of the river (Phase 1 of the Tierra Removal and the RM 10.9 Removal), but with the issuance of this ROD, the selection of the final remedy for the sediments of the lower 8.3 miles of the Lower Passaic River has been made. The next phase will be the remedy design. Due to the complexity and scale of the project, this is expected to take a few years, followed by remedial action, which is expected to take approximately 6 years.

C.2. Contaminants of Concern and Their Health Effects

C.2.1 Comment: Dioxin is the main contaminant of concern

Commenters noted that the Passaic River is part of the Diamond Alkali Superfund Site primarily due to dioxin from the 80-120 Lister Avenue facility in Newark, New Jersey and asked how much of the Proposed Plan is directly attributable to the removal of dioxin from the Passaic River. Commenters noted that there is a relatively small amount of dioxin by volume in the lower 8.3 miles, and asked whether the dioxin would require a different disposal method and whether it would be possible to determine the amount of dioxin being removed from given areas of the river. Commenters discussed dioxins extensively and urged EPA to make the remediation of the lower 8.3 miles a model for dredging and destroying dioxins. Commenters concurred with EPA's findings that historical loadings of chlorinated dioxins and furans, especially 2,3,7,8-TCDD, are the dominant driver of past, current and future risks to humans and wildlife in the Passaic River.

Response:

The Lower Passaic River is contaminated with many hazardous substances that contribute to the risks to human health and the environment, including, but not limited to, dioxins and furans, PCBs, polycyclic aromatic hydrocarbons (PAHs), pesticides and metals. The former Diamond Alkali facility at 80-120 Lister Avenue contributed numerous contaminants to the Lower Passaic River, including dioxins and furans, and other chemicals associated with the manufacture of herbicides and pesticides. It is only one of the facilities that contributed hazardous contaminants, including dioxins, to the river. To date, EPA has named well over 100 parties potentially responsible for past discharges of hazardous contaminants to the river. Remediating the lower 8.3 miles of the Lower Passaic River will address all of the hazardous contaminants in the sediments of this stretch of the river. There is no precise formula to evaluate how much the selection of the remedy, or the cost of the remedy, is directly attributable to any one hazardous contaminant.

EPA calculated that 24 kilograms (kg) of 2,3,7,8-TCDD are present in the sediments of the lower 8.3 miles of the Passaic River. This is an estimate based on sampling data. Due to the toxicity of dioxin, relatively small quantities can have a big effect on human health and the health of organisms living in the river.

As described in the RI/FFS and Proposed Plan, the presence of dioxin in the sediment of the lower 8.3 miles is relevant to how the dredged material will be disposed of, but it is not the only factor. Some lower 8.3-mile sediments have the potential to be characterized as hazardous under Resource Conservation and Recovery Act (RCRA) regulations. That characterization would be based on the sediments' failure of the Toxicity Characteristic Leaching Procedure (TCLP), not on dioxin concentrations. Once sediments are characterized as hazardous, RCRA requires treatment not just for chemicals that caused the sediments to be classified as hazardous, but for all "underlying hazardous constituents" (i.e., any other chemicals exceeding RCRA's land disposal standards), including dioxin. At this time, incineration is the only technology known to be able to treat sediments to the applicable RCRA standards when the sediments have been characterized as hazardous under RCRA and also contain dioxin as an underlying constituent at concentrations that trigger the treatment requirement.

It might be possible to estimate the amount of dioxin being removed from given areas of the river, depending on the sampling and analysis of the sediments. However, analysis of sediments removed from the river will be primarily for purposes of characterizing the material for disposal, not for estimating the amount of dioxin contained in the sediment. For further discussion of how the sediment will be evaluated for disposal, including the potential for treatment, see response to comment II.H.2.4

EPA calculated cancer risks and noncancer health hazards associated with consumption of fish and crab for the COCs present in the sediment of the lower 8.3 miles. The results of the HHRA indicated that dioxins/furans and PCBs are the primary contributors to the human health risk and noncancer health hazard for ingestion of fish and crab, with mercury being another contributor. The results of the BERA indicated that ecological risk drivers differed depending on the receptor: dioxins, DDT, PCBs, PAHs, dieldrin and mercury contribute most substantially to risks to benthic invertebrates; PCBs, dioxins and DDT contribute substantially to risks to aquatic-dependent birds; and dioxins, PCBs and mercury contribute substantially to risks to aquatic-dependent mammals.

C.2.2 Comment: Amount of contamination left under the engineered cap

Commenters asked how many pounds of contaminants would be left under the cap under EPA's preferred alternative.

Response:

As described in the RI/FFS and Proposed Plan, EPA estimated that the inventory of contaminated fine-grained sediments in the lower 8.3 miles of the Lower Passaic River includes approximately 24 kg of 2,3,7,8-TCDD, 23,000 kg of Total PCBs, 4,200 kg of Total DDx and 41,000 kg of mercury. As discussed in the response to comment II.H.3.3, EPA adjusted the extent and depth of the navigation channel included in Alternative 3, which became the selected remedy in the ROD. Under the selected remedy, approximately 6 kg of 2,3,7,8-TCDD, 3,000 kg of Total PCBs, 600 kg of Total DDx and 11,000 kg of mercury will be removed from the river. Therefore, approximately 18 kg of 2,3,7,8-TCDD, 20,000 kg of Total PCBs, 3,600 kg of Total DDx and 30,000 kg of mercury will be left under the bank-to-bank engineered cap. These numbers are all estimates based on sampling data.

The engineered cap will be designed to sequester any contaminants left in the river so that they will not pose unacceptable risks to human health and the environment, with regular monitoring and maintenance of the cap.

C.2.3 Comment: Health effects of contaminants and river water

Commenters expressed concern that the contaminants in the river are harmful to women of childbearing age and children, and that their effects are magnified when combined with other economic and environmental problems experienced by Newark's poorest communities. One rower observed that she has been splashed by river water with no health effects, while others expressed concern that they had been exposed to health effects after their hands had come into contact with Passaic River water. Commenters stated that eating fish contaminated with dioxin causes cancer, which causes people to die. Commenters asked about the health risks posed by past and potential future Passaic River cleanups.

Response:

The RI/FFS and Proposed Plan describe the human health and environmental effects of each of the COCs, which EPA evaluated in the RI/FFS HHRA and BERA. In a Superfund human health risk assessment, EPA assesses the extent to which long-term exposure to contaminants, depending on concentration, may increase the probability that a person will develop cancer or other noncancer health effects, such as reproductive problems, problems in fetal or early childhood development, or immune system damage, among others. EPA is aware that people who live near the Passaic River may experience other stressors such as those mentioned by the commenters, but the Superfund risk assessment process does not incorporate non-chemical social stressors, nor does it incorporate biological pollutants such as pathogens. The exposure route evaluated by EPA in the RI/FFS and Proposed Plan was eating contaminated fish and crab from the lower 8.3 miles of the Passaic River, as this is the pathway anticipated to be associated with the highest risks and hazards. Other exposure routes, such as dermal contact with sediment and surface water, are being evaluated in the 17-mile LPRSA RI/FS risk assessments. EPA has no evidence that an occasional exposure to a splash of surface water in the Passaic River would give rise to an unacceptable risk of cancer or noncancer effects. The risks and hazards evaluated by EPA in the RI/FFS arise from frequent on-going exposures to the COCs through ingestion of fish or crab. EPA and NJDEP also recommend that individuals follow fish and crab consumption advisories for the Lower Passaic River and Newark Bay.

The health risks addressed by this remediation are due to long-term exposure to contaminants in the sediments and fish or crab tissue in the lower 8.3 miles of the Passaic River. In contrast, EPA evaluated adverse impacts due to short-term exposure during remedial construction under the short-term effectiveness criterion of the NCP. These include direct contact, ingestion and inhalation of contaminants from surface water and sediments and routine physical hazards associated with construction work and working on water. Measures to minimize and mitigate such risks will be addressed in community and worker health and safety plans, by the use of best management practices and by following properly approved health and safety procedures.

During Phase 1 of the Tierra Removal and the RM 10.9 Removal in Lyndhurst, air monitors were deployed to monitor air emissions and criteria were developed to change the way dredging was done or to stop work should emissions exceed risk-based criteria. During the remedial design for the lower 8.3 miles of the river, EPA expects to conduct extensive public outreach so that stakeholders will have the opportunity to provide input into the remedial design, including details of construction impact mitigation and communication during implementation.

C.3. Long-Term Access to the River, Economic Development and Restoration

C.3.1 Comment: Long-term economic development

Commenters said that EPA's proposed cleanup plan does not include any measures to encourage or enhance the development of small businesses in all of Newark. Other commenters stated that EPA's proposed cleanup plan would result in a clean river, which would spur economic development, growth and jobs in the communities along the banks of the Passaic River. Commenters asked why EPA is not advocating for or advancing river bank improvements that would encourage economic development along the Passaic River.

Response:

Under the Superfund law, EPA’s goal is to reduce risks to human health and the environment from exposure to hazardous substances identified as COCs to target ranges defined in the law and EPA guidance documents. Business development is not a goal of the Superfund process, and the Proposed Plan could not include measures to accomplish that goal. A cleaner lower 8.3 miles of the Lower Passaic River is likely to spur economic development, growth and jobs in the communities along the banks of the river. However, EPA does not have the authority under the law to advocate for or advance economic development projects that are unrelated to cleaning up hazardous wastes and reducing risks. See also response to comment II.I.6.1.

C.3.2 Comment: Accounting for future use of the river in the selected remedy

Commenters said that future uses should be taken into account during the cleanup and that future development along the river, including waterfront parks, is a critical component of community and river recovery. Commenters were concerned that the preferred cleanup plan did not include landscape improvements in the areas surrounding the Passaic River or any out-of-river improvements geared toward attracting residents back to the Passaic River, encouraging economic development and mitigating flooding impacts. Commenters questioned whether the community would have any more use of the river than it does now. Commenters said that the purpose of the cleanup is not just to meet a standard, but to improve the river to the benefit of society, which means integration with redevelopment, social objectives and neighborhood improvements. Commenters stated that Newark's 2012 Master Plan includes numerous redevelopment and public access plans for the Passaic River that demonstrate the city's support for a cleanup of the river.

Response:

As documented in the RI/FFS and Proposed Plan, EPA considered a 2010 USACE Lower Passaic River Commercial Navigation Analysis report that included 1) a berth-by-berth analysis for 1997-2006 documenting that the lower 1.7 miles of the navigation channel are still in use for commercial navigation by a number of companies; and 2) a 2009 USACE survey of commercial users showing potential future commercial use of the channel up to RM 2.2. Based on these reports, and in consultation with USACE and NJDEP, EPA incorporated dredging to various depths in the navigation channel from RM 0 to RM 2.2 in Alternative 3, the preferred alternative in the Proposed Plan. In the Proposed Plan, EPA specifically requested public comments on the depths that would result from the proposed capping in the federally authorized navigation channel, specifically, whether shallower depths might accommodate reasonably-anticipated future uses in the lower 2.2 miles of the river.

As discussed in the responses to comments II.C.4.7 and II.H.3.3, EPA reexamined available information pertaining to current and future commercial uses of the Lower Passaic River navigation channel submitted and obtained during the public comment period. In further consultation with USACE and NJDEP, EPA adjusted the extent and depths of the navigation channel included in the selected remedy in the ROD to the following: 30 feet mean low water (MLW) from RM 0 to RM 0.6, and 20 feet MLW from RM 0.6 to RM 1.7. USACE has advised that it will support a recommendation for Congressional action to deauthorize the authorized navigation channel in RM 1.7 to RM 8.3 and modify the authorized depths from RM 0.6 to RM 1.7.

EPA also reviewed local government master plans and evaluated a 2007 State of New Jersey study that showed that the communities above RM 2.5 have included future increases in recreational access to the river in their master plans. Based on that information, in the portion of the river in which EPA anticipates the navigation channel will be deauthorized (i.e., between RM 1.7 and RM 8.3), reasonably anticipated future land and water uses include recreation (rowing and boating) and light commercial uses (water taxis), supporting a water depth of about 10 feet. The results of the master plans and New Jersey study were taken into account by EPA in the development of the selected remedy, which will result in attaining a minimum final water depth of approximately 10 feet for recreational uses. This generally requires smoothing of the sediment in some areas prior to cap placement as opposed to extensive additional dredging.

The Proposed Plan and ROD include targets for contaminant levels in sediment that will result in the reduction of risks from exposure to hazardous substances identified as COCs to meet EPA's protective goals, consistent with EPA's authority under the Superfund law. Under Superfund law, EPA cannot require measures that are unrelated to the purpose of reducing risks, such as out-of-river landscape improvements or improvements for the purpose of economic development or flood mitigation, except in the course of repairing property affected by remedial activities. (EPA's remedy does include restoration of habitat damaged by the remedial action.) However, EPA's experience at other Superfund sites is that, after remediation, the cleaner site often encourages economic development and enables the community to have more use of the site than when it was contaminated.

The selected remedy includes dredging prior to placement of the engineered cap to ensure that the capping will not worsen flooding. The USACE has authority to address flooding impacts. EPA understands that, as a separate matter unrelated to EPA's Superfund cleanup, the USACE has proposed projects for mitigating flooding impacts on the Lower Passaic River (see response to comment II.C.7.1). EPA will continue to coordinate with the USACE so that flood mitigation projects, if any, are consistent with the CERCLA remedial action.

C.3.3 Comment: Public access to the river

Commenters urged EPA to include in the remedial design more public access to and from the water for boaters with the addition of public floating docks and walkways from the docks to the shore. Commenters stated that a restored river would mean more desire for use and access. Commenters said that a project that results in a clean but inaccessible river is an unacceptable result. Commenters stated that the boating community is important to the current and future life of the river and adjacent communities, and that access and ability to use the river in all phases of the cleanup process and as a priority outcome of the cleanup itself are important. Commenters proposed that river access that will benefit the communities might at least somewhat offset the impact of remedial implementation.

Response:

Under Superfund law, EPA's goal is to reduce risks to human health and the environment from exposure to hazardous substances identified as COCs to target ranges defined in the law and EPA guidance documents. EPA does not have the authority to require public floating docks and walkways in the remedial design for the lower 8.3 miles of the Passaic River, because they do not serve to reduce risks from exposure to hazardous substances in the sediments. However, EPA's experience at other Superfund sites is that, after remediation, the cleaner site often encourages local municipalities and private entities to develop more public access to and from the water for recreational purposes than when the river was contaminated.

C.3.4 Comment: Integrating restoration into the selected remedy

Commenters asked EPA to plan for the integration of restoration with remediation, consider public access to the river in the design and explain how the remedy would deal with soft edges and littoral zone. Commenters indicated that shoreline restoration should be part of any remediation plan.

Response:

EPA is one of a group of Partner Agencies (including USACE, NJDEP, NOAA and USFWS) that are working cooperatively to remediate and restore the Lower Passaic River under separate authorities. During remedial design, EPA expects to work with the Partner Agencies to integrate restoration plans, such as USACE's Comprehensive Restoration Plan for the Hudson-Raritan Estuary. That design work will explain how the remedy would deal with soft edges and littoral zones. In general, when Superfund remedial actions damage or disturb wetlands and aquatic habitat, the remedy includes measures to reconstruct or replace those resources. When and if this becomes necessary during the course of the remedy for the lower 8.3 miles, details of design for habitat reconstruction will be developed with input from the local community and other stakeholders.

Shoreline structures such as docks, boat ramps and bulkheads are considered private property, and it is the responsibility of the property owners to repair and maintain them, subject to legal requirements imposed by the state or federal authorities, such as the USACE. At the same time, in general, when Superfund remedial actions damage or disturb shoreline structures, the remedy includes measures to reconstruct or replace those structures. Further enhancement of the shorelines may be considered by the Partner Agencies under Water Resources Development Act (WRDA) authority. Because the remedy includes dredging close to shorelines, specific offsets will need to be determined during the remedial design and remedy implementation stages to ensure the geotechnical stability of the currently hardened shorelines (see response to comment II.H.4.10 for more details). In addition, while dredging rates and construction duration were based on the assumption of two main dredges, EPA also assumed that one smaller dredge would be necessary for slower, more careful work such as dredging close to shorelines.

C.3.5 Comment: Proposed Plan did not evaluate biological pollution and floatables from CSOs and SWOs

Commenters expressed concern that none of the alternatives evaluated in the Proposed Plan addressed biological pollution and floatables from CSOs and SWOs.

Response:

Biological pollution and floatables from CSOs and SWOs are addressed under the Clean Water Act. EPA's CSO Control Policy, published April 19, 1994, is the national framework for control of CSOs. In 2013, EPA issued a combined Request for Information and Administrative Compliance Order to Newark that required the City to, among other things, develop and submit a schedule for sewer system repairs and submit quarterly reports on any inspections, citizen complaints and resulting repairs or improvements, and ordered the City to improve and implement its operation and maintenance plan. In New Jersey, NJDEP implements the stormwater permitting program, which regulates the discharge of stormwater into water bodies. The federal Superfund Program addresses hazardous substances, pollutants and contaminants that cause cancer risks and noncancer health hazards to humans (a category that does not include biological pollution and floatables), as well as risks to biota in the environment. Therefore, the alternatives evaluated in the Proposed Plan address the hazardous substances in the sediments of the lower 8.3 miles of the Passaic River.

C.4. Alternatives

C.4.1 Comment: Support for No Action

Commenters supported No Action, because the disruption to wildlife from remediation would be too great.

Response:

EPA did not select Alternative 1 (No Action), because it would not be protective of human health and the environment, would not contribute toward eventual achievement of federal and state surface water ARARs, would not be effective in addressing the contaminated sediments that are causing the unacceptable risks identified in the baseline risk assessments, and would provide no reduction of toxicity, mobility or volume of contaminants through treatment. The absence of construction impacts associated with No Action does not outweigh the negatives associated with doing nothing. Given the magnitude of the remedial action, all aspects of the work under the selected remedy are likely to have short-term impacts on the environment, including wildlife, that EPA will minimize to the extent practicable. Potentially adverse impacts on wildlife during construction are evaluated in the RI/FFS and Proposed Plan under short-term effectiveness, as discussed in the response to comment II.C.6.2. EPA has experience managing such adverse impacts from remediating many Superfund sites around the country (also discussed in the response to comment II.C.6.2).

C.4.2 Comment: Support for Alternative 2 (Deep Dredging with Backfill)

Commenters expressed support for Alternative 2 (Deep Dredging with Backfill), for the following reasons: 1) the companies potentially responsible for disposing of contaminants into the river should be required to pay for the most expensive and comprehensive cleanup plan; 2) this alternative would remove the toxic contaminants permanently; 3) it is the only alternative that does not require perpetual maintenance of caps; and/or 4) it would prove to be the least-expensive in the long run due to its permanence. Commenters expressed support for removing all contaminated sediments from the river.

Response:

Under Superfund law, EPA is required to evaluate remedial alternatives using nine criteria. The criteria do not address the question of who will perform the remedial action, or the amount that PRPs should be required to pay for remediation.

One of the nine criteria is reduction in toxicity, mobility or volume through treatment, which addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and/or significantly reduce the toxicity, mobility or volume of hazardous substances as their principal element. In its evaluation under this criterion, EPA found that Alternative 2 (Deep Dredging with Backfill) would remove more toxic contaminants permanently than any of the other alternatives. Another of the nine criteria is long-term effectiveness and permanence, which takes into account the residual risk remaining at the conclusion of remedial activities, and the adequacy and reliability of containment systems and institutional controls. In its evaluation under this criterion, EPA found that Alternative 2 would not require perpetual maintenance of a cap in the river, while Alternatives 3 (Capping with Dredging for Flooding and Navigation) and 4 (Focused Capping with Dredging for Flooding) would. EPA found that there are significant drawbacks associated with Alternative 2 under some of the other criteria, such as short-term effectiveness, implementability and cost. For example,

- While both Alternatives 2 and 3 meet the threshold criterion of protectiveness, Alternative 3 will do so in less than half the construction time of Alternative 2 and with a smaller volume dredged than Alternative 2. This means that under Alternative 3, the selected remedy, there will be significantly less short-term impact on the community, workers and the environment than under Alternative 2.

- Alternative 3, the selected remedy, is more implementable than Alternative 2, because Alternative 3 involves a significantly smaller dredging volume and shallower dredging depths than Alternative 2, which means less challenging logistics for sediment handling and fewer utilities to be located and evaluated.
- Alternative 3, the selected remedy, is less costly than Alternative 2, under each corresponding Dredged Material Management (DMM) Scenario.

The cost of maintaining the engineered cap over the long-term is included in the cost estimates of Alternatives 3 and 4. Even with long-term cap maintenance included, Alternatives 3 and 4 are less expensive in the long run than Alternative 2, under each corresponding DMM Scenario. While the long-term effectiveness is tied to maintenance of the cap in perpetuity, when compared with Alternative 2, Alternative 3 offered overall greater benefits in terms of implementability, short-term impacts and cost, while providing approximately the same level of protectiveness. While Alternative 4 would have a smaller short-term impact and be less costly than Alternative 3, Alternative 4 was not selected, because it did not meet the threshold criterion of overall protectiveness of human health and the environment, as well as comparing less favorably in the analysis of the other balancing criteria, as discussed in the response to comment II.C.4.9.

C.4.3 Comment: Opposition to capping

Commenters expressed opposition to capping as a remedy for the lower 8.3 miles, on the basis that: 1) extremely toxic contaminants would remain in the river as a problem for future generations; 2) a cap would fail due to flooding, scouring and underwater springs in the river; 3) bank-to-bank capping has never been done before; 4) capping technology has only been in place for approximately ten years, so its long-term effectiveness is unknown; and 5) a cap would require costly regular maintenance that would be difficult to do, since it cannot be visually inspected at any time. Commenters said that the cap at the RM 10.9 Removal area is being swept away. Commenters expressed opposition to capping contaminants in the river[3] on the basis that contaminants would be exposed again if the cap is not perfectly maintained. Commenters questioned whether there would be the political will to continue long-term monitoring and maintenance of the cap. Commenters noted that both the cap over the lower 8.3 miles and the cap over the CAD site in Newark Bay would have to be maintained in perpetuity.

Response:

Capping technology has been used to contain contaminated sediments for well over 30 years. According to EPA's 2005 *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*, as of 2004, capping had been selected as a component of the remedy for contaminated sediment at approximately 15 Superfund sites. Engineered caps have been installed bank-to-bank at sites such as the Grand Calumet River in Indiana. A survey of contaminated sediment capping projects conducted for the Lower Fox River and Green Bay, Wisconsin RI/FS (WDNR, 2002a,b) shows caps installed as early as 1978 had no chemical migration through them detected in subsequent monitoring programs. The USACE's 1998 *Guidance for Subaqueous Dredged Material Capping* describes USACE's experience capping contaminated dredged materials in open-water sites as beginning in the late 1970s, with over 20 capping projects in place as of the publication of that document. Monitoring data from many capped sites show that engineered caps are effective in isolating contaminated sediments from the environment, provided they are monitored and maintained. The bank-to-bank engineered cap included

[3] One commenter prefaced his statement by opposing "option 2," although his comments expressed opposition to capping.

in the selected remedy will be effective in isolating the contaminants in the lower 8.3 miles of the Passaic River, so that they will not be a problem for future generations, as long as the cap is monitored and maintained. As discussed above, EPA and USACE have experience monitoring and maintaining caps, even though they may not be visually inspected at all times.

The engineered cap developed in the RI/FFS and evaluated in the Proposed Plan was designed to withstand a 100-year flood event. The estimated cost of the cap included monitoring and maintenance, assumed to occur on a regular basis and after storm events, so that lost cap materials will be replaced and protectiveness maintained.

EPA agrees that future monitoring and maintenance of the cap are important elements of the remedy for the lower 8.3 miles, and that a cap in the lower 8.3 miles of the Passaic River and a cap over a CAD site in Newark Bay, if EPA were to select CAD for dredged materials management, would both have to be maintained in perpetuity. Planning the optimal method to assure the performance of future work is an aspect of implementation and potentially, enforcement, but is not an evaluation criterion (i.e., it should not point to the selection or rejection of one alternative over another).

To date, EPA's review of the cap at RM 10.9 shows that it is actually accreting sediments. It is not being eroded or "swept away."

C.4.4 Comment: Potential misunderstanding of EPA's preferred alternative

Commenters stated their support of EPA's preferred cleanup plan, but described it as "a comprehensive removal of contaminants" from the river and said that they did not believe in capping.

Response:

EPA's preferred alternative and selected remedy is Capping with Dredging for Flooding and Navigation with Off-Site Disposal of dredged materials. The remedy relies on a bank-to-bank engineered cap maintained in perpetuity and institutional controls to protect the cap and human and ecological health until RAOs are achieved. The engineered cap will be installed in the lower 8.3 miles of the Passaic River, with the exception of those areas where results of the pre-design investigation show that dredging will remove all of the contaminated fine-grained sediments, so that two feet of sand can be installed as backfill to address dredging residuals (EPA expects those areas to be in the navigation channel between approximately RM 0 and RM 0.6). Opposition to capping is addressed in the response to comment II.C.4.3.

C.4.5 Comment: Maintenance of the engineered cap

Commenters asked how long a cap would last, whether it will be a permanent solution, who would be responsible for maintaining the cap, what kind of maintenance would be necessary, and how much that maintenance would cost (per year and per storm). Commenters suggested that the PRPs be required to establish a trust fund to be held in escrow in case of catastrophic failure of the cap, while other commenters suggested that a permanent source of funding be established with a separate corporate structure so that maintenance would not be dependent on the responsible parties and government agencies would not be able to divert the funding to other uses. Commenters asked that EPA prepare a robust plan to ensure that the cap will remain protective in perpetuity, incorporating financial, legal and practical requirements for carrying out long-term monitoring and maintenance. A commenter stated that the 30-year monitoring period assumed in the FFS was wholly insufficient given that this remedy must work in perpetuity and that EPA should have prepared a cost estimate for the proposed cleanup that used a monitoring and maintenance period much longer than 30 years, as well as a "no discounting" scenario, to more accurately reflect the length of time that monitoring and maintenance would be needed.

Response:

As documented in the RI/FFS and Proposed Plan, the selected remedy is a permanent solution and will be effective in limiting the risk of exposure to contaminants in the sediments of the lower 8.3 miles of the Passaic River provided the integrity of the engineered cap is maintained. Therefore, the cap will need to be monitored and maintained in perpetuity. As discussed in response to comment II.C.4.3, *in situ* capping has been selected as a component of the remedy for contaminated sediment at other Superfund sites. This history of capping use shows that capping, with proper monitoring and maintenance is a permanent solution that can provide long-term protectiveness for human and environmental health by sequestering contaminated sediments.

Monitoring and maintenance of the engineered cap will be required as part of the implementation of the remedy. The mechanism for assuring monitoring and maintenance will be determined during future discussions with parties implementing the selected remedy.

EPA agrees that a robust plan is needed to assure that the cap remains protective. The frequency of monitoring and maintenance, as well as the cost, will be established during remedial design. For purposes of evaluating remedial alternatives in the FFS and Proposed Plan, EPA estimated the costs of long-term monitoring and maintenance of the cap (details can be found in RI/FFS Appendix H, Chapter 5). Costs included mobilization and demobilization of monitoring and maintenance equipment, bathymetric surveys, sampling and chemical analyses for evaluation of cap performance, assumptions for the amount of cap material that would be replaced periodically (e.g., after storm events) and annually. Cap maintenance costs were estimated for 30 years into the future, in accordance with EPA guidance (EPA, 1988). In addition, consistent with EPA guidance (EPA, 2000d), EPA used present value analysis to evaluate the costs of each alternative. This standard methodology allows for cost comparisons of remedial alternatives with different construction and operation and maintenance (O&M) durations on the basis of a single cost figure for each alternative. With the use of present value discounting, the cost of maintaining the cap beyond 30 years is so small that it does not change the overall cost of the selected remedy sufficiently to carry the estimate beyond 30 years. Table II.C.4.5 - 1 shows present value costs for the selected remedy estimated with O&M (including cap maintenance) for 30 years and for 100 years (based on updated cost estimates presented in Section III.D.1 and included in the ROD as Table 26 in Appendix II). For the selected remedy, the estimated present value cost based on 100 years of O&M differs from the estimated present value cost based on 30 years of O&M by less than 0.5 percent.

While EPA did not calculate and compare the total costs of the remedial alternatives using a no discounting scenario, the FFS did present all costs before discounting was applied (RI/FFS Appendix H Tables 1-2 through 1-10), so that a no discounting scenario could have been calculated. Table II.C.4.5 - 1 (which is based on updated cost estimates presented in Section III.D.1 and included in the ROD as Table 32 in Appendix II) shows costs for Alternative 2 with DMM Scenario A, Alternative 2 with DMM Scenario B, Alternative 3 with DMM Scenario A and Alternative 3 with DMM Scenario B (the selected remedy) with no discounting applied, all estimated with O&M for 30 years and 100 years. The no discounting scenario, with O&M for 30 years or 100 years, does not change EPA's conclusion that Alternative 2 is more costly than Alternative 3 under the same DMM Scenario.

C.4.6 Comment: Effect of an engineered cap on future use of the river

Commenters opposed capping as a remedy, because a cap would be detrimental to future boating activities on the river by: 1) restricting anchoring even in emergencies; 2) designating the lower 8.3 miles of the river a slow or no-wake zone; 3) precluding the installation of floating docks, boat ramps and piles through the cap; and 4) leaving mudflats that would prevent boats from reaching the shoreline, except at high tide. Commenters were also concerned that a cap would prohibit yachts, passenger and sightseeing boats from reaching tourist destinations (such as entertainment venues, hotels and restaurants), prevent the return of commercial shipping to North Newark and require setbacks or no-build zones on shore. Commenters who were in favor of capping wanted cap design and placement to be done in coordination with future restoration projects and public access. Commenters described the River Mile 10.9 Removal as having left behind a cap with sharp rocks exposed that are hazards to boating in the area and asserted that EPA's preferred cleanup plan would produce the same type of cap.

Response:

For those alternatives that relied on an engineered cap for protectiveness in the RI/FFS (Alternatives 3 and 4), EPA identified institutional controls that might be needed to protect the cap and ensure that it would remain protective in the future. EPA provided this information so that interested stakeholders could evaluate the remedial alternatives that included capping and provide meaningful comments about their preferences. The particular restrictions and controls identified by the commenters may not be necessary, or, to the extent incorporated in the remedy, may be confined to limited areas of the lower 8.3 miles. During remedial design, EPA will consider community preferences expressed during the public comment period for the Proposed Plan and input gathered during additional public outreach in the design of the cap and decision about the restrictions and institutional controls that are needed to protect the integrity of the cap. EPA does not agree that the cap at RM 10.9 creates hazards to boating and does not expect the cap to prevent current and/or reasonably anticipated future uses of the river, as discussed in response to comment II.C.4.7.

C.4.7 Comment: Support for additional dredging in the navigation channel

Commenters urged EPA to dredge the navigation channel to the maximum extent, so that future maritime activities are not compromised, with some commenters advocating restoration of the navigational channel in the entire lower 8.3 miles. Commenters requested that EPA consider dredging deeper in the navigation channel, because sedimentation would fill in the channel faster than expected. A commenter said that removal of contaminated sediments from the navigation channel is critical to his company's continued operation at a port facility in the lower two miles of the Passaic River. The commenter added that lack of channel maintenance had restricted vessel access to his docks due to shoaling in the river, causing the company to move vessels only at high tide or to refrain from fully loading vessels. Commenters cited the Hudson River and Lockheed West Seattle as examples of Superfund sites where dredging for navigational purposes was included as part of the CERCLA selected remedy.

Response:

Under Superfund law, EPA's purpose for cleaning up Superfund sites is to reduce risks to human health and the environment from exposure to hazardous substances identified as COCs to target ranges defined in the law. In developing alternatives for remediation, EPA considers the future use of the resources being cleaned up. EPA also must comply with applicable laws, such as the Rivers and Harbors Act, which prohibits creation of an obstruction to the navigable capacity of the waters of the United States without Congressional authorization.

As discussed in the response to comment II.H.3.3, EPA considered a 2010 USACE Lower Passaic River Commercial Navigation Analysis report that included 1) a berth-by-berth analysis for 1997-2006 documenting that the lower 1.7 miles of the navigation channel are still in use for commercial navigation by a number of companies; and 2) a 2009 USACE survey of commercial users showing potential future commercial use of the channel up to RM 2.2. The USACE report establishes that the river continues to be used for commercial navigation from RM 0 to RM 1.7. However, since the 2009 survey included in the USACE report, EPA has not received any information of current commercial navigational use of the channel above RM 1.7. USACE has advised that it will support a recommendation for Congressional action to deauthorize the authorized navigation channel in RM 1.7 to RM 8.3 and to modify the authorized depths from RM 0.6 to RM 1.7.

EPA also reviewed local government master plans and evaluated a 2007 State of New Jersey study that showed that the communities above RM 2.5 have included future increases in recreational access to the river in their master plans. Reasonably-anticipated future uses include recreation (rowing and boating) and light commercial uses (water taxis). In the portion of the river in which EPA anticipates the navigation channel will be deauthorized, water depths of approximately 10 feet are sufficient to support these future uses.

The 2010 USACE Lower Passaic River Commercial Navigation Analysis report, local government master plans, 2007 State of New Jersey study, information submitted and obtained during the public comment period and extensive consultation with USACE and NJDEP were all taken into account in the development of EPA's selected remedy. Thus, the remedy includes dredging in the lower 1.7 miles of the federally-authorized navigation channel beyond the depth necessary just to prevent the cap from exacerbating flooding. The end result will be to accommodate navigational depths that are consistent with current commercial use. From RM 1.7 to RM 8.3, the final water depth will be at least 10 feet for recreational use. EPA did not receive any information providing a basis to support dredging the navigational channel to the maximum extent of the authorized depth, except in the reach of the river between RM 0 and RM 0.6.

EPA is not aware of any data or analyses to support sedimentation rates other than those used in the computer modeling that was performed to support the depths developed for Alternative 3, the selected remedy. Additional modeling will be performed during remedial design to support the determination of final dredging depths, but EPA does not anticipate that any additional dredging will be appropriate.

The comment that lack of channel maintenance has restricted vessel access to docks due to shoaling in the river, causing companies to move vessels only at high tide or to refrain from fully loading vessels, is consistent with the findings in the USACE 2010 survey of commercial users.

C.4.8 Comment: Additional dredging in the navigation channel should not interfere with environmental improvement

Commenters stated that the most likely boat traffic in the future would be pleasure craft and that the remedial design should incorporate provisions for docking facilities and boat ramps. Should a choice have to be made between improving the river ecosystem and maintaining a channel for freight traffic, commenters would choose the ecosystem. Commenters stated that, while increased navigation may have a positive commercial impact on the State of New Jersey, dredging the navigation channel should not be paid for out of funds allocated for environmental cleanup of contaminants.

Response:

As discussed in the response to comment II.H.3.3, EPA considered a 2010 USACE Lower Passaic River Commercial Navigation Analysis report that included 1) a berth-by-berth analysis for 1997-2006 documenting that the lower 1.7 miles of the navigation channel are still in use for commercial navigation by a number of companies; and 2) a 2009 USACE survey of commercial users showing potential future commercial use of the channel up to RM 2.2. In addition, EPA reexamined available information pertaining to current and future commercial uses of the Lower Passaic River navigation channel submitted and obtained during the public comment period, which did not document any current commercial navigational use of the channel above RM 1.7. EPA also evaluated a 2007 State of New Jersey study, which showed that communities above RM 2.5 have included future increases in recreational access to the river in their master plans.

Since the remediation under CERCLA is required to comply with laws such as the Rivers and Harbors Act, which prohibits creation of an obstruction to the navigable capacity of the waters of the United States without Congressional authorization and is a location-specific ARAR, the selected remedy includes deeper dredging in the navigation channel in the lower 1.7 miles of the river. The remedy also provides for a minimum of 10 feet of water depth above RM 1.7 to accommodate reasonably anticipated future commercial and recreational land and waterway uses.

C.4.9 Comment: Support for Alternative 4 (Focused Capping with Dredging for Flooding)

Commenters expressed support for Alternative 4 or a combination of Alternative 4 and the CPG's "Sustainable Remedy," for the following reasons: 1) in order to allow the final cleanup to address chemical, biological and floatable pollutants; 2) because it would cause the least amount of disturbance so that the river could recover from the short-term impacts of construction; and 3) because it is more achievable and cost-effective.

Response:

Under Superfund law, EPA's purpose for remediating Superfund sites is to reduce risks to human health and the environment from exposure to hazardous substances identified as COCs to target ranges defined in the law and EPA guidance documents. Under Superfund law, EPA does not have the authority to require that a remedy address biological and floatable pollutants, because they do not serve to reduce risks from exposure to hazardous substances. Therefore, even if EPA had selected Alternative 4 (Focused Capping with Dredging for Flooding) or a combination of Alternative 4 and the CPG's "Sustainable Remedy", EPA could not require a cleanup that addressed biological and floatable pollutants that are not also hazardous substances, as that term is defined under CERCLA. As discussed in the response to comment II.C.3.5, biological pollution and floatables from CSOs and SWOs are addressed under the Clean Water Act.

Within the NCP's nine criteria that EPA is required to use to select a remedy, the short-term impacts of construction are included in the analysis of short-term effectiveness, and achievability is included in the analysis of implementability. Cost effectiveness is evaluated by balancing cost with the other criteria. Overall effectiveness of a remedial alternative is determined by evaluating long-term effectiveness and permanence; reduction in toxicity, mobility and volume through treatment; and short-term effectiveness. Overall effectiveness is then compared to cost to determine whether the remedy is cost-effective.

As described in the RI/FFS, Proposed Plan and ROD, EPA found that Alternative 4 would cause the least amount of disturbance to the river environment. However, Alternative 4 would not be more implementable or achievable than the other active alternatives, because Alternative 4 would face a significant technical feasibility challenge, as documented in the RI/FFS, Proposed Plan and ROD. Under Alternative 4, the process of reliably identifying discrete areas that release the most contaminants into the water column would involve a great degree of uncertainty, given the complex estuarine environment of the lower 8.3 miles of the Lower Passaic River. The river bottom changes constantly as the tides move back and forth twice a day, and unpredictably, as storm events scour different areas depending on intensity, location and direction of travel. In addition, while the configuration of Alternative 4 presented and evaluated in the ROD does not include dredging and capping of discrete areas in the navigation channel below RM 2.7, should such areas be identified in the navigation channel below RM 1.7 during design, Alternative 4 may also face an administrative implementability hurdle with respect to obtaining deauthorization or modification of the navigation channel in the lower 1.7 miles of the river. Given the current and reasonably anticipated future use of the navigation channel (see response to comment II.H.3.3), such Congressional action might not be obtained.

Finally, as documented in the RI/FFS, Proposed Plan and ROD, Alternative 4 is less cost effective than the selected remedy, Alternative 3, because, although Alternative 4 would cost less than the selected remedy, Alternative 4 would not reduce risks enough to meet the threshold NCP criterion of overall protection of human health and the environment and it would offer much less long-term effectiveness and permanence than the selected remedy.

C.5. Dredged Material Disposal Options

C.5.1 Comment: Opposition to CAD in Newark Bay

Commenters expressed opposition to a CAD site in Newark Bay for disposal of dredged materials, on the basis that: 1) the toxicity of or high contaminant concentrations in Passaic River sediments would cause risks to human or ecological health, should any dredged materials escape during transport to or filling of the CAD cells; 2) it would not make sense to take contaminated sediment out of one waterbody just to dispose of it in another, connected waterbody; 3) CAD cells would contribute to environmental harm in the Passaic River and Newark Bay; 4) it would lead to Newark Bay becoming a dumping ground for the region's toxic sediments; and 5) there is insufficient history of reliable data about the effectiveness of CAD cells. Commenters expressed concern that the dredged materials being discharged through the Newark Bay water column might not all end up in the CAD cell, or that an accident, such as a boat straying from the navigation channel, would cause the release of contaminants from a CAD cell. Commenters requested that EPA take the same approach as was taken in the Honeywell Corporation's cleanup of chromium-contaminated sediments in the Hackensack River, where a federal court ordered Honeywell to take the dredged sediments to a landfill for disposal. Commenters asked whether EPA might build a CDF in Newark Bay and expressed opposition to that approach as well.

Response:

EPA evaluated use of CAD to manage dredged materials, but did not select it as part of the remedy for the lower 8.3 miles of the Lower Passaic River as described in the response to comment II.C.5.2.

However, it should be noted that a CAD site has already been built in Newark Bay (it was named the "Newark Bay Confined Disposal Facility (Newark Bay CDF)," but is a CAD site as that term is used in the RI/FFS). This implementation of a CAD site did not lead Newark Bay to become a dumping ground for toxic sediments, contrary to the commenters' fears expressed with respect to future implementation of a similar approach. Rather, it was used for its intended purpose, which was disposal of sediment dredged from Newark Bay and the vicinity, and closed in 2012.

Monitoring of the Newark Bay CDF site showed that dredged materials being discharged into the CAD cells through the Newark Bay water column were, in fact, successfully placed in the CAD cells. During the operation of the Newark Bay CDF, one accident did occur, when a Passaic Valley Sewerage Commission (PVSC) barge accidentally discharged dredged materials from its Lower Passaic River berth near but not into the CAD cell. If CAD cells were used for the lower 8.3 mile remedial action, the disposal would occur on a much larger scale, with thousands of barges discharging to the CAD site, increasing the likelihood of accidents. The dredged material could include higher concentrations of contaminants than the dredged materials disposed of in the Newark Bay CDF, so if accidents did occur, the impact could have longer lasting effects.

While the possibility of accidents remains a concern for CAD, the risks posed by the toxicity of Lower Passaic River sediments applies to both CAD and off-site disposal in a landfill, since the CAD cells essentially would be landfills at the bottom of Newark Bay. In other words, accidents that might occur during transport of dredged materials from the lower 8.3 miles would affect on-land communities in the off-site disposal scenario and would affect the aquatic environment in the CAD scenario.

There is an almost forty-year history of CAD cell performance, since the first CAD sites were built in the 1980s on the west coast. Monitoring performed on CAD cells over the years shows that there have been no long-term releases (Palmerton, 2003). Table II.C.5.1 – 1 shows examples of Superfund sites where a selected remedy includes use of a CAD site or CDF.

In the RI/FFS, EPA evaluated both near-shore and in-water CDF options for disposal, but screened them out due to potential implementability challenges, such as disruption of circulation patterns in Newark Bay, impact on flooding, the need for low-permeability subgrade formation and permanent loss of aquatic habitat, which would trigger need for extensive mitigation under Clean Water Act Section 404(b)(1).

C.5.2 Comment: Support for CAD in Newark Bay

Commenters expressed support for a CAD site in Newark Bay for disposal of dredged materials, because CAD cells: 1) have been used in other waterways safely for many years; 2) have less impact on the community than off-site disposal by avoiding the handling of dredged material on land (in the processing and transport phases); 3) are more cost effective than the other disposal options evaluated in the FFS; 4) are easily sized to accommodate large volumes of contaminated sediments if Alternative 2 were to be chosen instead of Alternative 3; and 5) are a source of clean sediment that could be beneficially used to cap contaminated waterways or landfills.

Response:

In the RI/FFS and Proposed Plan, the first through third issues raised in this comment are evaluated under: 1) the implementability criterion of the NCP's nine criteria, specifically under the technical feasibility of implementing DMM Scenario A (CAD); 2) the short-term effectiveness criterion; and 3) the balancing of cost with the other criteria. In those evaluations, EPA found that CAD cells have been successfully implemented at other Superfund sites; CAD cells in Newark Bay would minimize on-land impacts to the community, but increase traffic (and associated waterborne commerce accidents) in the bay; and CAD cells in Newark Bay would be less costly than the other DMM Scenarios evaluated within each active alternative. However, EPA also found that DMM Scenario A (CAD) offers less long-term permanence and less reduction in toxicity, mobility or volume through treatment than the other DMM Scenarios. In addition, construction and operation of CAD cells in Newark Bay would have more substantial impact on the aquatic environment than the other DMM Scenarios, although some of that could be lessened through engineering controls.

In this case, DMM Scenario A (CAD) faces unique and significant administrative and legal impediments, because the State of New Jersey has asserted ownership of the bay bottom and strongly opposes construction of a CAD site in Newark Bay, citing the high concentrations of dioxin in Lower Passaic River sediments and unprecedented volume of contaminated sediment as a primary reason it should not be disposed of in the aquatic environment. The State's position is articulated in letters dated November 28, 2012, from Governor Chris Christie to former EPA Administrator Lisa Jackson, and March 12, 2014, from NJDEP Commissioner Bob Martin to EPA Administrator Gina McCarthy. While EPA has authority to acquire property interests when needed to conduct a remedial action under Section 104(j)(1) of CERCLA, including by condemnation if necessary, Section 104(j)(2) requires prior State agreement that the State will accept the property interest when the remedial action is complete. In the March 12, 2014 letter, NJDEP stated that it will not provide the assurance required by Section 104(j)(2). Therefore, the State's opposition is likely to make DMM Scenario A administratively infeasible. Given the State's position, DMM Scenario A (CAD) is unlikely to satisfy the NCP balancing criterion of implementability and the modifying criterion of state acceptance.

The sizing flexibility that a CAD site offers and the possibility that a CAD site might be a source of clean sediment that could be beneficially used to cap contaminated waterways or landfills are relevant to the Implementability criterion, adding to the technical implementability. However, administrative infeasibility remains as an overriding factor.

C.5.3 Comment: Opposition to off-site disposal

Commenters expressed opposition to off-site disposal, on the basis that it: 1) transfers the Passaic River's problem to someone else's backyard; 2) is not a permanent solution to toxic contaminants, but only moves them to a new location or another state at great cost; and 3) promotes private sector investment in undesirable and unsustainable hazardous waste landfill capacity. Commenters noted that the permanent risks of land disposal were not evaluated in the FFS.

Response:

Landfilling and incineration are common disposal methods for dredged materials. Both are permanent in that contamination is either entombed in a landfill with long-term monitoring and maintenance, or destroyed by high temperatures. EPA evaluated existing landfills in the RI/FFS and found adequate capacity for accepting the volume of dredged material that will be generated by the selected remedy, so investment in new landfills and incinerators will not be necessary. The risks due to off-site disposal were evaluated in the RI/FFS as short-term impacts, consistent with such evaluations at other Superfund sites. There is no unacceptable long-term risk associated with land disposal, because landfills are designed to contain hazardous wastes in perpetuity, with long-term monitoring and maintenance requirements in their operating licenses. The very purpose of such facilities is to ensure that contaminated material is handled as securely as possible.

C.5.4 Comment: Support for off-site disposal

Commenters supported off-site disposal, on the basis that: 1) it would destroy or neutralize the contaminants in the dredged materials; 2) it would be effective in the long-term and reduce toxicity, ecological impacts and risk to human health; and 3) it had been ordered by a Federal Court to be the disposal method in Honeywell's remediation of the Hackensack River.

Response:

EPA has selected off-site disposal to manage the dredged material, so no response to this comment is needed.

C.5.5 Comment: Siting of the sediment processing facility

Commenters asked that the sediment processing facility be enclosed within a building designed to minimize the impacts on nearby communities, that the facility be completely decommissioned following completion of the project, that it not accept sediment from other cleanup projects for processing and that there be community input should the facility be used for purposes other than the lower 8.3 mile remediation. Commenters also asked what criteria would be used in siting the facility and expressed the opinion that locations with direct rail access would be best to minimize truck traffic.

Response:

During remedial design, EPA will consult with NJDEP on air emission limits needed to meet legal requirements. Those limits will drive certain aspects of the design of the sediment processing facility. EPA also expects to consult with the affected communities during remedial design, to obtain input on how to minimize the impacts of remedial construction. EPA expects to obtain public input on the future use or decommissioning of any sediment processing facility after completion of the lower 8.3 mile action.

The RI/FFS (Appendix G) lists a number of desirable site characteristics for a sediment processing facility. These include, among others, rail access (e.g., proximity to rail lines or spurs, presence of rail infrastructure on-site), waterfront access, proximity to the lower 8.3 miles of the Passaic River, land size and usage, distance from sensitive populations (e.g., schools, hospitals), absence of floodplains, wetlands and sensitive wildlife habitat, and soil characteristics that support construction. The list of site characteristics was used to perform a feasibility study-level evaluation of parcels of land that might be available for the siting of a sediment processing facility, as part of the implementability evaluation under the NCP's nine criteria comparisons. In response to comments, the evaluation of available land was updated as discussed in Section III.C.2. During remedial design, more detailed siting studies will be conducted, in accordance with criteria that will include those listed in Appendix G, as well as any others that might be developed during design and in consultation with affected communities.

C.5.6 Comment: Opposition to locally sited thermal decontamination technologies

Commenters expressed opposition to locally-sited thermal decontamination technologies, on the basis that: 1) they are not economically or environmentally viable; 2) they bring the stigma of being a dumping ground for contaminated sediment to the local community; 3) they turn a water pollution problem into an air pollution problem; 4) the scale of such a facility would be unprecedented and pose serious risks to nearby communities (as illustrated by engineering and maintenance failures during bench scale pilots); and 5) even if operated properly, they would emit levels of pollution that would increase the environmental burden on a densely populated community with multiple existing emission sources.

Response:

EPA evaluated local decontamination (including thermal treatment technology and sediment washing) as a disposal option for dredged materials. It was not included in the selected remedy, because none of the decontamination technologies tested during the FFS development period proved implementable on a commercial scale, particularly with the large volumes of sediment that would require management under the selected remedy. Also, because a larger upland sediment processing facility would be needed for local decontamination (including thermal treatment), as compared to that needed to prepare the sediment for off-site disposal, the latter would have a lesser short-term impact than the former.

However, as EPA acknowledged in the Proposed Plan and ROD, local decontamination technologies (including thermal treatment and sediment washing) would offer some advantages over off-site disposal in terms of permanence and reduction of toxicity, mobility and volume through treatment. Several sediment decontamination vendors are continuing to develop their technologies and continue to express interest in handling Lower Passaic River sediments. It is possible that one or more vendors might succeed in demonstrating that their technology could decontaminate Lower Passaic River sediments and might be able to site and construct a local decontamination technology facility. The vendors would have to demonstrate that their operations would not pose serious risks to nearby communities and would have to comply with all relevant federal, state and local air quality regulations. Should this happen during the remedy design phase, EPA could modify the selected remedy through a ROD amendment or Explanation of Significant Differences in such a way as to allow for local decontamination and beneficial use of all or a portion of the sediment.

C.5.7 Comment: Support for locally sited decontamination technologies with beneficial reuse

Commenters supported the inclusion of off-site disposal in EPA's preferred alternative, provided that vendors with viable treatment alternatives would have the opportunity to demonstrate the ability to construct and operate a local facility during the remedial design phase. Commenters stated that dredged materials should be processed so as to allow for beneficial reuse at locations that are safe and provide local jobs. Commenters stated that local thermal decontamination meets the CERCLA preference for permanent treatment and is ecologically and economically sustainable.

Response:

The RI/FFS assessed a number of sediment washing and thermal treatment technologies for dredged material management and concluded that none of them were proven to be implementable on a commercial scale suitable to the large volumes contemplated by any of the active alternatives. As discussed in the ROD, it is possible that one or more vendors might succeed in demonstrating that their technology could decontaminate Lower Passaic River sediments and might be able to site and construct a local decontamination technology facility. Should this happen during the remedy design phase, EPA could modify the selected remedy through a ROD amendment or Explanation of Significant Differences in such a way as to allow for local decontamination and beneficial use of all or a portion of the sediment. See responses to comments II.H.2.8 and II.H.2.9 for further discussion.

C.6. Construction Effects on local communities and businesses

C.6.1 Comment: Construction effects on commerce and industry

Commenters expressed concern that implementation of the cleanup would adversely impact commerce and industry along the river, and discourage businesses from investing in the area.

Response:

Given the magnitude of the selected remedy, all aspects of the work are likely to have short-term impacts on the community, commerce and industry in and along the river. Potentially adverse impacts on communities and workers during construction are evaluated in the RI/FFS and Proposed Plan under short-term effectiveness. Implementation of Alternative 3 (Capping with Dredging for Flooding and Navigation), the selected remedy, would have a smaller impact on communities and workers than Alternative 2 (Deep Dredging with Backfill), because construction would not last as long and would involve handling of a smaller volume of contaminated sediments. While Alternative 4 (Focused Capping with Dredging for Flooding) would have a smaller impact than Alternative 3, Alternative 4 was not selected, because of other factors in the NCP nine criteria evaluation (documented in the RI/FFS, Proposed Plan and response to comment II.C.4.9).

EPA has experience managing such short-term impacts from remediating many Superfund sites around the country. For example, EPA's experience remediating the Hudson River PCBs Superfund site showed that while there were short-term impacts due to construction (such as traffic congestion in limited areas and navigation restrictions to boaters during dredging), the remedial work also generated economic activity including jobs. After the remediation, EPA expects that a cleaner Passaic River would encourage people and businesses to use the river. As demonstrated during Phase 1 of the Tierra Removal in Newark and the RM 10.9 Removal in Lyndhurst, EPA is committed to reaching out and coordinating with the affected communities (including local businesses) to develop health and safety plans to mitigate the impacts of construction as much as possible.

C.6.2 Comment: Construction effects on environment

Commenters were concerned that the cleanup would disrupt the river environment, and referred to perceived adverse effects on wildlife due to the River Mile 10.9 Removal.

Response:

In the RI/FFS BERA, EPA evaluated the health hazards experienced by wildlife exposed to the COCs in the lower 8.3 miles of the Passaic River over the long term (including developmental and reproductive problems, hemorrhaging, immune system problems and egg-shell thinning) and found them to be unacceptably high, justifying an action to remediate the river. EPA also evaluated potential short-term adverse impacts on the environment during construction including, among others, removal or disturbance of mudflats and the biologically active zone (BAZ), turbidity and contaminant resuspension during dredging and capping, and loss of foraging or spawning areas in the lower 8.3 miles. EPA anticipated that Alternative 2 (Deep Dredging with Backfill) would have the greatest short-term impact on the environment because of the longer construction duration and larger volumes dredged compared to Alternative 3 (Capping with Dredging for Flooding and Navigation), the selected remedy, which in turn would have greater impacts than Alternative 4 (Focused Capping with Dredging for Flooding). As discussed in the ROD, one of the reasons that EPA selected Alternative 3 was because it will reduce health hazards experienced by wildlife to almost the same degree as Alternative 2, while causing much less short-term impact on the environment. While Alternative 4 would cause even less short-term impact on the environment, it would not reduce long-term health hazards by as much as Alternatives 2 and 3.

EPA has experience managing such adverse impacts from remediating many Superfund sites around the country, and during remedy design, will incorporate steps to protect the environment and mitigate short term impacts. For example, risks due to resuspension during dredging could be minimized through the control of sediment removal rates (through careful operation of the dredging equipment). Temporary loss of benthos and habitat for the ecological community in dredged areas and in areas affected by resuspension would be mitigated with habitat replacement measures after construction. EPA expects that the remedial action will improve and replace existing open water, mudflat and intertidal habitat. Experience from remediations conducted at other Superfund sites shows that natural benthic re-colonization following a disturbance such as dredging and capping is usually fairly rapid, and can begin within days after perturbation. In some cases, full recovery to pre-disturbance species composition and abundance can occur within one to five years (Newell, et al., 1998).

C.6.3 Comment: Opening and closing the bridges during construction

Commenters were concerned that implementation of the cleanup would require the bridges over the Passaic River to be opened and closed thousands of times in total, or up to ten times per day, disrupting road, rail and pedestrian traffic, adversely impacting businesses, interfering with emergency response and stressing aging infrastructure to the point of breakage. Commenters stated that physical failure of the bridges due to structural or mechanical problems was a real possibility and would have long-term effects on local community mobility. Commenters specifically referred to the Dock Bridge located at RM 5, which serves Amtrak, New Jersey Transit and Port Authority Trans-Hudson (PATH) northeast corridor rail traffic. Commenters stated that EPA had not yet completed any studies of the potential impacts due to opening of bridges on roadway and passenger rail network operations, which initial studies performed by the commenters have shown are necessary. Commenters estimated that the monetary costs of the bridge openings on area commuters and businesses would be $2,070 per opening per day for road traffic and $12,000 for rail traffic. Commenters noted that Coast Guard regulations require advance notice for the opening of certain bridges, and specify periods of peak travel hours during which certain bridges cannot be opened. Commenters drew a parallel between targeted improvements of bridges over the Passaic River and the construction of access roads and other transportation improvements necessary for remedy implementation that have occurred at other Superfund sites. Commenters asked for a schedule of bridge openings and closings and whether EPA had evaluated the impact of bridge openings and closings on the implementation schedule. Commenters recommended that EPA: 1) assess the repair and maintenance needs of each bridge with respect to remedial implementation needs; 2) produce a plan to fairly distribute the cost of additional bridge operations so that local governments do not bear all of the costs to meet remedial implementation needs; and 3) produce a plan to minimize impacts of bridge openings on traffic particularly during peak hours.

Response:

The selected remedy will not require the bridges over the river to be opened and closed thousands of times in total, or up to ten times per day. Of the 13 bridges in the lower 8.3 miles, one has its swing span removed and one is being maintained in the open position. Of the remaining 11 bridges in the lower 8.3 miles generally maintained in the closed position, six have vertical clearances greater than 20 feet at high tide and another three have vertical clearances greater than 20 feet at low tide. Based on experience with the dredging of the Hudson River PCBs Superfund Site, EPA expects that bridges with a vertical clearance of greater than 18 feet will be navigable without being opened, assuming low profile tugs and barges are used. To navigate the three bridges with vertical clearances greater than 20 feet only at low tide, additional logistical planning may be needed to stage and schedule barge movement with the tides. In additional, periodic openings will be required to move over-sized equipment or to handle large debris.

The two bridges that present the greatest challenges to navigation (as a result of vertical clearances of less than 18 feet) handle vehicular traffic. They are located in the upper portion of the lower 8.3 miles, at RM 5.7 to RM 6.1. Accordingly, the amount of dredged material that will be moved past these bridges will be far less than the total of 3.5 million cubic yards addressed by the selected remedy. The response to comment II.H.4.2 and the analysis in Section III.C.1 discuss potential engineering solutions that exist to move dredged materials past these two bridges while minimizing the frequency of bridge openings necessary. Such engineering solutions will be fully developed in the remedial design phase, along with assessments of the maintenance needs of the bridges and a schedule of bridge openings and closings, if necessary.

The Dock Bridge, which serves Amtrak, New Jersey Transit and PATH, and is of particular concern, has a vertical clearance at high tide of 25 feet. EPA does not expect that this bridge will require opening during normal transport of dredged material and, therefore, the impact to rail traffic will be minimal, if there is any.

C.6.4 Comment: Construction effects on local infrastructure

Commenters were concerned about dredging that might take place close to infrastructure in the river, such as bridges. Commenters pointed out that the Dock Bridge has a lateral buffer zone within which dredging cannot take place, and urged that the remedial design consider protection of the bridge abutment and footings, fender system, and the utility tunnel under the bridge. With reference to statements in the FFS about dredging that might occur close to bulkheads and riprap, commenters requested a site-specific characterization of the potential for failure of riprap due to dredging. Commenters were concerned that Alternative 2 (Deep Dredging with Backfill) would disrupt infrastructure in the river bed.

Response:

EPA agrees that it will be necessary to ensure that dredging conducted close to bridge abutments and bulkheads includes precautions to prevent undermining or other adverse impacts, and that underwater utilities should also be protected. During remedial design, site-specific surveys will be conducted to develop more detailed plans to protect the infrastructure in the lower 8.3 miles of the Passaic River. EPA agrees that Alternative 2 would have a greater potential for disrupting infrastructure in the river bed than Alternative 3 (Capping with Dredging for Flooding and Navigation), the remedy that EPA is selecting, and Alternative 4 (Focused Capping with Dredging for Flooding). EPA expects to conduct extensive public outreach so that stakeholders will have the opportunity to provide input into the remedial design, including the details of infrastructure protection. See the response to comment II.H.4.10 for more discussion.

C.6.5 Comment: Construction effects on local community

Commenters indicated that off-site disposal would involve temporary on-site storage at the sediment processing facility followed by overland transport to licensed facilities for treatment and disposal of hazardous substances and would result in noise, traffic congestion, air pollution, and accident risk. Commenters expressed concern that implementation of the cleanup would be disruptive to the local community, commuters in the area and visitors to sports stadiums. Commenters wanted to ensure that EPA would plan and interact with the affected communities in order to mitigate the impacts, particularly by developing performance standards that address “quality of life,” communicating with local institutions (such as emergency management officials, environmental commissions and libraries) and providing information in multiple languages. The CAG requested that EPA and any PRPs implementing the remedy consult with the CAG quarterly before the beginning of construction and monthly during construction. Commenters asked whether the impact of noise, odors, air pollution and traffic on the surrounding towns had been adequately evaluated in the FFS, and asked for more information on odor control measures.

Response:

Potential adverse impacts on communities and workers during construction were evaluated in the RI/FFS and Proposed Plan under short-term effectiveness and included, among others, noise, light, odors, blocked views, vehicular and vessel traffic, potential air quality impacts and disruptions to commercial and recreational river users in the lower 8.3 miles. EPA anticipated Alternative 2 (Deep Dredging with Backfill) to have the greatest short-term impact related to quality of life issues because of the longer construction duration compared to Alternative 3 (Capping with Dredging for Flooding and Navigation), the selected remedy, which in turn would have greater impacts than Alternative 4 (Focused Capping with Dredging for Flooding).

EPA has experience managing adverse impacts from remediating many Superfund sites around the country. In particular, EPA has overseen Phase 1 of the Tierra Removal in Newark and the RM 10.9 Removal in Lyndhurst. In both actions, EPA demonstrated its commitment to reaching out and coordinating with the affected communities by holding special public meetings and meeting monthly with the CAG to develop health and safety plans to mitigate the impacts of construction, with community input. Air monitors were deployed during both actions to monitor air emissions and criteria were developed to change the way dredging was done or to stop work should emissions exceed criteria. The Tierra Removal design included several odor control measures, such as maintaining water levels over sediment being dredged in the river and over dredged materials in barges to reduce exposure of potentially malodorous sediment to the air; rinsing dredged material processing equipment as needed and at the end of each work day; covering dewatered sediment containers after filling; covering sludge storage tanks; and using fans to ventilate and disperse emissions.

After the selection of a remedy for the lower 8.3 miles of the Passaic River, EPA will issue an updated Community Involvement Plan which will guide interaction with the public during remedy design and implementation. During the remedial design phase, EPA expects to conduct extensive public outreach through public information sessions so that stakeholders, including local institutions and the CAG, will have the opportunity to provide input into the remedial design, including details of construction impact mitigation, quality of life performance standards (including air quality, odor, noise and light monitoring standards as appropriate), and communication during implementation. Just as fact sheets used for public outreach during the Proposed Plan public comment period were provided in English, Spanish and Portuguese, EPA expects to continue to provide information during remedial design in those languages, as appropriate.

C.6.6 Comment: Construction effects on rowing

Commenters were concerned that the implementation of the cleanup would disrupt the active and growing rowing community, and would close the lower 8.3 miles of the Passaic River to rowing for the duration of the construction. Commenters asked for more information about the kinds of disturbances to rowing that might be caused by implementation of the cleanup, such as the location of barge traffic and of the sediment processing facility. Commenters urged EPA to consider using the fish window for boating clubs to coordinate their more intensive activities.

Response:

Given the magnitude of the selected remedy, the in-river work is likely to result in short-term impacts on the rowing community in the lower 8.3 miles of the Passaic River. Potentially adverse impacts for rowers during construction were evaluated in the RI/FFS and Proposed Plan under short-term effectiveness, and include the potential for accidents, for impeding vessel passage and temporarily precluding in-water recreation in some locations. Implementation of Alternative 3 (Capping with Dredging for Flooding and Navigation), the selected remedy, will have a smaller impact on rowers than Alternative 2 (Deep Dredging with Backfill), because construction will not last as long and will involve handling of a smaller volume of contaminated sediments. While Alternative 4 (Focused Capping with Dredging for Flooding) would have a smaller impact than Alternative 3, Alternative 4 was not selected, because of other factors in the NCP nine-criteria evaluation (documented in the RI/FFS, Proposed Plan and response to comment II.C.4.9).

Detailed health and safety plans will be developed during the design phase, with input from the public and specifically the rowing community. The construction sequence developed in the RI/FFS for cost-estimation purposes and further refined in Section III.C.3 divides the river into five reaches, and assumes that dredging will occur simultaneously in several reaches in order to maintain the constant daily dredging rate that will allow for efficient sizing and consistent operation of the sediment processing facility. However, while one or more of these reaches may be dredged or capped simultaneously, for several months at a time, it is very unlikely that the entire lower 8.3 miles of the Passaic River will be closed to rowing for the duration of the remedial action. Throughout the RM 10.9 Removal, EPA demonstrated its commitment to reaching out and coordinating with the rowing community to minimize impacts on major rowing events, such as the annual Passaic River Regatta.

NOAA and the State of New Jersey are responsible for setting fish windows (those periods of time during which work on the river may halt to allow for fish migration) every year based on fish migration patterns that may vary with such factors as water temperature. EPA is not able to influence the timing of the fish windows to coincide with periods of intense activity for boat clubs.

C.7. Flooding

C.7.1 Comment: Did the Proposed Plan consider flooding?

Commenters were concerned that the Proposed Plan does not consider the effects of contamination brought into homes along the river during flooding events. Commenters wanted to ensure that the cleanup would not exacerbate flooding in the future and asked how EPA factored flooding into its analyses of the alternatives. Commenters asked for a report on the implications of flooding and scouring, including information on projected sedimentation rates post-remediation, how sedimentation is related to flooding and the impact of flooding events on a cap. Commenters characterized EPA's preferred alternative as including deep dredging in RM 0 to RM 2 in order to increase flood capacity, and urged EPA not to implement such a flood mitigation measure until after RM 8 to RM 17 is remediated, to avoid using funds allocated to environmental cleanup to address flooding issues, since the latter were not caused by the former.

Response:

As described in the RI/FFS, EPA used the peer-reviewed mechanistic model (that was used to evaluate alternatives) to simulate placement of a sand cap on the river bed of the lower 8.3 miles of the Passaic River, bank to bank, without any pre-dredging. The model predicted that the cap would exacerbate flooding in the area. In response, EPA used the model to simulate dredging of approximately two feet of sediment before placing the two-foot sand cap over the lower 8.3 miles. Results showed that this would not exacerbate flooding. Therefore, Alternative 3 (Capping with Dredging for Flooding and Navigation) includes dredging before capping to ensure that flooding would not be made worse. EPA's RI/FFS included a report on modeling that described predicted sedimentation rates post-remediation (Appendix BII of the RI/FFS). EPA's evaluation of the cap's ability to withstand erosion is further discussed in responses to comments II.H.1.3 and II.H.1.13.

The dredging that is included in Alternative 3 is to avoid causing the additional flooding that might otherwise occur due to installation of the cap, not to increase flood capacity or mitigate flooding that currently occurs, so no Superfund monies are being used for mitigation of current conditions that lead to flooding. Mitigation of current flooding conditions is being addressed by the USACE's Passaic River flood risk management projects, such as the Passaic River Main Stem and Passaic River Tidal Protection Area projects. As part of the USACE projects, EPA understands that USACE has evaluated flood control alternatives using hydraulic models that would include the impacts of flooding and scouring (USACE and NJDEP, 2014).

The selected remedy addresses the contaminated sediments of the lower 8.3 miles of the Passaic River. To the extent appropriate, a future study or studies will consider the effect of site-related contamination brought into the floodplains along the river, including homes in those floodplains. However, EPA did perform soil sampling for dioxins, PCBs and mercury on several recreational fields along the Lower Passaic River in Lyndhurst and North Arlington to determine potential impacts to recreational users and maintenance workers exposed to sediments left on the fields by Hurricane Irene, Tropical Storm Lee and Superstorm Sandy flooding. The results showed that the measured concentrations of dioxins, PCBs and mercury were well below levels of concern.

C.8. Jobs

C.8.1 Comment: Will the selected remedy provide local job opportunities?

Some commenters assumed that EPA's preferred alternative would provide local job opportunities, while other commenters urged EPA to ensure that jobs created by the remediation go to local residents, with local contracting and procurement (potentially by establishing a website similar to the Hudsonworks Marketplace). As examples of programs that stimulate local employment, commenters pointed to the use of EPA's Superfund Job Training Initiative during Phase 1 of the Tierra Removal and to a veterans' employment and skills training program being developed in Newark. Some commenters stated that jobs associated with a large-scale remediation would be filled by existing contractors from other states and would not result in a net gain of employment for residents of Newark. Some commenters stated that bank-to-bank dredging would have a negative impact on economic development, thereby reducing the overall number of jobs. Some commenters supported the CPG's "Sustainable Remedy" on the basis that it would provide green infrastructure projects that would bring new employment opportunities for New Jersey residents.

Response:

It is EPA's experience at other Superfund sites that remedial actions do tend to generate jobs during construction, although it can be difficult to quantify how many of the jobs are local. As was the case during the Hudson River PCBs cleanup and Phase 1 of the Tierra Removal, EPA is committed to using a variety of programs to encourage local hiring for remedial construction. Programs used in the past have included the Superfund Job Training Initiative and the Hudsonworks Marketplace website. If those programs remain available at the time the remedy for the lower 8.3 miles is implemented, EPA will encourage their use.

Given the magnitude of the selected remedy, the remedial construction is likely to have short-term impacts on the local community and businesses. However, EPA has experience mitigating such impacts and will work with the community and businesses to minimize adverse impacts to the extent possible (see response to comment II.C.6.1). EPA is not aware of economic analysis supporting the commenters' concern that the cleanup will have an overall depressing effect on economic activity.

No information has been provided to EPA on employment opportunities that might be generated by green infrastructure projects contemplated under the CPG's "Sustainable Remedy."

D. Site Characterization and Empirical Mass Balance Model

D.1. Conceptual Site Model and System Understanding

D.1.1 Comment: CSM is Inaccurate and Misrepresents the Distribution of Contaminants

Commenters stated that EPA's physical and chemical CSM is inaccurate and misrepresents the distribution of contaminants in the lower 8.3 miles of the Lower Passaic River, which leads to unsupported conclusions and a technically deficient preferred alternative. Other commenters stated that the FFS is based on a flawed CSM and fundamental misunderstanding of the LPRSA hydrodynamics, sediment transport and hydrology. Specific comments included:

a. EPA has not incorporated all of the data collected for the 17-mile LPRSA into its Proposed Plan and 2014 FFS for the lower 8.3 miles.
b. CSM fails to integrate the current understanding of the mechanistic processes of the river that has been confirmed through extensive analysis of the sediment, surface water, and biota. CSM is not consistent with contaminant concentration data or with EPA's own model result. It should include the basic system properties and process understanding. CSM does not acknowledge that an effect of deepening the LPR will be an increase in the import of contaminants from Newark Bay.
c. CSM is based on an outdated EMBM.
d. CSM considers nature and extent "structureless" (high concentrations are random).
e. CSM asserts that the river has reached quasi-steady state when concentrations are, in fact, declining, although more slowly than in the past.
f. CSM incorrectly assumes that the lower 8.3 miles of the river is unaffected by upstream background conditions.
g. CSM classification (partially stratified vs. partially mixed) is inconsistent. It should be a highly channelized and altered river-estuary that is more non-stationary than most partially mixed estuaries, which needs to be considered in sediment and contaminant transport modeling and evaluation of cap stability.
h. EPA has misrepresented the effectiveness of the bank-to-bank remedy.
i. Actual river conditions, including contaminant distribution and the influence of background on the lower 8.3 miles, are very different than those presented by EPA in support of its recommended remedy.

Response:

As documented in the RI/FFS and Proposed Plan, EPA developed and refined the CSM over the life of the project based on the following lines of evidence:

- Historical and current data collected in the Lower Passaic River, including data collected during the 17-mile LPRSA RI/FS.
- Peer reviewed mechanistic modeling framework consisting of linked hydrodynamic, sediment transport, organic carbon and chemical fate and transport models.
- Peer reviewed EMBM.

As discussed in more detail in the response to comment II.B.1.4, the CSM incorporated all of the historical and current data sets that were available from the 17-mile LPRSA RI/FS when the lower 8.3-mile RI/FFS was prepared, as well as data from other investigations. As discussed in the responses to comments II.D.1.7 and II.D.1.10, the rest of the data, collected during the 17-mile RI/FS but not submitted until after final editing of the RI/FFS was underway, were evaluated to verify the conclusions of the CSM.

The mechanistic model included the significant system properties and processes that drive sediment and contaminant fate and transport in estuarine systems. Extensive efforts over the last approximately 10 years were expended to develop a thorough mechanistic model of the internal hydrodynamic, suspended solids and geochemical exchange rates along the length of 17-mile LPRSA. While there tended to be a focus on the lower 8.3 miles, considerable effort was also expended in estimating the exchange rates between the lower 8.3 miles and the region upstream, since this exchange will influence the long-term recovery of the lower 8.3 miles. In addition, the mechanistic model explicitly included the process of dredging and capping and the deepening of the channel in Newark Bay due to on-going maintenance dredging. The mechanistic model also included the effect of deepening the lower 8.3 miles on sedimentation patterns (including potential increased import from Newark Bay) to assess the remedial alternatives evaluated in the FFS. The construction of the mechanistic model was guided by the iterative development of the CSM, which continues to evolve as new data are collected. In response to comments (see Section II.E and Attachment E), EPA re-evaluated the mechanistic model's calibration against bathymetry data, suspended solids data, and sediment and water chemistry data and found that continual improvements to the model have resulted in its improved ability to reproduce the wide range of data collected in the Lower Passaic River.

The EMBM was based on historical and current data collected in the Lower Passaic River and its watershed. The EMBM incorporated integrative terms, such as external solids load estimates and long-term average deposition rates, in its construction. As with the mechanistic model, the construction of the EMBM was also guided by the iterative development of the CSM. Initial conditions were set to 1995 data, and model projections were validated against all relevant data available at the time the RI/FFS and Proposed Plan were being finalized, including the 2008 and 2009 data. In general, the surface sediment data collected in 2008 and 2009 in the lower 8.3 miles fall within the range of projections from the EMBM and the associated Monte Carlo[4] uncertainty bounds. Thus, those data confirm the EMBM results. Specifically, as shown in Figures 5-11 to 5-17 parts b, c, and d in Appendix C of the RI/FFS, the intervals defined by mean concentrations plus two standard errors for surface sediment contamination for 2008 and 2009 fall within the concentration trajectories plus forecast uncertainty estimated by EMBM. Therefore, the EMBM projections are relevant to the FFS and are validated by the recent data. After the release of the Proposed Plan, the EMBM trajectory forecasts were updated with post-2009 data included by resetting the initial conditions in 2010 consistent with the mechanistic model. The updated EMBM trajectory forecasts are consistent with those in the RI/FFS and confirm the CSM's conclusions regarding contamination in the Lower Passaic River.

The CSM does not conclude that contamination is uniform and structureless throughout the lower 8.3 miles of the Lower Passaic River. EPA's evaluation of the surface sediment data documents the high degree of heterogeneity, with concentrations varying over four orders of magnitude in the Lower Passaic River (see the figures in Sections 2 and 3 of Data Evaluation Report (DER) No. 4 in Appendix A of the RI/FFS, which clearly illustrate the high spatial variability of contamination in the Lower Passaic River). However, the degree of variability or range of contaminant concentrations tends to be similar bank-to-bank, yielding similar median concentrations bank-to-bank. This means that the probability of

[4] Monte Carlo simulation is a statistical sampling method in which the realizations (i.e., individual values) are randomly generated from probability distributions to simulate the process of sampling from an actual population.

finding high COC concentrations in the navigation channel is just as high as the probability of finding high COC concentrations in the shoals.

This is not to say that the variations observed in surface sediment concentrations are completely random. Rather, it means that multiple processes in this complex estuary work together to determine the movement of contaminants, so that simple one-to-one relationships (such as concentration versus river mile or concentrations versus erosion/deposition) cannot be relied upon to predict future surface sediment concentrations; a mechanistic model that represents the major processes that drive sediment transport and contaminant fate and transport must be developed, as EPA did to support its analyses in the RI/FFS and Proposed Plan.

The quasi-steady state condition identified by EPA does not suggest that the river is not dynamic; rather it indicates that the pool of legacy sediment cycling within the river is significantly greater than external inputs. Suspended solids external to the system are routinely incorporated into the legacy sediments through alternating episodes of deposition and erosion to maintain the quasi-steady state. Thus the sediment's regular reworking by the tides and storm events serves to erode and expose older material while depositing a mixture of upriver solids and resuspended lower river sediments. It is directly apparent from both the beryllium-7 bearing sediments and the suspended solids study conducted by the CPG (2009-2010 physical water column monitoring program) that solids are resuspended and transported along much of the length of the Lower Passaic River. The tidal data in particular (see response to comment II.D.1.11), demonstrate that suspended sediments are routinely transported along the length of the river as part of the twice daily 4-mile displacement of the salt front.

In EPA's empirical, geochemical and mechanistic modeling, the boundary conditions from the Upper Passaic River and at Newark Bay were defined by existing data. In the geochemical evaluation and the EMBM in particular, the evaluation indicated similar variability and magnitude in the central tendency of surface sediment data from RM 2 to RM 12, beyond which concentrations declined to the external boundaries. The commenters may have misinterpreted EPA's analysis when they asserted that the CSM assumes that the lower 8.3 miles is unaffected by background conditions (represented by the Upper Passaic River, immediately above Dundee Dam). The Upper Passaic River is accounted for in EPA's CSM. EPA's evaluation establishes that resuspension of Lower Passaic River sediments contributes well over 90 percent of the dioxin in recently deposited sediments of the Lower Passaic River, followed by Newark Bay (approximately 5 percent) and the Upper Passaic River (3 percent or less). Resuspension of Lower Passaic River sediments contributes approximately 80 percent of PCBs and DDE in recently deposited sediments, followed by the Upper Passaic River (approximately 10 percent) and Newark Bay (less than 10 percent). Similar trends are shown for copper, mercury and lead. These findings, coupled with the fact that 85 to 90 percent of the fine-grained sediments in the Lower Passaic River are located below RM 8.3, further support the conclusion that resuspension of highly contaminated surface sediments already in the lower 8.3 miles of the river is the predominant contributor to COC mass in the water column, and thus to COC concentrations in fish and crab tissue.

EPA's evaluation in the ROD also shows that these percentage contributions would be altered dramatically through active remediation of the lower 8.3 miles. For example, bank-to-bank replacement of the highly contaminated riverbed with effectively clean material would greatly reduce the component of the mass balance that comes from resuspension of Lower Passaic River sediments. This would reduce the overall contaminant levels in surface sediment, but it would also have the effect of increasing the relative percentage contribution of the Upper Passaic River, Newark Bay and the Lower Passaic River above RM 8.3 to COCs depositing on top of the newly placed lower 8.3-mile riverbed. See response to comment II.G.2.3 for more discussion.

EPA's analysis based on the five high resolution dated sediment cores collected in 2005 clearly documents the history of increases and decreases of the contaminant concentrations on deposited solids in the Lower Passaic River. The high resolution dated sediment cores, which provide long-term records (approximately 60 years) of the trends of contamination in depositing solids, clearly document similar patterns from RM 2 to RM 12: rapid increase in COC concentrations from approximately the 1950s to the 1970s, after maintenance dredging was significantly curtailed and when relatively high sediment infilling rates coincided with a period when industrial discharges were most active; followed by a decline in COC concentrations from the 1970s to 1980s, when industrial discharges declined as a result of Clean Water Act regulations; ending with the record of approximately the last 20 years, when much of the channel has filled in, reaching quasi-steady state with COC concentrations declining at an almost imperceptible rate. This is discussed at length in Attachment B to Appendix C of the RI/FFS. The rate of change in COC concentrations over the last 15-20 years is so small that median 2,3,7,8-TCDD concentrations, a measure of the central tendency of the contaminant distribution, have not changed significantly from 1995 to 2013, supporting the CSM's description of the river as tending to a quasi-steady state condition. This is shown in ROD Figures 9 through 11 in Appendix I and similar figures in the RI Report, Chapter 4.

EPA agrees that the morphology of the LPR has been highly channelized and altered, with the hydrodynamic setting described as a partially stratified estuary. The dynamic nature of the LPR has received considerable attention in the CSM and is a significant factor in the historical accumulation of contaminants as the highly altered system filled in with sediment following cessation of maintenance dredging. Bathymetric survey data show that the LPR experiences periods of sediment scour and export followed by accumulation in response to variations in freshwater inflow, tides and coastal storm processes. These factors have been considered in the CSM and incorporated into the mechanistic modeling.

EPA concludes that the CSM, mechanistic model and EMBM all incorporate the current understanding of the Lower Passaic and provide a strong basis for evaluating the effectiveness of the various FFS alternatives and for selecting a remedy for the lower 8.3 miles of the Lower Passaic River.

D.1.2 Comment: CSM Needs to be Refined Based on Information from the 17-Mile RI/FS

A commenter stated that it is incumbent upon EPA to refine its conceptual model based on information collected by the CPG for the 17-mile RI/FS and to reexamine the benefits attainable by targeted remedies based on the in-river sediment contaminant data and an understanding of long-term net erosion/deposition patterns. Another commenter stated that the need for further refinement of the CSM is broad and not confined to "geochemical evaluations."

Response:

The data evaluation, empirical mass balance and mechanistic modeling performed by EPA for the RI/FFS included all historical and recent data that were available at the time the RI/FFS and Proposed Plan were prepared, including data collected by the CPG for the 17-mile RI/FS. EPA developed the EMBM using 1995 data to set initial conditions, and evaluated and updated its formulation using the 2008, 2009, 2010 and 2012 CPG data sets.

During the preparation of this Responsiveness Summary, EPA incorporated the data received after the preparation of the RI/FFS as part of its review of surface sediment patterns. EPA also updated the mechanistic model and incorporated these data sets to evaluate and set initial conditions, as discussed in more detail in Attachment E. As explained in the responses to comments II.D.1.7 and II.D.1.10, the additional technical evaluation of surface sediment patterns in the Lower Passaic River did not lead EPA to make any substantial changes to major conclusions of the CSM when the new data sets were added to the analysis.

Subsequent to the 2007 draft FFS, EPA substantially revised and updated the FFS, resulting in the issuance of the 2014 final RI/FFS, which incorporated into every aspect of the document all of the new data from the 17-mile RI/FS that were available up to the time of the preparation of the near-final draft of the RI/FFS. Refinements to the CSM were not confined to "geochemical evaluations" as indicated by the commenter.

D.1.3 Comment: Deep Sediments are Compacted and Hard to Erode

Commenters stated that more information about the lack of erodibility of sediments deeper in the sediment bed should be provided to support EPA's cleanup plan.

Response:

Information about the erodibility of the sediments is provided in the RI/FFS, Proposed Plan and ROD. One of the factors that EPA considered in its decision to select Alternative 3 (Capping with Dredging for Flooding and Navigation) over Alternative 2 (Deep Dredging with Backfill) was that sediments in the Lower Passaic River generally become less erodible deeper into the river bed, where the fine sediments have been consolidated under the weight of the sediments above.

The erodibility of Lower Passaic River sediments was measured using Sedflume, a device for quantitatively characterizing sediment erosion rates. The erodibility of sediments at the very near surface of the sediment bed was also measured using a Gust microcosm device. The Sedflume and Gust microcosm results showed that the fine sediment erosion properties in the Lower Passaic River are highly variable over small spatial scales; this variability was considered in the development of input parameters for the sediment transport model's simulation of erosion in the river. The Sedflume and Gust microcosm experiments are described in the following reports available on ourPassaic.org and in the administrative record for the Proposed Plan:

- Borrowman, T., E.R. Smith, J.Z. Gailani and L. Caviness, 2006. "Erodibility Study of Passaic River Sediments Using USACE Sedflume." Prepared for USACE Kansas City District and EPA Region 2. July, 2006.
- Sea Engineering, Inc., 2008. Sedflume Consolidation Analysis, Passaic River, New Jersey. Prepared for HydroQual, Inc. and EPA. 2008.
- Owens, M, J.C. Cornwell, S.E. Suttles and P. Dickhudt (Chesapeake Biogeochemical Associates). 2006. "Passaic River Erosion Testing and Core Collection: Field Report and Data Summary." Subcontract No. KC-ACE2002-31. Final Report to Malcolm Pirnie, Inc. March, 2006.

D.1.4 Comment: There is More than One Source of Dioxin

A commenter disputed the support in the CSM for the existence of only one source of 2,3,7,8-TCDD. The commenter stated that one source has been identified, but the hard work of identifying or eliminating sources has not been done. The commenter also stated that the System Understanding of Sediment

Transport (SUST) description of contaminant transport left open the possibility of multiple sources of dioxin and that core data may also indicate another source of dioxin. Furthermore, the commenter stated that both recent and ongoing sources of the contaminants observed at these LPRSA RM 8-17 “hot spots” are known to exist and pose a risk of recontaminating the lower 8.3 miles. Another commenter indicated that because the FFS neglects the magnitude of ongoing sources of contaminants, the proposed remedy is based on an inaccurate analysis of environmental conditions in the lower 8.3 miles.

Response:

EPA’s geochemical and mechanistic modeling analysis and evaluation included the significant external sources from the watershed as well as the legacy impact of the well-documented releases of 2,3,7,8-TCDD by Diamond Alkali and adjacent sources in the 1940s through 1960s. As described in the RI/FFS Appendix A, EPA’s analysis indicated that the 2,3,7,8-TCDD from the Lister Ave facility and adjacent sites is the dominant source of 2,3,7,8-TCDD in the Lower Passaic River, but EPA did not conclude that it was the only source. Because of the dominance of the legacy source of 2,3,7,8-TCDD in Lower Passaic River sediments, 2,3,7,8-TCDD concentrations in the Lower Passaic River are orders of magnitude greater than concentrations observed in the watershed inputs that come from tributaries, stormwater and combined sewer overflow. In both the EMBM and mechanistic model, the impact of high concentrations of 2,3,7,8-TCDD above RM 8, which are mostly located in pockets of fine-grained deposits, was explicitly considered. The impact of high concentrations above the lower 8.3 miles was accounted for in the forecast of future concentrations for the various remedial scenarios evaluated in the FFS. Therefore, the FFS included the significant sources of contaminants in its geochemical and modeling analysis in developing the basis for its remedy.

Evidence of a relatively recent and short-lived release of 2,3,7,8-TCDD near RM 11 was discussed in the RI/FFS. The effect of this release was observed in the high resolution dated sediment cores collected in 2005-2007 at RM 7.8, 11 and 12.6. EPA analysis of the high resolution coring data showed that the increase in 2,3,7,8-TCDD sediment concentrations was observed in a limited number of core layers dated as having been deposited around the year 2000. 2,3,7,8-TCDD concentrations in shallower layers, dated to approximately 2005-2007, decreased to concentrations consistent with levels observed during the 20 years prior to the circa 2000 event, indicating that the release had ended. None of the other contaminants analyzed in those sediment cores showed such a temporary increase in concentrations in those layers. The temporary increase in 2,3,7,8-TCDD observed in the cores at RM 7.8 and farther upriver was not observed in the cores collected at RM 1.4 and 2.2, indicating the limited impact of the circa 2000 release.

D.1.5 Comment: Surface Sediment Concentrations are Correlated with Physical Properties and are Influenced by Areas of High Concentrations Upriver

Commenters stated that the sediments upstream of RM 8 account for approximately one-third of the areas with 2,3,7,8-TCDD concentrations above thresholds of 500, 1,000 and 1,500 picograms/gram (pg/g)[5]. Commenters also stated that the interaction over the lower 12 to 14 miles means that areas upstream of the lower 8.3 miles can influence conditions in that stretch of the river and vice versa, and therefore, though EPA is relying on the 17-mile RI/FS to deal with the region upstream of the lower 8.3 miles, this bifurcation is not technically defensible. The interactions between the two areas mean that remedial options must consider the entire river to provide the information needed to compare and contrast alternatives.

[5] This unit is sometimes also expressed as nanogram/kilogram (ng/kg) or parts per trillion (ppt).

Commenters criticized the RI/FFS for characterizing the nature and extent of contaminants as a picture of patternless data with randomly distributed locations of high COC concentrations. Instead, commenters used variograms to demonstrate that contaminant concentrations appear to be related to deposition patterns in the river. Commenters provided maps showing that lateral concentration gradients tend to be much greater than longitudinal ones. Commenters suggested that 2,3,7,8-TCDD patterns are similar to patterns of other COCs and that normalization by organic carbon does not change the patterns. Commenters stated that cleanup alternatives involving bank-to-bank treatment of the contaminated sediments are unsupportable, given that the thesis of uniform bank-to-bank contamination in the 8.3 miles of the Lower Passaic River is poorly supported by the data. A much more detailed study of contaminant heterogeneity within the lower 8.3 miles must be done to determine the best approach to remediate sediment contamination in the lower 8.3 miles.

Commenters asserted that predictable patterns are present in the contaminant distribution in surficial sediment. Commenters indicated that spatial patterns of contaminants should be evaluated in more detail to understand how contaminants with different boundary conditions can have similar spatial patterns (e.g., Total PCBs and 2,3,7,8-TCDD). They also indicated that additional analyses are needed to explain development of current contaminant spatial distributions.

Response:

The mix of biased and unbiased design in the data sets available precludes a rigorous evaluation of the assertion that one third of the area with concentrations in excess of 500, 1,000 and 1,500 pg/g lies above RM 8. This calculation by the commenter excludes the more spatially representative 1995 data set collected for the 6-mile Passaic River Study Area RI, which documents the presence of many locations with elevated concentrations downstream of RM 8. The post 2005 sampling data do not comprise an unbiased or spatially representative data set of the area below RM 8, because the sampling locations were a mix of locations along equally spaced transects and locations targeted to specific areas for particular purposes (such as focusing on understanding contamination above RM 8 or delineating deposits with extreme concentrations along certain shoal areas). In 1995, the sampling was designed on a regular grid, with sample locations equally spaced longitudinally along the river.

EPA agrees that there is weak spatial correlation in the surface sediment data of the Lower Passaic River. When calculated directly from the 2,3,7,8-TCDD concentration data, there is no substantive spatial correlation within the lower 8 miles. However, as shown in Barabas et al. (2001), when an appropriate transformation is applied to the concentration data, there is a resulting weak spatial correlation and a large nugget effect, which means that there is substantial variability in sample concentrations at small distances. The large nugget effect also means that samples close together only have about 20 percent lower variability than samples at large distances, hence the weak spatial correlation.

Because the COCs tend to bind more strongly to fine-grained sediments, some association between contaminant concentration and sediment texture is typically expected at sediment sites. In the Lower Passaic River, the river bed below RM 8.3, bank to bank, is dominated by fine-grained sediments with pockets of coarser sediments. As discussed in response to comment II.D.1.1, EPA's evaluation of the surface sediment data documents the high degree of heterogeneity. However, the degree of variability or range of contaminant concentrations tends to be similar bank to bank, yielding similar median concentrations bank to bank. This means that the probability of finding high COC concentrations in the navigation channel is just as high as the probability of finding high COC concentrations in the shoals. For this reason, the remedial alternatives evaluated in the FFS address the lower 8.3 miles. Above RM 8.3, the bed is dominated by coarser sediments with smaller areas of fine-grained sediments, often located outside of the channel. Upstream of RM 8.3, where sediment texture is not dominated by a single texture and deposits of fine grained sediments do occur in small areas, discrete areas of highly contaminated sediments can be found. The region below RM 8.3 is more consistent with respect to sediment texture and shows little difference in median surface sediment concentrations as a function of geomorphic group. This is not to say that the variations observed in surface sediment concentrations are completely random. Rather, it means that multiple processes in this complex estuary work together to determine the movement of contaminants, so that simple one-to-one relationships (such as concentration versus river mile or concentration versus areas of erosion/deposition relative to geomorphic features) cannot be relied upon to predict future surface sediment concentrations; a mechanistic model that represents the major processes that drive sediment transport and contaminant fate and transport must be developed, as EPA did to support its analyses in the RI/FFS and Proposed Plan. The commenters' criticism that the RI/FFS characterized the nature and extent of contaminants as a picture of patternless data with randomly distributed locations of high COC concentrations is further addressed in the response to comment II.D.1.1.

Commenters asserted that predictable patterns are present in the contaminant distribution in surficial sediment, based on two primary lines of reasoning: (i) an approach to mapping COCs that relies on correlation between COC concentrations and areas that commenters characterized as erosional or depositional over time, and (ii) evidence of spatial patterns supported by a geostatistical analysis using semivariograms. The maps presented by the commenters focused primarily on the area around RM 10.9, where EPA surveys identified that sediment type changed dramatically from shoal (fine-grained) to channel (coarse-grained). The spatial correlation noted by the commenters at RM 10.9 is irrelevant to conditions in the lower 8.3 miles, where sediment texture generally does not change rapidly across the river. The downstream correlation noted among the few samples obtained at RM 7.3 is clearly inconsistent with the distribution of contamination exhibited in the rest of the data below this area, where high values are rarely accompanied by nearby values of similar magnitude (see Figures 2.1-1 and 2.1-2c in DER No. 4 of Appendix A of the RI/FFS). These figures show many areas with fairly similar concentrations, noted by the similar colors, while exhibiting an occasional high concentration that is generally not replicated by nearby locations. Thus, in selecting RM 7.3 for examination, the commenters have identified a small exception to the general lack of correlation exhibited by sediment concentrations downstream of RM 8.3.

The commenters also emphasized an apparent correlation among data relatively far apart while failing to note the high degree of variability in very closely placed samples. For example, at location CLRC-0062 in Appendix B of the CPG's comments on the Proposed Plan, Figure II-5 a , three samples that are located within 50 feet of each other vary from less than 50 to more than 1,000 pg/g in 2,3,7,8-TCDD. Thus, while some spatial correlation may exist above RM 8.3, even in this region, local variation can be substantial, making local concentrations impossible to predict accurately.

Commenters' assertion that there are correlations between COC concentrations and erosional or depositional areas is addressed in the response to comment II.D.1.10. Commenters' discussion of the use of semivariograms to demonstrate spatial patterns was limited to a paragraph, with little supporting analyses. The analysis presented was restricted to post-2005 data, which is primarily focused on areas above RM 8.3 and is not spatially representative for the areas below RM 8.3, as discussed above. In particular, during sampling design, locations below RM 8.3 were selected for particular purposes that are not compatible with assessing the spatial correlation of contaminant concentrations. Any spatial correlation suggested by the commenters' analysis is likely the result of correlations in the region above RM 8.3. It is in this region where EPA had already noted that sediment texture and surface concentrations are likely to be correlated.

Use of semivariograms involves a large number of assumptions and data pre-processing, such as declustering to attenuate the impact of redundant information provided by biased sampling design; transformation or straightening of the meandering river spatial coordinates to ensure that distances between samples are measured parallel with, or perpendicular to, the direction of flow; transformation of sample concentrations to address the highly skewed distribution of values and permit the use of standard statistical procedures; and assessment of the direction of maximum and minimum spatial correlation among sample locations (anisotropy). None of these assumptions is discussed in the commenters' submittal. The commenters did not provide enough information for EPA to evaluate the validity of their approach or to verify the soundness of their conclusions, or to support their statement that more spatial analysis of the data is required before a remedy can be selected. EPA's already extensive analysis in the RI/FFS, Proposed Plan and this Responsiveness Summary is more than sufficient to provide the information needed to support remedial decision-making in the ROD.

D.1.6 Comment: System Understanding of Sediment Transport is Incomplete

A commenter stated that Lower Passaic River System Understanding of Sediment Transport (SUST) should have been made quantitative and complete before issuance of the FFS Report. According to the commenter, it is incomplete in several respects: it substitutes analyses of model results for analyses of data to draw conclusions that cannot be substantiated due to lack of full calibration of the Estuarine and Coastal Ocean Model (ECOM) and ECOMSED (hydrodynamic and sediment transport model); and it falls short of providing a proper conceptual model of sediment transport in the system. According to the commenter, SUST should have included mean sea level (MSL) rise, correct calculations of 100- and 500-year flows, storm surges, discussion of tidal properties, ECOM success in modeling tides, effect of flow and tides on estuarine turbidity maximum (ETM) location from data, properties of ETM, and the effect of sticks and leaves. The commenter also stated that the CSM should explain the variability of sediment fluxes with position, river flow, tidal range, and, perhaps, atmospheric forcing.

Response:

The SUST document (Sea Engineering, Inc. and HDR|HydroQual, 2013) served EPA's intended purpose. As described in the document, the SUST was developed as a tool to synthesize then-existing data sets with sediment transport model analyses to answer site management questions. EPA never intended for the SUST to be based solely on data, as the commenter suggested. The SUST was an intermediate work product intended to outline an understanding of the significant sediment transport processes governing the fate and transport of contaminants in the Lower Passaic River. It was meant to guide future data collection and sediment transport modeling analyses necessary to evaluate remedial alternatives in the RI/FFS. To serve this purpose, it was not necessary for the SUST to include every detail of the sediment transport processes that exist in nature. The commenter's suggested additions to the SUST included topics that have been incorporated in the mechanistic models, have been addressed elsewhere in this Responsiveness Summary, or are ones that EPA disagrees need to be addressed in further detail in the SUST or mechanistic models. Leaf and stick litter falls in the latter category because of the transient nature and sub-grid scale spatial extent and influence. Topics that have been addressed in sections of this Responsiveness Summary include MSL rise (response to comment II.E.1.5), and effect of flow and tides on ETM location from data (response to comment II.E.1.5). Topics that have been included in the mechanistic modeling and modeling reports include calculations of 100- and 500-year flows, storm surges, tidal properties, ECOM success in modeling tides and properties of ETM. Addition of these data or processes to the SUST document retroactively would have served neither to advance system understanding nor to change the outcome of the RI/FFS.

D.1.7 Comment: Surface Sediment Concentrations of COCs are Decreasing Over Time

Commenters stated that the FFS provided a flawed analysis of spatial trends and natural recovery that is inconsistent with existing data. Commenters stated that surface concentrations have been decreasing over time, which undermines EPA's legacy sediment source theory and analysis that surface concentrations have remained constant from 1995 to 2012. Commenters assert that EPA's analysis is incorrect because it erroneously included the 2012 CPG Supplemental Sediment Sampling Program data set, which was at least partially biased towards anticipated hot spots. Because of this bias, the mean concentrations from this sampling program would naturally be elevated above those that would have been found during random sampling, thereby skewing EPA's resulting trend. A commenter presented an analysis that showed a decline over time in mean surface concentrations of 2,3,7,8-TCDD in depositional areas, based on determination of the net erosion and net deposition areas from differences between bathymetric surveys performed in 1995 and in 2011, and the assignment of observed bathymetric change (between 1995 and 2011) to the 1995 to 2013 surface sediment concentration samples.

Response:

EPA's evaluation in the RI/FFS of the distributions of the 2,3,7,8-TCDD concentration data from every LPRSA sediment sampling program indicated that the concentrations are not normally or log-normally distributed, but follow a highly skewed complex distribution. The means of such distributions do not represent the central tendency of the data, and hence these means cannot be directly used to evaluate changes over time. Since the various surveys were developed using different DQOs and were not designed to characterize mean concentrations over time, a more appropriate metric was required to represent the central tendencies of the data sets. Thus, EPA used the medians of the various data sets to evaluate changes over time. Use of the medians ensured that the analysis was not adversely affected by the highly skewed nature of the surface sediment data sets, nor by the non-normal distribution of any of the data sets. Figure 4-8 of the RI Report compared 2,3,7,8-TCDD surface sediment concentrations from these sampling events conducted over almost two decades and showed that median concentrations have not changed substantially over that period of time.

In response to comments, EPA incorporated CPG 2013 SSP2 data to augment analysis of the 2,3,7,8-TCDD surface sediment concentrations over time. However, the CPG 2013 SSP2 samples were almost all collected above RM 7, with only 7 samples collected in a transect across the river at around RM 7.2. These 7 samples are not representative of contamination in the lower 8.3 miles of the river. In addition, the number of samples is small and does not have the statistical power to make a real difference in the mean concentration. Therefore, EPA did not incorporate the CPG 2013 data in the statistical comparison test for the lower 8.3 miles. As stated in the RI report, for both RM 0 to RM 2 and RM 2 to RM 8, there are no statistically significant differences among the medians of the data sets between 1995 and 2012. These results indicate that since 1995, there has been almost no measurable change in the median surface sediment concentration of 2,3,7,8-TCDD below RM 8.3.

To evaluate the comment that mean surface sediment concentrations of 2,3,7,8-TCDD decline over time specifically in depositional areas, EPA repeated the commenters' analysis by calculating bathymetric differences between the 1995 and 2011 surveys and assigning bathymetric differences to the surface sediment samples collected from 1995 to 2013. Figure II.D.1.7 - 1 shows a comparison of 2,3,7,8-TCDD concentrations in surface sediment between groups of samples collected in the 1990s and post-2005 in the depositional areas. For the reasons stated above about the complexity of the surface sediment concentration data, EPA tested the trend in the median concentrations consistent with non-parametric statistical methods.[6] The statistical test of the median concentrations for these two groups of samples shows that the difference is not statistically significant (see bottom part of Figure II.D.1.7 - 1 for Steel-Dwass non-parametric test result). This confirms that median 2,3,7,8-TCDD surface sediment concentrations have not declined significantly since the 1990s.

Since none of the data sets collected by the CPG for the 17-mile RI/FS were specifically designed to characterize changes in surface sediment concentrations over time, EPA relied primarily on the five high resolution dated sediment cores collected in 2005 and the surface sediment samples collected in 2007 near the vicinity of the 2005 sediment cores. DER No. 3 in Appendix A of the RI/FFS presented an analysis of the chronologies obtained from these five dated sediment cores, which provide long-term trends of contamination in the Lower Passaic River. As stated in DER No. 3, EPA observed that for all five cores, the concentration of 2,3,7,8-TCDD slowly declined from the 1980s to the present. The rate of decline, as suggested by the roughly parallel trends on the log-scale plots, is approximately the same at all five locations. During this period, the decline in 2,3,7,8-TCDD concentrations was quite similar (approximately a factor of two variation among the 5 cores) for the last 20 years. The estimated rate of decline during this period is quite slow. As can be seen in the right hand panel of Figure 3-4 of DER No. 3 (or in Figure 3-3 of DER No. 3), concentrations in 2007 [150 to 500 nanograms per kilograms of sediment, (ng/kg)] are roughly half of those observed in 1980 (400 to 800 ng/kg), suggesting a "half-time" for the decline of 2,3,7,8-TCDD concentrations on the order of 30 years. While this may show a slight decline from the 1980 to present, it does not indicate that the median surface sediment concentration has declined from 1995 to 2012. Figure II.D.1.7 - 2 shows concentrations vs. year of deposition from the five dated sediment cores collected from RM 1.4 to RM 12.6. A regression line was plotted for data from 1995 to 2007 and shows that there was no trend between concentrations and year of deposition, with a slope of -0.0012. This slope is not statistically different from zero.

Another way to examine the change in concentrations over the years is to present the 2,3,7,8-TCDD surface sediment data in a scatter plot. Figure II.D.1.7 – 3 shows a scatter plot of 2,3,7,8-TCDD surface sediment vs. year of collection. Again, this plot shows there was no trend in the median 2,3,7,8-TCDD concentration with year of collection. A regression line through these points shows that the slope is not statistically different than zero. Thus, the conclusions EPA was able to draw from the five dated sediment cores using geochemical interpretation techniques regarding the very slow recovery of surface sediments are further supported by the collection of thousands of surface samples under the 17-mile LPRSA RI/FS and other programs over the past 20 years.

D.1.8 Comment: The River is or is Not Recovering by Itself

Commenters observed that the river has revitalized itself over the past 20 years, as evidenced by increased wildlife, while others commented that the river is not welcoming, as evidenced by dead animals, oil and contaminants.

Response:

[6] That is, the methods used make no assumptions about the underlying distribution of the data. These methods do not require the distributions to comply with any known distribution type (e.g., normal, log-normal).

The waters and sediments of the Lower Passaic River are constantly moving, due to the twice-daily tides, regular river flow and occasional storm events. Neither anecdotal accounts of wildlife sightings nor oil sheen observations are necessarily evidence of long-term trends in the health of the river (positive or negative). In the RI/FFS, Proposed Plan and ROD, EPA documented long-term trends in contaminant concentrations in the sediments and biota tissue based on sampling data collected from 1995 through 2013 (see response to comment II.D.1.1). Those data show that in that 18-year period, median surface sediment contaminant concentrations have remained high and almost unchanged. Lipid-normalized contaminant concentrations in fish and crab tissue have neither consistently increased nor decreased with time from 1999 to 2010, consistent with surface sediment concentration trends. These data show that the Lower Passaic River is not recovering by itself over time and form one of the lines of evidence supporting the need to take action to remediate the river.

D.1.9 Comment: Adjustment Factor for 2008 Dioxin Data Obscured Temporal Trend

The adjustment of the 2008 2,3,7,8-TCDD data by a factor of 1.9 has obscured temporal sediment trend analysis and caused an overstatement of the sediment risk. The adjustment of the 2008 sediment data for dioxins and furans was arbitrary; the bias in the split-sample results found for other compounds, specifically PAHs and PCBs, was ignored by EPA.

Response:

As part of its oversight of the 17-mile RI/FS, EPA collected split samples of a small subset of the Low Resolution Sediment Coring program samples collected by the CPG in 2008. In a memorandum (Malcolm Pirnie, 2009), EPA presented comparisons of contaminant concentrations in the split samples for all of the contaminants analyzed, including metals, dioxins/furans, PAHs and PCBs. The memorandum documented systematic differences that were statistically significant for a number of contaminants, including a particularly large difference in 2,3,7,8-TCDD concentrations between CPG and EPA split sample pair results.

However, although some differences were statistically significant, they were not all considered substantive. That is, given the limitations of analytical chemistry, systematic differences of less than 30 percent were not considered substantive. This threshold for substantive differences was based on a review of general accuracy requirements for Superfund, and in particular, the recognition that the criteria for laboratory accuracy is typically plus or minus 25 to 30 percent.[7] EPA methods for PCBs and dioxins both have accuracy criteria in this range.[8] In addition, the EPA sediment QAPPs required a plus or minus 25 percent agreement with the expected values for organic analytes based on an analysis of National Institute of Standards and Technology Standard 1944 (see Malcom Pirnie, 2008, for example). Thus, EPA determined that for the 17-mile RI/FS and lower 8.3-mile RI/FFS, statistically significant systematic differences of plus or minus 30 percent or less for split sample results did not warrant further investigation or correction. Similarly, differences that were not found to be statistically significant were considered too uncertain to warrant further examination.

Based on this conclusion, EPA determined that for metals, PCBs, most dioxin/furans and most PAHs with systematic differences that fell under the 30 percent difference threshold, concentrations reported by the CPG could be used without application of a correction factor. Some individual PAH compounds had

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[7] Compliance with these criteria is routinely determined by a calibration verification step in laboratory analysis.
[8] See Table 6 of EPA Contract Laboratory Program Scope of Work for Method CBC012, 2001 and discussion in Section 9.4 of EPA Contract Laboratory Program Method DLM22.

differences that were above the 30 percent threshold, but they were typically not very high in concentration and not major risk drivers. Thus, the PAHs were not identified for correction. The distribution of the statistically significant systematic differences is shown in Figure II.D.1.9 - 1. Each count on the vertical axis represents a single contaminant. However, there are 20 to 30 sample pairs that were averaged to produce the single analyte mean difference. For example, there are four dioxin/furan compounds and one PAH compound with an average systematic difference between -20 and -25 percent. Note that the percent differences plotted on the horizontal axis represent the average differences for the compound, and not the results for individual analyses. This figure is based on the Hodges-Lehmann Estimator given in Table 1 of Malcolm Pirnie, 2009.

Notable in the figure are the two red squares indicating 2,3,7,8-TCDD and Total TCDD which have average systematic differences between 40 and 50 percent (in the negative direction, indicating that CPG results were lower than EPA results). Given the importance of 2,3,7,8-TCDD to human health and ecological risk and hazards, EPA Region 2 further investigated the possibility that this systematic difference could be tied to differences in analytical procedures used by CPG and EPA laboratories by requesting the assistance of national experts in dioxin analysis from EPA's Office of Water, Engineering and Analysis Division. The EPA-Office of Water report (CSC and Interface, 2011) concluded that both laboratories (CAS for CPG and AXYS for EPA) deviated from the specified EPA dioxin analytical method (1613B). The concentrations reported by CAS were biased low relative to the AXYS results due to a less complete extraction of polychlorinated dibenzo-dioxins/polychlorinated dibenzo-furans (PCDDs/PCDFs) from the sediment matrix. The CSC and Interface, 2011 report provided a correction factor to apply to the low-biased results.

Following EPA's decision to apply a correction factor to dioxin concentrations from the 2008 Low Resolution Sediment Coring program, EPA further compared the corrected 2008 2,3,7,8-TCDD concentrations with 2,3,7,8-TCDD results obtained in the 2005 and 2007 Newark Bay sediment sampling programs (Vista Analytical laboratory), and 2009 Lower Passaic River sediment sampling program (Analytical Perspectives). The comparison showed that the data sets collected in the years immediately before and after the 2008 sampling program were consistent with the corrected 2008 2,3,7,8-TCDD concentrations. EPA concluded that applying a correction factor to the 2008 dioxin data was well supported by the available information in the administrative record.

D.1.10 Comment: Concentrations of COCs in Surface Sediments are Correlated to Depositional and Erosional Areas

A commenter stated that the concentration patterns in the LPR channel are related to the deposition patterns in the river, providing the following examples as evidence: (1) areas that have not accumulated sediments since 1949 (non-depositional regions) tend to have the lowest concentrations; (2) areas that accumulated sediments but have a surface within 6 inches of the 1966 surface are where the highest concentrations are found, though a range of concentrations are found here; and (3) areas of greater deposition since 1966 tend to have intermediate concentrations that presumably reflect what is currently being transported through the river system.

Response:

The commenter did not provide the maps of bathymetric change and corresponding sediment concentrations that were the basis of the commenter's analysis. In order to examine the commenter's premise, EPA first created maps of bathymetric elevations by interpolating the discrete bathymetric data available from 1949, 1966 and subsequent single beam surveys into continuous surfaces. This was done through the use of an interpolation technique called triangular irregular networks (TINs), which created a continuous surface for each survey, bounded by the outermost points in the survey (no extrapolation was done).[9] Multibeam bathymetric surveys obtained from 2007 and later provide a near-continuous coverage of the river bottom and so do not require the TIN interpolation.

To assess the commenter's conclusion that non-depositional areas tend to have the lowest concentrations, EPA first recreated the commenter's scatter plot of 2,3,7,8-TCDD surface sediment concentrations versus bathymetric changes from 1949 to 2011 (Figure II.D.1.10 - 1) by subtracting one bathymetric surface from the other (2011 minus 1949) and noting the direction and magnitude of the elevation change at each sediment data point. Note that because the spatial extent of the bathymetry surveys is limited,[10] concentrations at locations with no bathymetric coverage in either or both surveys were not included in the scatter plot, which means that about 80 percent of the available surface sediment concentration data were excluded from the commenter's analysis. The commenter also did not use all of the available concentration data; in EPA's figure (II.D.1.10 - 1), 2,3,7,8-TCDD surface sediment concentrations from 1991 through 2013 were included. Consistent with the commenter's presentation, a vertical line at zero bathymetric change was depicted to differentiate the points at locations where net sedimentation had not occurred since 1949 from locations where net sediment accumulation had occurred. The commenter's premise is that sediments deposited prior to 1949 should be relatively free of the 2,3,7,8-TCDD contamination that was released in subsequent decades. Thus, sampling at locations with no post-1949 deposition should yield pre-1949 sediments, resulting in low concentrations for these samples.

The first observation from the figure is that highly elevated 2,3,7,8-TCDD concentrations (i.e., higher than 1,000 pg/g) do occur at several locations that have not accumulated sediments since 1949, based on the commenter's definition of net sedimentation. When considering all of the available data with bathymetric coverage, over 90 percent of the locations that have not accumulated sediments since 1949 (points to the left of the vertical line per the commenter's criteria) have 2,3,7,8-TCDD concentrations above the sediment remediation goal of 8 pg/g. Further, nearly half (45 percent) have concentrations at or above 280 pg/g, the median level of contamination in Lower Passaic River surface sediments. Thus, while some locations do have lower concentrations, samples from "non-depositional" areas do not have consistently or reliably low 2,3,7,8-TCDD concentrations. Note that in most instances these concentrations are based on a 0 to 6 inch sample thickness, indicating a fairly thick layer of post 1949 sediments in this context.

The presence of contaminated sediments in these "non-depositional" areas is likely the result of regular cycles of deposition and erosion that occur across much of the LPR bottom. The identification of areas that have gained little elevation since 1949 does not preclude periods of erosion below the 1949 horizon with subsequent deposition of post-1950 contaminated sediments back to the original elevation. Thus the existence of the river bottom at the 1949 elevation in more recent surveys is just an observation of river bed elevation and not a reliable indication of pre-1949 sediments at the river surface. This sequence of events explains the existence of 2,3,7,8-TCDD contamination in these "non-depositional" areas. Further supporting this scenario is the wide range of 2,3,7,8-TCDD concentrations observed for

[9] This is a standard interpolation technique that is readily available in most geographical information system (GIS) software. It linearly interpolates elevations between nearest neighbor locations, forming an array of triangles as each point is linearly connected to all of its nearest neighbors.
[10] Few bathymetric surveys covered the entire width or length of the river.

these areas. The range of values is consistent with erosional/depositional cycles occurring over the past 60 years, resulting in the deposition of sediments whose 2,3,7,8-TCDD concentrations are characteristic of conditions in the river at the time of deposition. Since concentrations of 2,3,7,8-TCDD have varied widely over time (e.g., see Figure II.D.1.7 - 2), so have surface sediment concentrations in these "non-depositional" areas. Thus these areas are not static exposures of pre-1949 sediments, but rather, they represent areas that are regularly modified by erosion and deposition. This extreme variability in 2,3,7,8-TCDD concentrations (in addition to the limited area covered by the 1949 survey) also precludes the development of a statistical regression relationship between bathymetric change since 1949 and 2,3,7,8-TCDD concentrations that could be generally applied to the river.

Figures II.D.1.10 – 2A to 2C present maps of the bathymetry changes between 1949 and 2011, with the areas that have been "non-depositional" or erosional since 1949 indicated by the pink to red shading, and the areas that have been depositional indicated by the various shades of blue. Surface sediment 2,3,7,8-TCDD concentrations are also shown on the maps. Note that the area of coverage (shown by the red and blue shades) is quite limited and does not cover the river bank-to-bank, or above RM 6.85, or below RM 2.35. By river mile, the survey comparison is only possible for about 46 percent of the lower 8.3 miles.

As can be seen in the figure, there are a very limited number of sediment samples that are located in the areas that have been "non-depositional" since 1949 per the commenter's definition, making it difficult to test the reliability of the commenter's assertion. Furthermore, as noted above, there are samples with highly elevated 2,3,7,8-TCDD concentrations within or close to areas that have been "non-depositional" since 1949. For example, at RM 3.75, there are two locations with 2,3,7,8-TCDD concentrations of 4,900 and 7,000 pg/g very close to the boundary of a "non-depositional" area (see Figure II.D.1.10 – 2C). Additional examples of samples in excess of 280 pg/g within or close to areas that have been "non-depositional" relative to 1949 can be found at RM 4.2, RM 5.35, RM 5.95, RM 6.5 and RM 6.75 (shown by red circles on the figures). From these examples, it is clear that the "non-depositional" areas as defined by the commenter are not reliable indicators for the presence of low 2,3,7,8-TCDD concentrations, since values in excess of the median concentration (280 pg/g) occur quite frequently.

EPA also notes that the areas defined as "non-depositional" since 1949 by this comparison do not extend to other bathymetric comparisons. If bathymetric surveys from other years are used to calculate bathymetric change relative to 1949, the extent of the "non-depositional" areas would differ from those presented by the commenter. In comparing only the 2011 and 1949 bathymetric surveys, the commenter did not account for the uncertainty in the bathymetric changes, as well as potential erosion/deposition in the intervening years. Figure II.D.1.10 – 3 shows bathymetric changes for different years of surveys for RM 5.15 to RM 5.35, as an illustration. The boxed area on Figure II.D.1.10 – 2B shows the expanded view in Figure II.D.1.10 – 3. Erosional (non-depositional) areas are shown in red while depositional areas are shown in blue. Just two colors are used here to simplify the comparison among survey pairs.

The areas that have been "non depositional" since 1949, as defined by the commenter using the comparison between 2011 and 1949 surveys, are plotted on each map as yellow cross-hatched polygons. The exact match between the hatched areas and the areas of erosion can be seen for the 2011 map in the figure. It can be seen from a comparison across maps in the figure that comparing surveys from different years identifies different distributions of red and blue areas, indicating different areas of deposition and erosion depending on the surveys compared. Some hatched areas remain red throughout the comparisons while some hatched areas switch back and forth between erosional and depositional. Areas outside the hatched area also appear as erosional at times, depending on the surveys compared. These variations support the erosional-depositional scenario described above, which explains the presence of elevated sediment contamination in the 1949-2011 “non-depositional areas.” In summary, the 1949-2011 bathymetric comparison cannot identify areas that are likely to be consistently low in contamination, nor does it provide coverage for the entire lower 8.3 miles.

The second main assertion of the comment is that the highest 2,3,7,8-TCDD concentrations are found in the areas that accumulated sediments but have a surface elevation within 6 inches of the 1966 surface. Again, the commenter used a single snapshot of bathymetric change (1966 to 2011) and did not include the pre-2008 bathymetric data. As stated above, by comparing only two bathymetric surveys, the commenter did not account for the uncertainty in the elevation changes, as well as potential erosion/deposition in the intervening years. To respond to this comment, EPA re-created the commenter’s scatter plot of 2,3,7,8-TCDD concentration and bathymetric change from 1966, and added two vertical lines showing the areas with bathymetric changes of +/- 6 inches from the 1966 elevations (Figure II.D.1.10 – 4). The primary observation from this figure is that the concentrations in areas that are within 6 inches of the 1966 elevations can vary from greater than 10,000 pg/g to less than 30 pg/g. Also, extremely high concentrations (over 1,000 pg/g) are not found exclusively in the area within 6 inches of the 1966 surface, but also in areas that are experiencing 4 to 5 feet of deposition or erosion relative to the 1966 surface. Furthermore, the variability in concentrations at various levels of bathymetric change precludes the development of a useful or predictive statistical regression relationship between bathymetric change since 1966 and 2,3,7,8-TCDD concentrations.

EPA investigated the correlation between erosion/deposition from 1966 to post-2007 surveys other than 2011 and 2,3,7,8-TCDD surface sediment concentrations. Similar to Figure II.D.1.10 – 4, the 2,3,7,8-TCDD concentrations in surface sediment were plotted against bathymetric changes based on other bathymetric surveys relative to 1966 (i.e., 2007-1966, 2008-1966, 2010-1966 and 2012-1966). The discussion below focuses on the four sediment sample locations with 2,3,7,8-TCDD concentrations greater than 1,000 pg/g that fell within 6 inches of the 1966 surface based on the 2011 survey. These locations are highlighted in red in Figure II.D.10 - 4. Figures II.D.1.10 – 5A to 5D show the 2,3,7,8-TCDD concentrations plotted against the bathymetric changes between 1966 and other surveys. Three of the four sample locations with 2,3,7,8-TCDD concentrations greater than 1,000 pg/g that experienced less than six inches of net erosion or net deposition (middle section in Figure II.D.1.10 – 4), as determined based on the 1949 to 2011 bathymetric changes, are shown to have experienced greater than 6 inches of sediment deposition when the 1966 bathymetric survey is compared to the other bathymetric surveys. Note the horizontal displacement of the red-highlighted symbols in Figures II.D.1.10 - 5A to 5D.

In addition to the failure of these high concentrations to consistently plot within 6 inches of the 1966 surface, some of the samples with the lowest 2,3,7,8-TCDD concentrations (less than 50 pg/g) were found within 6 inches of the 1966 surface, indicating little circa 1966 or later contamination at these locations. These observations further highlight the fact that long-term bathymetric change is only one of the factors affecting contaminant distribution. EPA concludes that the variability in 2,3,7,8-TCDD concentrations over time, the uncertainty in the bathymetry itself and the demonstrated erosional to depositional conditions in the intervening years preclude the use of bathymetric change to develop reliable boundaries that delineate the most contaminated sediments in the river.

The third point of the comment is that the areas that accumulated more than 6 inches of sediment since 1966 (the right hand portion of Figures II.D.1.10 - 4 and II.D.1.10 - 5A to 5D) tend to have less variable and characteristically intermediate surface sediment contaminant concentrations than other areas, which likely reflects recent deposition. This conclusion was again based on a snapshot of bathymetric changes between 1966 to 2011 surveys, wherein a maximum value of approximately 3,000 pg/g was observed for areas with more than 6 inches of deposition (see Figure II.D.1.10 – 4). Similar to the observations described above, the relationship between concentration and deposition history changes when different bathymetry surveys are used in the analysis. For example, the 2,3,7,8-TCDD concentrations ranged from 2 pg/g to 16,000 pg/g when the 2007 bathymetry data were compared to the 1966 bathymetry survey (see Figure II.D.1.10 – 5A). Similar observations can be seen when the bathymetric changes were based on the 2008 and 2010 surveys (see Figures II.D.1.10 – 5B and II.D.1.10 – 5C). Contrary to the statement in the comment that "a careful analysis of historical data and sedimentation trends allow identification of different areas," the above analysis supports EPA's conclusion that the occurrence of extreme values or even intermediate concentrations of the COCs cannot be accurately predicted using bathymetry alone.

D.1.11 Comment: Surface Water COC Concentration Patterns Show that Contaminants in Sediments above RM 8 are Transported Downstream

A commenter stated that the CPG Chemical Water Column Monitoring (CWCM) program documented elevated water column concentrations of 2,3,7,8-TCDD above (i.e., at RM 10.2) and at the upper extent (near RM 7) of the salinity front. The commenter concluded that since these concentrations are similar to concentrations in recently deposited sediments described in the lower 8 mile RI/FFS, the bed upstream of RM 8 contributes to the water column concentrations, making contaminants available to be transported downstream into the lower 8 miles.

Response:

EPA agrees with the commenter's assertion that recently deposited sediments and concentrations of 2,3,7,8-TCDD on suspended matter associated with the turbidity maximum are similar in magnitude. In the RI/FFS and Proposed Plan, EPA also described contaminants as being transported by estuarine circulation from the lower 8.3 miles to upstream locations, and that under certain conditions these contaminants can be transported back to the lower 8.3 miles. The contribution of contaminants from upstream of RM 8.3 as a source of recontamination of the lower 8.3 miles after remediation was included in both EPA's EMBM and mechanistic models. However, contrary to the commenter's analysis, modeling results documented in the RI/FFS showed that remediating the river above RM 8.3 first would lead to more recontamination than starting the remediation below RM 8.3, supporting the conclusion that the lower 8.3 miles should be remediated first (see response to comment II.B.1.3 for more discussion).

To respond to this comment, EPA prepared several analyses. EPA first determined the distance from each sampling point (from the data collected for the 17-mile RI/FS) to the salinity front at the time of sample collection. This was done by using EPA's hydrodynamic model and calculating the distribution of salinity in the Lower Passaic River at the time of sample collection. Freshwater flows during the events were determined from U.S. Geological Survey (USGS) records, as part of the model development. The salt front was defined as the location where river salinity reaches 0.5 psu, where approximately half of the salt content in the water is derived from seawater and the influence of seawater can be easily detected by conductivity measurements.[11] This differs from the salt front definition used by the commenter (2 psu). Based on the location of the salt front expressed as a river mile, the distance to the salt front was calculated as the difference between the salt front location and the sampling location. Locations upstream of the salt front were designated by positive differences while locations downstream were assigned negative differences.

EPA approximated the 2,3,7,8-TCDD concentrations on suspended matter by dividing the whole water concentrations of 2,3,7,8-TCDD by the suspended solids concentration of the sample. While this procedure is typically used, it is subject to some uncertainty due to the way that the suspended solids were measured.[12]

Figure II.D.1.11 - 1 presents the 2,3,7,8-TCDD suspended matter concentrations as a function of river mile on the top diagram, and as a function of distance from the salt front on the bottom diagram. The high degree of variation in 2,3,7,8-TCDD concentrations can be seen in both diagrams. In both plots, tidal conditions at time of sampling are indicated by color. Samples obtained at RM 10.2 are indicated on both diagrams by hollow symbols. When plotted by river mile (i.e. the top diagram in II.D.1.11 - 1), no distinct maximum can be observed, contrary to the commenter's assertion. A simple spline fit curve has been drawn in the diagram to indicate the central tendency of the data. Essentially the curve is flat from RM 3 through 8.3 and suggests a decline at both ends of the distribution, with a greater decline below RM 2. The diagram at the bottom of Figure II.D.1.11 - 1 shows the same data plotted against distance from the salt front. In this instance, a clear maximum in concentration is centered on the salt front itself (distance = 0).

These relationships observed in Figure II.D.1.11 - 1 are also illustrated in Figure II.D.1.11 - 2. This figure is laid out similarly to the previous figure, except that the data have been binned by river mile or distance from the salt front. The bins for the river mile plot were arranged to match the main sampling locations shown in the river mile plot in Figure II.D.1.11 - 1 (e.g., the values for the station at RM 10.2 were assigned to the RM 9 to 10.2 bin). From this diagram, it can be seen quantitatively that the 2,3,7,8-TCDD concentrations in suspended matter are similar on average across the Lower Passaic River above RM 2. In particular, concentrations at RM 10.2 are not distinct relative to locations downstream, and actually have a slightly lower concentration than locations downstream. Therefore, the distribution of the concentrations on suspended matter do not provide direct evidence of the availability of contamination originating upstream of RM 8.3 and its transport to the lower 8.3 miles as the commenter asserts. However, the diagram at the bottom clearly shows a statistically significant higher average concentration associated with the salt front area (distance of 0 $\pm$ 1 mile) relative to areas both upstream

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[11] This definition of salt front is consistent with the technical definition of used by the United States Geological Survey and the Delaware River Basin Commission (http://www.state.nj.us/drbc/hydrological/river/salt/). Note the Delaware River Basin defines salt front as 250 mg/L Chloride concentration, and this is equivalent to 0.45 psu.

[12] In the CWCM program conducted for the 17-mile RI/FS, suspended solids were measured by using a wastewater monitoring procedure (Method TSS ASTM D 3977) wherein a sample aliquot is drawn from the bottle instead of using the entire contents of the bottle. As reported by Gray et al., 2002, and in Clark and Siu, 2008, this technique can introduce significant variability in the suspended solids value. Thus, the calculated 2,3,7,8-TCDD concentrations on suspended solids may be subject to significant variability unrelated to environmental conditions. For this reason, EPA reviewed the calculated 2,3,7,8-TCDD concentrations using EPA's ProUCL Version 5.0 software to identify outliers before doing further analysis. Five values were identified as outliers at the 99 percent level of confidence, values in the range of 1,610 to 35,400 pg/g. These values were excluded from subsequent analyses. This left a total of 515 sample results for evaluation.

and downstream of the salt front. The decline relative to the salt front is similar both upstream and downstream of the salt front.

This coincidence of the peak 2,3,7,8-TCDD concentration and the salt front is the result of estuarine circulation and should not be construed as a basis to identify source areas. Rather, this is a straightforward illustration of estuarine circulation in a partially mixed estuary, such as the Lower Passaic River. Specifically, the ETM generally coincides with the salt front and is the underlying reason that the highest 2,3,7,8-TCDD concentrations in the water column are observed there. Particles present at the ETM have arrived there as the result of the two-layer circulation process that is characteristic of the Lower Passaic River. The relationship between circulation, the salt front and the ETM has been extensively studied (see for example Sanford et al., 2001 and Milligan et al., 2001). The flow is such that the ETM tends to be a zone of very fine particles; that is, because the finer particles spend the greatest amount of time in the water column,[13] these particles are preferentially transported by the underlying up-estuary flow to the general vicinity of the salt front. The ETM can lag or precede the movement of the salt front due to the dynamic nature of circulation and the tides. Thus peak concentrations of particles can occur both upstream and downstream of the salt front, and it would be speculative to determine the source of these concentrations based on salt front movement alone.

However, concentrations of 2,3,7,8-TCDD are not constant across all particle sizes. This is readily illustrated by the differences between coarse and fine-grained areas upstream of RM 8. Even though the sediments below RM 8 show substantially less grain size variation (see RI Report, Chapter 3), concentrations of 2,3,7,8-TCDD are still likely to vary with particle size in the study area. Thus, since tidal circulation tends to deliver finer particles to the ETM, which is generally at or near the salt front, and since 2,3,7,8-TCDD tends to bind tightly to the finer particles, it is expected that the highest concentrations of 2,3,7,8-TCDD would be found there as well. In other words, since it is the deep, upstream moving layer that is primarily responsible for delivering these solids to the ETM and salt front area, these higher concentrations of 2,3,7,8-TCDD are the result of sediment resuspension that has largely occurred downstream of the salt front and ETM, and not upstream as concluded by the commenter.

The limited contribution from the area above RM 10.2 can perhaps best be seen by looking solely at low tide conditions, as shown in Figure II.D.1.11 - 3. Here the salt front is located relatively far below RM 10.2. Samples collected at RM 10.2 are shown by the hollow symbols. Notably, the 2,3,7,8-TCDD concentrations on particles from RM 10.2 are consistently low during this condition, when contributions by resuspension from downstream are clearly at a minimum. Overall, the distribution of the concentrations on suspended matter do not provide direct evidence of the availability of contamination originating upstream of RM 8.3 and its transport to the lower 8.3 miles as asserted in the comment.

D.1.12 Comment: Ratio of 2,3,7,8-TCDD to Total TCDD Should not be Used as a Fingerprinting Tool

Commenters stated that the ratio of 2,3,7,8-TCDD to Total TCDD is unfounded, and should not be used as a fingerprinting tool. Commenters asserted that the FFS relies on a study by Chaky (2003) for the 2,3,7,8-TCDD/Total TCDD ratio used in tracing the impact of Lower Passaic River dioxins throughout metropolitan New York Harbor. Commenters stated that EPA's reliance upon Chaky's work introduces fatal uncertainty into EPA's hypotheses and findings.

[13] Tidal movement results in the regular resuspension and settling of many different sized particles. However, once suspended, finer particles take longer to settle and thus can be transported further by tidal flows.

Response:

While Chaky's work provided an initial framework, EPA did not rely on his work alone in developing an understanding of the transport and fate of dioxin in the river. Rather, this work was one line of evidence used to guide EPA's investigations and hypotheses. Chaky's seminal study and conclusions on the ratio of 2,3,7,8-TCDD to Total TCDD were borne out by the sampling programs conducted for the investigations of the LPRSA and Newark Bay, from 1995 through 2013.

RI Report Figure 4-6a shows the ratio of 2,3,7,8-TCDD to Total TCDD for samples collected in the Lower Passaic River, above Dundee Dam, in the tributaries, CSOs, SWOs and Newark Bay. The Newark Bay samples show a generally increasing trend in the ratio as the samples get closer to the mouth of the Passaic River. The ratio in Newark Bay is about 0.25 and increases to 0.7 at the mouth of the river. Within the Lower Passaic River, the ratio varies from 0.2 to 1.1[14] with no clear trend along the length of the river. About 75 percent of the samples fall between 0.6 and 0.8. The Upper Passaic River data show very low ratios compared to the Lower Passaic River, which further supports the conclusion that the origin of the 2,3,7,8-TCDD contamination is the Lower Passaic River itself and not an external source.

The commenter asserted that the use of the ratio introduces fatal uncertainty based on two data points taken in locations identified as background in Chaky's work. The commenter pointed out that the TCDD ratio for both of these two samples is higher than the background location ratio (0.04 to 0.06). There are, however, plausible explanations for these two anomalies that are consistent with a proper understanding of dioxin chemistry and analytical techniques. The first observation involves a sample for a deeper segment (32 to 36 centimeters [cm]) in core JB13 from Jamaica Bay, while the second involves a single sample collected upstream of Hastings-on-Hudson, NY, in the Hudson River.

In the first instance, the deeper segment of JB13 represents sediment from approximately the mid-1960s. The 2,3,7,8-TCDD concentration of this sample is low (43 pg/g). This concentration is much lower (by several orders of magnitude) than contemporaneous samples of Lower Passaic River sediments, which have concentrations of approximately 20,000 pg/g. Chaky explained in his thesis that a potentially significant dioxin source is the extensive landfilling of coal ash around Jamaica Bay (Walsh, 1996) and that the use of Silvex (2,4,5-T) in the extensive clearing of marshland around the bay increased the 2,3,7,8-TCDD ratio. This is consistent with the understanding that a source at any location creates an "end member" in the trend of the ratio. However, a more limited source mass will generate a much smaller zone of influence on the ratio moving away from that source than a large source like the former Diamond Alkali operation.

The second anomaly noted by the commenter is the blind duplicate samples from the Hudson River upstream of Hastings-on-Hudson, NY (core name "mp152.7P"). As Chaky pointed out, this sample pair has the poorest agreement for Total TCDD. However, it exhibits very good agreement for 2,3,7,8-TCDD concentration, with a relative percent difference of just 9 percent. Chaky concluded that this sample was used as a quality assurance/quality control (QA/QC) sample only, and is not important for the general conclusion of his work.

[14] Ratios above 1.0, which are physically impossible, are an artifact of the level of imprecision in the lab analyses.

D.1.13 Comment: Derivation of Partition Coefficients for Dioxin-Like PCBs was not Documented

Commenters stated that the derivation of partition coefficients for dioxin-like PCB (DL-PCB) congeners was not documented and was not available from the Contamination Assessment and Reduction Project (CARP) modeling.

Response:

DL-PCB congeners were not included in the contaminants modeled under the CARP, a joint federal, state and local agency effort to identify, quantify and reduce sources of contaminants in the New York/New Jersey Harbor that were making disposal of navigational dredged materials more costly and difficult to manage (HydroQual, 2007); however, they were measured in the CARP monitoring program and are included in the CARP database. K_{POC} values for these congeners were computed using the CARP data and the same approach was used to develop the K_{POC} values for the contaminants included in the CARP model (HydroQual, 2007, Sections 2.1.1.1 and 4.3.3, and Appendix 4A.). The stations considered in the averages of the computed Log K_{POC} for the twelve PCB congeners with dioxin-like toxicity were limited to the Lower Passaic River (Passaic River Mouth, Surface and Bottom, and Passaic River, Mid-Tidal). The Setschenow constants, ΔH_{OW} values, and resulting K_{POC} values are documented in RI/FFS Appendix BIII, Table 3-7.

D.2. Mass Balance and Single Layer Box Model

D.2.1 Comment: EMBM is Flawed

Commenters stated that the EMBM conclusion seems plausible, though it is clearly uncertain because it rests on a number of unsupported assumptions, including that sediment resuspended in the mid-to-late 2000s has the contaminant concentrations found in the top 6 inches of sediment sampled in 1995; methodological differences between the 1995 chemical analyses and those of the mid-to-late 2000s do not affect the loading estimates; and the chemical concentrations on sediment being carried over Dundee Dam are the same as on sediments that deposit upstream of the dam. The commenters also stated that the objective function that minimizes the normalized sum of squares is relatively insensitive to changes in the source contributions. Commenters indicated that there are errors in the formulation of the EMBM contaminant mass-balance modeling and that the EMBM is flawed, with issues including: inconsistency with the Fate and Transport model; an incorrect conceptual approach; underestimation of flood and surge events; a failure to extend the prediction period beyond 2059 even though this is clearly important; a dominance of systematic errors over the random errors that can be assessed by a Monte Carlo analysis; and overall uncertain results with unrealistic error bars.

Response:

The EMBM is a technically defensible empirical approach that is derived from site-specific data. The model consists of two components: (1) a receptor mass balance analysis (EMBM receptor component) and (2) integration of results of the first component with current surface sediment and source data and historical contaminant trends (EMBM trajectory component).

<u>EMBM receptor component</u>. The objective of this first component of the EMBM is to determine the number of end members or sources contributing to the system, the chemical composition of each source, and the relative contribution of each end member to the receptor site. This receptor modeling

approach has been widely used in the field of air pollution, e.g., EPA Chemical Mass Balance Model (Watson et al., 2004). It has also been used at sediment sites that are contaminated with PCB, PCDD/PCDF and PAH compounds, such as the Fox River in Wisconsin (Su et al., 2000), San Francisco Bay in California (Johnson et al., 2000), Ashtabula River in Ohio (Imamoglu et al., 2002), Lake Calumet in Chicago (Bzdusek et al., 2004), and Tokyo Bay and Lake Shinji in Japan (Ogura et al., 2005). Therefore, the conceptual approach on which the Lower Passaic River receptor model is based is technically defensible.

During the original development of the receptor mass balance, the only extensive sediment data set available was the 1995 coring data collected during the 6-mile Passaic River Study Area RI. The concentrations in the top 6 inches of the sediment from the 1995 data set became the basis to define the resuspension source term for the analysis. As more data from 2008-2013 sampling became available, they were analyzed and found to support the use of the 1995 data set for the purpose of developing the receptor mass balance. The data sets from 2008 – 2013 were declustered, averaged and applied to the receptor model as the resuspension term, with the resulting percentage contributions falling within the range of values predicted by the model. Therefore, the model results that are based on use of 1995 data set to represent the resuspension term is still valid. As noted in the response to comment II.D.1.7, median surface sediment concentrations of most contaminants have not declined significantly from 1995 to 2013, so the use of the 1995 data set and the use of the more recent data sets to characterize the resuspension term would be expected to yield similar model results.

The commenters questioned the assumption that the chemical concentrations on sediment being carried over Dundee Dam are the same as on sediments that deposit upstream of the dam. The transport of sediments and associated contaminant concentrations was an important input in the model. Because it is difficult to find pockets of recently deposited sediments just below the dam, two methods were used to characterize the nature of the particles transported from above the dam into the Lower Passaic River. The first was to sample locations immediately above the dam where recent deposition had occurred. Recently deposited solids represent the solids transported in the water column and, therefore, would likely represent the solids that are coming over the dam. Secondly, sediment traps were deployed below the dam to capture solids in the water column during transport. As documented in the RI/FFS, these two data sets compared favorably, and so became the basis to develop the chemical profile for the Upper Passaic River source term in the receptor model.

The results of the receptor mass balance describe the relative importance of the current external loads to the river, as well as internal resuspension or chemical contribution from the sediment bed, for each of the COCs. The objective function is essentially a mass balance for general contaminants sources. In the RI/FFS application, contaminant concentrations were normalized to the variance so that contaminants with larger variances do not dominate the mass balance solution. This approach is consistent with multivariate statistical analysis of environmental data for which normalization and standardization are applied to ensure that constituents with larger concentrations do not dominate the analysis. Contrary to the commenters' assertion about the objective function, sensitivity and variability analysis presented in the RI indicates that the objective function responds to changes in source profiles and can be significantly affected by outliers in the data. Variability in data input for source characterization on the objective function was evaluated through a Monte Carlo analysis. It is important to note that any mass balance evaluation, whether done empirically or by applying a mechanistic model, will be sensitive to the large sources that dominate the system.

Every chemical model, whether empirical and numerical, is subject to uncertainty and errors. It is critical to understand how the uncertainty and errors propagate through the model as part of the uncertainty analysis. The most common errors are random, systematic (or bias) and model formulation errors. The random errors are a function of the field sampling and related experimental conditions used to obtain the measurements. In the Lower Passaic River investigation, QAPPs were developed and approved by EPA and laboratory procedures were implemented to adequately control the external factors that can significantly affect the measurements. The random errors generated by the variability in sample materials and other factors were incorporated in the Monte Carlo Analysis conducted for the EMBM. Systematic errors are associated with bias in environmental data and, in the case of the Lower Passaic River investigations, these are controlled by evaluation of Performance Evaluation samples and split samples, as well as other rigorous QA/QC procedures. Because of these controls, a systematic bias was identified in the 2008 2,3,7,8-TCDD data from the Low Resolution Coring Program conducted for the 17-mile RI/FS and EPA performed statistical comparison with split sample data to address the bias. The EMBM relies exclusively on measured validated site data and, therefore, random errors dominate the model simulation, contrary to the assertion from the commenters that systematic errors were dominant. The overall uncertainty propagated through the model is the result of the random errors and variability associated with estimation of average source profiles. The model formulation for the EMBM is based on a mass balance approach which is the fundamental basis for all sediment and chemical fate and transport models.

<u>EMBM trajectory component</u>. Results from the EMBM receptor component were integrated with observed surface sediment concentrations, current chemical compositions of external sources, and historical trends of contamination from dated sediment cores. The dated core profiles describe the historical trends of contamination on depositing sediment and provide a basis for estimating future concentrations in the absence of remedial intervention. Because the historical sediment records were used in the forecast, past storm events and the response of the river to those storm events were included in the empirical formulation. The EMBM trajectory component was developed to estimate future conditions based on the time history of the contaminant concentrations of the Lower Passaic River. The forecast was performed on the excess load, defined as the portion of the total contaminant load remaining after subtraction of the Upper Passaic River, tributary and CSO/SWO loads.

In response to comments, EPA made two changes to the EMBM trajectory component that resulted in an update to the results previously presented in the RI/FFS and Proposed Plan. These two changes were as follows:

- In both the RI/FFS and updated applications, the model was started in 1995 using the 1995 data set to set the sediment bed compositions. In the RI/FFS application, the model ran from 1995 to the end of the simulation. In the updated application, in 2010, the sediment bed composition was updated using the data from 2008 to 2013 sediment sampling conducted for the 17-mile RI/FS, so that the most recent data were reflected in the model for the forecast.
- In the RI/FFS and Proposed Plan application, the time history of contaminant trends was derived using dated core results from 1980. In the updated application, dated core results were limited to results from 1990 to the date of core collection (2005), which incorporated the current contaminant trend in the analysis, consistent with the period of the model simulation.

The EMBM trajectory simulation period for the RI/FFS ended in 2060, 30 years after construction of the last alternative to be completed (Alternative 2) to allow for risk assessment calculations. In response to comments, the durations of the alternatives were extended, as discussed in the response to comment II.H.4.1, and the EMBM trajectory simulation period was correspondingly extended to 2064.

A comparison between the EMBM and the mechanistic model is summarized in Section II.E.4.

Overall, the conceptual approach for the EMBM is consistent with the CSM and includes all the sources and by inference the various processes that affect the contaminant fate and transport in the Lower Passaic River.

D.3. Source Control and Recontamination

D.3.1 Comment: On-Going Sources of Contaminants

Commenters asked why EPA is proposing to clean up the river, when there are still on-going sources of contaminants that would result in the newly remediated area suffering from recontamination from adjacent sources, which is economically, environmentally and socially wasteful. Other commenters concurred with EPA's findings that current loadings, including CSO discharges, are minimal sources of chemical contaminants to the river relative to the well-documented large historical industrial discharges.

Response:

As discussed in the RI/FFS and Proposed Plan, EPA investigated potential sources of contaminants to the Lower Passaic River, including atmospheric deposition, groundwater, industrial point sources, Upper Passaic River, Newark Bay, major tributaries, CSOs and SWOs. Based on analyses discussed in the RI/FFS, direct atmospheric deposition, groundwater discharge and industrial point sources of contaminants currently are not significant contributors of COC mass (i.e., sediment particles and the COCs bound to them) in the recently deposited sediments or water column of the lower 8.3 miles of the Lower Passaic River. The Upper Passaic River, Newark Bay, the three main tributaries, and CSOs and SWOs were sampled between 2005 and 2011. A mass balance of suspended sediment and contaminant loads was performed with the data. Results show that the tributaries, CSOs and SWOs are minor contributors of COCs, since they are minor contributors of sediment particles compared to the Upper Passaic River and Newark Bay, and the mass of contaminants delivered by those particles is low compared to the sediments of the Lower Passaic River main stem. For COCs such as 2,3,7,8-TCDD, Total PCBs and mercury, concentrations on sediment particles from the tributaries, CSOs and SWOs are clearly lower than those on Lower Passaic River surface sediments. Current contributions to the recently deposited sediments of the Lower Passaic River are summarized in ROD Table 3 in Appendix II. Resuspension of Lower Passaic River sediments contributes well over 90 percent of the dioxin in recently deposited sediments of the Lower Passaic River, followed by Newark Bay (approximately 5 percent) and the Upper Passaic River (3 percent or less). Resuspension of Lower Passaic River sediments contributes approximately 80 percent of PCBs and DDE in recently deposited sediments, followed by the Upper Passaic River (approximately 10 percent) and Newark Bay (less than 10 percent). Similar trends are shown for copper, mercury and lead. These findings, coupled with the fact that 85 to 90 percent of the fine-grained sediments in the Lower Passaic River are located below RM 8.3, further support the conclusion that resuspension of highly contaminated surface sediments already in the lower 8.3 miles of the river is the predominant contributor to COC mass in the water column, and thus to COC concentrations in fish and crab tissue. EPA is remediating the contaminated sediments in the lower 8.3 miles because they are a major source of contamination to the Lower Passaic River and Newark Bay.

Addressing these sediments will lead to reduced contaminant concentrations in biota including fish and crab tissue, thereby significantly reducing potential human health and ecological risks.

As described in the RI/FFS and Proposed Plan, all of the major sources of contamination into the lower 8.3 miles of the Passaic River were characterized by data and incorporated into the mechanistic model that was used to simulate the effect of remedial implementation on the Passaic River and Newark Bay. EPA's modeling results show that, after bank-to-bank remediation of the lower 8.3 miles, incoming COCs from above Dundee Dam, from Newark Bay and from the Lower Passaic River above RM 8.3 will gradually recontaminate the new riverbed surface. EPA's model underestimates the effectiveness of the bank-to-bank remedies because, while the model assumes that the incoming COCs will remain constant until the end of the simulation period (until the early 2060s), EPA expects that those COCs will decline over time as the Lower Passaic River above RM 8.3 and Newark Bay are remediated through actions selected after the completion of the 17-mile RI/FS and Newark Bay RI/FS, respectively, and as Clean Water Act programs address COCs from above Dundee Dam. Such actions, taken while the remedy for the lower 8.3 miles is being designed and implemented, will reduce the incoming COCs and minimize the degree of recontamination, allowing the bank-to-bank remedies (Alternatives 2 and 3) to achieve protectiveness. In contrast, while EPA's model also underestimates the effectiveness of Alternative 4, because it does not account for any reduction in incoming COCs over time, the effect of recontamination on the protectiveness of Alternative 4 includes and is greatly exacerbated by the resuspension of highly contaminated sediments from the unremediated two-thirds of the lower 8.3-mile riverbed redepositing on adjacent capped areas. While EPA actions under the Superfund and Clean Water Act programs should reduce the incoming COCs in the future, the resuspension of highly contaminated sediments from the unremediated two-thirds of the lower 8.3 miles would continue unabated.

D.3.2 Comment: Failure to Identify On-Going Sources

Commenters stated that EPA's failure to identify ongoing sources was in contravention of EPA's sediment management principles, sediment guidance, and CERCLA policy.

Response:

In its April 1, 2008 memorandum to EPA Region 2, CSTAG's recommendation under Principle #1, Control Sources Early, was that Region 2 needed to evaluate more quantitatively the relative contribution of risks from dioxin and PCBs entering from over Dundee Dam, tributaries, CSOs-SWOs and instream sediments above RM 8 and Newark Bay. In 2008, EPA Region 2 completed a sampling program targeting those sources into the lower 8.3 miles, including all of the COCs, not just dioxins and PCBs.

EPA used these data, as well as data subsequently collected as part of the 17-mile RI/FS, to quantify the relative contribution of contaminants from sources entering the lower 8.3 miles. Those evaluations showed that, when compared to the resuspension of the major COCs (dioxins, PCBs, mercury and DDT) in the main stem of the Lower Passaic River, the tributaries or CSOs-SWOs are minor contributors of those contaminants (< 4 percent), and the Upper Passaic River and Newark Bay are small contributors of those contaminants (< 14 percent). The remedy selection process for the lower 8.3 miles correctly focuses on remediating the contaminated sediments in the main stem of the lower 8.3 miles of the Lower Passaic River as a major on-going source of COCs in the system.

The mechanistic model for the Lower Passaic River incorporated all of the data characterizing the sources of COCs entering the lower 8.3 miles into its predictions of surface sediment concentrations post-remediation.

D.3.3 Comment: Recontamination of the Engineered Cap

Commenters stated that the Proposed Plan failed to recognize that deposition of contaminated sediment from background sources would recontaminate a "clean" cap in the lower 8.3 miles. Commenters stated that resuspension of dredged materials and sediments from un-remediated portions of the LPRSA and Newark Bay would recontaminate capped areas. Commenters stated that given the high likelihood that the very costly remedy would be completely negated by the on-going contaminant sources such as those described above, the proposed remedial action should not be implemented. With respect to EPA's preferred alternative, other commenters suggested dredging an additional foot of sediment so that the more highly contaminated sediments settling on the cap initially would, eventually, be buried by less contaminated sediments as the river becomes cleaner through remediation and natural processes. The additional thickness of sediment on top of the sand cap would also provide additional protection to the cap from major flood events. Commenters expressed concern that the cap would be immediately recontaminated by the tidal action of the river.

Response:

As discussed in the ROD, the selected remedy would replace the highly contaminated riverbed of the lower 8.3 miles with effectively clean material (sand), bank to bank. There is no more comprehensive way to remediate the sediments of the lower 8.3 miles. EPA's modeling results show that, after the sand is placed bank to bank in the lower 8.3 miles, incoming COCs from above Dundee Dam, from Newark Bay and from the Lower Passaic River above RM 8.3 will gradually recontaminate the new riverbed surface. EPA's model underestimates the effectiveness of the bank-to-bank remedies because, while the model assumes that the incoming COCs will remain constant until the end of the simulation period (until the early 2060s), EPA expects that those COCs will decline over time as the Lower Passaic River above RM 8.3 and Newark Bay are remediated through actions selected under CERCLA. Furthermore, EPA expects that Clean Water Act programs will address COCs coming in from above Dundee Dam. Such actions, taken while the remedy for the lower 8.3 miles is being designed and implemented, will reduce the incoming COCs and minimize the degree of recontamination, allowing the selected remedy to achieve protectiveness. In contrast, while EPA's model also underestimates the effectiveness of Alternative 4, because it does not account for any reduction in incoming COCs over time, the effect of recontamination on the protectiveness of Alternative 4 includes and is greatly increased by the resuspension of highly contaminated sediments from the unremediated two-thirds of the lower 8.3-mile riverbed redepositing on adjacent capped areas. While EPA actions under the Superfund and Clean Water Act programs should reduce the incoming COCs in the future, the resuspension of highly contaminated sediments from the unremediated two-thirds of the lower 8.3 miles would continue unabated.

EPA does not agree with the comment that additional dredging, so that more highly contaminated sediments settling on the cap initially will eventually be buried by less contaminated sediments, is necessary or appropriate. EPA's analyses, as described in the ROD and this Responsiveness Summary show that the selected remedy will meet the threshold criterion of overall protection of human health and the environment without additional dredging beyond that which was included to ensure that flooding is not exacerbated by the remedy and to accommodate current and reasonably anticipated future land and waterway uses in the lower 1.7 miles of the navigation channel. The final depth of dredging will be determined during remedial design and will depend on the final thickness of the cap, more detailed modeling to ensure that flooding is not exacerbated by the remedy and other relevant factors.

D.3.4 External Sources of COCs were Underestimated

Commenters indicated that EPA's approach to quantifying external sources is flawed and should be replaced with relevant and quantitative analyses. Commenters asserted that external sources have more impact than resuspension of legacy sediments and that EPA's theory that legacy sediments are the primary source of contaminated material to the system is flawed and should not be used as the basis for any remedial action. Commenters asserted that the impact of contributions from outside sources was underestimated and upland sources within the lower 8.3 miles were not considered. In addition, the discussion of boundary conditions in the RI Report's DER No. 2 underestimated the impact of contribution from outside sources. Commenters stated that LPRSA RM 8-17 represents the true upstream boundary condition for the lower 8.3 miles, and that its potential contribution was not evaluated by EPA. Commenters further stated that the RI Report (including DER No. 2) analyzed the LPRSA's lower boundary condition at Newark Bay, but failed to consider much of the RI/FS work available for the Newark Bay Study Area (NBSA), particularly the CSM for the NBSA. Commenters concluded that because proper evaluation of such sources shows that ongoing contaminant discharges will continue to impact the lower 8.3 miles, remediation of the lower 8.3 miles is premature before these ongoing sources are controlled. Commenters also stated that EPA fails to identify known contaminated sites in the LPR and should have included such sites in its source analysis.

Other specific comments related to the calculation of external loads include:

a) Referring to a statement on page 3-1 of DER No. 2 ("The Upper Passaic River drainage basin (810 square miles) enters the Lower Passaic River at Dundee Dam (RM 17.4)."), commenters asked if any estimate can be made for the magnitude of solids loading expected from this watershed based on unit loadings.
b) Commenters stated that because CSO contaminant concentrations are higher in the CARP data than in data collected in by EPA/Malcolm Pirnie in 2007-08 to support the RI/FFS and the CSM for this project, CSO contaminant loadings should be recalculated using the 2007-08 data to be most representative.

Response:

As documented in the RI/FFS, EPA's approach to quantifying external sources used multiple lines of evidence, including direct quantitation of contaminant loads from upland sources; data from the various sediment and water column investigations conducted over nearly 20 years; fate and transport analyses (both empirical and mechanistic modeling); and integration of the chemical and physical analyses with results of biological investigations. There is no evidence to suggest that EPA's analysis has missed significant contaminant sources to the river, whether overland from upland locations or via tributaries below their respective heads of tide.

In particular, EPA's collection of suspended matter and beryllium-7 bearing surface sediments above the head of tide on the upper LPR (close to Dundee Dam) as well as on each of the three major tributaries to the Lower Passaic River provided direct quantitation of the contaminant concentrations on solids being delivered to the Lower Passaic River.[15] As discussed in the RI/FFS, EPA also conducted similar monitoring

[15] Measurements of suspended matter and beryllium-7 bearing surface sediments comprise two means of determining the contaminant concentrations on solids being delivered to the Lower Passaic River. The suspended solids that are collected from the tributary water column just at or prior to its confluence with the Lower Passaic

of CSO solids at the major CSO discharges. These sampling efforts integrated the significant natural, industrial and municipal contributions from 888 of the 935 square miles of the Passaic River drainage basin (see Table II.D.3.4 – 1). This sampling achieved this integration, since sources in these drainage areas reach the Lower Passaic River through transport by these tributaries. Thus, if tributary loads are not substantial, then upland sources in their drainage basins are not important current contributors to Lower Passaic River contamination.

In addition, EPA created maps of possible upland sources. An examination of these maps shows that most significant upland sources are captured within the various stream, stormwater and CSO drainage areas. Only those directly on the banks of the Lower Passaic River, or with direct outfalls to the river, can discharge directly to the river. There is no evidence that such discharges are now occurring in substantial amounts, based on the general lack of trend in contaminant concentrations along the main stem of the river, and the lack of variability across the high resolution cores obtained along the length of the Lower Passaic River, as discussed further below.

The beryllium-7 bearing samples from the tributaries provided an integration of the tributary solids contamination and, therefore, of upland sources in the respective watersheds, over a period of six months to one year. Thus, EPA's studies integrated source contributions across the entire watershed and over time. Using these data, along with direct measurements of flow from USGS gauges, EPA quantified the contaminant loads entering the Lower Passaic River from these sources. Those evaluations showed that, when compared to the resuspension of the major COCs (dioxins, PCBs, mercury and DDT) in the main stem of the Lower Passaic River, the tributaries or CSOs-SWOs are minor contributors of those contaminants (< 4 percent), and the Upper Passaic River and Newark Bay are small contributors of those contaminants (< 14 percent) [see ROD Table 3 in Appendix II]. EPA specifically examined the upland dioxin loads, and the analysis showed that none of the tributary or CSO loads presented the concentrations or the unique 2,3,7,8-TCDD to total TCDD ratio that is characteristic of Lower Passaic River sediment contamination. Thus, no evidence exists for substantial upland sources of dioxin.

Both of the EPA models (empirical mass balance and mechanistic models) demonstrated that external loads are small current contributors to the large mass of contaminated sediments in the main stem of the Lower Passaic River. These models both identified resuspension of contaminated sediments, present in the main stem of the river as a result of past discharges associated with the long history of industrial operations, as the primary current source of the COCs in the system, both in terms of contaminant mass and the contaminant pattern. No other current source to the Lower Passaic River has the contaminant

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River are the solids that the tributary is delivering to the Lower Passaic River at the time of collection. EPA analyzed the COC concentrations on these solids directly. By performing this sampling multiple times, EPA then determined the average COC concentrations on solids from the tributary discharges. As an alternate approach, EPA has collected beryllium-7 bearing sediments in each of the major tributaries just upstream of their confluences with the Lower Passaic River. As a result of a series of natural processes, suspended solids in a water body absorb measureable levels of this radioisotope while in the water column. When these solids settle to the bottom, they carry with them this beryllium-7 burden. However, beryllium-7 is a very short-lived radioisotope (its half-life is only 53 days). Thus, finding sediments with measurable beryllium-7 levels indicates that those sediments were recently suspended solids, and were deposited at the location within the last 6 to 12 months. Because suspended solids settle to the bottom on a fairly regular basis, a single sample of beryllium-7 bearing sediment is taken to show the suspended solids carried by the tributary past that location over the prior 6 to 12 months. EPA analyzed the COC concentrations on these sediments as a measure of the average COC concentrations on suspended solids transported by the tributary to the river over this same period. These techniques are not unique to the Lower Passaic River and have been used in many estuarine investigations, as discussed in the RI/FFS.

load magnitude or contaminant pattern capable of generating the mixture of contaminants observed in Lower Passaic River sediments.

The lack of important external loads is further supported by the results from the high-resolution dated sediment cores collected by EPA in 2005 (and supplemented with co-located core-tops in 2007). These cores showed similar slowly declining trends post-1980 along the entire length of the Lower Passaic River (see RI Figures 4-75a through g). These cores robustly integrate all of the significant sources to the water column at continually-depositional locations along the river bed from RM 1.4 to RM 12.6. While concentration patterns (i.e., increases and decreases) vary from core to core in layers deeper than those dated as being deposited in the 1980s, concentration patterns become more similar after the 1980s. This indicates that there were multiple discharges of COCs to the Lower Passaic River before 1980s, whereas after the 1980s, with the Clean Water Act in effect, discharges declined and contaminants were distributed throughout the Lower Passaic River by the tides and storm events. A high-resolution dated sediment core from above Dundee Dam, shows dramatically lower concentrations of 2,3,7,8-TCDD over the entire core length relative to the downstream cores, further supporting the lack of 2,3,7,8-TCDD contamination in the tributaries to the lower river.

These core and surface sediment sampling locations span the main stem of the river and encompass the tributary discharges into the main stem, integrating the potential discharges of the upland sources cited as examples by the commenter. If upland sources were significantly influencing the contaminant load at different points along the river, these high-resolution cores would show very different results than were obtained. That is, cores closest to sources would show high concentrations compared to cores farther away from the sources. Instead, the data show similar trends for any given contaminant along the length of the Lower Passaic River.[16]

EPA's evaluation of groundwater infiltration (estimated to contribute just 2 percent of the river's base flow) did not provide evidence to support substantive groundwater-related transport of COCs to the water column or sediment. Groundwater load estimates were demonstrated in the RI/FFS to be insignificant in comparison to loads derived from the legacy sediments, even for those contaminants that are likely to be mobilized in groundwater. 2,3,7,8-TCDD, PCBs and many of the other organic COCs, tend to adhere to solid particles; such contaminants would not be carried in sufficient quantities in groundwater to influence measurably the contaminant load in the river compared to remobilized legacy sediments. In many cases, the contaminants cited by the commenters as being of concern for the upland sites mentioned, such as cyanide ion, are not co-located with the primary risk drivers for the remedy. While dangerous to human health in gaseous form (e.g., as hydrogen cyanide) and in very high doses in water, cyanide ion at the concentrations mentioned does not result in human health risk through exposure to water and sediment in the same manner.

Commenters raised a concern relative to local contaminant accumulations at high concentrations adjacent to specific industrial facilities, pointing to specific examples addressed in targeted removal

[16] One noted exception to the above conclusion is the apparent short-lived release of 2,3,7,8-TCDD found to have entered the river around the year 2000 near RM 11 as evidenced in the dated sediment cores at RM 7.8 and farther upriver; this exception was documented in the RI Report and no other similar excursions in any other contaminant are apparent since 1980. The cores document a single discharge of 2,3,7,8-TCDD in the vicinity of RM 11 circa 2000, with an ensuing temporary change in contaminant patterns. Subsequent samples of recently deposited sediments show a decline to pre-2000 conditions with a return to the pre-2000 contaminant relationships as well, thus indicating that the release had ended. None of the other contaminants analyzed in those sediment cores showed such a temporary increase in concentrations in those layers. The temporary increase in 2,3,7,8-TCDD observed in the cores at RM 7.8 and farther upriver was not observed in the cores collected at RM 1.4 and 2.2, indicating the limited impact of the circa 2000 release.

actions over the past few years (RM 10.9 and Tierra Phase I). As noted above, EPA created maps of known contaminated sites along the river as part of the RI/FFS and these were considered in EPA's evaluation of possible sources. In this process, no other significant accumulations of contaminated sediments in the lower 8.3 miles were identified warranting such immediate action, whether adjacent to known contaminated upland sites or near tributaries.

Moreover, while the 2,3,7,8-TCDD concentrations observed in the Tierra Phase 1 Removal area were uniquely high, the concentrations at RM 10.9 were not. Concentrations at 20,000 pg/g of 2,3,7,8-TCDD such as those measured at RM 10.9 are routinely observed throughout the Lower Passaic below RM 12, especially below RM 8.[17] For example, see RI Figures 4-75a through g, which show elevated concentrations at depth in the high resolution cores across the entire length of the Lower Passaic River. See also RI Figure 4-4, which shows the occurrence of high concentrations of 2,3,7,8-TCDD in surface sediments along the length of the river.

The commenters' assertions do highlight the observations made in the RI that the surface sediments above RM 8.3 are composed of coarse-grained sediments with small pockets of fine-grained sediments. As a result, above RM 8.3, these deposits are likely to represent small reservoirs of highly contaminated sediments, and therefore are more likely to be identified as "hot spots" relative to less contaminated coarser-grained sediments. This is in contrast to the near bank-to-bank occurrence of highly-contaminated, fine-grained sediments below RM 8.3. Deposits above RM 8.3 are not only laterally constrained but are thinner than those below RM 8.3 (one to three feet above RM 8.3 versus up to 15 feet and sometimes more below RM 8.3). Thus, the contaminant mass available for transport downstream to the lower 8.3 miles is relatively limited compared to the mass below RM 8.3, despite the existence of comparable concentrations. The difference in concentrations between coarse and fine-grained sediments is shown in RI Figure 4-4, which compares surface (0-6 inches) concentrations of 2,3,7,8-TCDD above and below RM 8.3. In both cases, surface concentrations range from single-digit pg/g (parts per trillion) to tens of thousands of pg/g. However, the median concentrations found in coarse-grained sediments above RM 8.3 are much lower than those found in fine-grained sediments anywhere in the Lower Passaic River. Thus, the area above RM 8.3 is limited in both contaminated sediment area and volume relative to the area below RM 8.3 and currently plays a relatively minor role in terms of contaminant transport to the area below RM 8.3.

The commenter's assertion that EPA did not correctly identify the upstream boundary condition is incorrect. EPA evaluated the upland sources to the entire Lower Passaic River, as described previously in this response. These are the true boundaries for the Lower Passaic River irrespective of the subdivisions EPA has created in order to manage response actions (i.e., the lower 8.3 mile FFS, the Tierra Phase 1 removal, the RM 10.9 Removal). Additionally, EPA has quantitatively estimated the gross and net exchange rates from the area above RM 8.3 to the area below RM 8.3 (see RI/FFS Appendix B). Thus, despite the small potential for contaminant transport originating from the sediments of the Lower Passaic River above RM 8.3, as noted above, EPA has, nonetheless, quantified the effective upstream boundary loads at RM 8.3.

Regarding the commenters' assertions that ongoing contaminant discharges will continue to impact the lower 8.3 miles of the Passaic River, EPA's modeling results for the selected remedy show that, after the sand is placed bank to bank in the lower 8.3 miles, incoming COCs from above Dundee Dam, from Newark Bay and from the Lower Passaic River above RM 8.3 will gradually recontaminate the new riverbed surface. EPA's model underestimates the effectiveness of the bank-to-bank remedies because,

[17] The RM 10.9 Removal was undertaken to because of the accessibility of the mudflat to receptors, as well as to prevent any potentially significant migration of contamination from the mudflat.

while the model assumes that the incoming COCs will remain constant until the end of the simulation period (until the early 2060s), EPA expects that those COCs will decline over time as the Lower Passaic River above RM 8.3 and Newark Bay are remediated through actions selected under CERCLA. Furthermore, EPA expects that Clean Water Act programs will address COCs coming in from above Dundee Dam. Such actions, taken while the remedy for the lower 8.3 miles is being designed and implemented, will reduce the incoming COCs and minimize the degree of recontamination, allowing the selected remedy to achieve protectiveness.

EPA's Risk Management Principle #1 recommends control of sources early in the process, but also recommends that sources be prioritized. The narrative states, "where sediment remediation will have benefits to human health and/or the environment after considering the risks caused by the ongoing source, it may be appropriate for the Agency to select a response action for the sediments prior to completing all source control actions." Under current conditions, with every year that passes, additional loads of the COCs are transported out into Newark Bay and beyond. Given that external sources to the Lower Passaic River currently are very small contributors of COCs when compared to resuspension of legacy sediments in the main stem of the lower 8.3 miles of the river, EPA has determined that it is necessary and appropriate to remediate the sediments of the lower 8.3 miles as a major source of contamination to the rest of the Lower Passaic River and Newark Bay.

Calculating Loads

The Upper Passaic River drains about 805 square miles, and discharges over the Dundee Dam at RM 17.4 to the Lower Passaic River. Solids loads were developed based on flow data and suspended solids measurements made at Dundee Dam. The details of the data and the load calculated are presented in Attachment E. These loads were used directly in the mechanistic model for the Lower Passaic River.

As part of the modeling and geochemical analysis, CSO contributions of COCs were estimated as follows:

- For the EMBM, the particulate concentration on the CSO solids directly measured in 2007-8 were used to characterize the CSO source signature.
- For the mechanistic model, the total load including both particulate and dissolved phases was required. Since the CARP data directly measured the whole water concentrations, it formed the basis for estimating CSO loads not only in the lower 8.3 miles but also for other CSO inputs in the model domain.

Overall, the distribution of the CARP CSO data did not differ significantly from the distribution of the 2007-2008 data. It is important to note that the contribution of contaminants from CSOs is very small relative to other sources in both the EMBM and the mechanistic model, and the use of either data set to determine loads did not affect this conclusion.

D.3.5 Comment: Inadequate Characterization of COC Contributions from Tributaries and CSOs-SWOs

In reference to the RI's characterization of contaminant contributions to the Lower Passaic River from three tributaries (Saddle River, Third River and Second River), commenters stated that EPA's approach failed to adequately represent contaminant contributions from each of these tributaries and also likely overlooked several other tributaries that may be locally important contributors of contamination to the lower 8.3 miles. Commenters stated that by collecting samples only above the head-of-tide, EPA's analysis eliminated the lower 3.2 miles of the Saddle River, the lower 2 miles of the Third River and the lower 1.4 miles of the Second River. In addition, commenters stated that contaminant inputs from CSOs and SWOs were not adequately characterized and pose a threat for recontamination of remediated areas. Commenters concluded that EPA should fully characterize ongoing discharges and further evaluate legacy sediment contaminant hot spots associated with these discharges prior to considering remedial alternatives for sediments in the lower 8.3 miles.

Response:

EPA disagrees that the evaluation approach used in the RI/FFS failed to adequately represent contamination contribution from tributaries, CSOs and SWOs.

To respond to this comment concerning the small watershed areas below the head-of-tide, EPA compared the tributary samples above and below head-of-tide. In 2007-2008, EPA collected tributary samples above head-of-tide to eliminate any possible influence from the Lower Passaic River on the boundary condition characterization via upriver tidal transport. Samples collected above the head-of-tide represent integrated measurements of the tributary watershed that are not impacted by tidal mixing or other receiving stream-related mechanisms. In 2008, the CPG under EPA oversight collected samples from the three main tributaries (Saddle River, Second River and Third River) below the head-of-tide. EPA examined the 2008 data and also the more recent data obtained for the 17-mile LPRSA RI/FS on sediment contamination in the tributaries between the head-of-tide and the confluence with the Lower Passaic River. These data were obtained from what is primarily the tidally influenced portion of these tributaries. These results for 2,3,7,8-TCDD are plotted in Figure II.D.3.5 – 1. As is evident in the figure, the sediment concentrations in the region between the head-of-tide and the confluence with the Lower Passaic River (labeled “Below Head-of-Tide” in the figure) are generally lower than or comparable to those observed above the head-of-tide for the specific tributary and those observed in the Lower Passaic River. This is true for the simple concentration as well as the organic carbon normalized concentration (Figure II.D.3.5 – 2). Other contaminants were also evaluated and showed similar results (see Figures II.D.3.5 – 3A through 3G). This distribution indicates that there is no significant source of contamination in the region between the head-of-tide and the confluence with the Lower Passaic River for these tributaries. Otherwise the concentrations on sediments between the head-of-tide and confluence would be higher than those on head-of-tide sediments, at a minimum.

In addition, EPA’s CSM and mechanistic model had already incorporated the below head-of-tide samples collected by the CPG under EPA oversight in 2008. There is no evidence to suggest that EPA’s analysis missed significant contaminant sources from Saddle River, Third River and Second River between head-of-tide and confluence to the river.

EPA disagrees with the commenters’ assertion that contaminant inputs from CSOs and SWOs were not adequately characterized and pose a threat for recontamination of remediated areas. EPA collected samples from CSOs and SWOs in 2007 and 2008. For this program, CSO locations were chosen from a larger group of CSOs, based on the total area contained in the ‘sewer-shed’ (i.e., the size of the sewerage drainage area) for a particular CSO. The list of CSOs was obtained from information provided by Passaic Valley Sewerage Commission’s "City of Newark Land Use Distribution." The five selected CSOs had the largest drainage areas that discharge directly to the Lower Passaic River. Table 6-1 of DER No. 2 in Appendix A of the RI/FFS shows the drainage area and the percentage of each land use type at each CSO. The five CSOs sampled are located in Newark between RM 4 and RM 8.

Commenters referred to data collected in 1995 for the 6-mile Passaic River Study Area RI and CARP data collected between 2001 and 2004 to conclude that ongoing CSO and SWO discharges are important sources of ongoing contamination. EPA examined the 1995 data (published under Iannuzzi et al., 1997) and presented the findings in DER No. 2, Section 6.3. As stated in DER No. 2, EPA's findings disprove the findings of Iannuzzi et al. (1997), which had concluded that CSO discharges were a source of 2,3,7,8-TCDD to the River. This discrepancy in the characterization of CSO contaminant loads to the river is likely related to the commenters' sampling approach, which failed to properly characterize the CSO contributions. For the three CSOs discharging directly to the River, the commenters gathered samples of Lower Passaic River sediments near the discharge points rather than collecting suspended solids directly from the CSO chambers. Notably, the contaminant patterns reported for these three CSO locations were similar to the contaminant patterns observed in the surface sediments for the rest of the Lower Passaic River and did not match the patterns obtained by EPA's direct measurements of CSO solids. This observation is expected, since the tidal currents would be expected to disperse the relatively small solids loads from the CSO and deposit solids generally consistent with Lower Passaic sediments in the area.

EPA also examined the 2001 to 2004 CARP data and compared the results to EPA's 2007-2008 CSO/SWO data. The comparison can be found in DER No. 2. Out of nine CSO locations sampled for CARP, only one discharges directly to the Lower Passaic River. Three SWO discharge points along the Lower Passaic River were also sampled for CARP. Comparison between CARP and EPA CSOs/SWOs sample data for locations discharging directly to the Lower Passaic River showed that, on average, they are not statistically different (see DER No. 2, Section 6.4 for a detailed evaluation).

For additional discussion of EPA's characterization of external loads to the LPR system from tributaries, CSOs and SWOs, see response to comment II.E.2.6.

D.4. Bioaccumulation

D.4.1 Comment: Bioaccumulation Calculations not Reproducible

A commenter stated that EPA's revised FFS was significantly flawed because the process used to estimate bioaccumulation was not fully transparent and it could not be determined whether the calculations were correct and appropriate in the amount of time provided to the public. The commenter stated that EPA's data set should be rigorously reviewed, corrected, and appended to the Proposed Plan and FFS and that EPA should have provided information that included the list of samples used, the list of which sediment samples were paired with particular biota samples, how sums were calculated for classes of analytical compounds (i.e., Total PCB, Total DDx, Total Chlordane and PAHs), and how non-detects were treated. The commenter stated that EPA needed to justify development of risk estimates and preliminary remediation goals (PRGs) based on these poorly documented data sets and the EPA's bioaccumulation calculations constituted a fatal flaw in the preparation of the FFS and the selection of a preferred alternative in the Proposed Plan.

Response:

The information in the Proposed Plan and the documents in the administrative record file fully inform the public about the alternatives that EPA has evaluated, including EPA's preferred alternative. This includes information identified in the comment. Contrary to the commenter's assertions, EPA explained throughout DER No. 6 in Appendix A of the RI/FFS how non-detects were treated in the document (for example, see footnote 12 on page 2-13 and footnote 19 on page 3-5). EPA also described how the sums were calculated for classes of analytical compounds in various places within the DER. For Total PCB, the sums were explained in Section 3.1.1, pages 3-5 and 3-6. Total DDx and Total Chlordane are defined in Table 2-2.

Definitions of the terms low molecular weight PAHs (LMW PAHs) and high molecular weight PAHs (HMW PAHs) were not explicitly provided in DER No. 6, as these are commonly used terms. The LMW PAH concentration for each sample consisted of the sum of the concentrations of the following compounds: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene and 2-methylnaphthalene. The HMW PAH concentration for each sample consisted of the sum of the concentrations of the following compounds: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene and pyrene. In creating these sums, non-detect results for individual PAH compounds were assigned a value of zero. In cases where all individual PAH compounds were non-detect, half of the highest reporting limit was used.

D.4.2 Comment: Failure to Conduct Mechanistic Bioaccumulation Modeling

Commenters stated that EPA had failed to conduct mechanistic bioaccumulation modeling for the 2014 FFS; instead, EPA had used a simplified statistical analysis based on its “flawed” ecological CSM that incorrectly reflected the biology and ecology in the Lower Passaic River, and was at odds with the available site-specific data. Commenters stated that, for the 17-mile RI/FS being conducted by the CPG under EPA oversight, the CPG developed a bioaccumulation model to analyze the effectiveness of remedial alternatives at reducing contaminant concentrations in benthic organisms and fish in the Lower Passaic River. Commenters further stated that even though a bioaccumulation model was required pursuant to EPA’s Modeling Work Plan for the RI/FS, EPA had made no effort to conduct mechanistic bioaccumulation modeling for the 2014 FFS. EPA failed to use the site-specific bioaccumulation model that the CPG was developing for the 17-mile LPRSA RI/FS as required pursuant to the Administrative Settlement Agreement and Order on Consent. Commenters also stated that EPA failed to use its own site-specific sediment profile imaging (SPI) data, benthic community data collected and evaluated by the CPG for the LPRSA RI/FS, the expert advice of its own scientists, and information available in the peer-reviewed scientific literature to develop technically defensible bioaccumulation estimates. Because bioaccumulation modeling is such a critical element of the protectiveness evaluation, EPA’s overly simplistic approach and failure to use site-specific data undermine the overall technical defensibility of the final FFS.

Response:

EPA disagrees that its bioaccumulation model is at odds with site-specific data. EPA’s bioaccumulation modeling for the RI/FFS relied on site-specific data for the higher levels of exposure and used regional data (New York and New Jersey Harbor) for lower levels of exposure. Thus, the EPA bioaccumulation model is based on data specific to the Lower Passaic River and local watershed conditions.

The formulation of the model employed by EPA is based on the latest guidance in the development of site-specific bioaccumulation estimates, as given in Burkhard, 2009 (EPA guidance: EPA/600/R-06/047) and Burkhard et al*.,* 2013 (published in a peer-reviewed journal). The structure of the biota-sediment accumulation factor (BSAF) formulation reflects the standard theory of bioaccumulation; that is, animal body burdens are a result of their environmental exposure, with contaminant body burdens accumulated in proportion to the degree of exposure (i.e., the concentration of the contaminant in the environment). The nature of contaminants in the Lower Passaic River is such that they are strongly particulate-bound. Thus, their presence in the environment is controlled by their concentrations in the sediment. Because of the large reservoir of contamination in the sediments of the Lower Passaic River, water column concentrations are regulated by sediment-water interactions. Thus, animal exposure, whether through the sediments directly, through the water column, or through other animals exposed to these media, will occur in proportion to sediment concentrations. Hence, the bioaccumulation models and the BSAF formulations employed by EPA intrinsically incorporate sediment concentrations. Given the similar structure of the EPA model employed in the FFS to those in the published literature, the models and their results are technically defensible and fully support EPA's protectiveness evaluation.

EPA disagrees that its ecological CSM incorrectly reflects the biology and ecology in the Lower Passaic River, and is at odds with the available site-specific data. EPA has extensively and thoroughly researched the available information on the ecology of the Lower Passaic River, as documented in Section 2 of DER No. 6 in Appendix A of the RI/FFS. This information is incorporated into EPA's ecological CSM. EPA did use the SPI survey conducted by USACE and the New Jersey Department of Transportation (NJDOT) in 2005 to support their restoration planning efforts, as well as the benthic community data collected by the CPG for the 17-mile RI/FS, in the BERA ecological exposure assessment (see RI/FFS Appendix D).

The use of a mechanistic bioaccumulation model for the 17-mile RI/FS is appropriate to that effort. The mechanistic bioaccumulation model is still under development and as of February 2016 EPA has not approved it for use. Because EPA's bioaccumulation model was appropriate for use in the lower 8.3 miles RI/FFS, there was no reason for EPA to delay issuance of the Proposed Plan to allow for the completion of the 17-mile bioaccumulation model.

D.4.3 Comment: Depth of Biologically Active Zone Should be 2 Centimeters not 15 Centimeters

Commenters stated that EPA's statistical analysis of sediment-tissue contaminant relationships had exaggerated the potential for contaminants from deeply buried sediments to enter the food chain. Commenters stated that EPA had wrongly assumed that concentrations in fish were a function of concentrations in the top 15 centimeters (cm) of sediment, when site-specific data had indicated that the top 2 cm of sediment serve as a more appropriate representation of exposure. Commenters stated that because the top 15 cm of sediment represented the wrong exposure depth, EPA's regression equations, BSAFs, and Biota Accumulation Factors (BAFs) had yielded incorrect conclusions about the overall protection of human health and the environment that result from the various FFS alternatives. Commenters stated that the depth of the BAZ assumed in EPA's BERA was not supported by site-specific data.

Response:

EPA disagrees that the existing site-specific data do not support use of the top 15 cm of the surface sediment in the lower 8.3 miles to represent the BAZ, or use of contaminant concentrations in those top 15 cm for bioaccumulation modeling.

The top 15 cm is representative of surface sediment concentrations across the entire sample depth. The top 2 cm of sediment is a very thin layer that is subject to constant change due to erosion, deposition and other factors. This is evident from the various bathymetric surveys that regularly document changes in sediment surface elevation of 15 cm or more (see response to comment II.D.1.10). By contrast, a 15 cm composite, which is still a relatively thin surface layer, accounts for this variability and is a reasonable representation of the surface concentration at any point in time. Review of the data set of finely segmented cores with contaminant concentrations from depths of less than 15 cm (eight cores from 2008 low resolution coring program and two cores from 2005 high resolution coring program) shows significant variability: sometimes the surface concentrations are higher than concentrations averaged over the top 15 cm and sometimes they are lower. While the data set is limited, it suggests that a 15 cm composite reasonably represents concentrations at shallower depths.

The site-specific sediment-tissue regressional analyses developed by EPA also provide a basis for use of the top 15 cm to represent the BAZ. As discussed in the RI/FFS Appendix A, to calculate sediment-tissue concentration relationships for the Lower Passaic River that apply both to current highly-contaminated sediments and sediments with low contaminant levels that might exist post-remediation, EPA used current Lower Passaic River sediment data and regional NY/NJ Harbor sediment data with lower concentrations in conjunction with appropriate tissue data (see response to comment II.D.4.4). All of the sediment data from the Lower Passaic River and around NY/NJ Harbor were averaged over 15 cm. The sediment-tissue concentration relationships developed for the Lower Passaic River were compared to BSAF values compiled in an EPA BSAF database (Burkhard, 2009). The EPA BSAF database consists of approximately 20,000 BSAF values compiled from the literature, representing 20 locations (mostly Superfund sites) for organic contaminants. One of EPA's objectives in creating the BSAF database was to evaluate the reasonableness of BSAFs from other locations. The sediment-tissue concentration relationships that EPA calculated for the Lower Passaic River from sediment data averaged over 15 cm are consistent with the values in the EPA BSAF database. Therefore, for the Lower Passaic River, it is appropriate to estimate tissue contaminant concentrations on the basis of sediment contaminant concentrations averaged over the top 15 cm.

D.4.4 Comment: Statistical Errors in Analysis Of Relationships between Fish Tissue and Sediment COC Concentrations

Commenters claimed to have identified numerous statistical errors in the analysis used to derive bioaccumulation estimates in DER No. 6. Commenters asserted that these errors mean that the conclusions of the FFS are not technically defensible and stated that corrections are needed for the following:

- Commenters' analysis that the regression relationships between site-specific sediment PCB concentrations and mummichog tissue PCB concentrations, developed following EPA's multivariate approach, were primarily between tissue concentration and lipid content, not tissue concentration and 0 to 15-cm sediment concentration. Commenters concluded that EPA nonetheless used its regression models in the FFS as if sediment concentration, not lipid content, was the parameter explaining tissue concentration variability.
- Commenters' assertion that there is no discussion of the uncertainty associated with these models.
- Commenters' statement that the FFS failed to present confidence and prediction intervals, which are critical for the quantification of uncertainty in model predictions.
- Commenters' assertion that model "validation" relied on circular logic, failed to present standard tests of model performance, ignored failure to meet regression analysis assumptions, and hid behind weak graphical presentation of results.

Commenters stated that although DER No. 6 graphically presented regression model results and provided parameter estimates and coefficient of variation (R^2) values, it provided little additional model fit information. Commenters asserted that the R^2 value was offered as evidence of good fit for the models, but the R^2 value was misleading because it was achieved by adding off-site data to the models with much lower sediment concentrations, thereby securing the low end of the regression curve to increase the R^2 value. Another commenter stated that the confidence intervals provided for model prediction were quite large in most instances. Commenters further stated that bioaccumulation modeling presented in DER No. 6 ignored recent 2009 laboratory bioaccumulation test results collected on estuarine polychaetes and freshwater oligochaetes that were exposed to LPRSA sediments. A commenter conducted regression analyses of these site-specific data for the lower 8.3 miles and found excellent correlation between sediment and tissue concentrations for both 2,3,7,8-TCDD and Total PCBs, with R^2 values ranging from 0.98 to 0.99, respectively. The commenter concluded that regression slope confidence intervals revealed that bioaccumulation rates were fairly constant over the range of the sediment concentrations. The commenter stated that this was in contrast to the regression models presented in the report, which, because of the use of off-site tissue data from organisms with unquantifiable sediment exposure (e.g., Regional Environmental Monitoring and Assessment Program [REMAP], and CARP data), predicted that bioaccumulation rates increase as sediment concentrations decrease. Commenters stated that given the large uncertainty of these predictions, these models should not be used as the basis of a sediment remedy. Commenters stated that for a given chemical, species, and tissue type, better predictions could have been obtained using a model that was strictly site-specific, incorporated all available site sediment and biota data, and used a spatially weighted scheme (e.g., a surface weighted average concentration or SWAC) to relate the distribution of sediment concentrations to the observed distribution of biota concentrations in the system.

In contrast, other commenters agreed with the regression model approach used in DER No. 6 and were supportive of the narrow ranges of sediment contaminant concentrations being used to calculate BSAFs. Referring to Table 3-3, these commenters stated that the regression models for TCDD in blue crab and white perch were reasonably linear with sediment concentration. The commenters thought this seemed reasonable for the case of blue crab, which were less mobile and epibenthic, but was less so for white perch, which are both omnivorous and migratory based on their life history.

Response:

DER No. 6 in Appendix A of the RI/FFS provided risk managers with an appropriate level of information to evaluate relationships between tissue and sediment contamination levels and to understand the potential effects that might be expected under a range of remedial strategies. Rather than identifying statistical errors, the commenters requested a range of additional statistical outputs. The statistical information the commenters requested represents secondary diagnostic information and the results of statistical tests that are not necessary for risk managers to reliably interpret and apply the relatively clear findings of the analyses. For example, the graphical displays and the reported model fit statistics in DER No. 6 clearly demonstrate that tissue contaminant concentrations vary with sediment contaminant concentrations.

As to the commenters' regression analyses of the 2009 laboratory bioaccumulation test results, the commenters' proposed approach to incorporate these data actually results in less accurate predictions of tissue concentrations than EPA's approach (see further analysis and discussion below). Due to a lack of necessary data supporting trophic accumulation rates, the commenters' proposed modeling approach simply shifts the empirical calculation of accumulation from one of sediment-to-tissue directly, to a calculation of invertebrate-to-higher trophic level species accumulation factors. However, because invertebrate contaminant concentrations were shown to be nearly perfectly correlated with sediment contaminant concentrations, calculation of the accumulation factor (AF) is equivalent to calculation of an overall BSAF between higher trophic species and sediment directly. The commenters' proposed model structure is essentially as follows:

$$C_{Fish} = AF \times C_{Invertebrate}$$

where invertebrate contaminant concentration is linked to sediment concentration by a BSAF

$$C_{Invertebrate} = BSAF \times C_{Sediment}$$

So, noting that the accumulation factor AF is estimated empirically yields a net accumulation factor of $AF \times BSAF$, which is equivalent to a single *BSAF* factor between fish and sediment concentrations directly. The intermediate step proposed by the commenters results in the creation of an *AF* that is nothing more than an invertebrate-to-sediment BSAF, which is rolled up into the fish-to- sediment BSAF that EPA calculated directly from fish and sediment contaminant concentration data.

Predictive Power of the Model Proposed by Commenters

Figure II.D.4.4 – 1 is a reproduction of a figure provided by the commenters intended to show the relationship between observed and predicted tissue concentrations based on their proposed BSAF model. However, due to the incorrect method of display, it is impossible to gauge the predictive strength of the model. Observed values (green dots) should have been plotted against the predictions (blue circles) and compared with the 1–to-1 line. To correct this problem and to evaluate the predictive strength of their proposed model, the mean of the observed data and the predicted values were digitized using MATLAB© and plotted by EPA and are shown in Figure II.D.4.4 – 2. Figure II.D.4.4 – 2 shows that the averages of the observed fish tissue concentrations deviate severely from the 1-to-1 line, indicating that the predictive model is insensitive to variation in sediment concentration and, therefore, cannot be anticipated to provide reliable predictions of fish tissue concentrations. To measure the fit of EPA's regression relationships, EPA reported coefficients of determination based, correctly, on individual fish tissue samples, as opposed to averages (described below). In contrast, the commenters failed to report any statistical summary of the relationship between actual and predicted tissue concentrations. Absent this statistical summary, as an approximation of model fit, the coefficient of determination for a regression between the digitized averages and predicted values was calculated by EPA and was found to be R^2=0.66. This value comparing mean tissue concentration to predicted values would be expected to have a higher R^2 than values based on individual observations, and yet the R^2 values for the EPA model based on regression was much higher for all species considered. In addition, the EPA model was essentially unbiased, whereas the model proposed by commenters is highly biased, understating concentrations at the high end of the range and overstating them at the low end (see Figure II.D.4.4 – 2). This lack of model fit was not readily apparent based on the figures provided by the commenters.

Explanation of EPA's Approach

EPA developed sediment-to-tissue contaminant accumulation relationships based on standard multiple regression techniques referred to as analysis of covariance (ANCOVA). These techniques are used throughout every scientific discipline where the effects of both discrete variables (such as species of fish specimens) and continuous variables (such as concentration of a contaminant in tissue or sediment) are studied simultaneously. The method was formally discussed in the context of environmental monitoring by Hebert and Keenlyside (1995) when comparing the effectiveness of lipid normalization of organic contaminant concentrations with regression approaches.

The ANCOVA approach to bioaccumulation modeling has also been applied successfully at other large contaminated sediment sites. Although not specifically referred to as ANCOVA, Polissar et al. (2002)

used the same statistical framework to estimate spatial and temporal trends in fish and sediment concentrations at the Lower Fox River Superfund Site in Green Bay, Wisconsin. Santini et al. (2014) applied the ANCOVA approach to estimate the effects of a time-critical removal action at the Kalamazoo River, and Kern (2013) used the method to compare temporal trends among species and locations, and to estimate sediment to biota accumulation functions, also at the Kalamazoo River. Greenberg et al. (2011) used the same approach to develop biota-to-sediment accumulation relationships for resident fish at the Hudson River PCBs Superfund Site.

The ANCOVA approach combines a regression model linking sediment-to-tissue contaminant concentration relationships with an analysis of variance model, allowing for this regression model to differ among species. Use of the ANCOVA approach differs only slightly from an alternative approach wherein the regression portion of the model is simply fit separately to each species. Analyzing the data separately is equivalent to assuming that the relationships differ by species, rather than using ANCOVA to test this assumption. Generally speaking, either approach may be taken, although the ANCOVA approach provides investigators with the added understanding as to which species may have similar accumulation rates, which is often of interest. Additionally, when multiple species have similar accumulation relationships, the joint accumulation relationship can be estimated more accurately. This is because there is a reduced number of model parameters relative to the number of samples available for estimation. The ANCOVA analysis that EPA applied provided a unified framework for estimating accumulation functions for multiple species simultaneously. When the rate of contaminant uptake differed among at least one pair of species, differing accumulation relationships were estimated for each species.

Commenters described their attempt to apply the separate fitting approach to Passaic River data as resulting in unsatisfying relationships. This was primarily because their analyses were restricted to the narrow range of sediment contaminant concentrations within the LPR (for example, excluding less-contaminated reference areas), and secondarily because they failed to investigate inter-species relationships using ANCOVA which might have provided greater power to detect relationships for some contaminants. Because they did not analyze a sufficiently broad range of sediment contaminant concentrations and associated fish tissue concentrations, they incorrectly concluded that contaminant concentrations in biota were unrelated to contaminant concentrations in sediment, and that bioaccumulation models based on regression or BSAFs were unreliable and not applicable to risk management decisions.

This finding of no relationship is in direct contradiction to the results of the commenters' regression analyses of the 2009 laboratory bioaccumulation test data, which indicated strong sediment-to-tissue relationships for invertebrates. It also contradicts the key assumption underlying their suggested modeling approach, wherein BSAFs combined with AFs form the basis of their proposed bioaccumulation model. In other words, the commenters concluded that there is no relationship between biota tissue and sediment concentrations using the separate fitting approach and then concluded that there is a tissue-to-sediment relationship using the 2009 bioaccumulation test results.[18] Had commenters included data from less contaminated areas, such as the reference area that EPA included in its analysis, they would have identified the relatively strong relationships found by EPA (Figure II.D.4.4 - 3).

[18] See Figures 2-43 and 2-44 in TMO comments on the Proposed Plan, paper prepared by Iannuzzi, Iannuzzi and Beauchemin for examples of the commenter's calculations of tissue-to-sediment relationships.

Characteristics of Data and Practical Application of Results

Generally speaking, there are several characteristic features of the LPR tissue contaminant data.

1) At any particular level of sediment contaminant concentration, corresponding fish tissue concentrations vary by approximately one order of magnitude. This is illustrated in Figure II.D.4.4 - 3 (reproduced from DER No. 6), by the red brace at the upper right corner of the plot calling out one order of magnitude. This is characteristic of organic contaminants in fish tissue at the Kalamazoo, Fox and Hudson Rivers, (Iannuzzi et al., 2011; Polissar et al., 2002; Santini et al., 2014; Greenberg et al., 2011; and Kern 2013). No models at any of these sites have explained this intra-year variation mechanistically, but it is generally understood to be due to heterogeneity in individual organism exposure history combined with variation introduced through sample preparation, subsampling and analysis. This level of variation among individual organisms is pervasive, but in no way precludes estimation of accumulation relationships, provided that an adequate range of sediment concentrations is studied—including data from reference areas.
2) Contaminant concentrations in tissue and sediment at the reference area are clearly lower than those within the LPR. Application of statistical tests to "prove" this obvious finding is unnecessary and would not contribute to practical application of key results (Cherry, 1998). This difference in tissue concentrations at the reference area in comparison to those within the LPR suggests reducing sediment contaminant concentrations in the river can be expected to commensurately lower contaminant concentrations in tissue.
3) Reduction of tissue contaminant concentrations on the order of a factor-of-10 would require a reduction of approximately a factor-of-100 in sediment contaminant concentrations.
4) After remediation, one should continue to expect an order of magnitude of variation in fish tissue concentrations, consistent with variation seen in data from both the LPR and the reference area.

Figure II.D.4.4 - 3 conveys these characteristics in a simple way that risk managers can apply easily within the decision-making process. Additional statistical output and additional confidence and prediction intervals would do little to improve risk management decisions. Prediction intervals would exhibit the same order of magnitude of variation seen in the actual data. Figure II.D.4.4 – 3 leaves little doubt that 2,3,7,8-TCDD concentrations (a primary focus of the remedial alternatives evaluated in the RI/FFS) in tissue are positively associated with those in sediment. Statistical tests performed by EPA found highly significant correlation, as shown from R^2 values ranging from 0.70 for mummichog to 0.92 for blue crab. Additional statistical test results would do little to enhance this obvious finding. This graph also shows that meaningful reduction in tissue concentration would require sediment concentrations to be reduced to levels not currently seen within the lower 8.3 miles.

Response to Specific Technical Comments

Aside from the desire for a greater amount of statistical output:

1) Commenters claimed that EPA's model fit was "misleading because it was achieved by adding off-site data to the models with much lower sediment concentrations thereby securing the low end of the regression curve to increase the R^2 value."
2) Commenters also claimed that EPA had failed "to separate strong lipid effect from weak sediment concentration effect."

Use of Reference Area Data for Accumulation Relationship Development

EPA used sediment and tissue contaminant data from within the LPR as well as from a comparable reference area in the New York/New Jersey Harbor, including fish tissue and sediment data collected through the CARP database (available through http://www.carpweb.org/main.html), the EPA BSAF database (available through http://www.epa.gov/med/Prods_Pubs/bsaf.htm) and the REMAP (available through http://www.epa.gov/emap/remap/html/data.html).

EPA followed standard practice in identifying an appropriate reference area from which to estimate the relationship between contaminant concentrations in tissues with those in sediment under conditions where sediment contaminant concentrations are relatively low but the systems are otherwise comparable. This approach is consistent with the approaches used at the Lower Fox River Superfund Site, the Kalamazoo River Superfund Site and the Hudson River PCBs Superfund Site, all of which include reference areas as integral parts of their monitoring programs.

From an experimental design perspective, the optimal design for estimating the parameters of a linear regression model would use samples that are concentrated at the highest and lowest extremes of the independent variables (O'Brien and Funk, 2003). EPA employed this fundamental experimental design principle by including reference data in the analysis. As the commenters showed in their graphical depictions, regression models fit strictly to LPR data are poorly constrained and result in unreliable predictions. EPA corrected this problem by incorporating the reference area data into the analysis. This step increased the range of sediment and tissue concentrations by more than an order of magnitude, which increased the precision of the regression models dramatically, relative to those estimated without the reference data. Given the much larger variance in tissue concentrations relative to the narrower range of sediment concentrations found in the LPR, it is not surprising that the commenters failed to identify the strong relationship between tissue and sediment contaminant concentrations — particularly for 2,3,7,8-TCDD.

Relative Strength of Lipid and Sediment Effects

Commenters' assertion that EPA failed "to separate strong lipid effect from weak sediment concentration effect" is incorrect and apparently arrived at through analysis of data restricted to the LPR, ignoring the reference data. As was discussed in the previous section, this data restriction would be expected to reduce precision of parameter estimates and would have biased commenters' estimate of the importance of sediment for predicting tissue contaminant concentrations downward.

In response to this comment EPA calculated squared semi-partial correlation coefficients (i.e., partial coefficients of determination; Table II.D.4.4 - 1) based on individual species-specific regressions for 2,3,7,8-TCDD. These coefficients partition the total R^2 into components associated with variables in the regression model. For this calculation, these coefficients were calculated sequentially, first for log-lipid, followed by log-organic carbon (OC) normalized sediment, the only two variables in the regression models. With this sequential approach, the semi-partial R^2 for sediment represents the incremental increase in R^2 obtained by adding sediment to the regression model already including fraction lipid.

For 2,3,7,8-TCDD, the proportion of variance explained by organic carbon-normalized sediment was 70 percent, 92 percent, 59 percent and 89 percent for American eel, blue crab, mummichog and white perch, respectively. In contrast, fraction lipid in tissue explained 15 percent, 1 percent, 12 percent and 3 percent for American eel, blue crab, mummichog and white perch, respectively (Table II.D.4.4 – 1, Figure II.D.4.4 - 4). In these regressions, variation in sediment 2,3,7,8-TCDD concentration explained 5 times the variation explained by lipid for American eel and 159 times the variation explained by lipid for blue crab.

This evaluation shows that commenters effectively applied the mathematical equivalent of the BSAF approach in their alternative approach, and arrived at an inferior bioaccumulation relationship than that developed by EPA. EPA's method clearly provides a superior relationship that accurately captures a wider range of sediment and fish tissue conditions.

D.4.5 Comment: Evaluation of Seasonal Effects on Tissue COC Concentrations Obscured Non-Equilibrium Effects

Commenters stated that EPA's evaluation of potential seasonal effects on mean contaminant tissue concentrations was conducted in a way that obscured any differences that may exist between equilibrium and non-equilibrium concentrations. Commenters had the following concerns:

a) Commenters stated that since most samples of both blue crab (i.e., 49 of 53) and white perch (i.e., 26 of 37) were collected during time periods when their tissue concentrations were assumed to be "in equilibrium," it was not surprising that no difference was found between the two groups of samples, because the majority of the all-sample set was composed of equilibrium concentrations. Even if all non-equilibrium concentrations were higher or lower than the equilibrium concentrations, the difference between the combined (equilibrium and non-equilibrium) data and the equilibrium data might not be significant since the equilibrium data dominate the data set.
b) Commenters asked if in some of the boxplots in DER No. 6 Figures 2-5 and 2-6, the fish with the highest concentrations in the "all sample group" might be the non-equilibrium fish, because those concentrations did not appear in the range of concentrations of the equilibrium fish.
c) Commenters asked whether EPA hypothesized that the non-equilibrium samples should have lower concentrations than the equilibrium samples and wondered how EPA could explain the results if they did not support this hypothesis. Commenters stated that EPA's analysis should have presented a discussion of the results and how they compared with expectations.

Commenters stated that a true test of the difference between concentrations assumed to be in equilibrium and not in equilibrium would have been to directly compare the concentrations assumed to be in equilibrium (i.e., 49 for blue crab and 26 for white perch) with the concentrations that could not be assumed to be in equilibrium (i.e., 4 for blue crab and 11 for white perch) with graphical or statistical methods. Given the small sample sizes, a simple cumulative frequency distribution of all sample concentrations with the non-equilibrium concentrations coded in a different color might have sufficed for this comparison. Commenters also asked whether a t-test comparing means or tests of differences in upper percentiles of the two groups had been conducted by EPA.

Another commenter stated that: EPA paired sediment-biota data using unspecified criteria; BSAF calculations did not take into account that detritus-eating organisms form the base of the food web and that fish do not get contaminated from sediment but rather from water; BSAF/BAFs were calculated for species without significant tissue-sediment relationships; and confidence intervals were needed for BSAF/BAFs.

Response:

During development of the RI/FFS and in particular DER No. 6 in Appendix A, EPA evaluated the data available up to the time that EPA prepared the near-final drafts of the documents, in early summer 2013. In doing so, EPA included available data from the 17-mile RI/FS regarding contaminant concentrations in fish tissue and surface sediments, with the exception discussed below. As discussed in the response to comment II.D.1.5, the surface sediment data collected for the 17-mile LPRSA RI/FS from 2008 to 2012 are not evenly distributed in the area below RM 8. While some of the 17-mile RI/FS sample locations were placed in a grid-like fashion, most sample locations were selected to examine relatively small-scale features and not to characterize contamination across the lower 8.3 miles. Thus, many samples were placed in clusters, preventing their use in the simple averages needed for the BSAF calculations without application of sophisticated statistical techniques to properly weight the clustered samples. This is particularly true of the 2012 data set.

The only sediment data not included in the analyses in DER No. 6, because it was not available to EPA at the time that DER No. 6 was prepared, was the 2012 data set. This data set, in particular, does contain some sample locations intended to be spatially representative, but it also contains many locations chosen to examine specific features of the river. Nonetheless, as illustrated in the response to comment II.D.1.7 and in DER No. 4,[19] the median surface sediment concentrations of COCs from the 1995, 2008-2010 and 2012 data sets are essentially the same for the lower 8.3 miles. Above RM 8, contaminant concentrations in fine-grained sediments are also quite similar in the 2008-2010 and 2012 data. This indicates the new data were not particularly different from the earlier data used in the bioaccumulation analysis described in DER No. 6; that is, their central tendencies as indicated by the median concentrations were not significantly different. Additionally, this strongly suggests that the inclusion of these data in a spatially representative fashion in the calculation of the BSAF/BAF terms would not substantively modify the relationships between tissue concentrations and sediment concentrations. As noted above, the 2012 data could have been included in the BSAF calculations with the application of sophisticated statistical analyses to develop weighting schemes. While EPA did not choose that approach, as an approximation to the statistical analyses and to respond to this comment, EPA has included the 2012 data without spatial weighting in the BSAF and BAF calculations. Use of the 2012 data in this fashion will overestimate the surface sediment concentrations of the various contaminants to some degree since the 2012 data tend to be clustered in high concentration areas. Despite this bias to the calculations, the revised regression analyses are not substantively different than the original estimates and agree within the uncertainty of the original estimates is nearly all cases, as discussed further below.

Commenters asserted that a subset of the fish tissue samples used in the BSAF and BAF calculations may not represent animals in equilibrium with Lower Passaic River conditions, because Lower Passaic River fish specimens obtained during the migratory periods (potentially non-equilibrium specimens, as discussed in DER No. 6) were combined with fish tissue samples obtained during non-migratory periods, representing likely resident fish specimens (equilibrium specimens). In the original analysis presented in DER No. 6, EPA showed that the variance and the average of contaminant concentrations for Lower Passaic River tissue samples did not change as a result of excluding the potentially migratory specimens. EPA concluded that the exclusion of the migratory period samples would not substantively affect the BSAF and BAF calculations. In particular, EPA concluded that, although these specimens were obtained during periods when the fish may migrate, this does not mean that all were migratory animals and, therefore, were not representative of Lower Passaic River exposure.

To respond to this comment, EPA repeated the BSAF and BAF calculations, excluding the specimens collected during the migratory period. As described in DER No. 6, the basis for identifying migratory

[19] See for example, DER No. 4 in Appendix A of the RI/FFS, Figures 2.4-1, 3.1-8, 3.2-20 and 3.2-24. Note that on Figure 3.2-20, the 1995 median is identical to the 2012 median.

specimens is determined by time of collection. Essentially, winter to early spring specimens are considered to be potentially migratory and therefore not in complete equilibrium with their exposure environment. As described in detail in DER No. 6, migratory specimens were identified for only two of the four species examined, blue crab and white perch. However, it cannot be determined which specimens obtained during the migratory period are truly migratory animals, and which might have been resident specimens. All were caught within the Lower Passaic River and thus were exposed to Lower Passaic River conditions during some portion of their lives. EPA concluded that the various statistical tests suggested by the commenter would not provide meaningful information, even if differences were found. The exclusion of the migratory period specimens did not substantively change the relationship between sediment concentrations and tissue concentrations.

EPA does not agree that sediment and fish tissue samples were paired using unspecified criteria. The creation of tissue sediment pairs is discussed at length in Section 3.1.2 of DER No. 6. Distance was the criterion used to associate sediment data to a given fish sample. Several distance intervals were tested to optimize the best distance for sediment data integration. The analysis is summarized in Figures 3-2 to 3-4 of DER No. 6. Essentially, the averaging interval selected was based on the match between the sediment trend and the blue crab tissue trend for 2,3,7,8-TCDD (see Figure 3-3 of DER No. 6). Notably the sediment averaging window (± 2 miles about each fish sampling location) is equal to the average daily tidal displacement along the river. Thus the closest agreement of the sediment trend to the fish trend corresponded to the daily distance of tidal mixing of water and suspended solids in the Lower Passaic River.

EPA also does not agree that its calculation ignored the issue of detritus-eating organisms at the base of the food web, or that fish become contaminated from water rather than sediment. EPA's BSAF calculations are based on extensive research that document the correlation between sediment and fish body burdens, irrespective of trophic level or pathway (most recently, in the Lower Passaic River, Khairy et al., 2014 documented the link between fish and sediments). In estuarine systems no longer subject to significant external loads of a particular contaminant, the sediment bed becomes the reservoir of contamination, responsible for maintaining surface sediment concentrations as well as concentrations in the water column (EPA, 2014a). Regular erosion of deeper, more contaminated sediments serves to supply additional contamination to the surface sediments and water column. Both of these linkages are due to the twice daily tidal resuspension of solids from the estuary bed as well as the less frequent storm events that cause deeper erosion. These solids control concentrations of contaminants in the water column as well as the surface sediment concentrations. Thus, irrespective of where or how fish are exposed, their body burdens are ultimately linked to the concentrations in the sediment bed, since the bed controls the concentrations in all adjacent media. For this reason, it is only by control of the sediment bed contamination through remedial means that substantive decreases in fish tissue concentrations can be expected.

Lastly, EPA does not agree that BSAF/BAFs were calculated for species without significant tissue-sediment relationships. While the sediment and tissue ranges observed for the Lower Passaic River may have been limited, the data still behaved in a fashion that indicated a correlation between sediment and tissue. In some instances, stronger correlations observed in some species were used to supplement similar but weaker relationships in other species. This is the basis for the use of a species factor in the regression models. In limited instances (particularly for PCBs), the conditions were such that the actual range of average exposure was relatively narrow and so a true regression across a broad range of concentrations could not be completed. The existence of such relationships is well documented in the literature (see Burkhard, 2009 for example) and the calculation of BSAFs as completed in DER No. 6 is supported by this documentation.

To respond to the commenter's statement that confidence intervals were needed to the BSAF/BAFs, the upper and lower 95th percentile confidence limits for the original BSAF regressions developed for the RI/FFS are shown in Figures II.D.4.5 – 1 through 13.

Data inclusion and exclusion

To address the concern regarding the inclusion of migratory fish data and the comment that EPA did not use all of the available sediment data (see also the response to comment II.D.4.6, below), EPA repeated its calculations for the COPCs used to set the preliminary remediation goals. Specifically, EPA completed one set of calculations in which previously unavailable sediment concentrations from the 17-mile RI/FS data (from 2012 and 2013) were included in the analysis and the potentially migratory specimens of blue crab and white perch were excluded from the analysis. In this fashion, the new calculations provide a bounding estimate for the BSAFs and BAFs. That is, the inclusion of all the 2012 and 2013 data without adjusting for spatial distribution will tend to overestimate the surface sediment concentrations, providing an upper bound on the sediment exposure. Excluding the potentially migratory animals may tend to reduce the variance of the tissue concentrations while also shifting the mean of the remaining tissue samples to higher concentrations, if the migratory specimens are actually less contaminated. Thus, both adjustments to the data set would be expected to shift the average of the Lower Passaic River samples to higher concentrations.

In the original analysis, EPA examined a large number of compounds in four fish species for the development of tissue-sediment relationships. In the analysis presented here, only those compounds (2,3,7,8-TCDD, Total PCBs, Total DDx and mercury) and the corresponding fish species (American eel, blue crab, mummichog and white perch) that were used to set preliminary remediation goals were reexamined.

Preparation of the revised regressions

The procedures for incorporating the new sediment data set and the slightly reduced tissue data set followed the procedures used previously, as described in DER No. 6. Individual tissue specimens were matched to local sediment concentrations by averaging the available surface sediment samples (0-6 inches) from the area surrounding each tissue collection location. Specifically, this is the area from 2 miles upstream to 2 miles downstream of each tissue sample location. This method is discussed at length in Section 3.1.2 of DER No. 6. Normalization of the sediment data to organic carbon (organic compounds) or to iron (mercury) followed the procedures described in Section 3.1.3 of DER No. 6. The revised tissue–sediment relationships were constructed using the same multivariate regressions or BSAF calculations described in Section 3.2 of DER No. 6.

For each COPC-species pair, EPA contrasted the original regression provided in DER No. 6 with the new regression relationship developed as described above. In the following discussion, the three COPCs whose PRGs are based on the HHRA are discussed first, specifically, 2,3,7,8-TCDD, Total PCBs and mercury. For each of these COPCs, the regressions for American eel, blue crab, and white perch are examined since these three fish species are the basis for the human health risk estimates. For Total DDx, the PRG is based on ecological exposure and so all four fish species are examined, i.e., American eel, blue crab, white perch and mummichog.

Results

The regression results for 2,3,7,8-TCDD for the three fish species are shown in Figures II.D.4.5 – 1 to II.D.4.5 – 3. In each instance, the original regression is shown in blue along with its 5th and 95th percent confidence intervals. These confidence limits represent the uncertainty on the relationship itself, and not the variability of the data set, which generally is greater. The original points used in the regression are also shown in blue. The revised regression is shown in red, as are the points representing the revised tissue-sediment pairs, incorporating the 2012 and 2013 sediment data and excluding any potentially migratory specimens. In nearly all cases, the inclusion of the 2012 and 2013 sediment data causes the individual values for the Lower Passaic River to shift to the right of the diagram, indicating higher sediment concentrations in the revised mean sediment concentrations. This shift is due to the generally higher concentrations observed in the 2012 data as noted above. The exclusion of potentially migratory specimens had the greatest effect on white perch, reducing the number of samples available by about 40 percent, depending on the COPC.

To simplify the comparison graphically, the confidence limits for the revised regression are not shown so as to minimize the number of lines on each graph. The confidence limits for the revised curves can be expected to be similar in span to those of the original regression. A more quantitative comparison is provided in Table II.4.5 – 1, described below. In two of the three 2,3,7,8-TCDD figures, the revised regression lies within the uncertainty limits of the original regression for all concentrations to the left of the center of the diagram. This simple examination is sufficient to conclude that the original and revised regressions agree within statistical uncertainty at the lower concentrations. This portion of the graph is the area of greatest interest since the analyses are intended to predict the relationship between sediment and fish tissue at low concentrations, as a basis to estimate the PRGs.

This agreement is reflected in Table II.D.4.5 – 1 which compares the individual regression coefficients determined for the new versus the original analyses (see discussion in Section 3.2 of DER No. 6 for further explanation of the coefficients). Essentially, if the model results agree within the overall model uncertainty, then it can be expected that the individual coefficients will agree within their respective uncertainties. Note that for both American eel and blue crab, the individual regression coefficients (β_0, β_1, β_2) agree within error, that is, the probability that the individual βs are different is small, as indicated by a z-score probability greater than 0.05.[20]

For white perch, the revised regression does lie outside the uncertainty bounds of the original regression at lower concentrations. However, when the uncertainty about the revised regression is taken into consideration, the two regressions are not substantively different from each other. This is reflected in the z-score probabilities of the regression coefficients shown in Table II.D.4.5 – 1. Only two of the three coefficients have statistically significant differences, near a probability of 0.05 (5 percent). Ignoring for the moment that the difference in the regressions is not substantive given the uncertainties in the two curves, the difference shown in Figure II.D.4.5 - 3 would translate to a lower PRG for 2,3,7,8-TCDD if the 2,3,7,8-TCDD PRG were based solely on the white perch-sediment relationship. Since the PRG for 2,3,7,8-TCDD is set by combining the results for both American eel and white perch (see

[20] The z-score is a statistical test to estimate the probability that the original coefficient is different from the revised coefficient. It is appropriate to reject the hypothesis that the two coefficients are the same when the z-score probability is less than 0.05 or 5 percent. That is, EPA concludes that the coefficients are equal when the probability of the observed difference between the coefficients has less than a 5 percent chance of occurring.

Appendices D and E of the RI/FFS), the net result of the revised regression for white perch and the original regression for American eel would yield a PRG that is about one third less than the PRG of 7.1 pg/g identified in the Proposed Plan.

However, there is a third line of evidence in support of the original regression curves for 2,3,7,8-TCDD. As discussed in the response to comment II.G.2.2, additional data from above Dundee Dam collected for the 17-mile RI/FS validates the original regression at very low sediment concentrations. That is, the data from above Dundee Dam confirms the tissue-sediment relationship described by the original regression at very low concentrations. Given that the revised regression is not substantively different from the original regression, given the validation of the original regression by the data above Dundee Dam, and given the observation that the revised regression would only yield a slightly lower PRG, this analysis does supports EPA's original process for developing PRGs.

EPA conducted similar analyses for Total PCBs and mercury. Figures II.D.4.5 – 4 to II.D.4.5 – 6 represent the revised analyses for Total PCBs. In this instance, two of the three tissue-sediment relationships (American eel and white perch) were calculated as a BSAF, while blue crab was calculated based on the standard non-linear regression technique used in DER No. 6. The reasons for this are discussed in DER No. 6. The uncertainties for American eel and white perch are based on a linear regression through the data whereas the uncertainty bands for blue crab are derived from its non-linear regression analysis.[21] As can be seen in all three figures, the revised relationships all fall within the uncertainty estimated for the original analyses. In Table II.D.4.5 – 1, the coefficients for these relationships are shown to agree as well, being characterized by high values in the significance column (i.e., a low probability of actually being different). Based on the agreement between the relationships given their associated uncertainties, no revisions to the PRGs based on the revised data set are warranted for these species for Total PCBs. (See comment II.G.2.2 for further discussion on the PRG for Total PCBs.)

In a parallel fashion, Figures II.D.4.5 – 7 through II.D.4.5 – 9 present the results for the three fish species for mercury. As with the other COPCs just described, the revised regression falls within the uncertainty of the original regression model, and so the two regressions agree within uncertainty for each species. As a result, no revisions to the PRGs for mercury are warranted.

Figures II.D.4.5 – 10 through II.D.4.5 – 13 present the results for the last compound, Total DDx. All four species are represented in the figures, since Total DDx is primarily associated with ecological impacts in the Lower Passaic River. Again, as in all of the previous analyses, the revised regressions fall within the uncertainty of the original regressions, so no revisions to the PRGs for Total DDx are warranted.

Based on the analyses described above, consideration of the additional data obtained after the preparation of DER No. 6 did not have a substantive effect on the relationships between tissue and sediment derived in the original analyses. Similarly, the exclusion of potentially migratory specimens in the revised analyses did not result in a substantively different relationship between sediment and tissue. The exclusion of the 2012 and 2013 data and the inclusion of potentially migratory specimens do not represent a flaw or limitation in EPA's original analysis and it is not necessary to revise the PRGs developed based on this analysis. See comment II.G.2.2 for further discussion and analyses related to the PRGs.

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[21] Note that one data point for white perch was identified as an outlier as part of the analysis described above, as shown in Figure II.D.4.5 - 6. This point was included in the original analysis but was excluded from the revised analysis. It does not represent a potentially migratory sample.

D.4.6 Comment: Conversion Factor between Fillet and Whole Body COC Tissue Concentrations is not Defensible

Commenters stated that the correction factors used in the final FFS to convert between fillet and whole-body tissue concentrations are not scientifically defensible, because EPA calculated a correction factor for each tissue type by taking the ratio of mean fillet and mean whole-body data (i.e., the overall averages rather than paired data[22]). Commenters stated that information on the confidence intervals for the predictions of wet weight and confidence intervals around the ratio should be provided. Commenters also asserted that EPA did not use all of the available data from the 17-mile LPRSA RI/FS, such as paired and non-paired data from 2009, 2010 and 2012 data sets.

Response:

In preparing DER No. 6 in Appendix A of the RI/FFS, EPA used all of the data available at that time, including data from the 17-mile RI/FS up to 2010. Data for tissue samples collected in 2012 were not submitted to EPA until after the RI/FFS was in final review. In response to comments, EPA incorporated the new data in its evaluation of migratory fish and its bioaccumulation model estimates (see response to comment II.D.4.5).

The commenters also asserted that EPA failed to use matched pairs of samples. However, there can be no matched pairs of whole body and standard fillet by definition, since the whole body analysis does not leave a portion of the specimen that could be used for fillet analysis. The fillet would have to come from a different specimen. The whole body and fillet samples used in the analysis were obtained from a limited range of locations in the Lower Passaic River (RM 5 to RM 7), where median sediment concentrations are essentially the same. Thus, the samples effectively represent exposure to the same level of sediment contamination. As such, they are as close to matched pairs as possible given the sample types involved.

The commenters also asserted that EPA did not evaluate uncertainty in the analysis. In the RI/FFS, EPA did provide a partial estimate of the uncertainty associated with one of the two factors used in these calculations (see standard deviation and standard error columns in Tables 3-7 and 3-9 of DER No. 6). To respond to this comment, EPA performed a revised uncertainty analysis that incorporates the uncertainty in both terms.

Specifically, EPA conducted a series of statistical analyses, referred to as “bootstrapping,” using the available data to estimate the mean and uncertainty of the two factors involved in the conversion of fillet concentration to whole body concentration for white perch, and whole body concentration to fillet for American eel. As noted in DER No. 6, there are two terms to be estimated to develop the factor for each conversion. For organic compounds in white perch tissue samples, it is the ratio of lipid-normalized whole body concentration to lipid-normalized fillet concentration (r_1), and whole body lipid content to fillet lipid content (r_2), (see Table 3-7 and explanation in DER No. 6). For organic compounds in American eel, it is the reciprocal of these terms (see Table 3-9 and explanation in DER No. 6). EPA expects that the ratio r_1, the lipid normalized concentration ratio, would be the same across the various organic contaminants. This is based on the close relationship between organic contaminant concentrations and

[22] The use of the word “paired” here refers to the matching of one tissue type to another for the purposes of creating x,y pairs of data for use in a regression. For example, it would be possible to pair the fillet concentration of 2,3,7,8-TCDD in a fish with the associated viscera concentration of 2,3,7,8-TCDD from the same fish. As described above, such matched pairs could not be made for fillet and whole body.

lipid content. EPA also expects that variation between whole body and fillet contaminant concentrations are primarily due to variations in the lipid content of the two tissue types. Thus all organic contaminants should respond in a similar manner to the lipid content differences between whole body tissue and fillet tissue. This assertion was tested as part of this analysis and is described below.

Listed below are the steps involved for white perch to yield a single factor (R; i.e., r_1 x r_2) to convert whole body concentrations to fillet concentrations for all organic contaminants:

1. For each chemical, calculate the bootstrap distribution of the first term (r_1), the ratio of lipid-normalized whole body concentration to lipid-normalized fillet concentration.
2. Calculate the bootstrap distribution of the second term (r_2), the ratio of the whole body lipid content to fillet lipid content.
3. For each of the 1,000 bootstrap samples and 7 chemicals calculate the combined product (R_i) of r_1 and r_2, for 1 = 1 to 7, (i.e., for each chemical).
4. Average the R_i values across chemicals for each estimate, generating 1,000 bootstrap estimates of the average R.
5. This is the common correction factor applicable to all of the 7 chemicals.
6. Plot the 95 percent confidence intervals for the 7 individual correction factors for the individual contaminants (from step 3) to check for validity of the assumption of a single correction factor for all organic contaminants.

These procedures were followed for American eel as well, only with the reciprocal ratios. Figures II.D.4.6 - 1 and II.D.4.6 – 2 show the distributions of the factors generated by the bootstrap analysis.

Table II.D.4.6 – 1 summarizes the results of these calculations for white perch and American eel. Using the bootstrap technique yields revised estimates for R that agree with the original estimates within 6 percent or less. The uncertainty on the ratios as developed by the bootstrapping analysis is approximately ± 13 percent for the white perch factor and ± 20 percent for the American eel factor.

To complete step 6 from above, EPA prepared Figures II.D.4.6 – 3 and II.D.4.6 – 4. These compare the R or 1/R factors for the individual organic contaminants with the original mean factors determined for the RI/FFS. The error bars about the symbol for each contaminant represent the 95 percent confidence limits on the ratio for the contaminant. In all cases, the mean ratio shown by the heavy blue line is well within the uncertainty of the individual contaminant ratios. Based on this, EPA's approach of using a single R or 1/R value for all organic contaminants for tissue concentration conversions is well supported. It also indicates that the contaminant concentration differences between the two tissue types can be largely ascribed to the average lipid content difference between the two tissue types.

EPA conducted a similar analysis for metal concentrations in tissue. Unlike organic contaminants, metals are not specifically associated with lipid and cannot be easily grouped. Thus the metals were analyzed individually. Similar to the organic contaminants, for white perch, a factor to convert fillet to whole body is needed, whereas for American eel, a factor is needed to convert whole body to fillet. These are the same factors shown in Tables 3-8 and 3-10 for DER No. 6.

To estimate these factors and their uncertainty, EPA applied a bootstrap method similar to the one used for the organic contaminants, but for just one ratio per metal, without combining across inorganic constituents. This is equivalent to step one alone of the sequence described above.

The results for metals factors and their uncertainties are given in Table II.D.4.6 – 2. The uncertainties associated with the individual metal ratios, except lead in American eel, are comparable to those for the individual organic compounds.[23] The uncertainty associated with the lead factor for American eel could not be estimated due to the very limited data for eel fillets.

D.4.7 Comment: Editorial Comments on Data Evaluation Report No. 6

Commenters indicated that there were several errors in DER No. 6 that needed to be corrected, including that: a) Figure 3-1 was missing; b) concentration units for each of the equations on pages 3-19 through 3-28 should be provided; and c) there were punctuation errors in the parenthetical on page 1-2. Commenters also stated that Table 3-1 indicated that contaminant concentrations measured in the 0-6 inch sediment samples were used in the regression, BSAF and BAF calculations, and that this appeared to be consistent with how contaminant fate and transport modeling results are expressed. Commenters suggested that the use of 0-6 inch sediment for both regression (BSAF and BAF calculations) and fate and transport model should be documented in the text of the report. Other commenters asked that Wikipedia not be cited as a source for a statistical method.

Response:

The comment regarding typographical errors is noted. Figure 3-1 of DER No. 6 in Appendix A of RI/FFS is included in this response as Figures II.D.4.7 – 1A to 1C. EPA agrees that the text could have more clearly stated that both the regression (BSAF and BAF calculations) and contaminant fate and transport model used the 0-6 inch sediment layer.

In response to the comment about using Wikipedia as a source for a statistical method, EPA provides the following definition of robust regression from Gilbert, 1987: "The objective of robust regression is to reduce the impact of data far removed from the regression line. Standard least squares methods are highly sensitive to divergent data points, whereas robust methods assign less weight to this point."

Concentration units for each of the equations on pages 3-19 through 3-28 are as follows:

<u>Page 3-19</u>

$$C_{s-oc} = \frac{1}{n}\sum_{i=1}^{n}\frac{C_{s_i}}{f_{oc_i}} \qquad \text{Eq. 3-2}$$

Where:

$C_{s\text{-}oc}$	=	mean TOC-normalized concentration of the contaminant in the sediment (ug of contaminant/kg OC, except for 2,3,7,8-TCDD in pg of contaminant/g OC)
$C_{s\,i}$	=	concentration of the contaminant in sediment sample *i* (ug of contaminant/kg of sediment, except for 2,3,7,8-TCDD in pg of contaminant/g of sediment)
$f_{oc\,i}$	=	fraction organic carbon in sample *i* (kg organic carbon/kg sediment)
n	=	the number of samples in the sediment window of interest

<u>Page 3-20</u>

$$C_{s-Fe} = \frac{1}{n}\sum_{i=1}^{n}\frac{C_{sed_i}}{C_{Fe_i}} \qquad \text{Eq. 3-3}$$

Where:

[23] This can be seen by comparing the range of the uncertainty bars in Figures II.D.4.6 - 3 and II.D.4.6 - 4 as a percentage of the individual mean ratios with the LCL and UCL percentage values given in Table II.D.4.6 – 2.

$C_{s\text{-}Fe}$ = mean iron-normalized concentration of the metal in the sediment (mg of contaminant/kg of iron)
$C_{sed\ i}$ = concentration of the metal in sample *i* (mg of contaminant/kg of sediment)
$C_{Fe\ i}$ = fraction iron in sample *i* (kg iron/kg sediment)
n = the number of samples in the sediment window of interest

Page 3-24

$$Ln(C_f) = \beta_0 + \beta_1 Ln(C_s) + \beta_2 Ln(f_L) + \beta_3 Ln(f_{oc}) + \varepsilon \quad \text{Eq. 3-4}$$

$$C_f = e^{\beta_0} \times C_S^{\beta_1} \times f_L^{\beta_2} \times f_{oc}^{\beta_3} \times e^{\varepsilon} \quad \text{Eq. 3-5}$$

$$\frac{\left(C_f / f_L^{\beta_2}\right)}{\left(C_S^{\beta_1} / f_{oc}^{-\beta_3}\right)} = e^{\beta_0} \times e^{\varepsilon} \quad \text{Eq. 3-6}$$

Where:
C_f = contaminant concentration in fish tissue (ug of contaminant/kg of tissue, except for 2,3,7,8-TCDD in pg of contaminant/g of tissue)
C_S = contaminant concentration in the sediment (ug of contaminant/kg of sediment, except for 2,3,7,8-TCDD in pg of contaminant/g of sediment)
f_L = fraction lipid in fish tissue (unitless)
f_{OC} = fraction organic carbon in sediment (kg OC/kg sediment)
ε = normally distributed mean-zero random error (unitless)
β_i = coefficients specific to the compounds and species using the units of C_s and C_f defined above

Page 3-25

$$Ln(C_f) = \beta_0 + \beta_1 Ln\left(\frac{C_s}{f_{oc}}\right) + \beta_2 Ln(f_L) + \varepsilon \quad \text{Eq. 3-7}$$

Where:
C_f = contaminant concentration in fish tissue (ug of contaminant/kg of tissue, except for 2,3,7,8-TCDD in pg of contaminant/g of tissue)
C_S = contaminant concentration in the sediment (ug of contaminant/kg of sediment, except for 2,3,7,8-TCDD in pg of contaminant/g of sediment)
f_L = fraction lipid in fish tissue (unitless)
f_{OC} = fraction organic carbon in sediment (kg organic carbon/kg sediment)
ε = normally distributed mean-zero random error (unitless)
β_i = coefficients specific to the compounds and species using the units of C_s and C_f defined above

$$Ln(C_f) = \beta_0 + \beta_1 Ln(C_{s-oc}) + \beta_2 Ln(f_L) + \varepsilon \quad \text{Eq. 3-8}$$

Where:

C_f = contaminant concentration in fish tissue (ug of contaminant/kg of tissue, except for 2,3,7,8-TCDD in pg of contaminant/g of tissue)
$C_{S\text{-}OC}$ = mean TOC-normalized concentration of the contaminant in the sediment (ug of contaminant/kg OC, except for 2,3,7,8-TCDD in pg of contaminant/g OC)
f_L = fraction lipid in fish tissue (unitless)
ε = normally distributed mean-zero random error
β_i = coefficients specific to the compounds and species using the units of $C_{s\text{-}oc}$ and C_f defined above

$$Ln(C_f) = \beta_0 + \beta_1 Ln(C_{s-Fe}) + \varepsilon \qquad \text{Eq. 3-9}$$

Where:
C_f = contaminant concentration in fish tissue (mg of contaminant/kg of tissue)
$C_{S\text{-}Fe}$ = mean iron-normalized concentration of the metal in the sediment (mg of contaminant/kg of iron)
ε = normally distributed mean-zero random error (unitless)
β_i = coefficients specific to the compounds and species using the units of $C_{s\text{-}Fe}$ and C_f defined above

Page 3-26

$$\begin{aligned} Ln(C_f) = {} & \beta_0 + \beta_1 Ln(C_{s-oc}) + \beta_2 Ln(f_L) \\ & + \emptyset_{AE}[\beta_3 + \beta_4 Ln(C_{s-oc}) + \beta_5 Ln(f_L)] \\ & + \emptyset_{BC}[\beta_6 + \beta_7 Ln(C_{s-oc}) + \beta_8 Ln(f_L)] \\ & + \emptyset_{MM}[\beta_9 + \beta_{10} Ln(C_{s-oc}) + \beta_{11} Ln(f_L)] \\ & + \emptyset_{WP}[\beta_{12} + \beta_{13} Ln(C_{s-oc}) + \beta_{14} Ln(f_L)] + \varepsilon \qquad \text{Eq. 3-10} \end{aligned}$$

Where:
C_f = contaminant concentration in fish tissue (ug of contaminant/kg of tissue, except for 2,3,7,8-TCDD in pg of contaminant/g of tissue)
$C_{S\text{-}OC}$ = mean TOC-normalized concentration of the contaminant in the sediment (ug of contaminant/kg OC, except for 2,3,7,8-TCDD in pg of contaminant/g OC)
f_L = fraction lipid in fish tissue (unitless)
ε = normally distributed mean-zero random error
$\emptyset_{AE}$, $\emptyset_{BC}$, $\emptyset_{MM}$, and $\emptyset_{WP}$
= indicator variables for American eel, blue crab, mummichog, and white perch, respectively (unitless).
β_i = coefficients specific to the compounds and species using the units of $C_{s\text{-}oc}$ and C_f defined above

Page 3-27

$$\begin{aligned} Ln(C_f) = {} & \beta_0 + \beta_1 Ln(C_{s-Fe}) + \emptyset_{AE}[\beta_3 + \beta_4 Ln(C_{s-Fe})] + \emptyset_{BC}[\beta_6 + \beta_7 Ln(C_{s-Fe})] \\ & + \emptyset_{MM}[\beta_9 + \beta_{10} Ln(C_{s-Fe})] + \emptyset_{WP}[\beta_{12} + \beta_{13} Ln(C_{s-Fe})] + \varepsilon \qquad \text{Eq. 3-11} \end{aligned}$$

Where:
C_f = contaminant concentration in fish tissue (mg of contaminant/kg of tissue)

$C_{S\text{-}Fe}$ = mean iron-normalized concentration of the metal in the sediment (mg of contaminant/kg of iron)
ε = normally distributed mean-zero random error (unitless)
$\emptyset_{AE}$, $\emptyset_{BC}$, $\emptyset_{MM}$, $\emptyset_{WP}$
= indicator variables for American eel, blue crab, mummichog, and white perch, respectively (unitless).
β_i = coefficients specific to the compounds and species using the units of $C_{s\text{-}Fe}$ and C_f defined above

$$Ln(C_{fAE}) = (\beta_0 + \beta_3) + (\beta_1 + \beta_4)Ln(C_{s-oc}) + (\beta_2 + \beta_5)Ln(f_L) \quad \text{Eq. 3-12}$$

$$Ln(C_{fBC}) = (\beta_0 + \beta_6) + (\beta_1 + \beta_7)Ln(C_{s-oc}) + (\beta_2 + \beta_8)Ln(f_L) \quad \text{Eq. 3-13}$$

$$Ln(C_{fMM}) = (\beta_0 + \beta_9) + (\beta_1 + \beta_{10})Ln(C_{s-oc}) + (\beta_2 + \beta_{11})Ln(f_L) \quad \text{Eq. 3-14}$$

$$Ln(C_{fWP}) = (\beta_0 + \beta_{12}) + (\beta_1 + \beta_{13})Ln(C_{s-oc}) + (\beta_2 + \beta_{14})Ln(f_L) \quad \text{Eq. 3-15}$$

Where:
$C_{f\,AE}$ = American eel contaminant concentration (ug of contaminant/kg of tissue, except for 2,3,7,8-TCDD in pg of contaminant/g of tissue)
$C_{f\,BC}$ = blue crab contaminant concentration (ug of contaminant/kg of tissue, except for 2,3,7,8-TCDD in pg of contaminant/g of tissue)
$C_{f\,MM}$ = mummichog contaminant concentration (ug of contaminant/kg of tissue, except for 2,3,7,8-TCDD in pg of contaminant/g of tissue)
$C_{f\,WP}$ = white perch contaminant concentration (ug of contaminant/kg of tissue, except for 2,3,7,8-TCDD in pg of contaminant/g of tissue)
$C_{S\text{-}OC}$ = mean TOC-normalized concentration of the contaminant in the sediment (ug of contaminant/kg OC, except for 2,3,7,8-TCDD in pg of contaminant/g OC)
f_L = fraction lipid in fish tissue (unitless)
β_i = coefficients specific to the compounds and species using the units of $C_{s\text{-}oc}$ and C_f defined above

<u>Page 3-28</u>

$$Ln(C_{fAE}) = (\beta_0 + \beta_3) + (\beta_1 + \beta_4)Ln(C_{s-Fe}) \quad \text{Eq. 3-16}$$

$$Ln(C_{fBC}) = (\beta_0 + \beta_6) + (\beta_1 + \beta_7)Ln(C_{s-Fe}) \quad \text{Eq. 3-17}$$

$$Ln(C_{fMM}) = (\beta_0 + \beta_9) + (\beta_1 + \beta_{10})Ln(C_{s-Fe}) \quad \text{Eq. 3-18}$$

$$Ln(C_{fWP}) = (\beta_0 + \beta_{12}) + (\beta_1 + \beta_{13})Ln(C_{s-Fe}) \quad \text{Eq. 3-19}$$

Where:
$C_{f\,AE}$ = American eel contaminant concentration (mg of contaminant/kg of tissue)
$C_{f\,BC}$ = blue crab contaminant concentration (mg of contaminant/kg of tissue)
$C_{f\,MM}$ = mummichog contaminant concentration (mg of contaminant/kg of tissue)
$C_{f\,WP}$ = white perch contaminant concentration (mg of contaminant/kg of tissue)
$C_{S\text{-}Fe}$ = mean iron-normalized concentration of the metal in the sediment (mg of

contaminant/kg of iron)

β_i = coefficients specific to the compounds and species using the units of $C_{s\text{-}Fe}$ and C_f defined above

E. Mechanistic Model

E.1. Hydrodynamic and Sediment Transport Model

E.1.1 Comment: Hydrodynamic and Sediment Transport Model Framework Inadequate

Commenters criticized the hydrodynamic and sediment transport model framework used as part of the RI/FFS. These comments included the general topic of a lack of a framework for analysis of uncertainty and bias, and specific discussion of processes that were not included in the modeling simulations, such as scour around sheet pile structures, ship-induced sediment resuspension, flocculation, use of a single cohesive size class, ice cover and ice jams, bank roughness, wind waves and bioturbation. Other comments indicated that additional detail and complexity should be added to existing model features, such as the calculation of bed shear stresses (e.g., temporal changes in grain roughness and bedforms). Commenters stated that the grid resolution was too coarse to resolve the physics of flow and sedimentation patterns, including secondary currents. Commenters mentioned specific processes such as scour around bridge abutments and bank irregularities, and observations of erosional and depositional patterns at sub-grid scales. Some commenters noted that details of the grid convergence testing were not provided and others suggested alternate approaches for grid convergence testing. Commenters also questioned the bed structure of the model (i.e., parent bed, transitional layer, active layer and fluff layer) as well as the classification of layers as cohesive or non-cohesive based on grain size distributions.

Response:

EPA disagrees with the overarching characterization by commenters that the "FFS model framework is inadequate and inappropriate" to evaluate remedial alternatives. EPA notes that very similar frameworks of coupled hydrodynamic, sediment-transport, and contaminant fate and transport models have been used successfully and effectively for a number of other Superfund sites, including Lower Fox River, Duwamish River, Housatonic River and Gowanus Canal. The commenters' concerns about certain aspects of the modeling effort are addressed below; however, the basic modeling framework is a valid and appropriate approach for evaluation of remedial alternatives in the LPR.

Many of the comments suggested vastly expanding the scope and complexity of the modeling approach, which would have extended the RI/FFS schedule for many years. In contrast, EPA has concluded that the available modeling tools are able to simulate the hydrodynamic, sediment transport, and contaminant fate and transport dynamics to an appropriate level for remedial decision-making, and that further delay in addressing the risk to human health and the environment associated with current conditions is not warranted.

Grid Resolution

Commenters point out correctly that model grid resolution must be sufficient to adequately test and distinguish between remedial alternatives, yet many comments focus on very small-scale spatial heterogeneity observed in LPR field studies (bathymetry, sediment characteristics, contaminant distribution, etc.). First, it would be infeasible to design a model with a grid capable of resolving the smallest scales of spatial heterogeneity observed in the LPR. Computational stability would be impacted severely, requiring such small time steps as to render annual and multi-year model simulations impossible. Secondly, remedial methodologies (e.g., dredging, capping) are not spatially precise; rather, their smallest effective length scales are of a similar spatial scale to the model grid, making model resolution of sub-grid-scale effects much less relevant than the commenters imply. Modeling requires achieving an effective balance between process complexity, grid resolution, development time, and time-step stability (which controls scenario run time). The LPR-Newark Bay model developed by EPA to inform and support the analyses in the RI/FFS (also termed the RI/FFS model) is the result of such a balancing effort and provides adequate process complexity and grid resolution to evaluate remedial alternatives at temporal and spatial scales relevant to the remediation methodologies.

As the commenters aptly point out, "The spatial resolution of any numerical model is always a trade-off between the details required and the computational resources (number of processers and time to run the model) available. As such, it is realized that choices must be made to allow the most efficient grid size for the study that reaches this compromise between resolution and resource."

The spatial resolution of the RI/FFS model grid was developed to balance the ability to resolve hydrodynamic, sediment transport, and contaminant fate and transport processes and still perform long simulations to support the evaluation of risk reduction. Contrary to the commenters' statement, the grid resolution was evaluated with a grid convergence test (HydroQual, 2008), in which comparisons were made for salinity, velocity, bottom shear stress, and flushing time computed with the final grid and a grid with resolution increased by a factor of four. Comparisons to data showed only minor improvements in performance (and equivalent performance in some cases) at a cost of a factor of eight increase in computational time associated with the higher resolution grid. The RI/FFS model took approximately four months to run a 70-year simulation; a factor of eight increase in computational time would have resulted in a run time of over 2.5 years. The spatial resolution used for the RI/FFS model grid provides an appropriate balance between resolution and resource.

Shear Stress Calculations

EPA does not agree with the comment that use of near bed velocities based on the "log-law" velocity profile to calculate total bed shear stress should have been justified in the RI/FFS. The log-law velocity profile is a widely used method that produces reasonable results. It is a fundamental boundary condition of turbulent-closure models, whether they be the q^2-l closure model used in HDR's ECOM and the Princeton Ocean Model (POM) or the related k-ε turbulent closure used more commonly in engineering applications and computational fluid dynamics (CFD). The turbulent-closure scheme is the basis by which frictional interaction of the fluid with the bed generates vertical turbulent mixing of fluid momentum and associated scalar constituents. The log-law boundary condition for turbulent closure has been demonstrated to be a suitable approach (Burchard, 2002; Nezu, 1993; Rodi, 1993) in innumerable hydrodynamic models of rivers, lakes, estuaries and coastal waters. Physical similarity law also predicts the presence of a logarithmic region near the bed for thin-shear boundary layers (e.g., Blackadar and Tennekes, 1968), even over hydraulically rough boundaries. Note that the log-law boundary condition makes no assumptions about the form of the vertical velocity profile above the level at which the boundary condition is applied, allowing thermohaline and secondary circulation to form unimpeded, as appropriate to local hydrodynamic conditions and forcing.

Frictional Effects of Bank and Bottom Roughness

Commenters expressed concern about the representation of frictional effects due to bottom roughness and the fact that ECOMSED does not account for side channel roughness. While the commenter is correct in stating that this feature is not included in ECOMSED, EPA does not agree that bank roughness is a significant aspect of the LPR system. Bank roughness can be important in settings where the water depth at the bank is deep and channel width is extremely narrow, in which case the bank height can be a significant part of the wetted perimeter. As discussed in the RI/FFS, this is not the case in the LPR. Throughout most of the LPR, water depths at the banks are less than 3 meters (m) deep and widths are more than 100 m, meaning that the bank height is a small fraction of the wetted perimeter and does not represent a significant additional friction surface.

Regarding general bottom roughness, two independent acoustic Doppler current profiler (ADCP) data sets in the LPR were available for the calibration intervals of the hydrodynamic model calibration (i.e. 1995-1996 and 2004). During model calibration, these data were used to evaluate the agreement between simulated and measured vertical variations of currents at various locations. Through this effort, a total roughness parameter of 1 millimeter (mm) was determined to provide a satisfactory representation of frictional effects in the LPR, without the use of a 2-dimensional (i.e., horizontally variable) description of total bottom roughness.

EPA agrees that a model incorporating fully dynamic coupling between the hydrodynamic and sediment transport calculations would represent the complexity of the natural environment more completely than the RI/FFS model. Such a model might also include the effects on turbulence damping of strong near-bottom, vertical concentration gradients of suspended sediments, as well as a host of additional complex interactions that better represent full natural complexity (such as spatially and temporally variable bioturbation and biogenic roughness). It is also true that other model frameworks exist that do incorporate 2-way coupling between hydrodynamics and sediment transport processes, in either cohesive or non-cohesive environments. EPA does not agree, however, that inclusion of this greater model complexity results in significantly greater model skill or utility, but it always results in longer model run times and greater opportunities for error and/or instability. Indeed, in a detailed model-data comparison study south of Martha's Vineyard, Massachusetts, Ganju and Sherwood (2010) found that "commonly used representations of ripple-induced roughness, when combined with a wave–current interaction routine, do not significantly improve skill for circulation, and significantly decrease skill with respect to stresses and turbulence dissipation."

The LPR includes a complex range of environments in a very short distance, ranging from a coarse-grained river to a muddy tidal estuary in just 17 miles. Reliable 2-way coupled parameterizations for bedform development and decay do not exist for such a complex range of environments, nor would they necessarily perform better for the hydrodynamics than the present spatially constant total bottom roughness if they were available. The RI/FFS model's bedform formulation was developed for the purpose of preventing run-away erosion and downstream sand transport in the upper reaches of the LPR. It does this by reducing the grain stress under conditions conducive to large bedform development, and does so in a reasonable manner based on a widely recognized framework for non-cohesive bedform morphology (van Rijn, 1993). As stated in RI/FFS Appendix BII, Section 2.5, "Implementing this formulation significantly reduced excess erosion of the sandy regions of the upper LPR during storms, while predicting bedforms of approximately the same size as those observed in a multibeam survey of the upper LPR following a flood." EPA is confident that the present bedform submodel is appropriate and sufficient for its intended purpose.

Commenters questioned the sediment transport model formulation that accounts for conditions when the boundary layer is smooth turbulent or transitional, rather than the more common fully rough turbulent boundary layer. This concern was based on the observation that the bed itself is often characterized by roughness due to erosional features. The commenter misunderstood the context of RI/FFS Report Appendix BII, Section 2.5. Although physical bed roughness is a factor, the condition of "smooth or transitional" actually expresses a condition of the turbulent boundary layer near the bed and not a condition of the bed surface itself. In "hydraulically smooth turbulent" flow, bed roughness elements are fully enclosed within the viscous sublayer, so hydraulic roughness in the boundary layer is characterized by thickness of that sublayer rather than the physical height of the bed roughness elements. Conversely, in "hydraulically rough turbulent" flow, the thickness of the viscous sublayer is negligible, so hydraulic roughness under those conditions is characterized by the physical height of the bed roughness elements. "Hydraulically transitional turbulent" flow lies in between, and hydraulic roughness is characterized by an empirical function (e.g., RI/FFS Appendix BII, equation 2-9, p. 2-7) that relates the varying effect both of viscous sublayer thickness and height of the bed roughness elements. The RI/FFS model actually recognizes the presence of two principal length scales of bed roughness: larger-scale bedform roughness and smaller-scale grain-size roughness. At the length scale of the bedform roughness and larger, flow is nearly always fully rough turbulent, and hydraulic roughness is characterized in the hydrodynamic model by the total bottom roughness parameter (z_{0T}). Thus, this larger-scale hydraulic roughness controls the vertical velocity profile and turbulent mixing of sediment suspended in the water column. However, processes of sediment erosion and deposition occur right at the bed surface, and roughness at this length scale is characterized by the grain roughness parameter (z_{0s}), which—as described above— is a varying function of grain-size roughness and thickness of the viscous sublayer.

Bed Layering

Commenters expressed concern about the bed layering scheme and its ability to predict bed armoring. This comment shows a misunderstanding of FFS Appendix BII. The LPR version of ECOMSED incorporates the state-of-the-science bed model of SEDZLJS. SEDZLJS includes the erosion and deposition algorithms developed at the University of California at Santa Barbara (Jones and Lick, 2001) and the consolidation model of Sanford (2008). SEDZLJS contains a very detailed, data-informed bed layer structure and has done very well in terms of predicting 3D grain-size sorting in past tests (James et al., 2010). The SEDZLJS bed layer structure was further modified to account for the complications of depositional cohesive environments, allowing for consolidation of deposited bed layers and interactions with ephemeral floc deposits at the sediment-water interface. The fluff layer was added to satisfactorily address the ephemeral floc deposits, and the transition layer was required to avoid sudden, unrealistic jumps in bed properties during layer transitions. The final bed model is as sophisticated and multi-layered as any other existing mechanistic bed model, and it has been honed and tested through many trials.

Bioturbation

Bioturbation is not included in the consolidation model because it is very poorly constrained by observations, especially on the scale of the very near surface variations in cohesive sediment erodibility that are most influenced by the consolidation model. Excluding bioturbation is not ideal, but EPA considered it to be the best possible alternative in the absence of data. Exclusion of bioturbation likely results in too much fine scale variability in near-surface erodibility, but it does not affect tidal resuspension because this occurs primarily in the floc and transition layers that are outside of the consolidation model. Inclusion of bioturbation in Sanford (2008) generally increased fine sediment erosion during events, especially in mixed sediments. The current calibration of the model simulates most events successfully. If bioturbation were introduced into the consolidation model, other parameters would have to be adjusted to bring the model back into calibration with the data, resulting in the same overall model performance as that developed to support the RI/FFS. Inclusion of bioturbation effects on vertical transport of solids within the bed would only have a net effect in locations where vertical variations in grain size exist on the length scale of the mixing zone depth. As a result, inclusion of this additional transport mechanism would not be sufficiently important for solids transport to warrant additional computations. The net effect of this process is better left to the contaminant transport effects, where it is included.

Ship-Driven Resuspension

As noted in the RI/FFS Report Appendix BII, EPA omitted ship-driven resuspension from the sediment transport model because of both complexity and uncertainty in accurately incorporating the effects into the model. The amount of sediment re-suspension associated with vessel activity is difficult to quantify, even for researchers, and many approaches have been suggested (Hochstein and Adams, 1986; Hamill and McGarvey, 2001; Garcia et al., 1998; Hamill et al., 1998; Garcia et al., 1999; Maynord, 2000; Shepsis et al., 2005; Applied Technology and Management, Inc., 2006; Maderich et al., 2006; Hayes et al., 2010). EPA anticipates that ship-driven resuspension may be considered during the remedial design phase.

Commenters provided an unrealistic example of the potential for ship-driven scour in the LPR by referencing a calculation for the Upper Mississippi and Illinois Rivers, where conditions are quite different from the physical conditions in the LPR. A barge of the width used in the example would not be able to pass upstream of the Point-no-Point Conrail Bridge at RM 2.3 (USACE RM 2.6).[24] Based on channel design guidance specifications (USACE EM 1110-2-1613, referenced in USACE, 2010), a barge of that width also should not pass upstream of the former Central Railroad of New Jersey Bridge at RM 0.9 (USACE RM 1.2) because of the limited horizontal clearance. Even near the confluence with Newark Bay, the vessel sizes are limited by physical navigation channel dimensions. Though the water depths between RM 0 and RM 0.7 are deeper than upstream, the navigation channel width remains at 300 feet (ft). For vessels following safe navigation guidelines, this would limit the length of vessel able to operate in this region to 250 ft. Downstream of RM 0.9, the water depths are considerably deeper than the depth used in the commenters' calculation, which would reduce the potential for resuspension.

Additionally, the commenters' calculation of the volume of sediment resuspended under the conditions of the example presented, over 21 million cubic yards per hour, assumed an unreasonable and unlikely combination of conditions. Erosion of this magnitude would cause scour on the order of tens of feet into the bed while one vessel passed. Bathymetric survey comparisons completed by EPA indicate that, although certain locations of the LPR experience periodic erosion or deposition on the order of several feet, a majority of the bathymetric changes that occur in the river are within 0.5 ft.

Commenters also referred to statistics of vessel transits in the LPR between 2008 and 2012. From the information provided in the comment, it is clear that a majority (55 percent) of vessels had small drafts

[24] The RI/FFS uses the RM system developed by USACE, which follows the navigation channel of the LPR. The Data Evaluation Reports (Appendix A of the RI/FFS), EMBM (Appendix C of the RI/FFS) and mechanistic model (Appendix B of the RI/FFS) were developed at the beginning of the 17-mile RI/FS, and thus follow a RM system developed for the RI/FS, which follows the geographic centerline of the river. RM 0 is defined by an imaginary line between two marker lighthouses at the confluence of the LPR and Newark Bay: one in Essex County just offshore of Newark and the other in Hudson County just offshore of Kearny Point. River miles then continue upriver to the Dundee Dam (RM 17.4). The two RM systems are about 0.2-0.3 miles apart.

(0-9 ft) and that nearly 90 percent of the vessels had drafts less than 14 ft. Based on a 2012 high-resolution multibeam survey of the LPR completed for the 17-mile RI/FS, the mean bottom elevation between RM 0 and RM 0.7 is -19.7 ft National Geodetic Vertical Datum (NGVD) with a standard deviation of 3.3 ft, and between RM 0.7 and 2.3, the mean bottom elevation is -17.1 ft NGVD with a standard deviation of 4.2 ft. Though there are shallower locations along the inside of river bends or at the navigation channel toes, these statistics indicate that the river is deeper than reported by the commenters. As water depth increases (whether by deeper depth, lower vessel draft or tide elevation), the magnitude of the shear stresses that impact the riverbed decrease, thereby decreasing the magnitude of sediment that is resuspended by vessel activity.

Ice-Related Issues

EPA agrees that ice-related issues (e.g., jams, flooding and scour) are relevant to conditions in the LPR, but disagrees with the suggestion that ice-related issues should have been explicitly included in the RI/FFS model framework. The commenters' reference to ice-related problems included conditions, arising on the freshwater Upper Passaic River, illustrated with a picture of ice on the river, without making a distinction between the Upper and Lower Passaic River. The USACE Cold Regions Research and Engineering Laboratory Ice Jam Database lists five instances (February 1945, 1948, 1961, 2003, and 2004) of ice jamming on the Passaic River, but these jams all occurred in the freshwater portion of the Upper Passaic River, upstream of Dundee Dam. No ice jams have been reported in the Lower Passaic River. The two 2014 ice-jam concerns referenced by hyperlinks in the comments also pertain to sections of the Upper Passaic River. In contrast, a map in the referenced 2014 NOAA Weather Service presentation shows an absence of ice-related flooding for the Lower Passaic River and lower 8.3 miles of the Passaic River. Given the higher salinity water present in the lower 8.3 miles of the Passaic River and the daily rise and fall of the tide that tends to break up a forming ice cover, it is unlikely that ice jams will occur in the lower 8.3 miles of the Passaic River.

The potential for cap scour due to impact of ice floes along shallow margins of the lower 8.3 miles of the Passaic River is more difficult to assess because the issue has not been investigated explicitly. Seasonal flow is somewhat diminished during ice conditions (1,264 cubic feet per second mean January/February flow from October 2007 through May 2015 at USGS 01389500, Little Falls, New Jersey), and serious ice scour in northern rivers typically occurs when spring melt water causes sudden ice-jam break up. Similar ice-jam formation and breakup are exceedingly unlikely for the Lower Passaic River. The proposed two-foot thick cap and a cap-monitoring program included in the selected remedy provide a reasonable margin of safety in the event of minor ice scour along river margins in the lower 8.3 miles of the Passaic River.

Cohesive Size Classes and Flocculation

Commenters questioned the representation of cohesive sediment by a single state variable, rather than several different size classes, and indicated that flocculation should have been represented explicitly. Models must achieve a balance between complexity, computational efficiency and practicality, and it is common practice in sediment-transport modeling of mixed sediments to treat the cohesive component as a single "size class." Furthermore, floc settling speed is more relevant to modeling cohesive sediment transport than floc size, per se, and the RI/FFS model does include a semi-empirical relationship expressing changes in floc settling speed versus changes in suspended sediment concentration (which scales with bed shear stress and turbulence intensity). Whether the changes in floc settling speed represent changes in floc size or floc bulk density is not particularly relevant to modeling sediment mass transport. The commenters implied that the model should include more than one size class for cohesive sediments; however, this would introduce one or more additional degrees of freedom to the model response. It is unlikely that sufficient and appropriate data could be collected to constrain model response for more than one cohesive size class, so including more than one size class would increase model uncertainty (through the additional degrees of freedom) rather than decrease uncertainty.

The commenters also suggested using results of laboratory tests on flocculation and settling to quantify those processes in the LPR. However, numerous studies have demonstrated that flocculation is a very complex process and is highly dependent on local conditions (e.g., suspended sediment concentration, turbulence intensity, size of turbulent eddies, temperature and salinity, floc mineral and organic composition). Even employing "representative" samples of LPR sediments, it would be impossible for a laboratory study to accurately represent conditions in the LPR everywhere and at all times, so it would be very difficult to demonstrate that the laboratory results for flocculation could be used to decrease model uncertainty. Thus, the approach of the RI/FFS model to characterize flocculation of a single cohesive size class through a semi-empirical settling function developed during model calibration remains the most practicable approach.

Cohesive Versus Non-Cohesive Characterization

Commenters questioned the criteria used previously to distinguish cohesive versus non-cohesive treatment of the sediment bed, in which cohesive cells were specified where the D_{50} was less than 200 um (micrometers) and sand content was less than 60 percent of the bed solids. In an update to the sediment transport modeling undertaken to respond to public comments, the conditions for a cohesive cell were changed to D_{50} less than 200 um and cohesive solids more than 15 percent of the bed solids. This change affected the assigned bed conditions in the LPR upstream of RM 8.3 by increasing the number of grid cells where cohesive inputs were assigned, but had little effect between RM 0 and RM 8.3, where the vast majority of grid cells were already characterized as cohesive cells. The update to the sediment transport modeling is included in Attachment E to this document.

Erosion Rate Equation

Commenters correctly pointed out that when the erosion rate equation, $E = A \tau^n \rho^m$ is rearranged and the critical shear stress is specified for τ, then the erosion rate is the critical erosion rate, E_{CRIT}. The equation with E_{CRIT} and τ_{CRIT} was used in the analysis of the SEDFLUME data, consistent with the point made by the commenter.

E.1.2 Comment: EMBM and Sediment Transport Model Solids Fluxes are Inconsistent

Commenters compared net deposition terms from the EMBM to sediment transport model calculations of gross erosion and gross deposition to conclude that the two analyses are contradictory in terms of the assessment of the importance of solids sources outside the lower 8.3 miles on contaminant concentrations and recovery of the river. Commenters assumed that EPA didn't recognize that the gross erosion and deposition fluxes represent the cumulative counting of re-deposition and re-erosion of the same solids over time. Commenters also interpreted comparisons of boundary solids loading with gross fluxes (erosion and deposition) as a contradiction of the EMBM's results for solids contributions to net deposition. Commenters used solids fluxes reported in the RI (p. 5-19) to draw conclusions regarding the role of boundary loading in diluting contaminant concentrations in the top 15 cm of sediment.

Response:

The statement in the RI Report that compares the mechanistic modeling results of boundary solids loading and gross erosion and deposition terms has been misinterpreted by the commenters. The statement is not intended to dismiss external solids loading, but rather to provide the reader with an understanding of the relative magnitudes of the solids transport terms. The commenter's assumption that EPA did not recognize the repetitive counting of resuspension and deposition of the same solids is incorrect. This process is clearly shown in the intra-tidal time-series plots (RI/FFS Appendix B, Figures 4-1 to 4-14) and the cumulative gross erosion and deposition and net deposition plots (RI/FFS Appendix B, Figures 4-47 to 4-53). RI/FFS Appendix B contains several statements that note that the net deposition is a small difference between the significantly larger gross resuspension and deposition terms. The misinterpretation of the meaning of the comparison of the boundary solids load and gross resuspension and deposition terms leads to the commenters' incorrect conclusion of an inconsistency between the EMBM and mechanistic modeling results. The results of a sediment tracer simulation performed with the mechanistic model (FFS Appendix BII, section 6.1) show reasonable agreement between the EMBM and mechanistic model results.

The RI Report included brief summaries of results from the sediment transport and contaminant fate and transport models to give the reader a general sense of sediment and contaminant behavior. In the case of the sediment transport model, results are summarized in terms of solids fluxes averaged over time and space for time periods that include the 17-year simulation for the calibration period from October 1995 through September 2012 and annual averages for individual high- and low-flow years. Commenters apparently used this summary information to perform simple mass balance calculations intended to provide estimates of expected behavior of trends in contaminant concentrations in the sediment bed. These simple calculations lead to an improper interpretation of expected behavior because they include invalid assumptions and cannot account for temporal and spatial variability in the sediment fluxes, which have important effects on the temporal trends in contaminant concentrations. The commenters' process is inconsistent with, and yielded completely different results from, EPA's modeling.

In the commenters' simple mass balance calculation,[25] the mass of sediment in the top six inches of the sediment bed is characterized as the inventory of active sediment, and is compared to the average annual mass deposited to the bed to conclude that the deposition would dilute the surface sediment concentrations by 13 percent per year. This calculation includes invalid assumptions. In addition to the use of an inaccurate surface area, the calculation inaccurately assumes that the contaminant concentrations on solids depositing in the lower 8.3 miles of the Passaic River have zero concentration. Because the lower 8.3 miles of the Passaic River represents a source of contaminants to the upstream reach subject to estuarine circulation, the concentration of contaminants on depositing solids is not zero. The calculation also wrongly assumes that net deposition is spatially uniform. However, the net deposition is spatially variable with highest net deposition downstream of RM 3, which contributes to the concentration gradient approaching Newark Bay.

E.1.3 Comment: Use of Sedflume Erosion Results

Commenters suggested that differences in physical properties between Sedflume cores collected at the same sampling station could explain differences in erosion rates between the cores, and asked if the

[25] The actual surface area of the lower 8.3 miles of the Passaic River is 65 percent greater than the value used in the commenters' calculation.

differences in erosion properties in these cores could be related to differences in sedimentary history. Commenters questioned the equation used to relate erosion rate to shear stress and the approach of specifying average erosion rates rather than incorporating the variability among cores. Commenters asserted that the data collected were insufficient to fully characterize the sediment and correctly estimate the temporal and spatial distribution of erosion and deposition. Commenters stated that the Newark Bay Sedflume results (SEI, 2013) were not used to develop model inputs for the Newark Bay portion of the model domain. Commenters asked how the periods for consolidation tests were chosen, why 28 days was selected for the final test period, and how the test periods relate to field conditions where consolidation can occur over longer periods. Commenters questioned comparisons between results from the consolidation model and measured critical shear stress and bulk density.

Response:

As discussed in the RI/FFS, it is evident from the Sedflume data collected in 2005 that the Lower Passaic River sediment bed consistency can be characterized as highly variable based on comparison of replicate cores in which erosion rates between replicate cores sometimes differed by an order of magnitude. Replicate cores at each sampling site on the LPR varied in separation distance from approximately 1 to 10 meters, and, thus, were in relatively close proximity to each other.

The potential impact of vertical and spatial variability in erosion rates and sediment properties was not ignored by EPA. Those data were very useful in understanding the potential uncertainty bounds of the model predictions. When completing mechanistic modeling of a large spatial region, however, it is necessary to characterize the sediment bed throughout the model domain. In order to do so, a certain amount of simplification and spatial averaging is necessary in order to best utilize discretely located data sets.

This is especially true when populating the grid cells of a mechanistic model with sediment data. First, it would be impractical to collect sediment data at a sufficiently high resolution to measure the sediment properties and erodibility of the LPR bed within each model grid cell at the 1 to 10 meter scale of the replicate Sedflume cores. Second, when establishing the model grid cell inputs, each grid cell is assigned specific sediment property data representative of the entire grid cell. The ability to model variability within an area of the domain is dictated by the size of the model grid cells, which is limited by computational power (i.e., the ability of advanced computing technology to facilitate rapid model operation).

Typically, a thorough evaluation of bathymetric elevation data sets is completed to gain a quantitative understanding of the temporal and spatial distribution of erosion and deposition. In the RI/FFS, using several years of bathymetric survey data sets (1995-2001, 2007-2008 and 2010-2011), EPA evaluated the variability in amounts of erosion and deposition that occur in the LPR. The mechanistic model's ability to represent these fine-scale changes is limited by the size of the model grid cells; therefore, it is not practical to expect the model to reproduce the erosion and deposition extremes when calculations are performed on the scale of model grid cells. As a result, as discussed in RI/FFS Appendix BII, the model is expected to generate results with less variability than the data, but approximate the central tendency of the data.

The most recent Sedflume erosion and sediment property data available within the LPR from river miles 0 to 8.3 were used during RI/FFS modeling. The 2012-2013 Sedflume erodibility and sediment property data from Newark Bay (SEI, 2013) were still being evaluated and interpreted, and so were not incorporated into the RI/FFS. In response to comments, EPA considered the 2005 and 2012-2013 Sedflume data in making adjustments to the Sedflume-derived erosion parameters to increase the amount of sediment infilling computed in the sediment transport model to improve agreement with bathymetric differences determined from bathymetry surveys. This improvement provides a better representation of the patterns of sediment accumulation in the LPR and therefore improves the utility of the model for evaluating future conditions. The updated modeling results are presented in Attachment E.

The consolidation durations (1-day, 7-days, 17-days and 28-days) for the re-constructed consolidation cores were based on previous consolidation testing durations employed at other mixed, cohesive sediment consolidation sites. Results from these studies (e.g., SEI, 2006) suggest that suspended sediment slurries constructed from sediment samples consolidate to the same degree (i.e., sediment properties and erodibility) as *in-situ* cores within a time period of less than, approximately, 28 days. The SEI (2006) study, in particular, yielded results that illustrated a continuous increase of down-core critical shear stress magnitude as the consolidation duration increased. Further, this same study resulted in observations of the sediment wet bulk density reaching an asymptote after just 7 days, with only a minor increase in bulk density observed at durations greater than 7 days.

Similar findings were observed in the LPR consolidation core Sedflume report (SEI, 2008): the down-core critical shear stresses for the 7-day and 1-day consolidation cores were similar, with the 7-day core down-core critical shear stress profile slightly higher than the 1-day core. The 17-day (representative of a 14-day consolidation duration) and 28-day consolidation cores had similar down-core critical shear stress profiles, as well, and were an order of magnitude higher than the 1-day and 7-day critical shear stress profile magnitudes. The magnitudes of the down-core bulk densities also increased as the consolidation duration increased.

The 1- and 7-day consolidation durations are intended to mimic the short-term sediment deposition and consolidation processes happening in a waterway that may occur during any given tidal cycle (1 day) or following a larger event (e.g., a several-day storm flow event). The 14-day and 28-day consolidation durations are intended to mimic the longer-term consolidation that sediment may undergo as it is buried and continues to consolidate.

Sediments will, presumably, continue to consolidate for much longer time periods than this; however, use of the prescribed practical consolidation durations (1, 7, 14, and 28 days) yields a sufficient amount of information regarding the short- and long-term temporal consolidation behavior. The data provide an approximate upper limit of consolidation, which is useful in analysis and for modeling purposes. These data can be extrapolated to longer durations of consolidation, if desired.

The Sanford (2008) consolidation model (equation 2-17) used in the RI/FFS is a simplified first-order relaxation treatment for consolidation, which provides significant advantages over more detailed and computationally intensive alternatives. The consolidation model has been tested against laboratory and field data and showed good agreement (Sanford, 2008). According to Sanford (2008), the model is "biased towards muddy sediments that may contain a significant sand fraction, but for which cohesive behavior dominates… It is not intended to model all conceivable situations... [but] offers intriguing possibilities for simulating interactions between suspended sediments in the water column and deposited sediments in the surface layers of the sediments, as mediated through erosion and deposition." Therefore, it is aptly suited for describing the variation in sediment properties in the LPR.

The basic premise of the Sanford model is to reproduce changes in solids volume concentration (linearly related to wet bulk density) and critical shear stress for erosion with depth due to changes in sediment bed structure. Within the ECOMSED model framework, the Sanford model was employed using the equilibrium profile of bulk density, which varies as a linear function of solids volume concentration. The bulk density in the RI/FFS consolidation model is used as a surrogate for several other parameters, whose values and contributions to sediment consolidation and erodibility are not readily quantifiable at each depth in a core. However, since the bulk density varies as a linear function of the solids volume concentration, the overall mechanistic description remains unchanged from that described in Sanford (2008).

The RI/FFS sediment transport model was calibrated against short-term variations in total suspended solids (TSS) and long-term variations in bathymetric elevation changes. Initial attempts to fit consolidation model profiles to the measured bulk density and critical shear stress data using minimized least-squared errors techniques resulted in insufficient TSS and infilling. A series of alternative interpretations of *in-situ* field and re-constructed laboratory sediment core data, and alternative methods of spatial distribution, were subsequently employed in an effort to more accurately predict sediment infilling that is observed in the bathymetric difference data sets. The parameterization used in the RI/FFS model resulted in improved infilling predicted by the model, although at times less than indicated by the data. Updates made to the model after the Proposed Plan was issued, in support of EPA's response to comments, have further improved the simulated infilling rates. The updated parameterization and results are shown in Attachment E.

Bulk density and critical shear stresses are derived parameters; that is, they are a function of measured data and/or empirical relations. Bulk density is computed from the measured moisture content of a sample and converted to a bulk density assuming an individual particle density. Shear stresses are computed from the flow rates that are measured during the Sedflume erosion experiment. The flow rates are related to a critical shear stress using an assumed value for boundary roughness and assuming pipe flow theory is valid in the flume. Therefore, the bulk density and critical shear stress curves plotted in the RI/FFS Appendix BII are a result of a combination of fitting empirical models to the measured data using minimized least-squared errors techniques and improving model infilling and TSS predictions. There is inherent uncertainty involved in the measured data, and, therefore, also in the bulk density and critical shear stress predictions.

Down-core erosion rate profile models were also generated in an attempt to fit empirical formulations to the measured erosion rates for specific, applied shear stresses (Figure 3 from RI/FFS Appendix BII). Erosion rates, too, are subject to inherent uncertainties in measured data. Further, small-scale variation in sediment properties may impact sediment erosion rates, but this variability may not be accounted for in the approximating model profile.

Model-data curve fits are generated to best represent these measured and/or derived data; however, sometimes model fits, including the consolidation model used by EPA (Sanford, 2008) are approximations derived from idealized scenarios (i.e., laboratory studies using sediments with a narrow range of properties, as opposed to the highly variable sediment properties observed in the field). Therefore, when the model fits are extrapolated to field-measured data, model-data discrepancies are not unexpected. This does not impair the utility of the results.

In contrast to the observations of the commenters, the modeled erosion rates (Figure 3 from RI/FFS Appendix BII, Attachment A) appear to represent the erosion rate data well. There is a greater amount of model-data discrepancy visible for the 1-day and the 28-day consolidation cores, but the 7-day and 17-day core profiles are in good agreement with the data.

There are differences between calculated and measured erosion rates and critical shear stresses; however, the water column TSS and infilling model predictions using the updated parameterizations shown in Attachment E show better agreement with the data than when previous model parameterizations were used. The updated model now predicts more realistic bathymetric change (compared with the bathymetric change data) and represents even more accurate TSS values (compared with the measured TSS data).

Within the objectives of the model framework, the spatial averaging of small-scale variability was proper and more appropriate than spatial interpolation of the discretely located core erodibility data sets.

E.1.4 Comment: Hydrodynamic Model Calibration and Validation

Commenters stated that a more-detailed hydrologic evaluation is required and that additional data are needed to improve the understanding of hydrodynamic forcing and processes. Commenters expressed concerns about the implementation of the ECOM hydrodynamic model, and mentioned lack of calibration data; low horizontal and vertical grid resolution; the response of modeled tides to changing river flow, especially at upriver stations; reproduction of currents; a lack of verification of modeled density stratification; a high sensitivity to key but poorly known parameters, and not accounting for wind waves. Commenters questioned the rank-based system used to evaluate the hydrodynamic model calibration.

Response:

Hydrodynamic Model Calibration/Validation

EPA disagrees with the commenters’ criticism of the hydrodynamic model calibration (based on their review of the 2008 Hydrodynamic Report [HydroQual, 2008]) in which they discuss lack of calibration data, lack of skill assessment, and poor grid resolution. EPA has already considered and addressed these factors, as discussed below. There are several data sets available over a ten-year time period for model calibration (i.e., 1995-1996 in LPR, 2000-2002 in Kill van Kull and Newark Bay, and 2004 in LPR). HDR's operational model (System Wide Eutrophication Model [SWEM]) was employed for EPA’s study and extensive enhancements were made to the model grid in the LPR/Newark Bay/Kill van Kull area. At the start of the hydrodynamic calibration effort, the SWEM model had been operational for over ten years (since 1995) and was shown to produce reasonably good hydrodynamics in the NY-NJ harbor and coastal system. The current LPR hydrodynamic model results, as discussed in the 2008 Hydrodynamic Report, demonstrate that the model reproduces the observed hydrodynamic parameters (elevations, currents, salinity, and temperature) within the LPR system considering that the model boundary is placed more than 100 miles away in the New York Bight. There are differences between model results and observed data, but these are acceptably small, and the model does not consistently underestimate or overestimate any model parameters.

The tables and figures in the 2008 Hydrodynamic Report provided extensive quantitative calibration metrics, model-data comparisons for tidal water elevations, currents, water temperature, and salinity for numerous data sets available in the LPR, Newark Bay, and Kill van Kull area. As noted, data sets used for the model calibration span over a ten-year period (1995, 1996, 2000-2002, and 2004), under different hydrographic conditions. Between 1999 and 2004, the Harbor Deepening Project, a USACE project to deepen navigation channels from the Atlantic Ocean through New York Bay, Kill van Kull, Arthur Kill and Newark Bay to provide 50-ft water access to the four container terminals in those waterways, resulted in extensive changes to water depths in the Newark Bay and Kill van Kull portions of the model domain. The model was able to reproduce each important hydrodynamic parameter (tidal water elevations, currents, water temperature, and salinity) despite substantial changes in hydrographic conditions in the system.

Commenters asserted that the model results are poor, citing to Table 4-9 in the 2008 Hydrodynamic Report. EPA judged the comparison of modeled tidal amplitudes and phases to be in good agreement with three NOAA tide gages. The commenters' statement that model results are not reliable is inconsistent with both graphical and statistical comparisons, such as comparisons of observed and computed water elevations within the LPR, which show root mean squared errors of 6 percent or less and correlation coefficient (R^2) better than 0.90.

Commenters suggested that the model did not account for sewage treatment plant flow in Newark Bay, without identifying the treatment plant. It is not clear if the commenter was mistakenly referring to main outfall from the PVSC plant, which discharges in the Upper Bay of New York-New Jersey Harbor (which was included in the larger domain of the hydrodynamic model), or to the secondary outfall associated with the facility, through which excess flow occasionally discharges to Newark Bay. Rainfall-generated flows are represented in the model through combined sewer overflows and stormwater inputs.

The hydrodynamic model developed for the study has performed reasonably well, simulating hydrodynamic transport dynamics to an appropriate level for feasibility study and decision-making. The model results do not show consistent biases such as over- or under-computing any model parameters.

E.1.5 Comment: Sediment Transport Model Input Parameters, Calibration and Validation

Commenters asserted that a number of shortcomings exist in EPA's implementation of the ECOMSED and SEDZLJS models, including lack of calibration and validation data, poorly characterized boundary conditions, use of only one class of cohesive sediment, inaccurate representation of suspended sediment concentrations and rates, no demonstration that ETM processes have been correctly modeled, and high sensitivity to poorly known parameters.

Several comments were made about the modeled bathymetric change, including that the modeled bathymetric change has a tendency to predict long-term accumulation in a patchier or more localized way than is indicated by the data in this region (RM 2-RM 7), which may contribute to an under prediction of sediment accumulation over a large part of the lower 8.3 miles. Commenters stated that the interpretation described within the RI/FFS Report is difficult to understand, stating that some figures are difficult to comprehend due to the color scale choice used to illustrate; that the model and data, at times, showed opposite trends in bathymetric changes; that it was difficult to view cumulative sediment flux decreases on the plots; that the bathymetry change comparisons were poor; and that statistical model-data comparisons are needed for sediment data and bathymetric change data. Commenters questioned the characterization of "quite well" in reference to the fit between model and data; and whether longitudinal strips of net bed elevation change suggest a process or artifact of multibeam bathymetry.

Commenters also stated that there are a few distinct model grid cells that predict high sedimentation rates, creating a situation that, post-remedy, means 2,3,7,8-TCDD concentrations are unrealistically high in those few cells. They stated that unrealistic deposition rates may bias the understanding of the contaminant behavior at these locations.

In addition, the commenters described use of a "poorly known and/or inaccurate characterization of upstream and downstream boundary sediment inputs." A comment regarding boundary conditions recommended a characterization of particle size distributions of solids at the upstream and open boundaries. A commenter also characterized the solids budget as not well known. In reference to the amount of cohesive and non-cohesive sediments resuspended and transported during Water Year 1998, a commenter questioned if similar results have been observed in other studies, for comparison. The commenter indicated confusion about a statement regarding non-inclusion of hysteresis between the solids loading vs. river flow. The commenter opined on the importance of understanding the lag period of the LPR relative to riverine forcing, and the importance of including hysteresis in computing proper boundary loading conditions and, thus, natural recovery calculations.

The commenters were concerned that there is no demonstration that ETM processes and properties have been correctly modeled. Summarizing, the comments stated that it is necessary to demonstrate that the combined hydrodynamic, sediment transport, and fate and transport models actually represent key ETM processes, and that there may be more than one ETM in the LPR. The comments expressed concern that spatial patterns of erodible sediment and their connections to fluctuations in turbidity and contaminant distributions around the ETM were not characterized adequately. The commenters stated that extensive additional data should be collected to develop an understanding of the processes controlling the ETM because "it is not possible to correctly model complex ETM sediment and contaminant transport processes unless these processes are actually understood, sufficient data are available to verify the accuracy of the models, and the models are correctly implemented, calibrated and verified".

The commenters recommended measuring the TSS size distribution and collecting data for acoustic backscatter (ABS)/TSS data at different sites, completing a full-field quantification of particle size distribution at the boundaries, presenting statistical testing and error analysis for TSS vs. current speed, and assessing TSS sensitivity to ABS frequency. Commenters stated a quantitative comparison of TSS model and data is needed. Commenters further asserted that quantitative statistical analysis is required to verify statements regarding agreement in the range of TSS data, phase and computed concentrations, and that statistical analysis is required for TSS model-data flux comparison. Commenters asked what the statistical relations for the TSS predictions are and what their significance is at different confidence levels. Commenters questioned the relevance of discussion of intertidal TSS comparison, especially phase.

The commenters described concerns with how bed roughness was parameterized in the RI/FFS model. The commenters also disagreed with the manner in which the morphological zonal classification and geomorphic zones were delineated, and stated that the geomorphological zonation is oversimplified. They questioned the basis for using a 400-micron grain size for fractioning bed load from suspended load. The commenters asked for clarification regarding a reasonable concentration-dependent functional form (and what uncertainties are associated with this form). Commenters asked for clarification of an apparent typographical error in the phrase "a great deal water column-bed exchanges" on p.4-24 of RI/FFS Appendix BII. The commenters stated that the grain size data should be assessed for agreement with model composition changes (e.g., grain size data do not support change in composition at RM 8.3); they asserted that grain size correlation with morphological regions is not borne out by data in many places, and they stated that grain size and morphological information for Newark Bay is needed.

The commenters stated that grain size data based on side scan sonar are purported to show a 'dramatic shift' at RM 8.3 from sand/gravel upstream to silt and sand downstream, and they asserted that while a downstream fining of bed sediment is apparent, the percent clay and silts plots illustrate that clays and silts are present all the way up the river, and multibeam bathymetry data show erosive bed features in the LPR upstream of RM 8.3, suggesting that cohesive clays may be present along much of the river channel, but are in places covered with a veneer of sand and clay. Hence, commenters claimed that EPA's observation of a dramatic transition that is associated with the bed morphology, position of the salt front, and estuarine circulation is not substantiated by the grain size data. In addition, they commented that no calibration or images are given to detail the calibration of the sidescan sonar imagery with the grab samples from the bed. The commenters stated that the simple contention that particle size correlates strongly to morphologic regions in the river is not borne out by examination of the data in many places. The commenters stated that model-data agreement to within a factor of 2 is too crude for a sediment transport model and cites an incorrect metric used from Donigian, 1984.

Commenters criticized the comparisons of computed solids fluxes and data from ABS and concluded that scour during storms is underestimated, leading to uncertainty in natural recovery. Commenters asked for clarification on large bedform conditions, and stated that no comparisons between computed and observed bedforms were completed. Commenters requested EPA's justification for assuming a quasi-steady Rouse profile in terms of full error analysis, including the calibration of suspended sediment with acoustic backscatter. Commenters also stated that an analysis describing the effect of not accounting for Dundee Dam solids (suggests use of a watershed model) is required.

Response:

Model Parameter Updates

Subsequent to the release of the Proposed Plan, in support of its response to comments, EPA updated model parameters and inputs, including by modifying the model upstream boundary conditions at Dundee Dam based on more TSS, carbon, and contaminant data collected between 2000 and 2013 (see Attachment E). In addition, EPA modified the bathymetry near RM 7.5 where predictions of high deposition rates mentioned by the commenters were affected by the grid representation of the transition of the channel from one side of the river to the other. The erosion rates and vertical critical shear stress profiles of the sediment bed were altered to allow simulation of increased sediment infilling in the model. Grain size, sediment property and morphological information for Newark Bay were included in the updated modeling.

In addition, EPA ran the sediment transport model continuously for the calibration and projection periods, rather than cycling the 15-year set of sediment transport model with the results being passed to the carbon and contaminant models. Updated figures and text based on these changes are shown, in Attachment E, with the model results using the most recent parameterization. These changes have improved agreement between simulated and observed bathymetric change and reduced the patchiness of the sediment accumulation. Quantitative calibration metrics are included in Attachment E, along with more detailed presentation of the solids budget for the LPR. EPA has incorporated the updated model results in the risk calculations that appear in the ROD, further supporting EPA's remedy selection.

EPA has been able to improve the model performance by modifying and updating some parameters as described in Attachment E. As demonstrated by EPA's extensive modeling program documented in the administrative record, issues such as the amount of data, model grid-cell size, parameterization of the model, and additional sensitivity analyses necessary for modeling the conditions in the LPR, sufficient to provide a robust basis for remedial decision-making, have received a great deal of attention during the modeling process. Many of the comments suggested expanding the study of the LPR with lengthy data collection efforts and added modeling complexity that would have extended the RI/FFS schedule for many years. In contrast, EPA has concluded that the available modeling tools are able to simulate the hydrodynamic, sediment transport, and contaminant fate and transport dynamics to an appropriate level for feasibility study and decision-making, and that further delay in addressing the risk to human health and the environment associated with current conditions are not warranted.

Adequacy of Data

EPA disagrees with comments characterizing the available data as inadequate for development of the mechanistic models. The models were developed based on an extensive collection of data including a series of hydrographic data sets (see RI/FFS Appendix BI and HydroQual, 2008), numerous bathymetric data sets, sediment grain size measurements, erosion measurements, TSS estimated from optical and acoustical backscattering (see RI/FFS Appendix BII, Table 1-1), and a series of contaminant sampling programs for sediment and water column (Tables 3-6 and 4-1, respectively in RI/FFS Appendix BII). These data sets have been used to: populate the model bed elevations and in comparisons to simulated time-variable bathymetric changes; develop initial conditions and boundary conditions for the sediment transport model; and for comparison to simulated time-variable TSS concentrations. Sedflume and Gust Microcosm study results were analyzed extensively as part of the specification of down-core erosion parameters. The data were used to assign boundary conditions and initial conditions for carbon and contaminant concentrations in the bed and water column and for comparison to simulated water column and sediment carbon and contaminant concentrations. Data used to support the modeling included data collected in the 17-Mile RI/FS Low Resolution Coring, Physical Water Column Monitoring (PWCM) and CWCM programs. QAPPs for these programs were developed by the CPG with EPA oversight.

Geomorphological Classification

The geomorphological classification of the LPR was based on observation of obvious break lines in the bathymetric elevation contours and distinct bottom features (e.g., scour holes). It is not possible, as discussed in the response to comment II.E.1.3, to represent the complexity observed during high-resolution multibeam studies in a model whose grid cells are orders of magnitude greater than the scale of the data, bedforms and the morphology. The longitudinal strips of net bed elevation change observed by commenters are in fact real features of the data, not artifacts of the multibeam data. Artifacts in the multibeam data would be evident throughout the survey as distinct discontinuities or other irregularities, and not just in specific locations.

Characteristics Upstream and Downstream of RM 8.3

EPA does not agree with the comments expressing concerns about the grain-size partitioning near RM 8.3 identified by EPA. By observation of the simplified surface sediment classification (derived from side-scan sonar records), it is evident that there is a distinct change in classification near RM 8.3. Side-scan sonar classification, ground-truthing/calibration, and analysis imagery and details are provided in NJDOT's 2006 "Technical Report, Geophysical Survey, Lower Passaic River Restoration Project." As explained in that report, results of the side-scan sonar survey and shallow-core ground-truthing produced "a simplified surficial seabed classification map of the project area." (Emphasis added.) The report further described that image-based bottom classification is the segmentation of bottom sediments into discrete classes based on the characteristics of acoustic backscatter throughout a region, concluding that: "Segmentation is a valid and useful survey tool, even though it does not independently identify geophysical types."

In essence, segmentation allows large surface areas to be surveyed rapidly with acoustic (or other) technology, but incorporates inherent uncertainty because it determines classification based on surface reflectance (backscatter), instead of incorporating differing sediment sizes that may exist immediately beneath the surface. It also classifies based on representative grain sizes (e.g., median), as opposed to an entire grain size distribution. Further, the classification is a snapshot in time, because, as explained in Appendix BII of the RI/FFS, "it is based on surface [sediment] conditions which can vary rapidly with flow." Therefore, it is difficult to directly compare the side-scan sonar data interpretation maps with any sampling data except those collected at similar times.

EPA also disagrees that particle size does not correlate strongly to morphologic regions in the river, as stated by commenters. Figure II.E.1.5 - 1 shows the spatial plots and cumulative frequency distributions of percent silt and clay, with the data segregated by geomorphological zone in each row. The percent of the area (up to the limit of the geomorphological zones at ~RM 14.5) is indicated in the right-hand panels. Plots are not included for the abutment scour and bridge abutment zones because of the limited fraction of the surface area in those zones. The geomorphic zones themselves show distinctly different settings upstream and downstream of RM 8.3, with smooth channels representing the largest portion of the upstream reach and broad shoals the largest part of the downstream reach. Within each zone type, the cumulative frequency distributions show overlap in only a small fraction of the data at the lower and upper tails of the distribution, and higher fractions of fine sediment through most of the distribution for the downstream reach. Similar plots for the fraction of particle sizes greater than 250 micrometers [um] (medium sand and coarser) on Figure II.E.1.5 - 2 show a mirror image, with higher fractions of coarse particles in the upstream reach for each geomorphological zone type.

Solids Boundary Conditions and Solids Budget

The comment suggesting that EPA add a watershed model to the model framework in order to improve solids boundary conditions represents an unrealistic expectation of the accuracy of watershed models. Such an undertaking would be unlikely to produce any significant benefit in terms of model results. The discussion of the model simulation of the March 2010 high flow sampling event in RI/FFS Appendix BII explained that the results were likely affected by not having boundary solids measurements, but EPA concluded it would be too optimistic to expect a watershed model to make precise predictions, even if one had been available. Solids from the watershed were accounted for through the solids rating curve, and the discussion in RI/FFS Appendix BII recognizes that the boundary condition estimates reflect the central tendency of loading for that flow condition. The results for that event, however, are encouraging in that the response to the event reflects the conditions of the bed after running the model for over 14 years and produced water column solids that are qualitatively in agreement with the measurements.

Commenters asked if it is accurate to describe an event with a recurrence interval of more than 20 years as extreme, as RI/FFS Appendix BII did in discussing the March 2010 high flow event. From the standpoint of monitoring conditions in the river, an event that occurs less often than once in 20 years can be characterized as extreme.

The solids loadings specified in the RI/FFS modeling from the Passaic and Saddle Rivers are shown in RI/FFS Appendix BII, as rating curves in Figure 3-1 and time series in Figures 3-2 and 3-3, respectively. The higher flow portion of the Saddle River rating curve comes from a generic normalized solids loading function, as described in RI/FFS Appendix BII, and was used because of data limitations for higher flows in the Saddle River. Despite the steeper slope of the generic function compared to the rating curve for Dundee Dam, the solids load from the Saddle River was still only approximately 9 percent of the solids load over Dundee Dam. This is reasonable, given that the drainage area of the Saddle River is approximately 7 percent of the Upper Passaic at Dundee Dam. EPA disagrees with the comment that the "flashy" nature of the Passaic hydrograph makes use of a normalized solids loading function inappropriate. Graphical presentation of the LPR hydrograph (e.g., RI/FFS Appendix BII, Figures 4-6 and 4-40) show that elevated flow conditions can often last for weeks to months. This is clearly inconsistent with the characterization of "flashy."

Particle size distributions of water column solids at the Dundee Dam and Kill van Kull boundaries were measured as part of the chemical water column monitoring program for the 17-mile RI/FS and confirmed the assignment in the RI/FFS model of only a small fraction of fine non-cohesive solids during elevated flow conditions.

Hysteresis of suspended solids,[26] was not included in the specification of upstream boundary conditions for suspended solids because evidence of hysteresis was not observed in the Dundee Dam solids loading data. Attachment E contains a description of the updated boundary conditions for Dundee Dam based on more recent data, performed in response to comments. Included in the discussion is an evaluation of hysteresis in the solids concentrations versus river flow. While hysteresis is a characteristic in some settings, the site-specific data for the Passaic River did not support its inclusion in the upstream boundary conditions.

Solids Size Classes

The commenters refer to use of only one size of fine sediment class as being improper. While the RI/FFS model used only one size class to represent fine-grained sediment, that single cohesive class used in the LPR version of ECOM-SEDZLJS actually consists of a combination of a very slowly settling background population of particles and a relatively rapidly settling population of bed aggregates or flocs that are resuspended and deposited on a tidal cycle basis. This parameterization provides the benefit of reduced computational requirements (relative to multiple fine-grained sediment classes) while representing both the intra-tidal and longer-term variation in settling behavior resulting from changing proportions of particle types within the fine-grained class. Time varying flocculation and floc break-up are not modeled explicitly in ECOM-SEDZLJS, although an empirical dependence on suspended sediment concentration is

[26] Hysteresis of suspended solids refers to higher concentrations of suspended solids at a particular river flow on the rising limb of a hydrograph compared to concentrations at the same flow on the falling limb of the hydrograph.

used. In the absence of direct measurements of suspended-particle settling characteristics for the LPR, a semi-empirical approach was adopted. A reasonable concentration-dependent functional form was developed and parameterized to optimize agreement with observed suspended-sediment profiles derived from acoustic backscatter data (see FFS subsection 4.2). Additional discussion on this issue is provided in response to comment II.E.1.1.

ETM Processes

EPA agrees with the commenters that ETM processes are an essential aspect of sediment and contaminant dynamics in the LPR. In fact, ETM dynamics were central to the comparisons between model predictions and PWCM observations in RI/FFS Appendix BII, section 4.2 and Figures 4-1 to 4-14. The spatial structure of predicted ETM suspended sediment distributions was presented in RI/FFS Appendix BII, Figures 4-6 and 4-7 to help explain observed and modeled relationships between tidal phase and suspended sediment concentration fluctuations at various PWCM mooring locations presented in the rest of these figures. The point of these comparisons is that ETM dynamics concentrated a pool of readily erodible settling particles within the mooring array, and that the magnitude and phase of resuspension observed at any given time and site depended on the relative (upstream or downstream) location of this pool. The fact that the model reasonably reproduced observed ETM location and behavior in 2010, 14 years after the simulation started, is strong evidence both for the performance of the model and the robustness of ETM processes in the LPR. The RI/FFS Model Calibration Discussion, Section 4.6 in Appendix BII, also makes frequent reference to ETM processes and their importance in LPR sediment dynamics.

However, EPA disagrees with the commenters regarding the need to resolve every small scale fluctuation of turbidity dynamics, the need to collect extensive additional data, and the need to fully evaluate the nuances of ETM dynamics in the LPR. Long-term sediment accumulation in an ETM zone is the result of multiple cycles of resuspension and deposition of a pool of settling particles that are focused by ETM dynamics, with net accumulation representing the small difference between large tidal resuspension and deposition fluxes. The precise details of intratidal ETM dynamics are less important for long-term accumulation patterns than the generally correct prediction of the location, extent, timing, and intensity of the feature, which were demonstrated in Section 4.2 of Appendix BII of the RI/FFS. Since the LPR is a very dispersive system, small scale, short-term details are spatially smeared over these long accumulation times. Furthermore, the amount of sediment involved during each tidal cycle in the LPR is minute. Typical tidally resuspended sediment concentrations of 50-100 milligrams/liter (mg/l), integrated over a 7-meter deep water column, represent just a few millimeters of surface deposit at slack water, only a small fraction of which may remain on the bottom as a net deposit during the next flood or ebb. The importance of accurately representing the behavior of this thin surface layer was in fact the reason that a surface "fluff" layer parameterization was added to the sediment bed in the LPR sediment transport model, and connected vertically to deeper sediment layers. Thus, the level of ETM representation in the LPR sediment transport model is appropriate for the RI/FFS and for remedy selection. The fact that the model correctly matches changes in the phase of suspended sediment concentration relative to tidal height from below the ETM to above the ETM is an excellent indication that the model has correctly captured the dynamics of ETM formation and tidal advection.

Quantitative Calibration Metrics

EPA does not agree that model-data agreement to within a factor of 2 is too crude for a sediment transport model. The citation to an article by Donigian et al. (1984) does not support this comment. The metrics cited in the Donigian et al. (1984) report are based on annual and monthly values. Individual events will show considerably larger variation for many reasons with little impact on the overall calibration. The values reported within Donigian et al., (1984) should be interpreted consistent with time-averaging periods cited. Quantitative calibration metrics are included in Attachment E.

Hindcast Simulation

Commenters suggested that a hindcast simulation should be performed to evaluate the simulated shoaling patterns. EPA considered the value of a hindcast simulation, but concluded that a lack of information to describe open-boundary solids concentrations at the ends of the Kill van Kull and Arthur Kill and upstream riverine loadings would introduce enough uncertainty into the calculation that differences between model results and estimates of bathymetry changes could not be conclusively attributed to model parameterization versus loading estimate inaccuracies. Thus, a hindcast simulation was inappropriate and would not have provided usable information for the RI/FFS and remedy selection.

Monitoring Data

EPA agrees that collection of event-specific calibration data for ABS/OBS (optical backscatter) measurements during high flow events is good practice. However, safety concerns influenced conditions under which field data collection was conducted during the high flow sampling event(s). The ABS and relationships to TSS were based on the data collected as part of the 17-mile RI/FS PWCM program.

Source of Equations

Commenters questioned the basis for using a 400 micron grain size for selecting the equation (equation 2-4 of RI/FFS Appendix BII) for the critical shear stress for erosion of non-cohesive solids and fractionation into bed load and suspended load. The criterion of 400 um comes from Jones and Lick (2001) and Lick (2008) who approximated van Rijn's (1984 and 1993) use of a dimensionless particle diameter, d* of 10 for the boundary between the two equations (d* is used in equation 2-4 of RI/FFS Appendix BII). In the updated sediment transport modeling performed in response to comments (Attachment E) the value of d* of 10 is used directly in the selection of the equation for the critical shear stress. The dimensionless particle diameter, d*, includes particle density and kinematic viscosity.

Rouse profile

The Rouse profile for suspended sediment is derived from a force-balance approach near the bed between net-upwards turbulent mixing and gravitational sinking of sediment particles under steady or quasi-steady flow conditions. While it is a simplification of the relevant physics, it has been shown to be a reasonable approximation for a variety of applications. For example, in the Hudson River turbidity maximum (Orton et al. 2001) and the York River, VA (Friedrichs et al. 2008), two estuarine environments that are similar to the LPR, the Rouse balance was used with great success to derive suspended sediment settling velocities. Its use for the LPR thus represents both a reasonable approximation of the physics and an accepted method for estimating settling velocities. With respect to the commenter's mention of the calibration of suspended sediment with acoustic backscatter as part of the Rouse profile justification, it is noted that when suspended sediment concentrations estimated from acoustic backscattering are used for both the concentration and the concentration gradient, then the resulting estimate of settling velocity is independent of the calibration (Friedrichs et al. 2008). Even so, the assumed Rouse profile served only as a framework for developing an empirical relationship (RI/FFS Appendix BII, Eq. 2-22, p.2-15) for the concentration-dependent gravitational settling speed of cohesive sediment resuspended by tidal flow. The final form of the empirical relationship and its parameters were obtained after an extensive modeling effort by fitting model response to site-specific data (i.e., estimates of suspended solids derived from acoustic backscatter). The “error analysis” suggested by the comments is, in fact, the demonstration of goodness-of-fit for the calibrated model. If the model simulates the spatiotemporal distribution of suspended solids acceptably well, then use of the empirical settling function is appropriate. That the empirical settling function also has a basic physical underpinning (i.e., the force-balance on suspended particles) is a positive, albeit not essential, factor.

Clarifications

The statement containing the phrase “a reasonable concentration-dependent functional form” on p 2-14 of FFS Appendix BII referred to the development of the subsequent two pages, which described the empirical basis for estimating the settling velocity of the single fine particle size class in the LPR sediment transport model. This functional form incorporated a concentration-dependent settling velocity to account for flocculation of rapidly settling tidally resuspended sediments, as well as slowly settling background (wash load) suspended sediments. The functional form (linear dependence on concentration for the tidal floc settling speed combined with an essentially constant background settling speed, resulting in a weighted average bulk settling speed) was determined and parameterized by extensive testing against observations.

Commenters indicated that decreases in cumulative downstream solids fluxes during low-flow periods on net upstream transport were not readily apparent in RI/FFS Appendix BII Figures 4-47 through 4-53. Cumulative sediment flux decreases are identified by slope decreases in the middle panel of RI/FFS Appendix BII Figures 4-47 through 4-53. From these figures it can be seen that between years 2001 and 2002, the cumulative slope approximates zero, thereby indicating that the sediment flux at that time has slowed or stopped. It is not immediately apparent if other studies have investigated sediment flux in a manner similar to that shown in Figures 4-55 to 4-57 of RI/FFS Appendix BII.

The statement containing the phrase “a great deal water column-bed exchanges” (RI/FFS Appendix BII, P.4-24) was made when describing the locations from which sediment enters the system and is entrained in the water column. In this case, the 17-year average fluxes were computed from a number of input sources to the LPR as well as exchanges between the water column and the bed, from where resuspended sediment were derived.

Commenters criticized the comparisons of computed solids fluxes and data from ABS and concluded that scour during storms is underestimated, leading to uncertainty in natural recovery. While the commenters suggested a simple cross-plot, the presentation of the solids fluxes versus flow in RI/FFS Appendix BII, Figure 4-15 provides insight into the transition from net upstream transport during low flow to net downstream transport during higher flow conditions.

“Large bedform conditions” as used in RI/FFS Appendix BII was a relative term used when describing the implementation of the roughness parameter. Large bedforms can be megaripples, dunes, or larger features; however, the point of the discussion in RI/FFS Appendix BII, Section 2.5 was to describe how the skin friction shear stresses were computed. The formulations employed in ECOMSED-SEDZLJS work to smooth the transition between different transport regimes, and prevent unrealistically large grain stress estimates as bedform sizes increase. The model parameterized the effect of bedforms as a source of form friction in a reasonable manner, but did not attempt to model the formation, movement, and disappearance of bedforms, and therefore no quantitative comparison with bedforms observed in the multibeam surveys is appropriate.

E.1.6 Comment: Capping/Armoring Analysis and Simulation of Extreme Events

Commenters criticized the capping/flooding analysis for having been conducted for ten-day periods around specific flood events, rather than with a continuous simulation, and also recommended that fine sediment be included in the analysis to account for the effect of normal fluvial evolution on a cap. Commenters noted that the description of the capping/flooding analysis provides estimates of the entrainment of the coarsest particle sizes within the Upland Borrow Sand (UBS) but does not detail the entrainment of the finer grain sizes within the sediment size distribution. Commenters questioned entrainment of the remainder of the size distribution, the influence of bedforms, the effect of not including a hiding factor in the analysis, and the overall effectiveness of the UBS as a capping material. A commenter asserted that the assumption that the armor stone is non-erodible is unproven and should be evaluated for 100 and 500-year flows.

Commenters criticized the approach used for specifying the hydrograph and magnitude of storm flows used in the evaluation, and that future systems changes have been ignored, citing a possible Passaic River flood diversion tunnel; climate change and sea-level rise (which could increase sedimentation and improve recovery); a storm surge barrier in New York Harbor; and abandonment of the shipping channel above RM 0. In addition, comments stated that the severity of extreme surge and flood events had been underestimated because the coupled nature of storm surges and floods was not considered, nor was the effect of urbanization on historical flow conditions.

A commenter critiqued the use the same 15-year hydrograph consecutively. Further, a commenter stated that it is unreasonable to include 2007 and 2010 (greater than 1 in 25 year storm events) six times in a 47 year simulation and that the model should incorporate the hydrographs from the previous 47 years.

Commenters recommended an analysis of bed shear stresses based on data, and that the return period of bed shear stress should be evaluated and used in the evaluation of future conditions.

Commenters stated that the solids budget of the system is poorly understood and that the effect of changes in bathymetry (associated with each of the alternatives) on the system trajectory needs to be understood in order to define and evaluate the remedial alternatives.

Commenters expressed concern that the deposition realized within the contaminant fate and transport model is so great that over the full projection period, it likely exceeds the initial water depth. According to the commenters, this behavior appears to be due to unrealistically high deposition rates within the hydrodynamic and sediment transport model that are further exaggerated in the contaminant fate and transport model as a consequence of recycling hydrodynamic and sediment transport results to reduce the computer time needed to complete a model projection run.

Commenters asked for assurances that the proposed remedy will not exacerbate flooding, sedimentation, or scouring of the river.

Response:

Subsequent to the release of the Proposed Plan, in order to respond to substantial comments about every aspect of the RI/FFS model, EPA updated model parameters and input. Updated model results are provided in Attachment E. These changes include a modification to the bathymetry near RM 7.5 where predictions of deposition had been affected by the grid representation of the transition of the channel from one side of the river to the other. This modification substantially reduced the deposition in this area cited in one of the comments, as mentioned above.

Capping and Flood Modeling

Period of Simulation

EPA agrees that the prediction of sediment entrainment from the cap over a period of time is uncertain. To address the uncertainty, the RI/FFS model used a conservative modeling approach to assess the performance of remedial actions under 10 days of high river flow and flooding. The flows evaluated included the 100 and 500-year flood events, which are considered to be extreme flooding and flow events. Since these flows were applied conservatively in the model, they are expected to model worst-case scenarios, more likely to have a negative impact (in terms of erosion) than natural fluvial evolution. For the evaluation of the alternatives over longer time periods, the sediment transport and contaminant models were run for a 30-year time period following implementation of remedial alternatives, which consider natural fluvial evolution.

Occurrence of Floods and Storm Surges

The design phase, when work plans and specific designs will be developed to address redistribution of contaminants, is the appropriate time to consider potential future extreme climate change events, the risk of accidents and erosion from storm surges during construction. The commenters state that the LPR is shaped, in part, by periodic large floods and storm surges that often occur in connection with one another; however, the commenters provided only a three few examples. EPA found in a preliminary analysis that there was very little correlation between the timing of peak flows and peak storm surge (i.e., 0.02 r^2 value). In a recent example that contradicts the commenter's assertion, the extreme storm surge experienced during Hurricane Sandy (Fall 2012) resulted in a LPR flow no larger than typical river flows.

The 25-year record provides 300 values of monthly maximum water surface elevations (surges) and paired river flows; EPA judged this to be a sufficiently large data set for evaluating the correlation (or lack of correlation) between storm surge and high river flow events. Several high river flow events have been observed between 1981 and 2004 (and later), providing EPA with a sufficient number of high-flow data points to make this determination at the FFS level.

EPA does not agree that the value selected for the largest anticipated flow rates is highly uncertain. The extreme flow return period analysis was completed in 2007-2008 by the USGS. Since that time, several extreme flow events have occurred (e.g., in 2007, 2010, 2011, etc.) which may serve to alter the long-term hydrograph and extreme value analysis. While it is possible that multiple consecutive storm flow events could cause damage to the river bottom and remedial cap before repairs and/or maintenance could be completed, the commenters' example dated from 1903. Flood protection and drainage on the river have likely improved in the last century, and it is difficult to say for certain that this scenario could happen again. Moreover, this scenario is hypothetical. The creation of future events from historical hydrographs and water levels is the most technically defensible means of predicting the future. Flow information available at the time of design can be used to evaluate flows of specific recurrence intervals and be factored into the specification of a stable armor stone. Incorporating armor stone in a layer below the surface of the cap is an option for maintaining a stable armor layer and avoiding increased spatial extent of flooding, should flow data suggest that higher flows need to be considered.

Solids Types in Capping Analysis

FFS Appendix BI described application of the SEDZLJS model to the remedial activities as a cap stability and erosion analysis. In this sense, use of only sand-sized and larger particles was a conservative simplification. Sand-sized particles will comprise the majority of the initially-placed capping material. Fine sediments that are transported into the LPR will be resuspended and advected with the ambient currents until deposition and consolidation occurs. Deposition and consolidation will act to increase the critical shear stress of the surface sediment as cohesion increases. In absence of fine sediments, however, the non-cohesive, sand-sized capping material may mobilize at lower shear stresses. Therefore, consideration of behavior of solely sand-sized particles is a conservative measure of evaluating capping performance.

Hiding/Sheltering Effects

Entrainment of finer sediments is considered within ECOM-SEDZLJS through an algorithm that incorporates a pseudo-sheltering effect when modeling sediment transport. A hiding, or sheltering, factor is not needed, or explicitly used, in any of the modeling efforts. Sheltering factors are more appropriate for energetic rivers with distinctly bimodal grain size distributions, as opposed to the lower energy LPR system with relatively smooth grain-size distributions (e.g., Parker et al., 1982; Wilcock et al., 2001; Wilcock and Kenworthy, 2002; Wilcock and Crowe, 2003; and Parker, 2008). In a system such as the LPR, a hiding factor will only serve to add additional degrees of freedom, and is unnecessary, as hiding factors are more appropriate for non-cohesive beds where the sediments mobilize individually. In cohesive sediment systems such as the LPR, beds typically erode by mass failure of small aggregates and/or clumps of the bed surface. In this sense, individual grains are not "sheltered" from being individually eroded.

In the ECOMSED-SEDZLJS model, the critical shear stress threshold that determines when any surface particles begin to erode is the bulk sediment critical shear stress of the surface layer. Once the bulk shear stress is exceeded, individual particle sizes with critical shear stresses lower than the bulk critical shear stress begin to erode, implicitly employing a sheltering effect to the smaller particles until this threshold is reached. As finer sediments are eroded from the bulk sediment surface, the bulk sediment critical shear stress threshold increases, decreasing the likelihood of erosion of fine material within the model (because the probability of exceeding the bulk sediment critical shear stress decreases).

The erosion results of the capping material (Figure 5-7 in FFS Appendix BI) indicate that a low percentage of the sediment distribution is expected to be mobilized and entrained. A maximum of 10 cm of bed elevation decrease (i.e., erosion) was reported for the modeled scenario. This implies that the UBS functions very well as a capping material, retaining 84 percent of the original UBS cap thickness.[27]

[27] Original UBS cap thickness = 2 feet (0.61 meters). Maximum erosion predicted = 0.3 feet (0.1 m). Amount of sediment lost = 0.1/0.61 = 16 percent, resulting in 84 percent (or more) of material retained.

Stability of Upland Borrow Sand Cap

In the cap flooding analysis, commenters questioned whether the modeled UBS cap roughness parameter (z_0 = 0.005 m) was sufficiently large to account for possible formation of dunes, which are large-scale bedforms. However, owing to their low aspect ratio (dune height to wavelength), the relative contribution to bed roughness of dunes can be less than closer-spaced, smaller-scale bedforms, such as large ripples or closely packed cobbles. For example, for 5 m depth a dune comprised of median UBS (nominal diameter 2057 um) with a height of 0.81 m and a wavelength of 37 m would only represent a bedform roughness comparable to the modeled cap roughness (z_0 = 0.005 m). Formation of such a large bedform would require a total bed shear stress in the range of 18 Pascals, which is far in excess of peak total bed shear stress calculated by the model for the 100-year storm. Additionally, the formation of large dunes would require significant bed erosion and would represent a failed cap.

For the cap flooding analysis referenced by the commenters, areas of the LPR bed that were subject to erosion of more than 3 inches (0.076 m) were represented as being covered by 6 inches armor stone[28] (in a second step of the modeling analysis) with an assigned roughness parameter of z_0 = 0.01 m (0.39 inches). Thus, formation of dunes large enough to exceed the assigned UBS cap roughness is not relevant to the modeled flooding scenario because bed shear stress was insufficient to develop large dunes and significant cap erosion was constrained by armoring where required. A model-assigned roughness for UBS of z_0 = 0.005 m for unarmored capped areas remains valid, representing in this case robust ripple roughness. The assumption that all unarmored areas capped by UBS developed robust ripple roughness was conservative for the flooding analysis, because the specified bedform condition would overestimate water depth above capped areas where bed shear stress was insufficient to generate robust ripples. Regarding the modeled shear stresses and subsequent capping erosion, the critical shear stresses for entrainment are noted in Table 5-2 in the FFS by τ_{cs}, the critical shear stresses for suspension. The critical shear stress for erosion, $\tau_{ce,}$ denotes when particle mobility begins, and grains begin to saltate/travel as bedload, but not necessarily in suspension. Therefore, even at the highest modeled bed shear stresses (approximately 90 dynes/cm^2 from Figure 5-9 in the FFS), there are two size classes whose critical shear stress thresholds for suspension are larger than the maximum modeled bed shear stress (which amounts to 10 percent of the distribution, higher than stated by the commenters).

Fine sediments whose critical shear stresses are lower than the modeled shear stress would be more mobile than the coarser classes if the shear stress imparted by the flow was applied unhindered to each individual particle. However, much of the finer sediment will be in the interstices of larger sized sediment or beneath the coarser material as the bed armors itself, and protected from the full force of the shear stress. Therefore, it is more likely that finer sediments will erode rapidly and initially, but the erosion rate will slow as the surface bulk density increases and the sediment surface becomes armored.

The suggestion that, out of a 2-foot thick layer of mixed UBS, 0.1 feet would be remaining after the finer sediments winnowed, is not consistent with the bed model. The commenters based their suggestion on the assumption that because 95 percent of the sediment distribution is smaller than the coarsest sediment size, 95 percent of the cap thickness (1.9 feet) would erode. However, this implies that the finer sediments in the mixture are all subjected to the direct impact of bed shear stresses (i.e., are not

[28] In updated engineering calculations, which used hydrodynamic model output, the armor layer was revised to be a 0.5 foot thick layer of armor stone with a D_{50} (median stone diameter) for the armor stone of 2 inches (see Figure 2-1 in Appendix F of the RI/FFS). See response to comment II.H.1.13 for additional discussion on this topic.

sheltered) and all fine particles in the cap layer will erode. This is very unlikely to be the case. Fine sediment that is in the interstices of larger sediment, or buried beneath larger sediment, will be, at least, partially sheltered. As finer sediment erodes, the bulk surface sediment will comprise a coarser sediment size distribution. At some point, the sediment surface will be sufficiently armored that fine sediment beneath will be sheltered from the flow.

Modeling Future Conditions for Alternatives

Sea Level Rise

Several commenters stated concerns about the potential for future storm surges, sea level rise, and other conditions related to climate change to affect the performance of the modeled remedial alternatives. EPA did incorporate some future climate change predictions into the RI/FFS model such as the potential for increased storm flow intensities, as described below. Others, such as sea level rise and storm surges, were not incorporated, because of the large range of uncertainty in expected future sea level rise values, particularly at the regional/local level.

Another comment regarding incorporation of sea level rise suggested scenario-based modeling efforts or a stochastic (i.e., Monte Carlo simulation) approach to evaluating anticipated results might be worthwhile. However, Monte Carlo simulations are time-consuming and would add significant computing durations to the already computationally intensive modeling process. As demonstrated by EPA's extensive modeling program documented in the administrative record, issues such as additional sensitivity analyses necessary for modeling conditions in the LPR sufficiently to provide a robust basis for remedial decision-making have received a great deal of attention during the modeling process. Many of the comments suggested expanding the study of the LPR with lengthy modeling runs that would have extended the RI/FFS schedule for many years. In contrast, EPA has concluded that the available modeling tools are able to simulate the hydrodynamic, sediment transport, and contaminant fate and transport dynamics to an appropriate level for remedial decision-making, and that further delay in addressing the risk to human health and the environment associated with current conditions is not warranted.

Hydrograph for Evaluation of Alternatives

The assignment of the hydrograph for simulations of future condition requires an assumption about how the future flows will compare to those of the past. Options include assuming that past conditions are the best estimate of the future conditions, or performing time trend analyses to estimate conditions that assume a trajectory fit through the historical data will continue into the future. Time trends that include the influence of the droughts of the 1930s and 1960s may artificially extrapolate to unreliable future estimates because of where they appear in the historical record. Whether or not they will occur in the future is unknown, as is the effect of climate change on the frequency of high flow events.

The approach for specifying the hydrograph used in projections as a repeating sequence of the 1996-2010 years of the calibration period was based on the agreement between the cumulative frequency distribution of those years compared to the long-term record going back to 1900. EPA rejected an alternate approach of extending the duration of the historical record (e.g., the suggested 47-year continuous simulation) because of the additional requirements to develop forcing for the longer period, with no basis for judging the alternate approach to be an improvement. The same conclusion applies to the option of reordering the sequence of the individual yearly hydrographs, which EPA also considered.

It has not been demonstrated that the armor stone identified for the selected remedy, Alternative 3, is non-erodible; however, the armor stone diameters described in the FFS report are sufficiently representative for modeling and for remedial decision-making. While armor stone sizes that resist erosion completely can be specified based on current conditions and anticipated remedies, the necessary diameters and properties can best be determined during design, when the final river bottom elevation and anticipated flow speeds (i.e. shear stresses) will be known. Therefore, final stone size for armor stone will be determined during the design phase, where it is more appropriate. In general, selection of appropriate cap material, selection and placement of armor, and their combined effects on cap stability and potential flooding are critically important issues that will require additional scrutiny during the remediation design phase.
EPA guidance (EPA, 2005a) recommends that remediation alternatives be based on extreme events with a probability of occurrence of 0.01 per year. This recommendation fully recognizes that more extreme events with recurrence probabilities less than 0.01 may still occur in any particular year, but the 1-in-100-year recurrence event serves as a tractable criterion for evaluation and comparison of remediation alternatives. Potential impacts and risks of events more extreme than this are considered during remedial design.

The commenters made the point that extreme events (e.g., high river flow and intense storm surge) can co-occur, which is correct; however, the recurrence probability of the joint event will be much less than the probability of either extreme event occurring alone. Furthermore, the 1-in-100-year joint recurrence of high flow and intense storm surge will be comprised of component flow and storm surge conditions of much less severity than the independent 1-in-100-year flow and 1-in-100-year storm surge.

The commenters suggested further that evaluation of remedial alternatives should be based on the 100-year bed stress event, not the 100-year flood or storm-surge event. It would be impracticable to collect sufficient data to perform recurrence analysis to estimate a 100-year bed stress event, because instrumentation would need to be deployed and in-place for a range of extreme flow and storm surge events. The number of years over which monitoring would be required to capture the range of conditions is uncertain. Monitoring extreme events also involves the risk that instrumentation deployed in the LPR could be lost, which would further extend the time of data collection. Such a monitoring program would also need to be complex to measure bed shear stresses which vary spatially on a variety of larger and smaller length scales. The 1-in-100-year storm employed in the FFS for evaluation of remediation alternatives was based on river flow (i.e., volumetric rate of flow), not on inundation as implied by the commenters. Recurrence probability for river flow is a suitable surrogate for bed shear stress, which varies proportional to flow squared (Soulsby, 1997).

Infrastructure Modifications

The potential large-scale capital improvement projects and/or infrastructure changes mentioned by the commenters, (e.g., flood tunnel, storm surge barrier, etc.) are hypothetical in nature. Since there are no definite or near-term plans to construct any of these features, it would not have been an appropriate use of resources to address them in the RI/FFS modeling. Any number of suppositional scenarios can be inserted into the model. However, it is only prudent to include determinate modeling scenarios, i.e., those with the highest likelihood of occurring.

The solids budget of the system, which is described in more detail in Attachment E, would not be expected to return to historical conditions in response to deepening of the navigation channel in the lower two mile of the LPR. Changes in bathymetry in the navigation channels of Newark Bay have changed the Newark Bay solids budget by allowing more solids to be transported into the bay from New York Harbor, but reduced the shear stresses that allow solids to be carried along the axis of the Bay to the LPR.

E.2. Organic Carbon and Contaminant Fate and Transport Model

E.2.1 Comment: Assumption that Organic Carbon does not Associate with Non-Cohesive Particles

The comments on the organic carbon model framework stated that it does not associate any organic carbon with non-cohesive particles. The comments stated that additional documentation and justification should be provided to support this assumption about the behavior of organic carbon in the system. The commenter also suggested that declining trends in sediment particulate organic carbon may be related to the specification of zero particulate organic carbon fraction (f_{OC}) on non-cohesive particles.

Response:

Subsequent to the release of the Proposed Plan, in support of EPA's response to comments, EPA updated the sediment transport and carbon model. The updated modeling results show substantially more stable sediment carbon concentrations (see Attachment E).

Although it is likely that there is a small amount of organic carbon associated with non-cohesive solids in the LPR, this was not included in the model because data are not available to directly quantify the amount of carbon that might coat a sand particle, and because of the expected limited fraction of contaminants transported with non-cohesive particles. LPR organic carbon data are limited to bulk samples on mixtures of cohesive and non-cohesive particles. While the data can be analyzed to identify trends of decreasing f_{OC} with increasing non-cohesive fraction or with increasing bulk density (an indicator of increasing non-cohesive fraction) it is not possible to discern if the measured f_{OC} is associated with the cohesive sediment mixed in with the larger particles or with the larger non-cohesive particles themselves. In the Housatonic River, sediments were fractionated by size and f_{OC} measured on the subsamples (Weston, 2004a). In the coarse sediment portion of the river, f_{OC} directly measured on non-cohesive size particles averaged approximately 0.3 percent, substantially lower than the commenter's estimate derived from an analysis of LPR bulk sediment mixtures. Scanning electron microscopy analyses of the Housatonic Rivers quartz particles showed only blotchy organic films or coatings (Weston, 2004b). In the muddier portions of the Housatonic River the f_{OC} on larger particles was over 10 percent in many cases, but these were attributed to large pieces of organic matter such as sticks and leaves. Sediment profile images confirm the presence of macro-organic material in the LPR sediment, but these behave differently than large sand particles, which typically have higher particle densities.

Carroll et al., (1994), which is cited by a commenter as evidence of particulate organic carbon on non-cohesive solids in the Hudson River, does not identify the larger-sized fractionated sediment as sand particles, but rather reports f_{OC} on particles of different sizes. The f_{OC} values of 6 percent and more on particles of greater than 293 um (Carroll et al., 1994, Table 1) make it unlikely that these were sand particles with organic carbon coatings. Di Toro et al. (1991) summarizes data from Prahl (1982) which included measurements of f_{OC} on sand sized particles, which were further segregated based on density. Sand-sized particles with densities greater than 1.9 g/cm3 had f_{OC} of 0.2 to 0.4 percent, while the f_{OC} of lower density sand-sized particles exceeded 10 percent. It would be inconsistent to model the transport of low density, high f_{OC} particles with the non-cohesive transport equations because these lower density particles would not be transported as bedload in the same way as the sands that are represented in the LPR non-cohesive solids classes.

An additional factor in the decision to limit the assignment of f_{OC} to cohesive particles is that the vast majority of non-cohesive transport in the LPR is present as bedload rather than suspended load, and adding bedload to the contaminant fate model would require additional model development and necessitate smaller timesteps due to the faster settling velocity of the non-cohesive particles. An alternate partitioning treatment would also be required for contaminants sorbed to particles moving as bedload because these particles rapidly exchange between the stationary bed and the moving bedload layer through the process of saltation.

Given the additional complexity that the addition of non-cohesive associated particulate organic carbon transport would add to the modeling analyses, the lack of supporting data, and the limited contaminant transport expected with non-cohesive particles, EPA concluded that including partitioning to non-cohesive particles was not a reasonable addition to the modeling analyses.

E.2.2 Comment: Ability of Models to Reproduce Organic Carbon Behavior and Concentrations

The comments stated a number of critiques with the calibration of the organic carbon model. They stated that the total quantity of organic carbon and distribution of different forms of organic carbon play an important role in the predicted fate and transport of contaminants. For example, modeled contaminants bound to dissolved organic carbon (DOC) do not settle, while those bound to algal carbon settle at a slower rate, and those bound to detrital carbon settle at a faster rate. The comments stated that additional analyses should be presented to demonstrate the models' ability to reproduce these various forms of organic carbon.

The comments also stated that determining the ability of the model to accurately predict the forms of organic carbon in the water column may be limited by the available data. The comments referred to the Final Modeling Work Plan (HydroQual, 2006) which identifies the potential need to collect additional data to calibrate the organic carbon model concurrently with contaminant sampling, whereas in fact, the CWCM surveys did not analyze samples for most of the eutrophication-related parameters noted in the work plan.

Another critique of the organic carbon model calibration is the model's ability to reproduce the total concentrations of organic carbon measured in the water column and sediment bed. The commenters stated that although the model reproduces average concentrations in the water column, it does not reproduce the variability of the data and there are biases for individual surveys. In addition, they stated that the modeled sediment organic carbon concentrations do not compare well to the data on average or for individual data points and are biased low compared to the measured values.

Commenters stated that the plotting scales used for the model to data comparisons rendered it difficult to judge the model's ability to reproduce the data.

Response:

During the review of comments received on the Proposed Plan, as part of EPA's detailed evaluation of comments, EPA has improved and expanded the calibration analysis to include additional qualitative calibration plots, and has performed a quantitative skill assessment analysis, which is presented in Attachment E.

As part of EPA's evaluation and response to comments, EPA has also improved the water column organic carbon and algal carbon components of the organic carbon model. While the model is still biased low with respect to particulate organic carbon (POC), particularly in the upper reach of the LPR (RM 8-17), the model compares more favorably to POC in the lower 8.3 miles of the LPR. The mean difference of measured and simulated surface POC is about 0.5 mg/L, and it is about 1.2 mg/L in the bottom layer of the model. The model tends to underestimate the higher observations of POC in the bottom waters, but this may be, in part, an artifact of comparing 5-day averaged model outputs to instantaneous water column samples. The model versus data comparisons of DOC are, in general, good. Although a search of literature did not identify any modeling studies that reported error statistics for DOC, relative differences reported for related variables ranged from 5 to 300 percent with the majority of those values falling between 22 and 56 percent (See Attachment E, Table 7-2). The median absolute relative differences in the upper reach of the river are about 15 percent and 11 percent for the surface and bottom data, respectively. The model underestimates the surface and bottom DOC with a mean difference of about 0.8 mg/L in the surface and about 0.45 mg/L in the bottom relative to median concentrations of about 5 mg/L. Median absolute relative differences for surface and bottom DOC increase to about 25-30 percent in the lower reach (RM 0-8), but the mean differences also decrease to about 0.31 to 0.34 mg/L relative to median concentrations of about 3 to 3.5 mg/L.

EPA has also improved the calibration of the algal component of the organic carbon model. In the upper reach of the LPR, the mean difference in chlorophyll-a (Chl-a) is 0.014 µg/L with a median absolute difference of about 2 µg/L. The cumulative frequency distributions of the observed and computed Chl-a also compare well in the upper reach. The model versus data comparisons for Chl-a are not quite as strong in the RM 0-8reach as compared to the upper reach, but they are still reasonable. About 50 percent of the model versus data comparisons for the RM 0-8 reach show absolute differences of less than 5 µg/L. The CFD for Chl-a in the RM 0-8 reach shows that organic carbon model is biased slightly high relative to the observed data, except for the upper approximately 10 percent of the data, wherein the model is biased slightly low.

EPA does not agree that the plotting scales chosen for presenting model versus data comparisons for Chl-a were too large. In general, the scales were chosen so as to capture the largest values observed in the data. For example, the Chl-a maximum of 120 µg/L was chosen because some observed Chl-a concentrations are indeed that high (if not higher). However, there is seasonal behavior in the Chl-a data, with low values during the winter and high-flow events, and higher values during the summer months. EPA chose a uniform scale (0-120 µg/L) to demonstrate that the organic carbon model does reproduce some of the seasonal and flow-related events that affect Chl-a, POC and nutrient behavior in the LPR. EPA also included revised spatial plots in Attachment E, Sections 7 and 15.2, which better illustrate the capabilities of the model in capturing the temporal and spatial behavior of water column POC, DOC, and Chl-a observed in the data.

Changes to the sediment transport model along with revisions to the carbon model boundary conditions have improved the agreement with the sediment fraction organic carbon data (see Attachment E, Section 7). There is still a large amount of scatter in the relationship, but the mean difference and median absolute difference for f_{OC} in the lower 8.3 miles have been reduced to 2 percent and 3 percent respectively.

EPA has expanded and improved upon the calibration of the organic carbon model in the water column and the sediment bed. Details of the revised calibration skill assessment may be found in Attachment E. In assessing the calibration of the model to the observed POC data, in many cases the comparisons are based on a 5-day model average versus an instantaneous grab sample.

Additional details provided concerning the calibration of the algal component of the organic carbon model (Attachment E) include both qualitative and quantitative skill assessments. A review of the model outputs suggests that, on average, the total particulate organic carbon pool is comprised of 40-80 percent algal carbon. There is, however, spatial variability and temporal variability in these percentages from year to year and within year variability as well. Lower percentages of algal carbon can be observed during the winter months, while during the summer, algal carbon makes up a large portion of the total POC.

E.2.3 Comment: Organic Carbon Deposition on the Engineered Cap after Remediation is Underestimated

The comments stated that the organic carbon model does not predict that future sediment organic carbon concentrations will recover to present day levels after placement of capping material and that the sediment organic carbon concentration would need to recover in order to support a benthic community. The comments also suggested that this underestimate of future sediment organic carbon concentrations is likely the result of an underestimate of the magnitude and distribution of accumulation of sediments on top of cap after completion of the remedy as well as the tendency for the organic carbon model to underpredict bed organic carbon concentrations. They stated that this underestimate of organic carbon deposition across the surface of the cap results in an underestimate of recontamination in the contaminant fate and transport model.

Response:

With the modifications to the sediment fate and transport model that were introduced during EPA's updating and re-calibration, the model results now show deposition and accumulation of organic carbon in the sediment bed in some portions of the LPR. However, there are regions of the river where, after capping, the model does not show that organic carbon re-populates the sediment bed. These regions are usually found on the outside bends of the river, where net deposition is not expected to occur. Additional detail can be found in Attachment E.

The model shows that after implementation of the remedy, a range of conditions develops over time. While some locations remain non-depositional to minimally depositional, others deposit larger amounts of sediment. In additional to the amount of sediment deposited, the properties of that sediment influence the predicted future contaminant concentration. While some areas remain rather sandy with lower f_{OC} others return to mostly cohesive in composition with higher f_{OC}. For Alternative 3, the pre-remedy and post-remedy reach average bed f_{OC} are equal to approximately 2.5 percent and 0.7 percent respectively. By 2064 the reach average f_{OC} has recovered to approximately 2 percent. In 2064 the channel f_{OC} remains fairly low at about 1 percent while the f_{OC} in the shoals has recovered to about 2.7 percent.

EPA does not agree that f_{OC} is the factor controlling the level of future recontamination in the remedial alternatives. Under current conditions, with the ongoing resuspension source in the lower 8.3 miles, the median water column particulate concentration of 2,3,7,8-TCDD in the Lower Passaic River, based on the 17-mile RI CWCM data, is approximately 180 ppt and the mean is approximately 390 ppt. These values are consistent with measures of recently deposited sediments (see the response to comment II.D.1.11). With the resuspension source eliminated for the lower 8.3 miles, the water column concentrations, projecting into the future, will be reduced by more than an order of magnitude. Since the capped area will be a combination of clean material from the cap combined with depositing water column solids, the result will be an approximately two orders of magnitude reduction in sediment concentrations relative to present day values. See Attachment E for further detail on the projected future concentrations under each of the remedial alternatives.

E.2.4 Comment: Contaminant Fate and Transport Model Framework inadequate

Commenters indicated a number of concerns with the contaminant fate and transport model framework, including the lack of a Lower Passaic River specific modeling QAPP, documented concerns with the predecessors to the LPR version of the contaminant fate and transport model, the structure of the model, and the way certain processes were included in or excluded from the model.

Commenters raised concerns with the CARP and SWEM models that the LPR contaminant fate and transport models are based upon. The comments cited concerns with the original SWEM model calibration in the New Jersey tributaries, concerns with the CARP model calibration noted in the CARP model documentation and by reviewers of that model, as well recommended improvements to the CARP model.

Commenters stated that a number of data collection efforts and analyses to support the modeling that were recommended in the CARP model report (HydroQual, 2007) and the Final Modeling Work Plan (HydroQual, 2006) have not been completed or incorporated by EPA into the FFS contaminant modeling framework. These include the collection of data in a systematic way to aid in calibration and the application of the model to conduct a hindcast.

The comments on the structure of the model included concerns with the model grid and the bed structure. Comments on the contaminant model framework stated that the contaminant fate and transport grid is too coarse as a result of the aggregation done to reduce model run times. They stated that as a result of grid aggregation the model cannot properly assess the benefits of a targeted remedy. The comments requested further documentation of the grid aggregation process, to better understand the way in which values computed by the hydrodynamic and sediment transport model are aggregated across multiple grid cells. Comments concerning the model bed structure included concerns with the horizontal layering of the bed as well as the lack of the representation of a “fluff layer” in the contaminant model.

Comments on the model framework also included concerns that particular processes were not included in the model, including capital and maintenance dredging, navigation scour, wind-wave driven resuspension, and dredging resuspension. In addition, comments noted concerns with the way partitioning and benthic mixing are represented in the model. Specifically, comments cited the impact of equilibrium partitioning to slower settling algae and non-settling dissolved organic carbon, on contaminant transport, and potentially longer desorption time scales for resuspended particle bound contaminants as concerns. They also stated that the ten centimeter depth of benthic mixing used in the contaminant model is inconsistent with the fifteen centimeter exposure depth used in the RI/FFS risk assessment calculations, and that the rate of benthic mixing results in excessive contaminant flux to the water column.

A number of comments suggested that a combination of the lack of a "fluff layer," equilibrium partitioning assumptions, and the parameterization of bed mixing result in the model underestimating the level of recontamination after remedy implementation.

Finally, a number of comments cite the lack of modeling of PAHs as a shortcoming of the modeling framework.

Response:

FFS Models based on SWEM and CARP Models

Before EPA began modeling with respect to the LPR, both the SWEM and CARP models upon which the LPR FFS models are based had been reviewed at various points in their development. Comments that refer to the earlier SWEM (HydroQual, 2002) and CARP (HydroQual, 2007) applications are potentially misleading in that an unfamiliar reader may not realize that additional developments to the carbon and contaminant fate and transport models were accomplished prior to and as part of the RI/FFS modeling. The original SWEM model was calibrated with data from water year 1995 and validated with a 1989 data set, which was sufficient for the Long Island Sound and NY-NJ Harbor portions of the domain, but it lacked sufficient data in the New Jersey tributaries. Enhancements to the calibration of the SWEM models in the NJ tributaries are described in (HydroQual, 2002). As part of the CARP, the SWEM-based carbon model was tested for an additional four-year period (1998-2002). Following the CARP report (HydroQual, 2007) the CARP mercury model was also refined to address comments received on the CARP model (HydroQual, 2010). These modifications made to the SWEM and CARP models did not arise out of the LPR investigation, but have been incorporated into the modeling that supported the RI/FFS.

As part of the LPRSA CERCLA process, additional spatial resolution was added in the LPR, Hackensack River and Newark Bay portions of the model grids previously used in CARP. The LPR FFS models have been further improved based on comments received from the NRRB and CSTAG, and the peer review of the sediment transport, organic carbon and contaminant fate and transport model (HDR|HydroQual, 2013). Since the release of the Proposed Plan, EPA has further improved the models, in response to public comments received on the Proposed Plan and the documents in the administrative record. These most recent improvements are documented in Attachment E. Quantitative calibration metrics are also included in Attachment E.

A Lower Passaic River-specific "Final Modeling Work Plan" (HydroQual, 2006) was developed that included the information necessary to guide model development and application. This approach is consistent with the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP) manual (EPA-505-B-04-900A), which says (at p. vii): "While this UFP-QAPP Manual uses the term QAPP, the information may be incorporated into other planning documents, such as a Sampling and Analysis Plan (SAP), Work Plan, and Field Sampling Plan." Consistent with the Guidance for Quality Assurance Project Plan for Modeling (EPA/240/R-20/007), the Final Modeling Work Plan describes the problem to be solved and includes: background information on the Lower Passaic River; reviews available data from historical databases; describes the modeling tasks and provides a schedule for their sequencing and completion (including documentation requirements); provides data quality objectives for the project and describes how the modeling will be used to achieve those objectives, including a conceptual site model and justification for selection of the existing CARP modeling framework; describes how calibration will be conducted, including model performance measures and skill assessments; describes an approach to uncertainty analysis; and describes how model results will be validated.

Data Considerations

EPA agrees that some of the planned analyses from the CARP modeling report (HydroQual, 2007) and the LPR Final Modeling Workplan (HydroQual, 2006) have not been conducted as envisioned at the time those reports were written; however, most of the recommendations have been implemented as part of the lower 8.3-mile RI/FFS and 17-mile RI/FS. These items include:

- Monitoring of storm water and runoff.
- Sampling at the Dundee Dam for both dissolved and particulate contaminant phases with coincident measurements of suspended sediment, POC and DOC.
- Dissolved-phase measurements within the model domain.
- Methylmercury measurements.

The post-audit of the CARP mercury model was performed (see HydroQual, 2010). Recommendations for collecting PAH partitioning data were not implemented because these data were not needed to support the RI/FFS fate and transport modeling.

The data sets used for calibration of the RI/FFS models included the 17-mile RI/FS data available as of the completion the RI/FFS. Subsequent to release of the Proposed Plan, as part of the response to comments, EPA incorporated additional 17-mile RI/FS data into the development and updated application of the models. EPA executed simulations of the remedial alternatives with sediment contaminant initial conditions based on the 2005-2013 RI/FS data, presented in Attachment E, as suggested by the commenters.

During the peer review of EPA's RI/FFS model, some of the peer reviewers recommended that a hindcast be conducted. As documented in the September 2013 mechanistic model peer review report, EPA considered the value of a hindcast simulation, but concluded that a lack of information to describe open-boundary solids concentrations at the ends of the Kill van Kull and Arthur Kill and upstream riverine loadings would introduce enough uncertainty into the calculation that differences between model results and estimates of bathymetry changes could not be conclusively attributed to model parameterization versus loading estimate inaccuracies. Similarly, uncertainties in the estimates of the timing and magnitude of external loads for the carbon and contaminant models would render it difficult to attribute deviations between predictions and data to model parameterization. In addition there would have been limited data to compare model results to if a hindcast were conducted for the carbon or contaminant models.

Grid Resolution

EPA disagrees with the comment that a finer sediment transport grid should have been used for contaminant fate and transport simulation to evaluate a capping alternative with a footprint smaller than bank-to-bank (e.g., Alternative 4). Due to the scale of the reductions in contaminant concentration to achieve needed risk reductions, the corresponding scale of the required remedial footprint is large enough that targeted removals at the collapsed grid scale adequately represent the benefit of a targeted remedy. Remediation of one third of the lower 8.3 miles results in a reduction of approximately a factor of 19 in the area-weighted average concentration between 2010 (983 ppt) and 2064 (50.8 ppt) when the footprint is based on flux. The targeted remedial footprint would need to approach 100 percent of the area to achieve appropriate levels of reduction in contaminant concentration and approach the remediation goal of 8 ppt for dioxin. Documentation for the process of aggregating the sediment transport model results to the coarser carbon and contaminant fate and transport grid is provided in Attachment E. A sensitivity to running the carbon and contaminant model on the finer sediment transport model grid is also included in Attachment E.

Bed Layering Approach

EPA concluded it is not feasible to construct a non-horizontal bed layering scheme, as suggested by a commenter. Within each grid cell, an individual layer cannot be thicker in part of the cell and thinner in another. From grid cell to grid cell, the layering scheme could specify varying thicknesses. However, the data used to develop initial conditions and available for model-data comparisons were collected with fixed depth intervals; for example, the 17-Mile RI/FS Low Resolution Coring was segmented from 0 to 0.5, 0.5 to 1.5, 1.5 to 2.5, 2.5 to 3.5 and 3.5 to 5.5 ft. Further, the commenter's description of 6 layers in the bed is incorrect. The bed layers are 1 cm thick through the top 107 cm (~3.5 ft) with a single deep archive layer representing the sampling interval from 3.5 to 5.5 ft. The thickness of the surface layer is allowed to vary between 0.5 and 2 cm to reduce numerical mixing due to cyclical deposition and erosion.

EPA disagrees with the comment suggesting that the use of a 10 cm mixing zone depth in the contaminant fate and transport model is inconsistent with the use of a 15 cm exposure depth for linkage to bioaccumulation calculations and risk assessment analyses. See Section III.B.2 for a detailed technical discussion of the basis of these two vertical specifications in modeling analyses. As explained in the technical analysis, approximately 80 percent of the benthos reside within the top 10 cm of the bed, while the remaining 20 percent may burrow deeper than 10 cm. The 10 cm mixing zone represents the depth interval where the most intense mixing occurs, while the 15 cm BAZ represents the depth over which biological exposure occurs. In addition the model is calibrated to the available RI data which are predominantly from 0-15 cm for the surface layer.

Partitioning Approach

EPA disagrees with the comment that the combination of the FFS contaminant fate and transport model's equilibrium partitioning, coupled with a 1 cm surface layer (which can vary from 0.5 to 2 cm) rather than a "fluff" layer and sorption to slowly settling algae, contributed to the depletion of surface contaminant concentrations too rapidly and masked recontamination. Given the high frequency of resuspension for the majority of the system, relative to the travel time through the system, the solids that are resuspended on a regular basis may not have enough time to reach equilibrium with the water column within a single resuspension and subsequent re-deposition, but would likely reach equilibrium over the course of the repeated cycles of resuspension and deposition. With a relatively low rate of mixing between the surface and subsurface sediment layer, the particles that are resuspending regularly will not pick up a concentration as high as the bulk of the subsurface layers each time they are deposited to then desorb on the next tidal cycle. To some degree, the impact of non-equilibrium partitioning is captured by the site-specific partition coefficients used in the model, which are based on field-measured particulate and dissolved concentrations from the study area and the surrounding water bodies. The same logic applies to sorption of contaminants to algae that settle slowly and are present in the LPR for a long travel time relative to the timing of the intra-tidal resuspension and re-deposition of solids from and to the bed. Specification of kinetics of partitioning to algae might affect the time history of the contaminant buildup on algal carbon, but would not change the ultimate concentration as the algal cell is transported from the LPR.

Processes Included and Excluded from Modeling Approach

Careful consideration was given to processes mentioned by commenters as missing from the modeling approach. EPA agrees that sediments exposed during dredging would have higher contaminant concentrations than surface sediment in some places, and that some of these contaminants could be released to the water column during dredging. Releases during dredging were included in the modeling performed for the RI/FFS, and the sequence of construction anticipated by EPA in the FFS analysis of capping included placing capping material on top of the residual sediment to minimize the time that deeper sediments are exposed to the water column.

The effect of dredging on bathymetry changes was not omitted, as suggested in a comment. Bathymetry changes in Newark Bay over time were represented as a series of step changes in the model bathymetry based on information on the progression of navigation channel depth changes implemented by USACE as part of the Harbor Deepening Project. Dredging of the navigation channel in the LPR was represented in detail in the simulation of remedial alternatives.

Consideration was given to ship resuspension and wind-wave resuspension, and EPA judged that those processes would be important for Newark Bay, but were of minor importance for the LPR. See the response to comment II.E.1.1 for discussion of ship resuspension. As discussed in RI/FFS Appendix BII, a sensitivity analysis for wind-wave resuspension showed a change in gross solids flux from Newark Bay to the LPR of approximately 5 percent and no change in the net solids flux compared to a simulation without wind-wave generated shear stresses.

PAHs were excluded from modeling because of the large range of properties associated with the range of PAHs that are potential COPCs for the LPR, which would have required modeling numerous individual PAH compounds. This is further complicated by reactions that degrade individual PAH compounds and in the process generate other PAH compounds.

E.2.5 Comment: Model Shows that Natural Recovery is Occurring and External Sources of COCs are Significant

Commenters stated that the data and the RI/FFS model show that there are areas of the river that are recovering at a slow rate, which is being limited by areas of elevated concentrations, and that sources from outside the lower 8.3 miles have a significant impact on both the lower 8.3 miles and adjacent study areas. Commenters stated that cleaner solids entering the system and deposition at a rate at least equal to the rate of sea level rise must result in dilution of the contamination present in the system and subsequent accumulation of those cleaner sediments. Commenters stated that controlling the areas of elevated concentration will result in a quick reduction in average concentration, and can accelerate recovery in other areas. Commenters also state that contaminant sources outside of the lower 8.3 miles will result in recontamination of any remedy applied to that stretch of the river.

Response:

As discussed in the response to comment II.D.1.7, the data do not show a statistically significant decreasing trend in median surface sediment concentration from 1995 to 2013. Similarly, reach-average surface sediment concentrations predicted by the model do not show a significant decrease over time for the calibration period between 1995 and 2013.

Because deposition, erosion or both are occurring at various locations and time scales, the trend in bed concentration cannot be thought of as simply the current pool of solids in the top of the sediment being diluted by new cleaner solids. In addition, changes in flow and tidal surge over time may result in future changes in the balance between deposition and erosion modifying the dynamic equilibrium cross-section throughout the river.

Sources outside the lower 8.3 miles of the LPR include the sediments above Dundee Dam and the other heads of tide, combined sewer and storm water overflows, and the sediments upstream within the LPR and downstream in Newark Bay. All of these potential sources of recontamination are included in the mechanistic model. See response to comment II.D.3.1 for discussion of model results in the context of the alternatives evaluation performed for the RI/FFS, Proposed Plan and ROD.

E.2.6 Comment: Contaminant Fate and Transport Model Input Parameters and Calibration

A number of comments questioned the quality of the calibration of the RI/FFS contaminant fate and transport model. These include concerns regarding the data used to develop the inputs and to calibrate the model, the representation of processes and their parameterization and the presentation and interpretation of the data and model results.

A number of comments suggested that additional data should have been collected to better characterize external loads to the LPR system from tributaries, combined sewer overflows and storm water overflows. Some comments suggested that a number of sources such as the Peripheral Ditch, Pierson's Creek, Rahway and Elizabeth Rivers, Piles Creek, Morses Creek and Fresh Kills Creek were not included in the model and should have been added. Furthermore, a number of comments also requested additional analysis of existing data that may make the external loading estimates more robust, and a more detailed presentation of the analyses used to develop the external loading estimates.

Some comments suggested that the process used to establish sediment initial conditions for the 1995 time period results in too much averaging or smoothing of the sediment data. The comments suggested that the averaging across geomorphic regions prevents the model from being capable of reproducing important patterns in the sediment data. They also stated that the averaged model conditions do not reproduce the averaged data. Other comments stated that there are not enough data to appropriately define concentrations in the sediment bed. Some comments requested additional details on how the spin up of bed concentrations was performed, what the vertical concentration patterns look like after the spin up, and if there are any high resolution data to indicate the near surface pattern in sediment concentrations.

Other comments noted that not all of the 17-mile RI/FS data were used for development and calibration of the RI/FFS model. In addition, the comments stated that where the model is compared to the data, the model does not compare well with the data, including sediment initial conditions, sediment calibration predictions of temporal and spatial patterns, and water column calibration predictions of temporal and spatial patterns including concentrations within the ETM. In particular the comments cited the over prediction of water column concentrations in the later years of the simulation following a number of high flow events and suggested that this is the result of a misrepresentation of the rate and depth of mixing within the sediment bed and interactions between the sediment bed and water column including the effects of the fluff layer. The comments stated that additional analyses and calibration statistics should be provided to compare the model calibration to all available data, indicate the quality of the calibration, and evaluate the uncertainty in model predicted concentrations. The comments stated that unless EPA addresses the current quality of the model calibration and the uncertainty in the predicted results, the model cannot be used reliably to make predictions of contaminant concentrations or which contaminants limit the effectiveness of the alternatives.

A number of comments stated that conducting a hindcast would provide insight into the quality of the calibration and the source of current patterns of contamination, indicating historical sources of contamination in addition to those captured by the model and the potential for future recontamination.

A number of comments requested that EPA provide additional documentation on inputs to the model and values computed by the model. These included requests for additional details on the input parameters such as partition coefficients and their development, and for presentation of additional mass balance information to confirm that the models conserve mass and as a diagnostic for sources and sinks of contaminant.

A number of comments requested further analyses or documentation of the impact of the relatively high flows near the end of the calibration period, the rate of decline in modeled sediment concentrations relative to the data, and the relationship with the response to those storms in the model.

Response:

In response to these and other comments, EPA updated the model. In addition to changes in the sediment transport modeling approach (continuous simulation), EPA made changes to upstream boundary concentrations of particulate organic carbon and the particulate component of contaminants based on recent data. In addition, EPA made changes to the magnitude of particle mixing in the bed of the contaminant model. Projections of future contaminant concentrations for No Action and active remedial alternatives start with initial conditions based on the 17-mile RI/FS data. Results of the updated models and quantitative calibration metrics are presented in Attachment E.

As noted previously in the response to comment II.E.2.4, under Data Considerations, most of the data collection efforts recommended for the CARP data were addressed in the context of the RI/FFS and the 17-mile RI/FS efforts. The available data as of the time that the lower 8.3 mile RI/FFS was finalized were included in the development and assessment of the model. Additional 17-mile RI/FS data that have become available since the completion of the RI/FFS and release of the Proposed Plan have been incorporated into the updated model, as described in Attachment E. The additional data included encompasses the 17-mile RI/FS data through the second round of supplemental sediment sampling completed in October 2013.

With the addition of these data to the analysis and the revisions to the model, the agreement between the model results and data have improved. Additional tools for assessing the performance of the model both qualitatively and quantitatively have also been applied and the results are presented in Attachment E. Based on these improvements, the absolute magnitude of the model results have changed, but the conclusions reached in the RI/FFS and Proposed Plan about how each alternative would affect surface sediment concentrations post-remediation have not changed; i.e., that in order to achieve COC concentrations approaching as closely as possible to remediation goals, bank-to-bank remediation in the lower 8.3 miles is necessary.

Contaminant Sources

Comments suggested that the model did not represent a number of potential sources of COPCs. Flows from the entire watershed of the Lower Passaic River model domain and the corresponding loads are incorporated into the model. These flows and loads are captured differently depending on the individual source. These sources include:

- The tributaries flowing directly into the LPR (Passaic River, Saddle River, McDonald Creek, Third River, and Second River) and the Hackensack River are represented explicitly in the sediment transport, carbon and contaminant models.
- The Elizabeth and Rahway River loads are incorporated into the Carbon and Contaminant models with the flow from the associated drainage area represented by storm water flow in the sediment transport model.
- Contaminant loads from the Brookfield and Fresh Kills landfills were carried forward from the CARP project. No estimate of flow volume was available for the Hackensack Meadowlands Development Commission landfill.
- Runoff loads from all other areas including tributaries not explicitly represented in the model and areas draining directly to the water bodies represented in the model are represented by storm water and combined sewer overflow flows and loads in the sediment transport, carbon and contaminant models.
- A number of the cited sources, including Peripheral Ditch, Pierson's Creek, Piles Creek, Morses Creek, and Fresh Kills Creek were not explicitly represented in the model although the runoff from these drainage areas is represented as part of the CSO/SWO loads. Additional data would be required to estimate individual loads from these potential sources. Given the size of these drainage areas and their distance from the study area, a more accurate representation of the loads from these potential sources would have been extremely unlikely to have had any impact on remedy selection.

A review of the contaminant mass balance figures presented in Attachment E, demonstrates that the contributions of most sources noted above are small. For 2,3,7,8-TCDD during the calibration period, the external sources are negligible compared to the resuspension occurring within the Lower Passaic River. For Total PCBs, the load coming over Dundee Dam, which has been specified using all of the available 17-mile RI/FS data, is not negligible but is still small compared to the internal resuspension. The other source terms represent a small fraction of the Dundee Dam load, although they may become more significant in the future after a remedy is implemented.

The concentrations used to represent the smaller tributaries, CSO and SWO sources were developed originally under the CARP project using a combination of regional and site-specific data. The resulting values were revisited as part of the RI/FFS effort and revised where the CARP values were inconsistent with additional site-specific data collected more recently as part of the 17-mile RI/FS. Those revisions were discussed in RI/FFS Appendix BIII, Attachment G. The original CARP values used to assign CSO, SWO and small tributary concentrations were collected under two programs: 1) the New Jersey Toxics Reduction Work Plan Study I-G (GLEC, 2008), which collected CSO samples including six locations that discharge to the Hackensack River, two locations that discharge to the Arthur Kill and one location that discharges to the Rahway River, and SWO samples including three locations that discharge to the Passaic

River, one to the Hackensack River and one to Newark Bay; and 2) the New York State Department of Environmental Conservation CARP, which collected CSO samples at locations including one location discharging to the Kill van Kull. For the CSOs, the data from the two CARP sampling programs were pooled and the geometric mean of the total concentration data was used for all contaminants with the exception of PCBs. For PCBs, the geometric mean of the New Jersey data was used for the RI/FFS model. CSO concentrations in the RI/FFS model were not adjusted from the values established for the CARP programs, because the CARP program values were not significantly different from those obtained in EPA's CSO sampling conducted in 2008.

A similar approach was used for SWOs, taking the geometric mean of the data pooled from both the New Jersey and New York CARP sampling programs. The exception to this approach was for the dioxin and furan compounds. For these compounds, the SWO data were divided into urban and rural groups, and the geometric mean of the urban data was assigned to the RI/FFS portion of the CARP model domain. As described in RI/FFS Appendix BIII, Attachment G, the SWO values from the CARP model overestimated the 2,3,7,8-TCDD and 2,3,4,7,8-PCDF concentrations measured as part of the 17-mile RI/FS. Therefore, in the RI/FFS, EPA used the geometric mean of the 17-mile RI/FS data for the SWO concentrations. Figures presenting the comparison between the CARP and RI/FFS data are presented in RI/FFS Appendix BIII, Attachment G. Attachment G also presents the basis for using the SWO concentrations to assign concentrations for the smaller tributaries.

<u>Contaminant Model Bed Concentration Inputs</u>

Several comments criticized EPA's approach used to set model sediment initial conditions. Given the quantity, distribution and variability of the sediment concentration data, EPA concluded that averaging of multiple data points within a given geomorphic region provided a better representation of the concentration over that region than treating individual data points as absolute values. The approach used to develop the initial conditions in the RI/FFS model resolves average concentrations and spatial patterns at scales relevant to the model instead of attempting to resolve concentrations in the bed at scales which the model cannot resolve and the data do not support. Further, given the level of contaminant concentration reductions necessary to achieve required risk reductions, the footprint of any potentially successful remedial action would not be at the scale of individual data points.

To test the RI/FFS interpolation method and further respond to comments, EPA computed a drop one cross validation using the larger 2008 through 2013 data set. At each location where there was a measurement available, that value was removed and the value at that location was predicted using the remaining data. A prediction was made for each point and the predicted and measured values were compared. For geomorphic zones where no data were available, the value from the nearest geomorphic zone of the same type was used. This process was then repeated using an approach where the river is broken into groups based on silt areas, left and right shoals, and channel. The channel was then subdivided where depositional history estimates were available. Thiessen polygons were constructed removing one point at a time and estimating values for each point from the remaining data. The resulting estimates are presented in Figure II.E.2.6 - 1. The top panel presents the geomorphic region approach and the bottom panel presents the grouping and Thiessen polygon approach. The points where neighboring geomorphic regions were used as the estimated concentration are indicated on the top panel. All points were included in the statistics presented in the bottom right corner of each panel. Note that the RI/FFS approach does a slightly better job than the grouping and Thiessen polygon approach of estimating concentrations at unmeasured locations based on this analysis, but the variability in the data makes it difficult to predict absolute concentrations in unmeasured locations regardless of the interpolation approach used.

The comments also suggested that the model initial conditions did not reproduce the data, citing the reach average time series plots. With multiple data points spanning orders of magnitude falling within a single model grid cell in many cases, the model is not expected to reproduce those individual points. The aim of the model is to reproduce the central tendency of the data. The RI/FFS Appendix BIII text noted that the initial conditions as plotted on the trajectory plots cannot be expected to reproduce the arithmetic mean of the data. The model result plotted is an area-weighted average for the entire surface of the lower 8.3 miles of the LPR, while the coverage of the data used to develop initial conditions is not distributed evenly over the surface of the lower 8.3 miles.

Several comments noted that the complete 17-mile RI data set was not used either to set initial conditions in the model or to verify model performance. As part of EPA's evaluation and response to comments, EPA updated the model and implemented a number of changes (see Attachment E). The modeling approach used to support the analyses in the RI/FFS included a simulation beginning in October 1995 and running through September 2013, with modeling results compared to all of the available 17-mile RI data collected through the 2012 SSP sampling event. EPA applied the same approach in the updated model, comparing results from a run starting in 1995 and running through 2013 to the 17-mile RI sediment data collected through the 2013 Second Supplemental Sampling Program. The updated model was also run beginning in October 2010 through September 2064 with initial conditions based on the data collected as part of the 17-mile RI after 2007. The updated simulation beginning in 2010 was used for comparison to the available 17 Mile RI CWCM water column data collected through June 2013. The updated modeling approach (Attachment E) incorporates all of the available data into the test of the model's performance and addresses the concern of using model-predicted values as the starting point for future projections. The same approach used to set the 1995 sediment initial conditions in the RI/FFS model, based on averages across geomorphic regions, was repeated for the updated model with the post-2007 data to develop the initial condition used for October 2010. The updated model-predicted vertical gradient from the end of September 2010 was applied to the top 15 cm average from the post 2007 data. While the additional data do improve the coverage and spatial information, the reach average concentrations predicted with both the RI/FFS model and the updated model converge during hurricane Irene (e.g. Attachment E, Figure 11-21), and the deviations between the modeling results beyond that time are related to other changes made to the updated model.

<u>Contaminant Model Bed Concentration Spin-up</u>

Some comments requested additional detail on the spin-up of the model. The spin-up in the updated model used the same approach used in the RI/FFS model, and this approach is described in more detail here. In a river or estuary, the vertical profile of sediment concentrations for a given location and time is the result of a number of processes, including rates of deposition and/or resuspension, differences between water column and bed contaminant concentrations, rates of physical and biological mixing in the sediment, the partitioning behavior of the chemical and others. Although data are not available to assign vertical variations in concentrations within the top 15 cm of the bed, because the model incorporates processes that cause vertical gradients to develop, it can be used in a spin-up mode to start with vertically uniform concentrations and after a period of simulation, the result is a distribution of vertical profiles that varies from grid cell to grid cell based on local conditions in each grid cell. At the beginning of the spin-up, the concentration is assigned as a constant value over the top 15 cm of the bed based on the interpolation of the sediment data, which were generally sampled from 0 to 6 inches (approximately 15 cm). After running the model for the period of October 1995 through September 2008, the model developed gradients in concentrations over the top 15 cm that are a function of the processes noted above. The development of this gradient causes the 15-cm average concentration to change over time; however, vertically varying concentrations in each grid cell at the end of the spin-up period were multiplied by the ratio of the initial to final 15-cm average concentration to produce a vertically varying concentration that both reflected the local processes and had a mean based on the 1995 15-cm average data.

After this spin up, the ratio of the top 2 cm to the 15 cm average, for 2,3,7,8-TCDD, ranged from 0.013 to 1.26 within the lower 8.3 miles. Among the grid cells in the lower 8.3 miles, 88 percent had top 2 cm concentrations less than the 15 cm average. There are very few data to which the values in the top 2 cm can be compared: in the 2008 Low Resolution Sediment Coring study conducted for the 17-mile RI/FS, the CPG, under EPA oversight, collected a total of eight finely-segmented cores, of which six were in the lower 8.3 miles; and in the 2005 High Resolution Sediment Core study,[29] Malcolm Pirnie (MPI) collected finely-segmented cores for EPA, including one at RM 7.8 with a surface interval of 0-3 cm. The 2008 cores were segmented at 0-2 cm, 2-5 cm, 5-10 cm, and 10-30 cm. For the six 2008 cores within the lower 8.3 miles, the ratio of the top 2 cm slice to the top 15 cm, estimated as a length-weighted average of the top three slices plus 5 cm from the 10-30 cm slice, was calculated. For 2,3,7,8-TCDD, those values ranged from 0.019 to 1.64, with 66 percent (four out of six) of the cores having surface concentrations less than the 15 cm average. The 2005 core from RM 7.8 was segmented at 0-3 cm, 3-6 cm, 6-9c m, 9-15 cm. The ratio of the top 3 cm to the top 15 cm for 2,3,7,8-TCDD was 0.54. The model and the limited number of data points fall within the same range.

The next step in the spin-up was to re-run the same spin-up period from October 1995 through September 2008 in order to adjust the initial conditions above RM 7, which were based almost entirely upon 2008 data. This step was done after establishing vertical concentration gradients in the sediment because the vertical gradient in the surface sediments will impact how the model responds over time. The area-weighted average sediment concentration was computed at the beginning and end of the spin-up period for each chemical, and the 1995 initial condition for each grid cell was adjusted based on the change in the reach average concentration. For example, the 2,3,7,8-TCDD concentration above RM 7 increased by a factor of 1.25 over the course of the spin-up period and therefore the 1995 initial conditions in the top 15 cm above RM 7 were multiplied by 0.8. At the same time, the resulting vertical gradient was again applied to the top 15 cm for all cells in the model domain.

Finally, the same approach used to establish the vertical gradient in bed concentrations for the spin-up was applied to the 2010 reset, using the model computed vertical gradient from the end of September 2010 applied to the October 2010, 15 cm average computed from the post 2007 data. Table II.E.2.6 - 1 presents the maximum, minimum, mean, and median values for the 2 cm to 15 cm ratio computed for each step of the spin-up, 2010, and the six finely segmented 2008 cores. In addition, the table indicates the percentage of the ratios where the surface value was less than or equal to the 15 cm value computed for each step of the spin-up, 2010, and the six finely segmented 2008 cores. The table also indicates the scale factor used for the concentrations above RM 7 at the start of the calibration period in 1995.

[29] 2005 High Resolution Cores: The five 2005 MPI high resolution cores had varying surface depth intervals that were specified based on sedimentation rates, but the thinnest was 0-3cm (two cores, one in lower 8.3 miles); one had 0-6 cm and the two with high sedimentation rates were 0-15 cm and 0-18 cm.

Effect of Storms

Commenters recommended evaluating the effect of 2007-2012 storms on the dioxin distribution in order to more accurately determine the surface contaminant concentrations following four high flow events between 2007 and 2012. In order to address these comments, EPA compared updated modeling results to the following data collected for the 17-mile RI/FS after these high flow events:

- 2008 - July to December - Low Resolution Coring (LRC) Program (111 locations)
- 2009 - October and November -Benthic Sampling (111 locations)
- 2010 – August – Benthic Sampling (21 locations)
- 2012 - January and February – Supplemental Sediment Sampling Program (85 locations)
- 2013 - September and October – Supplemental Sediment Sampling Program 2 (76 locations).

A direct evaluation of the effect of these four storms on contaminant concentration is complicated by the spatial distribution of the sampling stations and sediment heterogeneity. Cores collected in the vicinity of each other would likely show different patterns, but whether the differences were caused by temporal changes related to the storms or spatial variations would not be clear.

The model-simulated effect of these storms can be observed in the updated model results, as described in Attachment E. Although there are difficulties comparing an absolute response to the high flows between 2007 and 2012, both the updated model and data show a noticeable increase in surface sediment concentrations particularly between 2010 and 2012. For 2,3,7,8-TCDD in the lower 8.3 miles, the mean of the data increases from about 400-500 ppt to about 3000 ppt, although there are spatial biases in the sampling locations from both data sets. That is, the mean of the data from either data set does not represent the average concentration over the lower 8.3 miles of the LPR. For the same period, the area weighted average concentration from the updated model simulation (without the reset) increases from about 500 to 800 ppt. Other contaminants show a range of responses from little to no noticeable change, increases and decreases in concentration.

Hindcast

The issue of hindcasting is discussed in the response to comment II.E.2.4.

Partition Coefficients

The partitioning coefficients used in the FFS models were developed for the CARP model based upon high volume particulate and dissolved contaminant measurements from NY/NJ harbor and the surrounding waters. The samples collected as part of the CARP study included stations within the model domain. The development of the partition coefficients assumed three phase partitioning and included the effects of both temperature (PCBs) and salinity (PCBs, dioxins, and furans) for those contaminants where the appropriate information was available.

The octanol-water partition coefficient (K_{OW}) and the DOC partitioning scale factor (A_{DOC}) values from the CARP study and the partitioning equations presented in Section 2 of the CARP modeling report (HydroQual, 2007, Eq. 2-2 [three-phase partitioning], Eq. 2-9 [van't Hoff Equation] and Eq. 2-10 [Setschenow Equation]) can be combined to solve for the particulate organic carbon partition coefficient (K_{POC}) for samples where total dissolved chemical, particulate chemical, POC, DOC, temperature, and salinity are available. The resulting equation can be used to compute the particulate organic carbon partition for each sample:

$$Log\ (K_{POC}) = Log\left(\frac{C_{PART}}{C_{DISS}} \times \frac{1 + A_{DOC} \times K_{OW} \times DOC}{POC}\right)$$

$$-\frac{\Delta H_{OW}}{2.303 \times R} \times \left(\frac{1}{298.15} - \frac{1}{273.15 + T}\right)$$

$$-K^{Salt} \times 0.6 \times \frac{Salinity}{35‰}$$

The mean Log (K_{POC}) or geometric mean K_{POC} (approximately the median) was applied in the CARP project and carried forward to the RI/FFS. The values used in the RI/FFS model for K_{OW}, K_{POC}, ΔH_{OW} and K^{Salt} are reported in RI/FFS Appendix BIII, Table 3-7. Note that a value of zero for either ΔH_{OW} or K^{Salt} results in each of those respective terms dropping from the equation. Log K_{POC} values were recomputed using the 17-mile RI/FS HV-CWCM data. The resulting partitioning coefficients were higher than the values used in the FFS, but based on the partitioning sensitivity analyses (see RI/FFS Appendix BIII Section 5.3) the decision was made to not modify the RI/FFS values.

E.2.7 Comment: Adequacy of Responses to Model Peer Review Comments

Comments expressed concern over how comments from the FFS model peer review were addressed in the response to the peer review and FFS appendices, noting concerns about the sediment transport calibration, sediment mixing due to bioturbation in the contaminant fate and transport model, and the model grid scale.

Response:

EPA has further evaluated and improved the RI/FFS model since the peer review. In many cases changes were made specifically to address peer review comments. Additional changes to the model have also been made as part of EPA's evaluation of and response to the comments received on the Proposed Plan. The changes made by EPA to update the RI/FFS model in response to comments are documented in Attachment E, along with the associated improvements in model calibration metrics.

The comment referred to an analysis recommended by the peer reviewers, but not performed by EPA in the RI/FFS; i.e., carrying the sensitivity to boundary solids through the sediment transport, carbon and contaminant models. Given the high degree of uncertainty in the upstream boundary condition (discussed further in the response to comment II.E.3.2), EPA decided to spend time reducing that uncertainty rather than testing the sensitivity of modeling results to that input parameter. As discussed in the response to comment II.E.3.2, EPA was able to reduce the uncertainty substantially by re-calculating the solids loading versus flow regression, adding data collected at Dundee Dam through 2013 to the data set used in the RI/FFS model.

While EPA improved the RI/FFS model with the benefit of the peer reviewers' comments, some of the additional analyses suggested by the peer reviewers, including analyses to address uncertainty and grid scale testing, could not be conducted due to computational constraints, as documented in the 2013 peer review report (HDR|HydroQual, 2013). EPA has had to balance vastly expanding the scope and complexity of the modeling approach with the need to make a decision to address on-going risk to human health and the environment. EPA has concluded that the available modeling tools are able to simulate the hydrodynamic, sediment transport, and contaminant fate and transport dynamics to an appropriate level for remedial decision-making, and that further delay in addressing the risk to human health and the environment associated with current conditions is not warranted. See Section II.E.3 for further discussion of comments related to uncertainty and sensitivity analyses.

E.2.8 Comment: Model Projections are Flawed

Comments on the RI/FFS contaminant model projections stated concerns with the future forcing functions used in the model, the way alternatives were simulated, the lack of sensitivity/uncertainty analyses conducted for all alternatives, and the lack of recontamination computed by the model.

The comments stated that the recycled 1995-2010 hydrograph, and tidal forcing conditions used in the model to project 45 years into the future, do not appropriately account for future conditions. The comments stated that the future flows used in the model either incorporate too many high flow events by repeating 2007 and 2010 high flow events multiple times, or do not account for the potential for more frequent larger storms associated with climate change. The comments stated that at the tidal boundaries the models do not appropriately account for future sea level rise, or for increased magnitude and frequency of storm surge events associated with climate change.

Comments stated that both the uncertainty in the future boundary conditions and the response of the contaminant model to storm events are understated. Some comments stated that the model underestimates the impact of sources from outside the LPR and of sediments outside of the study area on the recontamination, while others stated that the model underestimates the impact of cleaner sediments from these sources in reducing concentrations. Comments stated that the model projection results show that the sources within the LPR, but upstream of RM 8.3, will contribute the majority of the contaminant fluxes to remediated areas and further downstream to Newark Bay.

A number of comments expressed concern with the way the alternatives were simulated and evaluated. They stated that the remediation should be sequenced from upstream to downstream similar to the approach used in some other rivers. In addition they stated that direct dissolved releases of contaminants exposed during dredging are not accounted for in the model. They further stated that Alternative 4, the targeted cleanup alternative, should have been designed to target areas of high concentration rather than areas of high flux to select dredging locations, since area-weighted concentration was the metric used by EPA to evaluate the protectiveness of each remedial alternative.

Some comments stated that the top 15 cm average concentration is not the appropriate exposure concentration to assess risk and remedy success. A number of comments stated that the over-prediction of water column concentrations indicates that the model does not appropriately account for processes controlling bed-water column interactions and that this prevents the model from being a reliable tool for assessing potential remedies. The comments stated that, as a result, the model underestimates recontamination, that the PRGs for many COPCs and COPECs are lower than background and therefore cannot be achieved and that the post-remedy concentrations averaged over the lower 8.3 miles should approach the present concentrations coming over Dundee Dam, sediment concentrations above RM 8.3 and sediment concentrations below RM 0 in Newark Bay over time. The comments stated that the failure of the model to approach these concentrations is the result of an underestimation of the depositional area in the lower 8.3 miles and misrepresentation of water column sediment bed interactions in the contaminant model.

A number of comments related to the analyses presented in the modeling reports requested additional or alternate presentation of concentration and mass balance outputs from the model in order to better understand the model projection results.

Finally, comments also that stated that, given the concerns with the model and the uncertainty of the results, that the model is not a reliable tool for prediction of future concentrations and that as a result the Proposed Plan overstates the benefits of the preferred remedy.

Response:

Projection Hydrograph and Tidal Boundaries

The distribution of flows at Little Falls over the last century agrees with the distribution of flows from the 15-year hydrograph used for the model projections (Figure II.E.3.1 - 1). This agreement suggests that the range of flows is an appropriate representation of the longer term flow record, and that there is not a long-term trend toward a change in the flow conditions. While studies project sea level rise to rise globally over the next 100 years between 1 and 4 feet, a great deal of uncertainty remains with respect to regional and local estimates of future sea level rise and storm surges. This is further complicated by potential capital projects in the Passaic basin which may or may not be implemented to mitigate impacts such as flooding. The consideration of the potential impact of future changes to the hydrodynamic forcings are discussed further in the response to comment II.E.1.6.

Contaminant Sources From Outside the Lower 8.3 Miles

The RI/FFS model assumed no reduction in future concentrations entering the model domain from the external sources including the Passaic River at Dundee Dam, tributaries, CSOs and SWOs. As discussed in the response to comment II.D.1.7, the surface sediment data do not indicate statistically significant natural recovery on a lower 8.3-mile-wide basis during the last approximately 18 years, indicating that external sources of clean solids are not enough to dilute the in-place contamination in the lower 8.3 miles. Given the legacy nature of the COCs for the LPR and the potential for other programs (such as those under the Clean Water Act) to control external sources, the use of current estimates of COC concentrations without any reductions in the future provides a reasonable upper bound on the potential for these sources to recontaminate any remedy in the future. The combination of these observations suggests that using an upper bound estimate of the future concentrations associated with these sources is a conservative approach that would tend to overstate the potential future impact of external sources and does not favor the selection of one remedial alternative, including no action, over another.

The other potential sources of recontamination included in the model are the sediments within the model domain upstream and downstream of the lower 8.3 miles. The fluxes to and from the lower 8.3 miles (from above RM 8.3 and below RM 0) are presented in Attachment E. Although there is resuspension and transport of contaminant from those areas, the resuspension above RM 8.3 is approximately one-third of the lower 8.3-mile resuspension flux. EPA's modeling of the selected remedy shows that it results in an 11 percent reduction in the net flux at RM 8.3 and about a factor of four reduction in the net flux at RM 0. As described above, the model provides a reasonable upper bound on the potential for COCs entering the lower 8.3 miles from upstream (above RM 8.3) and downstream (Newark Bay) by assuming no remediation of the contaminated sediments in the LPRSA above RM 8.3 and in the Newark Bay Study Area, whereas each of these areas is currently the subject of an RI/FS under EPA oversight, upon completion of which EPA expects to select a remedy for each.

Evaluation of Alternatives

In a riverine system, remedial construction typically is sequenced from upstream to downstream, because transport in the upstream direction does not generally occur, so that contaminants released during dredging will be transported downstream to un-remediated areas and can potentially be captured when those areas are dredged. However, this approach is less effective in the LPR, because of the influence of tides and estuarine circulation. Depending on location within the estuary, fresh water flows and tides may result in transport either in the upstream or downstream direction, or in both directions at once (upstream at the bottom and downstream at the surface). The circulation results in the potential for solids released during dredging to be transported in all directions.

The diffusive release of dissolved contaminant directly from the bed during dredging was not directly incorporated into the model, as stated in the comments. The model does compute diffusive exchange from the bed during dredging, but because the surface sediment concentration is not updated during dredging, the model underestimates the magnitude of that exchange when elevated concentrations found at depth are dredged. To address the concern of diffusive exchange from the bed during remedial implementation, EPA intends that backfill will be placed as quickly as possible once dredging is completed within a given dredging unit. To assess the potential impact of this diffusive release on model computations, a conservative upper bound for this term was computed and compared to the contaminant release associated with the loss of solids from the dredge bucket incorporated into the model. A worst case scenario would be a dredging unit with high sediment concentration, low water column concentration and a slow dredging rate. Assuming a dredging rate of 400 cubic yards (cy) /day (the lowest rate used in the model), a water column concentration of zero, a diffusive exchange rate of 0.001 m^2/day, a Log K_{POC} of 6 L/kg and a Log K_{DOC} of 4 L/kg would result in a diffusive loss from the sediment of about 5% of the dredging loss, which is not significant in the context of model uncertainties. The Log K_{POC} of 6 is on the low end of the values for the contaminants included in the model. For 2,3,7,8-TCDD, the loss rate would be half of that and for the more hydrophobic contaminants even less. While these releases could be significant during a period with deeper, more contaminated sediments left exposed to the water column with no ongoing dredging, the release from the bucket during dredging is much greater, and resuspension of residuals will be minimized by timely capping and/or backfill.

The selection of the dredging and capping footprint in Alternative 4 was criticized for the use of flux rather than concentration to target areas for remediation. To address this comment, EPA simulated a concentration-based remedial footprint (sensitivity scenario described in Attachment E) and a flux-based remedial footprint (Alternative 4) using the updated model and compared the results. These simulations and their results are discussed in Attachment E, Section 12. The results show that Alternative 4 is as effective at reducing concentrations as the sensitivity scenario, and potentially slightly more effective. This is consistent with the data, the EMBM and the mechanistic model showing no statistical decline in concentrations over time (approximately 1995 through 2013) in spite of generally lower contaminant concentrations on sources of solids to the lower 8.3 miles. The resuspension of contaminants from within the lower 8.3 miles results in contaminant concentrations on depositing solids that are greater than the contaminant concentrations on suspended solids entering the lower 8.3 miles. In addition to the greater reduction in concentration, the Alternative 4 approach also results in less flux of contaminant out of the lower 8.3 miles than the sensitivity scenario.

Exposure Depth

As discussed in the response to comment II.D.4.3, COC concentrations averaged over the top 15 cm of sediment are representative of concentrations in the ecological exposure zone. The 15 cm data have been used both to calibrate the contaminant fate and transport model and to develop the fish tissue concentration-exposure concentration relationships used in the risk assessment. The 15 cm exposure depth used to average model projection results for subsequent use in the risk assessment is discussed in detail in Section III.B.2.

Bed Water Column Interactions, Background and PRGs

As part of EPA's evaluation of and response to comments, EPA updated the RI/FFS models, as described in Attachment E. As a result of those updates, the sediment transport model now computes more widespread deposition and less erosion into deeper, more contaminated sediments. As a result of the updates in the sediment transport, organic carbon and contaminant fate and transport models, the contaminant fate and transport model better reproduces water column concentrations (see Attachment E Figures 11-26, 11-27, 11-33, 11-34 and 11-40 through 11-44). The results in the lower 8.3 miles now show greater potential for recontamination. In general, water column particulate concentrations under present conditions are less than sediment concentrations, and the highest concentrations occur in the water column within the lower 8.3 miles. With the resuspension source from within the lower 8.3 miles reduced or eliminated as a result of remediation, that particulate concentration will be reduced further. The result is that the depositing solids after remediation will have much lower concentrations than present day depositing solids. In the updated model runs, the reach-average concentrations approach closer to the background levels from above Dundee Dam, but there are still erosional to minimally depositional areas where cap material will remain at the surface of the sediments, reducing the reach-average concentration. This is consistent with the current sediment chemistry data, which shows that within the lower 8.3 miles there are lower concentration values mixed in with average and higher concentration values. The concentrations in depositional areas can be expected to approach water column values which will reflect a combination of ongoing legacy resuspension terms from outside the lower 8.3 miles and sources of solids entering from outside the model domain mixed with any resuspended clean cap or backfill material from within the remediated area.

Additional Analyses and Outputs

In response to comments, additional documentation of the contaminant fate and transport model's performance including quantitative skill assessment results and mass balance outputs for the calibration and projection simulations are presented in Attachment E, Section 11.

Reliability of the RI/FFS Models

As part of EPA's evaluation of and response to comments, EPA updated the RI/FFS sediment transport, organic carbon and contaminant fate and transport models and implemented a number of changes which have significantly improved model performance (see Attachment E). The updated model results are in better agreement with TSS data during typical-flow and high-flow conditions, and the results are comparable to the RI/FFS model results during low-flow conditions. The updated model results also show an improved spatial pattern of erosion and deposition, with smoother spatial gradients compared to the previous results, which showed mixed patterns. The changes in sediment transport model bed parameterization coupled with continuous hydrodynamic and sediment transport simulations result in increased infilling and less deep-erosion during the high flows in 2007, 2010 and 2011. This has the effect of reducing erosion of more highly contaminated sediments, buried deeper in the bed, during the high flow events, as compared to the RI/FFS model results. As a result, the updated model better represents the reach-average water column concentrations of 2,3,7,8-TCDD, Tetra-PCB and Mercury in the LPR. Based on these improvements, the absolute magnitude of the model results have changed, but the conclusions reached in the RI/FFS and Proposed Plan about how each alternative would affect surface sediment concentrations post-remediation have not changed; i.e., that in order to achieve COC concentrations approaching as closely as possible to remediation goals, bank-to-bank remediation in the lower 8.3 miles is necessary.

E.3. Uncertainty Analysis

E.3.1 Comment: Other Methods for Conducting Uncertainty and Sensitivity Analyses

Comments on the sensitivity and uncertainty analyses included recommendations for additional or expanded sensitivity analyses for specific parameters, such as the increased frequency of high flows or the timing of a high flow (such as specifying the 100-year flow during the period of remediation).

Commenters suggested alternate and more complex methods for addressing uncertainty in linked models. One comment characterized the modelling approach as outdated because it does not allow a means to minimize biases and uncertainty. Multi-modeling (i.e., several different models) was recommended to generate an ensemble of results as a means of assessing and reducing bias in a single model. In addition, commenters suggested that error, bias, and uncertainty be propagated through the hydrodynamic, sediment transport, carbon, and contaminant fate and transport models.

Commenters stated that deterministic models are frequently calibrated by trial and error with one set of model coefficients and then these models are used to make predictions of future conditions resulting from changes in model inputs, without any quantification of model uncertainty. The commenters pointed out that there are alternative calibration methods that use optimization algorithms to yield model coefficients that produce the minimum difference between model results and measured data. The results of sensitivity analysis to changes in this optimized set of model coefficients are then used to generate quantitative estimates of model uncertainty which can then be applied to compute uncertainty in model projection results.

Commenters provided several references to publications related to uncertainty analysis of mathematical models for aquatic ecosystem research, including addressing model structure and parameter uncertainty, making the point that this is particularly important in the modeling of ecosystem and biogeochemical processes for which exact equations cannot be formulated. Commenters also provided a citation for a review of Bayesian approaches, which includes references to applications in water and water resources and an additional citation which contains additional references that the commenter characterizes as defining the current practices that make up the state of the art.

Response:

EPA's uncertainty analysis for the RI/FFS model followed an approach recommended in EPA's Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (EPA, 2005a). The alternative approaches recommended by the commenters cannot be used for models with the computational complexity and long run times that the RI/FFS model has, as described below.

Future Hydrograph

The assignment of the hydrograph for simulations of future condition requires an assumption about how the future flows will compare to those of the past. Options include assuming that past conditions are the best estimate of the future conditions, or performing time trend analyses to estimate conditions that assume a trajectory fit through the historical data will continue into the future. Time trends that include the influence of the droughts of the 1930s and 1960s may artificially extrapolate to unreliable future estimates because of where they appear in the historical record. Whether or not they will occur in the future is unknown, as is the effect of climate change on the frequency of high flow events.

The approach for specifying the hydrograph used in projections as a repeating sequence of the 1996-2010 years of the calibration period was based on the agreement between the cumulative frequency distribution of those years compared to the long-term record going back to 1897, as shown on Figure II.E.3.1 - 1. EPA considered, but rejected, an alternate approach of extending the duration of the historical record (e.g., the suggested 47-year continuous simulation) because of the additional requirements to develop forcing functions for the longer period, with no basis for judging the alternate approach to be an improvement. The same conclusion applies to the option of reordering the sequence of the individual yearly hydrographs, which EPA also considered and rejected.

Uncertainty analyses incorporating effects of climate change on the hydrograph, in general, or on the frequency and magnitude of high flow events, was judged by EPA to be unreasonable from a computational resource basis (see additional discussion below) and because of a lack of information to quantify the likelihood of alternate estimates. Even if computational constraints did not exist and an array of results were generated with alternate assignments of the impact of climate change on the hydrograph, the information would not aid the remedy selection process unless the likelihood of each alternate set of flow conditions could be quantified. Likewise, EPA judged that the remedy selection process would not benefit from additional sensitivity simulations involving specifying the 100-year flow during the period of remediation. At the feasibility study stage, it would not be appropriate to begin representing alternate construction contingencies for preparing to minimize the impacts of an extreme flow event during implementation of the remedy. Such contingencies are more appropriately evaluated during the design phase.

Uncertainty Methods

EPA disagrees with the commenters' assertion that EPA's modeling framework is outdated because it is comprised of a series of linked models, which can result in a propagation of biases and uncertainties. It is important to recognize that propagation of uncertainty does not necessarily occur in a cumulative manner through the linked models. In addition, use of linked models may in some instances actually facilitate the identification of aspects of the model that require further review and refinement, thereby reducing uncertainty and biases. That is, the ability of the sediment transport model to reproduce solids reflects the influence of discrepancies between model and data in the hydrodynamic model, and the chemical fate results reflect the influence of analogous discrepancies in both the hydrodynamic and sediment transport models. Linking models, therefore, does not necessarily result in an adverse effect on the overall model calibration. For example, if a discrepancy between model and data in one model does not produce effects on model-data agreement in the subsequent model[s], it provides an indication of the limited influence of those results on the subsequent models. On balance, these sequentially linked model results provide a diagnostic check on the adequacy of predecessor model[s], highlighting aspects of each of the sub-models that may require further consideration and refinement.

When viewed from this perspective, use of linked models and the feedback that results provide a quality assurance check on the overall model development process. Hence, the ability of the sequential models to account for [i.e., explain] variations in fluid transport, solids and chemical concentrations serves as an indication of its utility, given that the results that are achieved are obtained in association with whatever degree of propagation of errors is operative.

The Bayesian "state of the art" practices for characterizing uncertainty recommended by the commenters have generally only been applied in relatively simple modeling applications, applications that did not necessarily rely upon "state of the art" modeling frameworks applied to highly complex settings. There is a tradeoff in the complexity of the model and the nature of the uncertainty analysis that can reasonably be performed. While the complexity of the RI/FFS model makes it resource-intensive to perform the numerous simulations that would be needed to fully characterize uncertainty, the model is still appropriately complex and robust to serve as a useful tool for evaluating relative differences in effectiveness among the remediation alternatives under consideration.

Uusitalo (2007) highlights several of the advantages and disadvantages of use of a Bayesian modeling approach. Although a Bayesian approach does provide a quantification of uncertainty, actual applications to environmental settings are limited in number and, when applied, the problem settings and models are considerably less complex than models used for the lower 8.3 miles of the Lower Passaic River. Uusitalo notes that Bayesian networks (BN) are limited in their ability to deal with continuous data and that this situation may ultimately be problematic, given that the data will need to be discretized. That is, the data need to be approximated by constant values that are contained within several defined intervals, as when concentration data are grouped within bins to create a histogram. With this in mind, the author provides the following cautionary statement:

> “In practice, even large ecological data sets are rarely large enough to allow a high number of intervals per variable; … *The problem of the sufficiency of data is multiplied if the model structure is complicated* ... These distributions become weakly defined if the data has to be divided into a large amount of conditional distributions and there are only a few data points per distribution. In practice, this means that in order to build meaningful [Bayesian networks], we will often have to restrict the number of intervals, which diminishes the benefits of theoretically being able to capture complex empirical distributions. So, while there are no theoretical minimum limits for the amount of data in the context of BNs, in practical applications the amount of data may well be the limiting factor in the modelling.” (Uusitalo, 2007; italics added for emphasis)

Dilks et al. (1992) provided a relatively early example of a Bayesian Monte Carlo application that was based on a rather simple BOD-DO model of the Grand River. Although the authors were supportive of the beneficial aspects of this approach in the case of the Grand River setting, they also emphasized that the precision of estimates of the frequency distributions will be directly related to the number of iterations that are performed. They stated that the approach will be “more amenable to Monte Carlo analysis than a more computationally intensive model,” such as the RI/FFS model.

Another approach identified by commenters was to employ multi-modeling techniques (run multiple models and average the results). In the case of the Lower Passaic River and Newark Bay, while EPA has been developing the RI/FFS models, modeling has also been under development over recent years for the 17-mile RI/FS. While the RI/FFS and 17-mile RI/FS models share a basic framework, the current versions of the models have been parameterized differently (note that as of February 2016, the 17-mile

RI/FS model was still in development and had not been approved by EPA for use). In spite of this, they appear to yield similar results based on comparisons of recent simulation results (as of February 2016). This is probably a reflection of the constraint that the models are calibrated to the same data sets and, ultimately, the simulations must produce a reasonable representation of these observations, even though they may differ in parameterization.

EPA has expended considerable effort to develop an extensive modeling program, as documented in the administrative record. Many of the comments suggested expanding the study of the LPR with lengthy data collection efforts and added modeling complexity that would have extended the RI/FFS schedule for many years. In contrast, EPA has concluded that the available modeling tools are able to simulate the hydrodynamic, sediment transport, and contaminant fate and transport dynamics to an appropriate level for remedial decision-making, and that further delay in addressing the risk to human health and the environment associated with current conditions is not warranted.

EPA has reviewed the references that discuss the theory and application of many of the model optimization and uncertainty algorithms provided by commenters. The optimization and uncertainty analysis approaches cited by the commenters are intended to reduce the computational burden of performing the thousands of model runs normally required to yield an optimum set of model coefficients that best match observed data, to then perturb these coefficients in a way that does not significantly deteriorate model calibration results, and finally to produce a quantitative representation of model uncertainty. Most of these optimization and uncertainty techniques were developed for groundwater models to address the issue of limited knowledge of the heterogeneous parameter, hydraulic conductivity. Many of the references related to groundwater modeling are discussed in two USGS publications (Doherty and Hunt, 2010b and Doherty et al., 2010a). These optimization and uncertainty techniques developed for groundwater models are inappropriate for complex models like the LPR-Newark Bay hydrodynamic, sediment transport, organic carbon and contaminant fate and transport models, because the solution time is likely to be on the order of hours for a groundwater model, versus months for the RI/FFS model. As a result, the thousands of model runs needed to implement this type of approach make it infeasible to apply to the RI/FFS model.

Commenters identified surrogate modeling as discussed in Razavi et al. (2012) as an approach that could be used for the RI/FFS model. There are two general types of surrogate modeling: response surface modeling and lower fidelity modeling. The purpose of developing surrogate models is to provide information to optimize model calibration and evaluation of model uncertainty with the surrogate model and apply these results to the large complex model, but with a considerably reduced computational burden. The first type of surrogate model, response surface modeling, uses functions to empirically approximate the results of the full complex model. The number of simulations with the full complex model required to develop the empirical functions increases with the number of parameters that will be varied in analyses with the approximate model (a model of the model). A variety of functions are used to approximate the original model including polynomials, multivariate adaptive regression splices, and artificial neural network. The second type of surrogate model is the lower-fidelity surrogate that is similar to EPA’s mechanistic model, but with less detail such as reduced number of equations describing the various model processes or possibly less spatial resolution and coarser time scales. In surrogate modeling (both response surface and lower fidelity models) the goal is to approximate the responses of the original simulation model for various values of model parameters of interest.

Table 1 of Razavi (2012) summarizes 32 studies using response surface surrogate models in water resources. In theory, it would be feasible to run the models listed in Table 1 of Razavi (2012) to generate response surfaces because of the substantially shorter simulation time required by those type of models, as compared to the RI/FFS model. Ten of the surrogate model applications are groundwater optimization problems. Three of the applications are water quality models (Ostfeld and Salomons, 2005 using CE-QUAL W2; Zou et al., 2007 and 2009, using WASP). Zou et al. (2007) reported that it took only 10 minutes to run the full-scale WASP application on a Pentium III, 933 MHz PC, which would be reduced to approximately one to two minutes on the computers running the RI/FFS model. By contrast, the RI/FFS sediment transport model requires approximately three months to complete continuous simulations through the projection period. As a result, the total computational burden of running the RI/FFS model to provide sufficient results to develop the response surface model would be unacceptably large. For a total 18 to 20 parameters from the RI/FFS models (hydrodynamic and sediment transport, organic carbon and contaminant fate and transport) to be evaluated and allow a quadratic surface to be fit to the results, approximately 200 simulations would be required (Alvarez, 2000). Given the time needed for a continuous sediment transport simulation, followed by organic carbon and contaminant fate and transport model simulations, approximately 1,200 computer-months (i.e. 200 quad-CPU computers for six months, or 100 computers for one year, or 25 computers for 4 years) would be required for the model simulations, and additional time would be required for fitting the response surface to the model results and then applying the response surface model in the analysis. This estimate is for only the No-Action alternative. If response surface models were to be developed for the three active alternatives evaluated in the FFS, additional time and or computers would be required.

Another category of surrogate models is a lower-fidelity surrogate model which a commenter suggested could be developed for the Passaic River organic carbon and contaminant fate and transport models to evaluate uncertainty quantification (UQ) and sensitivity analyses (SA). Commenters outlined the method of pairing a lower fidelity model with the original complex model to perform UQ and SA based on a paper by Doherty and Christensen (2011). This approach is an expansion of surrogate modeling discussed in Razavi et al. (2012). It suffers from the same limitation in that the number of runs of the complex model required to properly calibrate the lower fidelity model results in an unacceptable computational burden. For example, the groundwater test case presented in the paper ran 1,000 model simulations of the complex model to provide “data” for calibration of the simple model. At a few months’ run time for the Passaic River mechanistic models, this would yield a total run time of 2,000 to 3,000 months. Even using many high speed computers, application of this method is still infeasible.

Because of the long run times for the RI/FFS model, application of the approaches described above for optimizing model calibration and quantifying model uncertainty is not practicable or necessary for the intended purpose. The RI/FFS sediment remedial alternatives are discrete reductions in sediment chemical concentrations rather than a continuum of options. Therefore, the degree of model uncertainty need only be sufficiently small to reliably distinguish among proposed remedial alternatives. As noted above, the model is still appropriately complex and sufficiently robust to serve as a useful tool for evaluating relative differences in effectiveness among the remediation alternatives under consideration.

One possible approach for consideration and discussion would be to develop and calibrate a simpler set of LPR-Newark Bay models that run in a matter of days rather than months. Unlike the low-fidelity surrogate modeling approach, these simpler models could be calibrated against available river data and not the outputs of many complex model runs, thereby eliminating an enormous computation burden. To achieve this goal, model kinetics probably would have to be simplified, grid segmentation coarsened and time scales lengthened. However, undertaking this approach would be in direct conflict with the comments that argue the RI/FFS model should have more detailed representation of the physics and chemical reactions occurring in the Lower Passaic River, in addition to greater spatial resolution (see comment II.E.1.1). These simpler models would have a higher degree of lumped parameters and empiricism than is present in the current RI/FFS model and therefore might have undefined model error when applied to conditions very different than calibration conditions. This demonstrates that there is a trade-off between complex models with long run times and simpler models with possible unknown model error. EPA used a set of appropriately complex models to simulate the complex estuarine dynamics of the Lower Passaic River and Newark Bay to select the remedy for the sediments of the lower 8.3 miles of the Lower Passaic River.

Another commenter suggested that future environmental conditions should be characterized on the basis of an ensemble of simulations. In addition to the computational burden associated with such an approach, as stated previously, specification of a suite of projection conditions would require that assumptions be made with respect to how future flows and boundary conditions might differ relative to the conditions assigned to date. Trend analyses may actually be misleading if effects related to climate change result in alterations in future conditions relative to the preceding historical record. As described above in "Future Hydrograph," EPA concluded it would not be feasible to characterize uncertainty associated with global climate change, and therefore the 1996 – 2010 flow record[30] was used for projections. Finally, an ensemble approach is inappropriate for use in the context of a Superfund feasibility study. EPA is not aware of any cases where an ensemble approach has previously been applied in a feasibility study setting, particularly in a setting as complex as the LPR.

E.3.2 Comment: FFS Sensitivity and Uncertainty Analyses for Model were Incomplete

Commenters stated that the analyses used to test model sensitivity and uncertainty did not address all adjustable parameters in the model. The commenters also suggested that varied parameters were tested incorrectly or over too small of a range, did not address all contaminants simulated in the model, were not completed for all alternatives. Commenters noted differences in results from the EMBM and mechanistic modeling and asked if results of sediment capping tracer simulations would have been different if the simulations were performed with a different hydrograph or longer duration. Commenters stated that the sediment tracer simulations were interesting but did not address the comparison between historical infilling rates and those computed in the FFS simulations, and asked if additional infilling would have been computed if additional solids loading had been specified at Dundee Dam.

In discussing boundary solids loading, commenters noted that uncertainty in boundary solids loading results in uncertainty in computed sedimentation rates, and discussed the range of estimates of solids loading from the Passaic River to Newark Bay presented in a compilation presented in Shrestha et al. (2014).

Commenters asked if the results were sensitive to the vertical distribution of the releases during dredging, which are specified with half in the bottom layer and half in the surface layer.

[30] As discussed in the response to comment II.E.1.6, the approach for specifying the hydrograph used in projections as a repeating sequence of the 1996-2010 years of the calibration period was based on the agreement between the cumulative frequency distribution of those years compared to the long-term record going back to 1900.

Response:

Commenters' suggestions to modify the approach for sensitivity analyses by tailoring the percent change in model inputs on a parameter-by-parameter basis reflect an attempt to blend sensitivity and uncertainty analyses. The objective of EPA's sensitivity analysis was to evaluate how specific output metrics vary in response to a uniform change in individual input parameters. Following EPA guidance (EPA, 2009c), input parameter values were either increased or decreased by a fixed amount of their base values. A larger perturbation of one parameter (e.g., changing upstream boundary TSS loads during high flow conditions by 100-200 percent, as suggested by commenters) would yield a larger response in the output metrics, but would not show the input parameter to which the model result is most sensitive, which is the objective of a sensitivity analysis.

EPA disagrees that the sensitivity results for the upstream boundary concentrations hide the true sensitivity of this model input, as implied by the comment. In RI/FFS Appendix BIII, sensitivity results were presented for two contaminants, 2,3,7,8-TCDD and octachlorodibenzodioxin (OCDD). These two contaminants have noticeably different contributions from the upstream boundary, which are demonstrated in the responses shown for sediment and water column concentrations. In the case of 2,3,7,8-TCDD, the results are relatively insensitive to doubling and halving the upstream boundary condition, which is in contrast to the response to changes in the boundary concentrations of OCDD, which has a more substantial contribution from the watershed, but does not drive risk in the Lower Passaic River.

EPA disagrees that it is necessary to include sensitivity analyses for every adjustable parameter and each contaminant modeled. The parameters selected for sensitivity analyses were selected based on a balancing between computational considerations and an understanding of the response of the simulation results to variations to model parameters during the calibration process. The 48 contaminants included in the contaminant fate and transport modeling were selected based on consideration of ecological and human health risk. The 48 contaminants cover a range of physical properties, including hydrophobicity. The contaminants included in the sensitivity analyses, 2,3,7,8-TCDD and OCDD, represent the upper and lower range of hydrophobicity of the 48 contaminants, thereby giving upper and lower limits to the response to this important contaminant fate and transport parameter. EPA also disagrees that it is necessary to perform sensitivity analyses for each alternative. Sensitivity analyses across alternatives would highlight the effect of changes in bathymetry, sediment composition, and contaminant initial conditions, but would not provide useful information to inform model parameter assignments.

<u>Sediment Tracer Simulations</u>

The sediment tracer simulations were limited to one year because of the increased computational requirements of the tracer simulations relative to the calibration simulation (10 vs. 4 Classes). It is likely that simulation of a different year would lead to somewhat different results; however, the selection of a year with a mean flow closest to the long-term was judged to be more reasonable than arbitrarily choosing an alternate year to demonstrate typical conditions. Variations around the distribution of deposition computed by the EMBM would be expected from year to year; however, the agreement in the comparison with the average flow year is quite reasonable.

Boundary Conditions

EPA relied on the data set available at the time of RI/FFS model development to specify the upstream boundary condition, which was a source of uncertainty. EPA used data from Little Falls to develop a relationship (or regression) of solids loading versus flow; however, the majority of that data set was from daily load monitoring during the 1960s. Changes in solids loading between the 1960s and the present is a potential contributor to uncertainty in boundary loading. EPA's comparison of the TSS estimated from OBS data collected above Dundee Dam during the 17-mile RI/FS PWCM program to the flow-based regression showed a great deal of scatter around the regression, but general consistency.

In response to comments, EPA re-calculated the solids loading versus flow regression, adding data collected by the New Jersey Dischargers Group (PVSC, 2013) [see Attachment E for more details]. The new regression resulted in a decrease in the estimated solids loads coming over Dundee Dam for the recent years compared to the relationship derived from the 1960s data (used in the RI/FFS modeling). How the solids loading changed over time between the 1960s and recent years cannot be determined. Using the new solids loading versus flow regression that included recent data did reduce the uncertainty in the boundary condition specification.

Shrestha's (2014) compilation of solids loadings from the Passaic River to Newark Bay does not address the time-scale of the data records or the methods used to develop the estimates. Some were from monitoring programs of months to a one-year period (Suszkowski, 1978; Sommerfield and Chant, 2010). Among the loadings discussed in Shrestha 2014 were: 1) the load from HydroQual (1991), which is an estimate of solids entering the LPR at Dundee Dam and not an estimate of the load to Newark Bay; and 2) the loads of Lowe et al., 2005, which are estimates of inputs to the LPR from the drainage area above and below Dundee Dam. Use of these loads to characterize the source of solids to Newark Bay would be inappropriate, since it would require an assumption of no deposition in the LPR. Differences in solids loading from one year to another represent variability, rather than uncertainty. Further, EPA disagrees that additional monitoring is needed at the mouth of the Passaic for use as a boundary condition. Data at that location internal to the model domain can only be used for model-data comparisons, as has been done as part of the sediment transport calibration effort.

EPA placed the model open boundary at the Kill van Kull, as far from the region of interest (i.e., the LPR) as feasible, so that assigned boundary conditions would have little influence on local conditions in the region of interest. Such is the case with the TSS boundary concentration. While it would be possible to return to the raw data to determine regression confidence levels, EPA does not agree that this would be useful, particularly given the relatively high values for the coefficients of determination.

Dredging Releases

In the process of incorporating dredging releases into the RI/FFS model, the releases were initially distributed uniformly through the water column layers and subsequently revised to specify a 50 percent split in the bottom and surface layers of the water column. Although the results from this intermediate step were not presented in the RI/FFS report, the observation that the change did not produce a notable difference provided a basis for concluding that it was not necessary to perform a sensitivity simulation for this specification for inclusion in set of sensitivity analyses presented in the RI/FFS report.

It is clear that because of the long run times for the RI/FFS mechanistic models, implementation of the approaches for optimizing model calibration and quantifying model uncertainty is difficult. However, for remedial decision-making, the question is whether the degree of uncertainty in the RI/FFS mechanistic models allows a significantly statistical distinction of the differences in the computed river response to various remedial alternatives. The RI/FFS sediment remedial alternatives are discrete reductions in sediment chemical concentrations rather than a continuum of options. Therefore, the degree of model uncertainty need only be sufficiently small to enable the model to reliably distinguish among proposed remedial alternatives.

EPA could have performed simulations with specification of an extreme flow at many points before, during, or after remediation. The response of the RI/FFS model to specification of the 100-year flood during remediation would likely fall somewhere between the results of including the storm before remediation and after remediation, though this would depend on whether potential contingencies (e.g. closing any open dredge cells) were included in the simulation. Without linking the model setup to potential construction contingencies, the results of such a series of simulations would not provide useful information.

E.4. Consistency between Mass Balance-Single Layer Box Model and Mechanistic Model

E.4.1 Comment: Mechanistic model results inconsistent with EMBM results

Commenters stated that the results of the mechanistic model appeared to be inconsistent with those of the EMBM in at least three crucial ways: long-term differences between alternatives, different trends and different response to floods. Commenters stated that there were significant differences in the predictions of the two models for the four alternatives evaluated in the FFS. Commenters stated that this was important because the EMBM was largely independent of the chain of linked models (hydrodynamic, sediment transport and contaminant fate and transport) and provided a check of sorts on the linked models, even though the EMBM also appeared to be flawed.

Response:

The EMBM and the mechanistic model developed for the RI/FFS are both based on the same scientific principle of a mass balance. While there are differences between the two approaches, they both provide important and independent lines of evidence for evaluation of current and future conditions for contaminant transport in the Lower Passaic River. The differences include the following:

- The EMBM is a spatially-integrated model developed to simulate average characteristics in the lower 8.3 miles of the river, while the mechanistic model represents the system in a finer scale using a computation grid that extends from the Dundee Dam to the southern end of Newark Bay.
- The EMBM consists of two components: 1) an inferential receptor mass balance (EMBM receptor component) from which solids contribution from the various sources is derived, and 2) a single box formulation that uses an empirical approach to projecting future conditions (EMBM trajectory component). The finely-resolved mechanistic model consists of a computationally integrated detailed formulation for mechanisms including hydrodynamics, sediment transport and organic carbon as input to the fate and transport model.
- In the EMBM receptor component, resuspension is not physically modeled, but the net contribution from the sediment bed (referred to as the resuspension source) is inferred from the receptor mass balance as a percent contribution of the solids in the system. The finely-resolved model has a mechanistic formulation that computes erosion fluxes as a function of

measured erosion rates using shear stress from the hydrodynamics, and divides the total erosion fluxes into bed load and suspended load components.

- In the EMBM trajectory component, net accumulation on the sediment bed is based on calculated bathymetry differences and is assumed to remain constant in the future. The mechanistic model simulates deposition and erosion fluxes as a function of defined or calculated critical values for each particle class size, and allows for consolidation effects in deposited cohesive sediment layers.
- Unlike the mechanistic model, the EMBM does not directly include surge and flood events on a time simulation basis to predict contaminant fate and transport in the river. Since the EMBM is data-driven, these processes are captured by the data sets used to develop and forecast future concentrations. In the EMBM, current and historical measurements from the high resolution and low resolution sediment coring data represent the net result of all the processes that have impacted the system over time.
- In the EMBM trajectory component, the sediment bed is assumed to consist of a 6-inch layer that is completely mixed with the incoming net deposition flux from the water column. In the mechanistic model (contaminant fate and transport model), there is an active layer (mixing zone), which is comprised of 10 vertical 1-cm slices in which bioturbation takes place and archival layers below that.
- The EMBM trajectory component does not explicitly include contaminant release and other losses in the water column that occur during dredging as part of its estimation of future concentrations for remedial alternatives. Rather, it assumes that concentrations decline linearly to a target value defined by the degree of the remediation. For example, for a bank-to-bank dredging and capping remedy, in the EMBM trajectory component, the surface sediment concentrations would decline linearly from the onset of dredging to a value of almost zero concentration at the end of capping. The finely-resolved mechanistic model includes explicit consideration of the dredging process and accounts for the transport and fate of the sediments released to the water column as dredging progresses. In addition, the mechanistic model adjusts the sediment bed bathymetry and dynamically links these changes between the hydrodynamic and sediment transport models.
- In the EMBM, the uncertainty bounds were constructed using 5^{th} and 95^{th} percentile of the mean based on a Monte Carlo simulation that accounted for the variability in source characterization and other parameters. The uncertainty in the mechanistic model was developed as described in RI/FFS Appendix B.

Despite these formulation differences, the results from the spatially-integrated EMBM are generally consistent with those of the finely resolved mechanistic model. Figures II.E.4 - 1 and II.E.4 - 2 show the mean and uncertainty results of EMBM and mechanistic model for the various alternatives evaluated in the ROD. The figures indicate that there is no significant difference in the EMBM and mechanistic model as the average results for the mechanistic model trajectory are generally within the Monte Carlo bounds predicted by the EMBM trajectories for the lower 8.3 miles. Furthermore, the percentage contribution from the various sources obtained from the EMBM receptor mass balance compare reasonably with solids transport behavior in the sediment transport model evaluation for existing bed conditions as reported in the RI/FFS Appendix B, Section 6. Therefore, the results of the EMBM can reliably be used as another line of evidence to support the CSM presented in the RI/FFS, Proposed Plan and ROD.

F. Risk Assessments

F.1. Human Health Risk Assessment

F.1.1 Comment: HHRA did not use Site-Specific Fish and Crab Consumption Rates

Commenters asserted that the baseline HHRA overstated risk by failing to consider site-specific information and by adopting overly conservative assumptions for fish and crab consumption rates. Commenters stated that EPA used studies outside of the LPR to derive consumption rates rather than using the results of two peer-reviewed, site-specific creel-angler surveys conducted in the LPR by TMO in 2000-2001 and the CPG in 2011-2012. Commenters asserted that the TMO and CPG creel-angler surveys produced lower fish and crab consumption rates than those used by EPA in the RI/FFS. Commenters stated that EPA's use of the TMO creel-angler survey results to calculate fish ingestion rates of 23.95 and 28 grams per day was erroneous, because EPA used the maximum reported fish ingestion rate rather than the 90th or 95th percentile values that the Risk Assessment Guidance for Superfund (RAGS) Part A (EPA, 1989) recommends should be used. Commenters stated that rather than rely on the peer-reviewed literature, the fish consumption rates used in the RI/FFS HHRA were taken from an anonymous and non-peer-reviewed EPA Region 2 document, cryptically identified as a "Technical Memorandum."

Response:

<u>Fish and Crab Ingestion Rates (IRs) Did Consider Site-Specific Information</u>

EPA did consider the creel-angler survey conducted in the LPR by TMO in 2000-2001, as described in Ray et al. (2007a,b), in the overall development of the IR for both fish and crab. EPA did not consider the CPG survey conducted in 2011-2012, since the study results were not available for EPA's evaluation at the time the RI/FFS was developed. In response to these comments, including the submission of the CPG study, EPA evaluated that study and it is addressed later in the response.

The 2012 Technical Memorandum, developed as part of EPA's oversight of the 17-mile LPRSA RI/FS, describes EPA's careful consideration of a wide range of creel-angler surveys, including the TMO survey, to select the fish and crab ingestion rates for use in the 17-mile and lower 8.3-mile HHRAs. EPA's goal was to develop ingestion rates that are consistent with exposures to the RME individual consuming fish and crab from the Lower Passaic River. The RME is, by definition, the highest exposure reasonably expected to occur at a site under both current and future uses (EPA, 1989) and is consistent with the goals of the Superfund program to design remedies that are protective of all individuals who may be exposed at a site (55 FR 8710, March 8, 1990). EPA's Superfund risk assessment guidance requires the evaluation of completed exposure pathways (i.e., those individuals who consume either fish or crab) under current and future conditions and therefore, individuals reported as not consuming fish or crab were not included in the evaluation.

Fish and crab consumption surveys relevant to the LPRSA were identified by EPA based on the criteria outlined in EPA's 2000 Ambient Water Quality Guidance (EPA, 2000b). The analysis was organized by the following data sources: local data, similar geography/population groups, data from national surveys and EPA's default intake rates. In addition, the evaluation also considered Superfund guidance regarding evaluation of site-specific data.

Based on this evaluation, EPA developed the IRs based on the following findings:

- The fish ingestion rate was based on the only two published surveys conducted in the New York/New Jersey Harbor estuary with enough information to calculate statistical distributions of ingestion rates for fish and crab (Burger, 2002; Connelly et al., 1992). The Burger survey (2002) was conducted in the Newark Bay Complex and included survey sites in the Newark Bay Study Area, which is part of the Diamond Alkali site.
- The Burger (2002) and Connelly et al. (1992) surveys were reviewed in a number of ways, including peer-reviewed through EPA's grant award process, published in the peer-reviewed literature and/or identified in EPA's 2011 Exposure Factors Handbook (EPA, 2011). The Exposure Factors Handbook is the source of many default parameters used in the Superfund program.
- The two surveys used different sampling methods (i.e., intercept and licensed angler survey), yet resulted in comparable consumption rates. They also represented large angling populations from coastal New York and New Jersey watersheds.
- The fish ingestion rate calculated by EPA is consistent with rates calculated from other surveys conducted within EPA Region 2 and nationally.
- The fish ingestion rate is consistent with rates used in EPA decisions within Region 2 at sites with sediment contamination where fish ingestion was considered.
- The fish ingestion rate is consistent with ingestion rates at other large river bodies in Region 2 where more areas along those rivers may be accessible for angling than is currently the case with the LPR, based on EPA's expectation that the future improvements to parks and open space along the Lower Passaic River will lead to increased access to the river.
- The crab ingestion rate is based on the only published survey conducted in the New York/New Jersey Harbor estuary with enough information to calculate statistical distributions of crab ingestion rates (Burger, 2002).

<u>Ingestion Rates are Not Overly Conservative</u>

EPA's 2012 Technical Memorandum considered exposures to the RME and Central Tendency Exposure (CTE) or average individual, consistent with EPA guidelines and guidance. In the Burger 2002 and Connelly et al., 1992 surveys, outliers were removed from the analysis; further, the 90th percentile, and not the 95th percentile, was used as the basis for deriving the IR based on the skewness of the data.

EPA evaluated the raw data collected for the Burger (2002) study in the Newark Bay Complex to estimate the 50th percentile and 90th percentile fish ingestion rates shown in Figure II.F.1.1 - 1. For people who only fished (i.e., who did not also go crabbing), 65 of the respondents provided estimates of the self-caught meals per month, serving size and months per year that they fish.[31] Four of the records were excluded from the ingestion rate estimates, because the respondents estimated a serving size greater than 30 ounces per meal (i.e., greater than about 2 pounds of fish per meal). For the remaining 61 consumers of self-caught fish, daily ingestion rates were estimated for each individual by multiplying the serving size (in ounces/day) by a conversion factor for grams/ounce, number of meals per month and months per year of fishing, and by dividing by 365 days per year. The 50th percentile ingestion rate was 3.7 g/day, the mean ingestion rate was 13 g/day and the 90th percentile ingestion rate was 37.3 g/day. The distribution was highly skewed, increasing to 62.9 g/day at the 95th percentile.

The HHRA for the Hudson River PCBs Superfund Site (TAMS, 2000, Table 3-1) summarized fish ingestion rate percentile values for the 1991 New York angler survey (Connelly et al. 1992), a statewide mail

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[31] Eight additional people who only fished and said they ate fish were not included in the calculations because they did not provide answers for all three variables.

survey that included over 1,000 New York anglers who caught and consumed fish in 1991. The 50th percentile fish ingestion rate for all flowing water bodies was 4.0 g/day and the 90th percentile was 31.9 g/day. This survey was also conducted to determine anglers' awareness and knowledge of fish consumption advisories. About 85 percent of anglers were aware of fish consumption advisories, and almost half reported that they would eat more sport-caught fish if there were no problems with contaminants.

EPA evaluated the data collected for the Burger (2002) study in the Newark Bay Complex to estimate crab consumption rates. For people who only crabbed (i.e., who did not also fish), 76 of the respondents provided estimates of the number of self-caught crab meals per month, number of crabs per meal and the number of months per year that they go crabbing. Two records were excluded from the ingestion rate estimates because the responses were considered outliers: one reported eating 48 crabs per meal and the other reported eating 22 crabs per meal 25 times per month. For the remaining 74 consumers of self-caught crabs, EPA estimated daily ingestion rates for each individual by multiplying the number of crabs per meal by number of meals per month and months per year of crabbing, and by dividing by 365 days per year. In addition, EPA assumed that the average edible portion of crab was 45 g per crab, based on the average weight of edible meat (muscle and hepatopancreas) from crabs collected as part of the 17-mile LPRSA RI/FS. The 50th percentile ingestion rate was 3.0 g/day, the mean ingestion rate was 8.2 g/day and the 90th percentile ingestion rate was 20.9 g/day. The distribution was highly skewed, with a 95th percentile of 38.4 g/day that was almost double the 90th percentile.

Evaluation Was Consistent with EPA Guidelines, Guidance and Policy

EPA followed Agency guidelines, guidance and policy. The IRs calculated by EPA represent the 90th percentile consistent with the EPA's 1992 Exposure Assessment Guidelines that recommend using the 90th percentile or above to represent a high end exposure such as the RME individual (EPA, 1992).

EPA's 1992 Exposure Assessment Guidelines defines exposure as contact between a chemical, physical or biological agent and a target (e.g., exposed individual) [EPA, 1992]. Based on this definition, EPA's evaluation of fish and crab consumption surveys in the 2012 Technical Memorandum included consumption patterns only among anglers reporting consumption of fish and/or crab. Non-consumers were not further evaluated since the fish/crab ingestion exposure pathway is not complete.

This approach of evaluating only fish consumers is consistent with RAGS Part A (EPA, 1989) that defines the RME as the maximum exposure that is reasonably expected to occur under baseline conditions, not a worst-case exposure scenario. This approach is reaffirmed in the NCP which clarified that only potential exposures that are likely to occur are included in the RME evaluation. RAGS Part A guidance further indicates that current and future exposures should be evaluated in the absence of institutional controls such as the health advisories for fish and crab consumption that are in effect on the Lower Passaic River.

RAGS Part A recommends the following procedures for calculating a contact rate: "Contact rate reflects the amount of contaminated medium contacted per unit time or event. If statistical data are available for a contact rate, use the 95th percentile value for this variable" (EPA, 1989, p.6-22). RAGS Part A goes on to say that "the 90th percentile value can be used if the 95th percentile value is not available." Consistent with this recommendation, in those cases where fish ingestion rate data were available and supportive of statistical calculations, EPA used the 95th percentile, or other similar high end value such as the 90th percentile, in the calculation and noted this in the text of the 2012 Technical Memorandum.

In the Superfund 1991 Standard Default Exposure Assumption guidance (EPA, 1991), EPA provides guidance recommending the use of default exposure assumptions to reduce unwarranted variability in the exposure assumptions used by Regional Superfund staff to characterize exposures to human populations in the baseline risk assessment (EPA, 1991). The guidance is also intended to encourage a consistent approach to assessing exposures where there is lack of site-specific data or consensus on which parameter value to choose, given a range of possibilities.

Based on these guidance documents, EPA's 2012 Technical Memorandum analysis evaluated the number of anglers reporting fish consumption in the available surveys, variability in fish ingestion rates across surveys and consistency with fish ingestion rates used by EPA Region 2 in Records of Decision at other sediment sites for which fish and crab consumption were evaluated since 1991.

Peer Review of EPA's 2012 Technical Memorandum

Although EPA's 2012 Technical Memorandum, which EPA developed in the course of overseeing the 17-Mile RI/FS, itself was not peer-reviewed, information presented and used to develop ingestion rates in EPA's Technical Memorandum was obtained from published, peer-reviewed literature. Therefore, EPA relied on existing data that had already gone through a rigorous review process.

Ingestion Rates Based on TMO's 2000-2001 Creel-Angler Survey Results

TMO's 2000-2001 creel-angler survey results were described in a paper by Ray et al., 2007a. The fish IR derived from this paper (Ray et al., 2007a) was then used by Urban et al., 2009 to calculate cancer risks and noncancer health hazards for an adult and child consuming fish from the Lower Passaic River. The Ray et al. 2007a paper identified a fish consumption rate for an adult of 1.8 g/day at the 95th percentile for the Lower Passaic River. This fish consumption rate was calculated by including a large majority of anglers (54 of 61 anglers) who stated that they did not consume the fish they caught from the Lower Passaic River and thus had zero exposure to Lower Passaic River fish (Ray et al., 2007b). Consistent with RAGS Part A, anglers with zero fish consumption cannot be considered an RME individual and are not included in the development of the fish IR used by EPA. The fish consumption rates calculated by EPA using data from Ray et al. (2007b) based only on anglers reporting fish consumption from the Lower Passaic River are 23.95 g/day (estimated maximum annual consumption, Table 3, Ray et al., 2007b) and 28 g/day (the reported maximum, p. 525, Ray et al., 2007b).[32] These two values are comparable to the 26 g/day consumption rate for anglers recommended in EPA's 1997 Exposure Factors Handbook (EPA, 1997a); the 2011 Exposure Factors Handbook (EPA, 2011) does not provide a value for comparison.

The work plan for the 2000-2001 TMO fish consumption survey of the Lower Passaic River conducted by TMO was submitted to EPA for review and not approved because it was not consistent with EPA guidance. In addition, EPA and NJDEP reviewed the data reported in Ray et al. (2007b) and identified several concerns with use of the survey data for the LPRSA, and other limitations in the risk assessment developed by Urban et al., 2009, which were published in *Science of the Total Environment* as Letters to the Editor (Mugdan, 2010 and Buchanan et al., 2010).

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[32] There is some debate as to whether 28 g/day is the maximum rate among the fish consumers, or 23.95 g/day is the maximum and the higher value is an estimated number based on sensitivity analysis. For the 2012 Technical Memorandum (2012c), the distinction is irrelevant.

Urban et al., 2009 calculated cancer risks and noncancer hazards based on the survey results and statistical analysis reported in Ray et al., 2007a, b, respectively. The paper presents calculated cancer risks and noncancer hazards for adults and children consuming fish from the Lower Passaic River based on deterministic and probabilistic analyses. The Letter to the Editor (Mugdan, 2010), highlighted three major concerns: the fish ingestion rate underestimates fish consumption; risks and hazards from ingestion of crab were not evaluated; and other exposure assumptions (e.g., exposure duration, and not combining child and adult cancer risks for total risks) lead to an underestimate of risks and hazards.

Based on the deterministic risk assessment, the paper reported cancer risks of 3×10^{-4} to the child but did not combine the cancer risks of the child and adult which resulted in a combined risk of 3.6×10^{-4} (Table 2). The calculated noncancer hazards to the child were not specified in the Abstract. Review of the specific calculations provided in Table 3 indicates a total noncancer hazard for the child is an HI equal to 20.4 and for the adult the HI equals 4.27. Both HIs exceed the goal of protection of an HI equal to 1.

As described above, EPA concluded that the fish IR developed by Ray et al. (2007a, b), and used by Urban et al. (2009) to calculate exposure, underestimated cancer risks and noncancer hazards. Since the publication of the Urban et al. (2009) paper, additional information has been identified that supports EPA's conclusions that the cancer risks and the noncancer HI presented by Urban et al. (2009) are underestimated, including:

- The Urban et al. (2009) paper, Section 2.1, indicates that data from carp were not included in the calculation of the fish EPC; rather catfish was assumed to represent the carp. Section 2.1 of Urban et al. (2009) explains the exclusion of carp was based on "no suitable analytical analyses of carp tissue in the OurPassaic.org database." The RI/FFS HHRA included data on carp based on sampling events following the publication of the Urban et al. (2009) paper. Inclusion of carp in the EPC calculations results in increased EPCs and increases in the resulting cancer risks and noncancer hazards from fish consumption in the Lower Passaic River.
- A noncancer toxicity value for dioxin was issued in 2012. Evaluation of the noncancer hazards based on exposures to dioxin would increase the total noncancer hazard from consumption of fish and crab.
- Crab data were evaluated in the RI/FFS HHRA that indicated the cancer risks exceed the risk range established under the NCP, and the goal of protection of an HI equal to 1 was also exceeded.

<u>Ingestion Rates Based on the CPG's 2011-2012 Creel-Angler Survey Results</u>

As part of their comments on the Proposed Plan, the CPG commenters derived a fish consumption rate of 8.4 g/day based on a year-long creel-angler survey in the 17-mile LPRSA, which the commenters developed in the course of performing work on the 17-Mile RI/FS (though without EPA's approval or oversight). The commenters' creel-angler survey identified 25 fish-consuming anglers, as well as data on fish species caught, parts eaten, cooking method, and estimation of amount caught and eaten by the anglers. Based on information provided in the CPG's HHRA (submitted as part of their comments on the Proposed Plan), EPA understands that the CPG used statistical modeling and weighting factors to calculate the ingestion rate of 8.4 g/day from the 25 anglers' responses. The sampling weights were used to estimate population statistics.

Although the use of statistical sampling weights to generalize the sample to the target population is a valid methodology, the CPG commenters did not provide adequate data and information for EPA to conduct an in-depth evaluation of the data collected or verify the fish consumption rate. EPA attempted to recreate the 8.4 g/day ingestion rate calculated by the CPG based on the text description provided in Attachment B of CPG's HHRA, but was unable to do so. Without using the CPG's weighting factor, EPA calculated a 90th percentile ingestion rate of 35.3 g/day based on the CPG's creel-angler survey information (see Table II.F.1.1 – 1). When the weighting factor was included, EPA calculated a 90th percentile ingestion rate of 14.1 g/day as shown in Table II.F.1.1 – 1. Sampling weights derived by the CPG for each angler intercepted during the CAS (as discussed in Attachment B of the CPG's HHRA) decreased the ingestion rate by a factor of at least 2.5 from 35.3 g/day to 14.1 g/day.

EPA then used the data reported by the CPG to calculate ingestion rates using the methodology described in EPA's 2012 Technical Memorandum. Based on CPG's data and EPA methodology, the 90th percentile value of 20.2 g/day shown in Table II.F.1.1 - 2 is much closer to the 34.6 g/day used in the RI/FFS HHRA than the 8.4 g/day included in the CPG's comments.

The information submitted by the CPG in their comments on the lower 8.3-mile Proposed Plan lacked sufficient information to allow EPA to conduct an in-depth evaluation of the data collected during the CPG's creel-angler survey or the CPG's fish consumption rate calculation. The survey was conducted using a work plan that was not approved by EPA, and the results of the survey have not been published or made fully available to EPA for review; therefore, EPA concluded that it is inappropriate to include this information in its remedy selection process.

F.1.2 Comment: Fraction Ingested Term Overly Conservative

Commenters asserted that the baseline HHRA used an overly conservative assumption for the fraction ingested (FI) term, leading to overstated estimates of risk.

Response:

EPA RAGS Part A (EPA, 1989) defines the FI term as "fraction that is ingested from contaminated source;" thus, an FI of 1 assumes that 100 percent of the fish or crab caught and consumed is obtained from the lower 8.3 miles of the LPR. Consistent with EPA RAGS Part A, use of an FI less than 1 is not appropriate for the lower 8.3 miles, for the following reasons:

- The lower 8.3 miles has adequate quantity and quality of fish and crabs to support the estimated level of ingestion of fish and crabs for the RME individual, both currently and in the future;
- The fish and crab ingestion rates capture ingestion of only the contaminated source; an FI term lower than 1 could apply only if other sources of fish or crab were included in the diet being analyzed;
- The Lower Passaic River is in a densely populated urban area, with access to the river for fishing and crabbing through parks, boat docks, and publicly-accessible parking lots abutting the river and residences on the river banks. Therefore,
    - anglers have ample opportunities to return to areas where they have successfully caught fish or crab, especially adolescents or lower income families, who have limited means of transportation;
    - workers have the opportunity to fish and/or crab during the work day or on their way to and from work; and

    - there are many municipalities along the Lower Passaic River so there is the potential that individuals may move within these municipalities, and yet continue to fish and crab, and consume fish/crabs from the lower 8.3 miles of the Passaic River.
- Many municipalities and counties along the lower 8.3 miles of the Passaic River have published master plans that call for the expansion and improvement of parks and open space along the river that, if implemented, will make the area more amenable to fishing and crabbing (City of Newark, 2010; City of Newark et al., 2004; Clarke Caton Hintz et al., 2004; Clarke Caton Hintz et al., 1999; Heyer, Gruel & Associates, 2003; Heyer, Gruel & Associates, 2002). As noted in EPA's Land Use in the CERCLA Remedy Selection Process (EPA, 1995), comprehensive community master plans are a valuable source of information in determining reasonably anticipated future use for future risk scenarios.

Use of an FI = 1 is consistent with other risk assessments conducted in Region 2.

F.1.3 Comment: Cooking Loss Values Overly Conservative and Incorrect

Commenters asserted that the baseline HHRA overstated risk by using overly-conservative assumptions for cooking loss. In addition, commenters pointed out that the incorrect cooking loss value was applied for TCDD and PCBs in the CTE scenario.

Response:

As discussed in the RI/FFS HHRA (Appendix D), contaminant losses from cooking may be a function of the cooking method (*e.g.*, baking, frying or broiling), cooking duration, temperature during cooking, preparation techniques (*i.e.*, trimmed versus untrimmed, with or without skin), lipid content of the fish, fish species, magnitude of contamination in the raw fish, extent to which lipids separated during cooking are consumed, reporting method, and/or experimental study design. In addition, personal preferences for various preparation and cooking methods and other related habits (such as consuming pan drippings) may result in consumption of contaminants "lost" from the fish as a result of cooking. Based on these uncertainties and the variability in cooking methods, EPA does not agree with or accept the use of anything other than a zero percent cooking loss for the RME individual. EPA did incorporate cooking loss as a part of the CTE evaluations in the RI/FFS HHRA.

During the response to comments, EPA determined that the TCDD cooking loss in the RI/FFS HHRA had been miscalculated, so that an incorrect value of 49 percent was used in the CTE risk and hazard calculations. In Table C-1 of the 2000 EPA Guidance on Fish Advisories, five fish species are listed for the contaminant TCDD in both the skin-on and skin-off scenarios. The percent cooking reductions are as follows:

Species	Activity	Cooking Reduction (percent)
Carp	skin-on and cooked	37
Carp	skin-off and cooked	54
Chinook Salmon	skin-on and cooked	43
Chinook Salmon	skin-off and cooked	57
Lake Trout	skin-off and cooked	61
White Bass	skin-on and cooked	80
Walleye	skin-on and cooked	44
	Average	53.7
	Median	54.0

The average and median percent reduction from cooking loss using all seven data points is about 54 percent, as is stated by the commenter. In the original research study from which EPA derived the CTE value of 49 percent (Zabik and Zabik, 1995), seven cooking methods were used to assess cooking reductions in TCDD. Salt boiling and canning resulted in a loss of <35 percent TCDD, while the other cooking methods resulted in losses of about 50 percent (Zabik and Zabik, 1995). The use of a 49 percent cooking loss (as in the RI/FFS HHRA) versus the 54 percent cooking loss suggested by the commenter does not significantly change the CTE risk and hazard estimates, as shown in Table II.F.1.3 – 1. As discussed in the RI/FFS, Proposed Plan and ROD, risk management decisions are based on RME risk and hazard results, so use of the 54 percent cooking loss in the CTE calculation would not have changed the remedial decision for the lower 8.3 miles.

During the response to comments, EPA determined that, for PCBs, a 20 percent cooking loss value was inadvertently used for the CTE calculations for fish consumption, instead of a 30 percent cooking loss value. To respond to this comment and comment II.F.1.5, EPA recalculated risks and hazards to assess the impact that the 30 percent cooking loss and updated exposure parameters (e.g., 80 kg body weight [BW] and 20 years exposure duration [ED] for the adult) would have on results estimated in the RI/FFS and Proposed Plan. A comparison of the risks and hazard results is presented in the graphs in Figures II.F.1.3 - 1 and II.F.1.3 - 2. As shown on these figures, the updated results are not significantly different than the results presented in the RI/FFS HHRA. Cancer risks for the CTE individual remained at the upper end of the NCP risk range (i.e., 10^{-4}) and noncancer hazards remained higher than EPA's goal of protection of an HI equal to 1.

F.1.4 Comment: Fish Species Consumption Patterns Not Site-Specific

Commenters asserted that the baseline HHRA overstated risk by failing to consider site-specific information and by adopting overly-conservative assumptions for fish species consumption patterns. Commenters stated that the fish and crab tissue exposure point concentrations (EPCs) in the RI/FFS HHRA were not based on species abundance or parts of the biota that are likely to be consumed.

Response:

Any species preferences exhibited by anglers who eat self-caught fish in the Lower Passaic River have a high degree of uncertainty because of the contamination present in the river and the existence of a prohibitions on fish and crab consumption, which has an impact on the reliability of self-reported consumption (suppression). The fish used in the calculation of the EPCs are the predominant fish species of the lower 8.3 miles of the Passaic River targeted for sample collection consistent with EPA guidance. An equal-weighted concentration was used to represent the EPCs for fish because, although anecdotal information indicates that these fish species are consumed, reliable information pertaining to fish species preferences and consumption patterns is not available for the Lower Passaic River. EPCs for crab were based on parts of the crab that may be consumed, which included the combined muscle and hepatopancreas. This approach is well supported by the current knowledge base, as discussed in the RI/FFS HHRA. As such, and as further discussed in the response to comment II.A.2.1 (Principle #8), this does not result in an overestimation of risk.

As discussed in response to comment II.F.1.1, EPA did consider the results of the creel-angler survey that was conducted on the LPR by TMO, notwithstanding the fact that EPA did not approve the work plan or oversee the study. EPA also considered the results of the CPG's survey, but without the raw data, EPA was unable to conduct an in-depth analysis and interpretation of the data. As with the TMO survey, EPA did not approve the CPG's workplan or oversee the study. Further, the work plan for the CPG survey and the results of the survey have not been published or made fully available to EPA for review. Given the potentially significant suppressive effect of the prohibitions of fish and crab consumption on reporting, without the kind of thorough review provided by publication in a peer-reviewed journal it would not be appropriate to rely on the site-specific consumption preferences developed by the CPG based on the results of the CAS.

F.1.5 Comment: Default Exposure Parameters Outdated

Commenters stated that several default exposure parameters applied by EPA in the HHRA are not consistent with the most recent EPA Office of Solid Waste and Emergency Response (OSWER) Directive (EPA, 2014b). Commenters stated that the correct values for cooking loss derived from EPA's Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories (EPA, 2000a) should have been used. Commenters recommended that EPA refer to the Directive and update the HHRA with the relevant parameters.

Response:

Several default exposure parameters used in the RI/FFS HHRA were updated after the RI/FFS was completed and in two instances, the new exposure parameters in the 2014 OSWER Directive (EPA, 2014b) were not consistent with those used in the RI/FFS HHRA: adult BW (i.e., HHRA used 70 kg vs. the updated 80 kg value) and residential adult ED (i.e., HHRA used 24 years vs. the updated 20 years value for the adult). To respond to this comment, EPA calculated the risk/hazard estimates using the two updated parameters. The risk/hazard estimates were not significantly affected as a result of these parameter updates as shown in Figures II.F.1.3 – 1 and II.F.1.3 - 2. Significantly, the cancer risks and noncancer health hazards calculated for the RME individual with the 2014 Standard Defaults still exceed the NCP risk range and the goal of protection of an HI equal to 1. This finding of calculated risks above the NCP risk range and HI equal to 1 for the RME individual supports the need for remedial action. Refer to response to comment II.F.1.3 for a discussion of the cooking loss values.

F.1.6 Comment: HHRA only Evaluated Fish and Crab Consumption Pathway

A commenter stated that the FFS ignored risks presented by PAHs in sediment that would substantially affect the risk assessment. The commenters noted that the Region only relied on fish and crab consumption to characterize risk in support of the preferred alternative and that the HHRA did not account for direct sediment exposure, which, according to the commenters, represents a significant contribution to overall cancer risk when critical exposure and toxicity parameters (e.g., age-specific sediment adherence factor, chemical-specific dermal absorption factors, high PAH concentrations in LPR sediment, and age-dependent adjustment factors accounting for PAH mutagenicity) are included in the assessment.

Response:

The RI/FFS and HHRA did not ignore risks associated with PAHs. Rather, using a phased approach to managing the site, the HHRA focused on providing information necessary to determine whether an action is necessary for the lower 8.3 miles and to select an appropriate remedy. This phased approach is consistent with EPA's Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (EPA, 2005a). The RI/FFS HHRA assessed the cancer risks and noncancer health hazards associated with exposure to COCs in the lower 8.3 miles due to angler/sportsman and other family members consuming self-caught fish and shellfish (crab) from the lower 8.3 miles of the LPR. In the HHRA, EPA evaluated the contaminants considered to be the most bioaccumulative, most persistent in the environment and most toxic to human beings, to capture the primary risk drivers.

EPA's focus on the contaminants and exposure pathways most significant to the lower 8.3 miles is consistent with the experience at other Superfund sediment sites, where HHRAs have shown that bioaccumulative contaminants, such as dioxins and PCBs, consumed through ingestion of fish and shellfish (crab), are associated with the highest cancer risks and noncancer health hazards, i.e., consistently higher than risks associated with ingestion, dermal contact or inhalation of chemicals in surface water or sediment during recreational or other exposures. Because PAHs are not bioaccumulative contaminants, risks presented by PAHs were not evaluated in the RI/FFS HHRA. Further, since fish rapidly metabolize and excrete PAHs, fish tissue residue concentrations of parent PAH compounds are limited.

Two commenters (the CPG and TMO) submitted their own site-specific HHRAs as part of their comments on the Proposed Plan, in which potential risks for direct contact to sediment were evaluated. As part of this response to comments, EPA reviewed the commenters' site-specific calculations assessing the contribution of direct contact to PAH in sediment to risk/hazard.

Results from the site-specific HHRA submitted by the CPG indicated that the total cumulative risk to an adult angler was 1×10^{-4}, which included risk from direct contact to sediments at 1×10^{-6}, risk from contact to surface water at 4×10^{-7}, and risk from consumption of fish at 1×10^{-4}. The CPG concluded that the primary contribution to total cumulative risk is consumption of fish, with exposure to COPCs in sediment contributing only one percent to total cumulative risk. Looking at direct contact with sediment risk only, the total (all COPCs in sediment) potential cancer risk for the adult angler calculated by the CPG was said to be 1×10^{-6}, with carcinogenic PAHs contributing 30 percent to the total sediment risk. The sum of the seven carcinogenic PAHs associated with sediment risk was identified as 3×10^{-7}, which is below the risk range that, according to the NCP, would lead to a remedial action.

Conversely, results from the site-specific HHRA conducted by TMO determined that the combined risk to the adult angler from fish ingestion and direct contact to sediment was 3×10^{-4}, which included the fish consumption risk of 2×10^{-4} and the sediment risk of 1×10^{-4}. The estimated total sediment risk of 1×10^{-4} for the adult angler included risk associated with all COPCs, with risk specifically for the carcinogenic PAHs contributing to 99 percent of the total sediment risk (Total PAH risk = 1×10^{-4}).

The risk assessments conducted by TMO and the CPG produced completely different results for exposure to PAHs in sediment, primarily due to the differences in exposure point concentrations, toxicity values and exposure assumptions selected by each group for the calculations. Summary tables providing a comparison of the toxicity values and exposure parameters used by the commenters to calculate sediment risk are provided in Tables II.F.1.6 - 1 and II.F.1.6 - 2.

The two commenters selected different exposure parameters to represent the site-specific exposures for the adult angler receptor. One of commenters (TMO) did not provide the sediment exposure concentrations used in their risk assessment as part of their submission, preventing EPA from evaluating those. In addition to using different sediment exposure point concentrations, the two risk assessments used two very different sets of toxicity values. TMO used toxicity criteria for PAHs developed by EPA (oral and dermal slope factors) that were released for external peer review in a document that clearly states "do not cite or quote" and have not been finalized and adopted by EPA (see Table II.F.1.6 - 1). These criteria are under development by EPA and should not be used in any risk assessment until such time as the Agency has addressed all comments, updated supporting documents, and finalized and posted the information as an Integrated Risk Information System (IRIS) chemical file. The toxicity criteria used by the other commenters (the CPG) were obtained from the 2013 public comment draft version of "Toxicological Review of Benzo[a]pyrene in Support of Summary Information on the Integrated Risk Information System (IRIS)." A disclaimer contained in this document states,

> This document is a preliminary draft for review purposes only. This information is distributed solely for the purpose of pre-dissemination peer review under applicable information quality guidelines. It has not been formally disseminated by EPA. It does not represent and should not be construed to represent any Agency determination or policy.

Use of draft toxicity values is inconsistent with EPA policy and does not conform to OSWER Directive 9285.7-53 (EPA, 2003) regarding the selection of toxicity values. Thus, not only have the commenters used different toxicity values, but neither set of toxicity values conforms to EPA's process and policy.

EPA calculated three sets of risks for direct contact to PAHs in sediment using the exposure concentrations for PAHs that are incorporated into the draft baseline HHRA for the 17-Mile LPRSA (submitted as part of the CPG's comments on the Proposed Plan), along with toxicity values and exposure assumptions selected by EPA, TMO, and the CPG, respectively, as shown in Tables II.F.1.6 - 1 and II.F.1.6 - 2. The estimated risks are summarized in Table II.F.1.6 - 3. The toxicity values and exposure assumptions selected by EPA were calculated based on current EPA dermal assessment guidance and acceptable oral and dermal cancer toxicity values; exposure factors available in EPA guidance for this pathway are provided in Table II.F.1.6 – 2. Exposure factors used by TMO and the CPG are inconsistent with the standard default exposure assumptions and assumptions used by EPA for this comparison. As shown in Table II.F.1.6 - 3, the cancer risks calculated by EPA were lowest when using the CPG methodology. The CPG calculation were based on exposure parameters much lower than the EPA standard default parameters. While the exposure parameters used by TMO were more consistent with EPA methodology, the risks calculated by EPA using the non-final toxicity values selected by TMO, which is not consistent with the OSWER Directive 9285.7-53, resulted in lower cancer risks than those calculated with the toxicity values selected by EPA. In any case, all three sets of cancer risks calculated by EPA in this evaluation are lower than those calculated for ingestion of fish/crab.

F.1.7 Comment: EPC Calculation was Based on Outdated Statistical Software

Commenters stated that EPA used outdated statistical software for the calculation of EPCs for fish and crab, which dramatically impacted the estimated EPC for DL-PCBs in fish. Commenters stated that using the current version of ProUCL (version 5.0) would have resulted in a 40 percent increase in the EPC for DL-PCBs in fish over that reported by ProUCL version 4.1. Specifically, commenters stated that the EPC for DL-PCBs in fish should have been 22.86 ppt and not 16.3 ppt as reported by EPA. They recommended that EPA use the most recent version of ProUCL, asserting that EPA had elected to use outdated statistical software for the RI/FFS HHRA (ProUCL version 5.0 has been available since September 2013) and claiming that this error impacted risk and hazard estimates in the HHRA. Commenters stated that EPA should recalculate the EPCs for the HHRA using ProUCL version 5.0 and use such to estimate both hazard and risk for DL-PCBs. EPA should use the most current version of ProUCL for the calculation of EPCs.

Response:

EPA used the most current version of ProUCL available at the time the current baseline risks were calculated, which was ProUCL version 4.1. ProUCL version 5.0 was not publicly released until after the risk assessment report was completed. EPA has since compared the results of the two ProUCL versions to assess the new version's impact on estimated EPCs.

When ProUCL version 4.1 was updated to version 5.0, minor changes were made to the decision tables that are used to make suggestions for selecting an upper confidence limit (UCL) to estimate EPCs. For ProUCL version 4.1, data distributions were determined by the software in both the UCL module and background threshold value [BTV] module based on only one goodness of fit (GOF) test statistic (e.g., Shapiro Wilk test for normality or lognormality). However, in ProUCL version 5.0, data distributions are determined based upon all GOF statistics (e.g., both Shapiro -Wilk and Lilliefors tests for lognormality) available in ProUCL. These updates and additions were incorporated in the decision tables of ProUCL 5.0, and can lead to different suggestions for EPCs.

EPA used ProUCL 5.0 to calculate the DL-PCB EPC. ProUCL outputs for versions 4.1 and 5.0 are shown in Figure II.F.1.7 – 1. The values computed by the two ProUCL versions are the same, as shown in Figure II.F.1.7 – 1, though the "suggested UCL to use" provided in the output differs. ProUCL 5.0 recommended the 95 percent Chebyshev (Mean, Sd) UCL (21.9[33] ppt), while ProUCL 4.1 recommended the H-statistic UCL (15.2 ppt) (refer to Figure II.F.1.7 - 1). However, as shown in the recommendations provided in the ProUCL version 4.1 output, the H-statistic is provided for historical reasons only because the H-statistic often results in unstable (both high and low) values of 95 percent UCL. The ProUCL 4.1 output recommended avoiding the use of H-statistic based 95 percent UCLs and recommended the use of nonparametric methods to compute 95 percent UCLs for skewed data sets which do not follow a gamma distribution. The note at the end of the ProUCL version 4.1 output for the fish DL-PCBs states:

[33] Commenters reported having calculated a value of 22.86 ppt for DL-PCBs using ProUCL version 5.0; however, EPA was not able to reproduce this value, and ProUCL output was not provided by the commenters.

Note: Suggestions regarding the selection of a 95 percent UCL are provided to help the user to select the most appropriate 95 percent UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Laci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Consistent with the ProUCL output recommendation, EPA consulted a statistician to help select an alternative to the H-statistic. The statistician reviewed the ProUCL version 4.1 output along with the DL-PCB data set and selected the 95 percent BCA Bootstrap UCL (16.3 ppt) as an alternative to the H-statistic. The 95 percent BCA Bootstrap UCL was subsequently used as the EPC in the RI/FFS HHRA.

If the RI/FFS HHRA had used the 21.9 ppt value recommended in ProUCL 5.0 as the estimated EPC, which is a 34 percent increase over the value selected by EPA for the HHRA, the risk calculated for fish consumption would have been 34 percent greater than the result calculated in the RI/FFS HHRA. In the RI/FFS, the fish cancer risk estimated for the combined adult + child receptor using the 16.3 ppt EPC was 6×10^{-4}. If the 21.9 ppt is used as the EPC, the cancer risk estimated for the combined adult + child receptor would increase to 8×10^{-4}, which remains above the NCP risk range. However, as a result of the 34 percent increase in the estimated risk associated with DL-PCB, percent contributions to total risk for the primary COCs would not change significantly, as shown below:

	Contribution to Total Risk	
	Using ProUCL 4.1	Using ProUCL 5.0
Dioxin/Furans	70 percent	67 percent
DL-PCBs	11 percent	15 percent
Total PCBs	16 percent	15 percent

In further response to this comment, EPA recalculated EPCs using ProUCL version 5.0 for all of the COPCs. Except for the UCL for dioxin–like PCBs, the ProUCL version 5.0 suggested UCLs that were the same as or very similar to those suggested by ProUCL version 4.1, as shown in Table II.F.1.7 - 1. Thus, using UCLs suggested by ProUCL version 5.0, instead of ProUCL 4.1, would not have resulted in any significant change to the EPA evaluation of risks and hazards in the RI/FFS HHRA. Cancer risks and noncancer health hazards would still exceed the acceptable NCP risk range and the goal of protection of an HI equal to 1. The relative percentages that the primary COCs contribute to total risk would not significantly change, as shown in the table above. The 40 percent increase in the EPC for dioxin-like PCBs would equate to an increase in risk by 1.4, which is not a significant change in the risk estimate.

F.1.8 Comment: EPC Calculation did not Include all Available Data and was Based on a "Generic" Fish

Commenters stated that EPA relied on only 39 fish samples in calculating the EPCs for all COCs, which represents only a fraction of the more than 100 available fish samples with analytical data that have been collected over the past two decades, and which is a significantly smaller sample size than used for other large sediment Superfund sites. Commenters stated that, given the magnitude of the remedy EPA proposed, all available data should be used to characterize the lower 8.3 miles. Commenters stated that EPA should incorporate all available LPRSA fish and crab tissue data in the HHRA and recalculate risk and hazard. Further, commenters stated that because there are limited tissue data from only two time periods to compare, it is not possible to conduct a reasonable statistically-based evaluation of potential trends in chemical concentrations.

Commenters noted that EPA specifically states in the HHRA that "in the absence of site-specific data to support consumption patterns, equal intake of all representative species was consumed" and assert that this statement is not an accurate characterization of EPA's approach in the HHRA. According to commenters, EPA instead derived the fish EPC, or the value used to represent the chemical concentration available from a particular route of exposure, based on the number of samples of each species in the total pool of samples, rather than equal weighting (i.e., American eel is assumed to be 41 percent of the fish diet, smallmouth bass 3 percent, etc.). Commenters asserted that the EPC determined by EPA is thus an artifact of the sampling and analysis program, and is not based on either the relative abundance of fish caught by the community, or the species that are typically of interest to recreational fishers.

Commenters stated that EPA used a non-standard nomenclature for dioxin-like compounds; the nomenclature should be revised to be consistent with EPA Toxicity Equivalence Factors (TEF) guidance (EPA, 2010b).

Response:

EPA did use all of the available historical data to evaluate spatial and temporal trends that characterized the lower 8.3 miles. Fish (mummichog, white perch and American eel) and blue crab tissue data from 1999 to 2010 (as described in the RI Report, Chapter 1) for all of the COCs were plotted and analyzed in RI/FFS Appendix A, DER No.6. EPA concluded that the variability or range of fish tissue concentrations observed in the 2009 data encompassed that observed in the 2000/2001 data.

EPA also used the available historical data to conduct an analysis of the correlation between contaminant concentrations in biota tissue samples and in corresponding sediment samples, as discussed in RI/FFS Appendix A, DER No. 6. The goal of EPA's analysis was to develop site-specific relationships relating contaminant concentrations in animal tissue and with those found in sediment to incorporate site-specific conditions that control the transfer of the contaminants from sediment to animal. As discussed in response to comment II.D.4.5, the analysis was successful in obtaining strong sediment-tissue regressions for the COCs.

To characterize current conditions in the RI/FFS HHRA, EPA used site-specific fish and crab tissue chemistry data collected by the CPG for the 17-mile LPRSA RI/FS throughout the lower 8.3 miles during the late summer/early fall 2009 fish and decapod crustacean tissue sampling event (August and September 2009, with a supplemental effort in October 2009), because the 2009 data better represented current and potential future conditions of the river than the data from previous decades and because this approach was consistent with that used for the 17-mile RI/FS HHRA. The 2009 data were collected in the lower 8.3 miles under an approved QAPP with EPA oversight and the data met appropriate QA/QC criteria for inclusion in an RI/FFS HHRA. The 2009 samples were collected throughout the 8.3-mile study area, which coincides with the risk assessment assumptions that fish are caught and consumed anywhere within the lower 8.3 miles

Along with the blue crab, a variety of fish encompassing the types that anglers and wildlife might consume were included in the EPC estimate to represent the major trophic categories of species that occur in the river. Fish species included mummichog, American eel, white perch, common carp, smallmouth bass, white catfish, and white sucker. The specific tissue sample types varied among studies and included whole body for the ecological risk assessment, skinless fillet, skin-on fillet, muscle, hepatopancreas, muscle/hepatopancreas for the RI/FFS HHRA, and “all edible tissue.”

In order to account for the distinct ecological groups of fish that may be appreciably consumed by recreational anglers/sportsmen, EPA used analytical data from six species, rather than a single species, or trophic level, to derive an equal-weighted concentration to represent the EPC for fish. EPA used an equal-weighted concentration to represent the EPC for fish because reliable information pertaining to fish species preferences and consumption patterns was not available for the LPR (refer to the response to comment II.F.1.1). Thus, equal intake of all representative fish species known to be consumed by anglers and their family members was assumed. The RI/FFS HHRA provided information regarding concentration differences observed among the six species and addressed the uncertainty for those individuals who consume only a specific species.

For dioxin-like compounds, the HHRA provided a specific definition of the nomenclature that was used for these compounds. The definition clearly spelled out what was and was not included for that class of compounds so that it is possible to clearly differentiate between the sets for COPCs. The nomenclature is consistent with EPA’s 2010 guidance on dioxin TEFs (EPA, 2010b) and the 1996 Reassessment of PCB cancer toxicity (EPA, 1996).

F.1.9 Comment: Toxicity Assessment Approach for Dioxins and PCBs

Commenters stated that EPA used a cancer slope factor (CSF) for TCDD that was developed almost thirty years ago, thereby ignoring updated pathology classifications from the National Toxicology Program; EPA should have used the CSF of 9,700 $(mg/kg\text{-}day)^{-1}$ based on the updated pathology classification that is reported in the peer-reviewed literature in 1992. In addition, commenters stated that the TCDD oral Reference Dose (RfD) used by EPA in the HHRA was based on two studies of a single high-exposure incident that evaluated health endpoints of questionable relevance and that contained several critical flaws; commenters concluded that the use of this RfD resulted in unreasonable estimates of noncancer hazard due to LPR fish or crab ingestion. Commenters stated that noncancer hazard should be recalculated using the Joint Food and Agriculture Organization of the United Nations and World Health Organization Expert Committee on Food Additives (JECFA) Tolerable Daily Intake (TDI).

Commenters stated that EPA’s toxicity assessment approach resulted in overestimates of PCB and dioxin risks, and key uncertainties in the dioxin toxicity equivalence scheme were not acknowledged. Commenters said that calculating a risk for exposure to Total PCBs using the PCB CSF, and a risk for DL-PCB congeners using the TEFs and the CSF for TCDD was a duplicative analysis of the potential toxicity of the DL-PCB congeners, because the CSF for PCBs already includes the carcinogenic potential of the dioxin-like PCBs in the PCB Aroclor mixtures tested in the animal studies that form its basis. Commenters stated that EPA’s approach of subtracting the DL-PCBs from Total PCBs did not address the double-counting issue, so that the resulting PCB risks were overstated.

Commenters indicated that because a CSF for TCDD was used in the HHRA, EPA had assumed that TCDD acts via a mutagenic mode of action, which the commenters stated is incorrect; commenters stated that the consensus within the scientific community is that TCDD acts via a receptor-based mode of action and that a non-linear approach for deriving toxicity criteria for dioxin should instead have been used to reflect that fact. Commenters stated that because of the CSF EPA used, the cancer risks determined in the HHRA were grossly inflated and not scientifically defensible. Commenters stated that EPA should revise the HHRA to incorporate a threshold-based mode of action for TCDD (e.g., Oral RfD protective of both cancer and noncancerous effects) and that doing so will greatly impact the risk estimates for TCDD.

Response:

TCDD Slope Factor

EPA's selection of an oral CSF of 150,000 $(mg/kg\text{-}day)^{-1}$ is consistent with the OSWER Directive 9285.7-53[34] (EPA, 2003), which addresses the selection of toxicity values at Superfund sites, as a Tier 3 value, and is consistent with the 1996 PCBs Cancer Reassessment (EPA, 1996). The Case Study example provided in the 1996 document identified the CSF of 150,000 $(mg/kg\text{-}day)^{-1}$ which was selected for the RI/FFS HHRA calculations. The CSF of 9,700 $(mg/kg\text{-}day)^{-1}$ used in the TMO HHRA was based on information reported in peer-reviewed literature which does not follow the toxicity hierarchy outlined in the OSWER Directive 9285.7-53. The peer-reviewed literature value is 16-fold lower than the CSF EPA selected following the hierarchy set forth in the OSWER Directive.

The Tier 3 toxicity value selected by EPA for the FFS HHRA, is not the only Tier 3 toxicity value available. As identified in the Regional Screening Level Questions and Answers #44, a range of toxicity values meeting the Tier 3 criteria for TCDD exists and include the following:

- CalEPA Office of Environmental Health Hazard Assessment (OEHHA) value of 130,000 $(mg/kg\text{-}day)^{-1}$ (CalEPA, 2009).
- EPA's Office of Health and Environmental Assessment (1985) value of 156,000 $(mg/kg\text{-}day)^{-1}$.
- EPA's HEAST (1997b) value of 150,000 $(mg/kg\text{-}day)^{-1}$ developed based on the EPA (1985).

All three Tier 3 toxicity values are acceptable for performing HHRAs under CERCLA and are more comparable in magnitude, differing by a factor less than 1.2, as opposed to the peer-reviewed literature value suggested in the comment, 9,700 mg/kg-day, that is 16-fold lower.

Oral RfD

EPA disagrees that the assessment of noncancer toxicity of TCDD is flawed as stated in the comment, and that a threshold-based mode of action should be incorporated in the HHRA. The TCDD RfD used by EPA was derived as part of EPA's Reanalysis of Key Issues Related to Dioxin Toxicity and Response to National Academy of Sciences (NAS) Comments, Volume 1 (2012), which is included in EPA's IRIS assessment available at: http://www2.epa.gov/iris. The RfD was developed based on consideration of all available, relevant and appropriate data on noncancer effects caused by TCDD. The development of the IRIS assessment included development of a draft Toxicological Review, release for public comment and external peer-review through EPA's Science Advisory Board, final EPA and interagency review, and development of revised document that also included a Response to Comments. The assessment builds on recommendations from the NAS.

As stated in the IRIS file, EPA has high confidence in the TCDD RfD. The two co-principal studies used to derive the RfD (Baccarelli et al., 2008 and Mocarelli et al., 2008) were well conducted and showed health effects in humans. EPA agrees that the exposure assessment is a limitation of Mocarelli et al. (2008) because of the atypical exposure profile (high dose exposure followed by gradual elimination).

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[34] The OSWER Directive 9285.7-53 provides the hierarchy of human health toxicity values and provides guidance for the sources of toxicity information that should generally be used in performing HHRAs under CERCLA.

However, the use of physiologically based pharmacokinetic modeling to estimate internal exposures over the critical window and to account for the potential influence of the initial high peak exposure mitigates this limitation. The maternal exposures reported in Baccarelli et al. (2008) were not subject to large fluctuations, since the maternal blood measurements occurred several years following the accident and the newborns were exposed over a much narrower critical window (i.e., during pregnancy).

The selection of the oral RfD for TCDD from IRIS followed OSWER Directive 9285.7-53, issued in 2003. EPA selected the oral RfD for dioxin, a Tier 1 Toxicity Value, as outlined in the Directive.

JECFA Value

The value recommended from JECFA mentioned in the comment (the TDI) would be considered a Tier 3 value under the OSWER Directive. It is important to recognize that JECFA established a provisional tolerable monthly intake (PTMI) value to guide risk management decisions that could reduce dietary exposures, and the Committee was keenly aware of national interests concerning their food supplies. The PTMI was not designed for the purpose of conducting the types of quantitative risk assessments performed by EPA at Superfund sites.

PCB TEFs

EPA disagrees that application and use of a TEF approach to characterize DL-PCBs and non-dioxin-like PCBs, or Total PCBs, significantly overestimates the cancer risks from PCBs. The calculated total cancer risks that include both DL-PCBs and Total PCBs for ingestion of fish and crab for the combined adult/child consumers are 5×10^{-3} and 2×10^{-3}, respectively (see Table 3-6 of the RI/FFS HHRA that shows the calculation of total risks and risks from individual COPCs). Recalculating total cancer risks for these receptors by omitting the DL-PCB cancer risks results in total risk values of 4×10^{-3} and 2×10^{-3}, for fish and crab respectively. Thus, inclusion of the DL-PCB risks does not significantly overestimate the total calculated risks from consumption of fish and crab.

The approach used by EPA to evaluate dioxin-like and non-dioxin like PCBs followed guidance outlined in these documents:

- *2013 Use of Dioxin TEFs in Calculating Dioxin TEQs at CERCLA and RCRA Sites* (May, 2013). This document provides frequently asked questions and corresponding answers on the use of dioxin TEFs in calculating dioxin toxicity equivalence (TEQ) concentrations at Superfund and RCRA sites.
- The 2010 Risk Assessment Forum document titled: Recommended TEFs for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds (EPA, 2010b).
- The 1996 Reassessment of PCBs: Cancer Dose-Response Assessment and Application of Environmental Mixtures. The response to comment II.F.1.12 addresses applicability of conducting a TEF sensitivity analysis.

F.1.10 Comment: Background Risks were Underestimated

Commenters stated that the HHRA used a cascade of conservative assumptions that resulted in a profound distortion of risk. Commenters also stated that EPA's incomplete background evaluation underestimated the contribution of upriver sources and significantly overstated the risk reduction that can be achieved by the selected remedy. Further, commenters stated that the RI/FFS HHRA failed to effectively quantify and compare regional background risks from above Dundee Dam.

Commenters asserted that background risks and hazards were estimated based only on concentrations of TCDD and non-dioxin like PCBs, and that these data represented only a fraction of all dioxins and furans and Total PCBs (non-dioxin like and dioxin-like). Commenters also stated that background risks and hazards due to PAHs should have been evaluated. Commenters asked that EPA revise its background analysis to include PAHs, all dioxins, furans and dioxin-like PCBs. Commenters stated that there were inconsistent, erroneous and non-standard risk calculations used in EPA's HHRA with regard to reporting of results, cooking loss, and segregation of the hazard index.

Response:

EPA disagrees that the RI/FFS HHRA contained overly conservative assumptions, and that it disregarded standard EPA risk assessment guidance. EPA is aware of no deviations from guidance other than the inadvertent use of 20 percent cooking loss instead of 30 percent cooking loss for PCBs in fish for the CTE scenario, as discussed in the response to comment II.F.1.3. As noted in that response, risk management decisions are based on the RME scenario; therefore, the results associated with the 20 percent CTE scenario will not affect the calculated cancer risks and noncancer health hazards under the RME scenario that is used to make the risk management decision for the lower 8.3 miles. Other small differences in the calculated hazards may be the result of rounding differences between software packages.

In a situation where HI values exceed 1 even though chemical-specific hazard quotients (HQs) do not exceed 1 (i.e., adverse systemic health effects would be expected to occur only if the receptor were exposed to several contaminants simultaneously), segregation of HIs by effect is performed. When that occurs, chemicals are segregated by similar effect on a target organ, and a separate HI value for each effect/target organ is calculated (EPA, 1989). However, Table 3-7 of Appendix D of the RI/FFS (and Tables 12 through 14 of the ROD) shows that for the lower 8.3 miles, the individual HQs under the RME scenario for the primary COC contributors to the total HI [i.e., TCDD TEQ (Dioxin/Furan [D/F]), TCDD TEQ (PCBs), Total PCBs, and methyl mercury] all are above an HQ = 1 (except for methyl mercury under crab ingestion). A target HQ of 1 was used to calculate PRGs for each of the COCs, because the health endpoints of dioxin, PCBs and methylmercury are distinctly different.

The selection of toxicity values followed the OSWER Directive as described in the detailed responses to comments II.F.1.1 and II.F.1.5 that address the development of toxicity values in the risk assessment process, as well as the exposure assessment components, respectively.

Background Contributions

EPA did consider background contributions in determining the remediation goals as discussed in Section 2.4.3 of the FFS Report. The Upper Passaic River just above Dundee Dam was used as the background location for the lower 8.3 miles. Contrary to the commenters' assertions, estimates of cancer risks and noncancer health hazards associated with background sediment concentrations for consumption of fish and crab were calculated (see Section 3 of Appendix E of the RI/FFS), using the same risk assessment methodology and assumptions that were used in the baseline risk assessment for the adult and child angler/sportsman (RI/FFS Appendix D). Background risks were only calculated for those COPCs having total cancer risks above the NCP risk range of 10^{-4} to 10^{-6} and individual noncancer health hazards above a HQ of 1 [i.e., total non-dioxin-like PCBs, 2,3,7,8-TCDD (representing TCDD TEQ (D/F)) and mercury (representing methylmercury)]. EPA anticipates that human health risk associated with PAHs and other contaminants will be evaluated in the 17-mile RI/FS HHRA, consistent with a phased approach to managing the site.

F.1.11 Comment: HHRA did not Evaluate Risks from Pathogens and Remedy Construction

Commenters noted that EPA focused the RI/FFS HHRA exclusively on chemical risk and hazard to LPR anglers and did not address the presence of pathogenic organisms in the river potentially posing a significant health threat to river users. The commenters questioned reasonableness of sediment remediation to address a dose of dioxin-like compounds from ingestion of fish or crab from the LPR that is similar to or less than what an infant receives on a daily basis in the first months of life from breast milk. In addition, the commenters stated that cancer risk estimates actually apply to a very small population and therefore EPA should include population risk estimates to provide appropriate context for the cancer risk estimates.

Additionally, the commenters pointed out that there was no analysis of physical risks posed by the proposed remedy (e.g., likelihood of a truck or train accident), claiming that a single death or serious injury sustained while conducting the remediation would be far worse than choosing the no action alternative with regard to overall impact to human health. Moreover, the model used by EPA to predict future sediment COPC levels (and by extension, future fish and crab COPC concentrations) likely underestimated future COPC concentrations, and therefore risk, suggesting even higher unacceptable risks after the proposed remedy is complete. Therefore, EPA should re-evaluate the remedial alternatives in the context of revised risk and hazard estimates based on scientifically defensible exposure factors and toxicity factors.

Response:

Other Sources of Exposure (Pathogenic Organisms)

Water quality, including the presence of pathogens, falls under the purview of the Clean Water Act legislation and not CERCLA. The Clean Water Act regulates discharges of pollutants to surface water. The Superfund Program (CERCLA) addresses hazardous substances, pollutants and contaminants that cause cancer risks and noncancer health hazards to humans (a category that does not include biological pollution and floatables), as well as risks to biota in the environment. EPA's risk assessment process does not provide for the evaluation and interpretation of biological pollution data in the context of EPA's risk-based decision-making process under CERCLA. The Clean Water Act goal of water quality, defined in terms of supporting specific activities and uses of water bodies, complements yet differs in important ways from CERCLA's goal of reducing risks to human health and the environment posed by exposure to hazardous substances. Under the Clean Water Act, EPA addresses water quality conditions, consistent with the Act's definition of protection and restoration of fishing, swimming, and other designated uses, while CERCLA is a risk-based program with a goal of protecting human health and the environment by reducing exposures of people and biota to concentrations of hazardous substances. Because of the difference in legislative mandates, the presence of pathogenic organisms in the LPR and the risks associated with them are not included in the RI/FFS HHRA.

Consumption of Human Breast Milk

This pathway was qualitatively evaluated in the Uncertainty section of the RI/FFS HHRA. The commenters are correct in noting that human consumption of breast milk (breast-fed infant) exposures to dioxins under general population exposure conditions are substantially higher than the fish consumption pathways associated with the Passaic River. Indeed, because of the biomagnification of highly lipophilic compounds (such as dioxins and PCBs) in breast milk, breast-fed infant exposures will always be higher on a body-weight basis than exposures to any other age group for virtually all exposure scenarios. While widespread conditions in the general population such as early childhood exposure to dioxins are not specifically addressed under EPA's CERCLA authority, CERCLA's goal of reducing risks to human health and the environment from exposure to hazardous substances identified as COCs is beneficial to society at large.

It should be noted that all regulations to air sources and all site-specific clean-ups have typically compared the source- or site-specific exposures to comparable background exposures. For example, adult intakes by a pathway impacted by a source or site contamination should be compared to the same adult intakes in the background condition.

Risks from Truck/Traffic Exposures.

Although there were no quantitative analyses regarding physical risks posed by the proposed remedy (e.g., likelihood of a truck or train accident), qualitative short-term risks to human health and the environment were addressed for each alternative in Section 4 of the FFS. Consistent with EPA Superfund guidance [OSWER Directive 9355.3-01 (EPA, 1988) and OSWER Directive 9285.7-01C (EPA, 1991a)], qualitative or quantitative analyses of short-term risks associated with remedial alternatives is acceptable. As noted in the FFS, measures to minimize or mitigate the potential for adverse short-term impacts would be addressed in community and worker safety plans, and by the use of best management practices.

Risks to Populations

The HHRA followed Agency Superfund policy that indicates the RME individual is the principal basis for evaluating potential human health risks at Superfund sites (see RAGS Section 6.1.2 and the NCP's Preamble).

Risks Following Remediation

In order to assess the risk posed by the lower 8.3 miles of the Passaic River sediments after remediation, a mechanistic contaminant fate and transport model and an EMBM were developed to predict the concentrations of COPCs in lower 8.3-mile surface sediments and the water column under No Action and three active remedial alternatives. EPA used the future modeled surface sediment concentrations in the RI/FFS HHRA to estimate the future residual risks remaining in the lower 8.3 miles post-remediation. The results showed that the selected remedy, in conjunction with MNR and institutional controls, would be protective of human health and the environment. For dioxin and PCBs, immediately after construction, lower 8.3-mile surface sediment concentrations are predicted to reach the interim remediation milestones that correspond to interim protective fish and crab concentrations, potentially allowing NJDEP to consider lifting or relaxing the stringency of prohibitions on fish and crab consumption.

Models to predict post-remediation sediment concentrations have some degree of uncertainty. EPA has responded to comments regarding the models' calibrations, projections, and interpretations used to estimate future risks and hazards in Sections II.E.1 and II.E.2. EPA's risk assessment for future modeled conditions evaluated the same COPCs and exposure pathway (ingestion of fish and crab) as were evaluated for baseline conditions in the RI/FFS HHRA. The exposure factors and toxicity factors used to estimate both baseline and future risks and hazards are consistent with EPA policies, guidance and guidelines (see responses to comments II.F.1.1 and II.F.1.5).

F.1.12 Comment: Sensitivity Analysis on TEFs was not Conducted

Commenters noted that in the RI/FFS HHRA, EPA used static TEFs for PCDD/Fs and dioxin-like PCBs, and stated that using TEF distributions could provide greater insight regarding robustness of the underlying data, degree of accuracy and attendant uncertainty in the cancer risks and noncancer hazard posed by these compounds in the Lower Passaic River, particularly in the case of DL-PCBs. The commenter stated that EPA had cited, but did not follow EPA guidance regarding the conduct of sensitivity analyses to illustrate the impact of TEFs (EPA, 2010b), and that this is a critical oversight by EPA because the LPR sediment contains large concentrations of dioxin-like PCBs and failure to understand the uncertainty associated with the TEFs (and thus the risk and hazard) can leave risk managers with incomplete information.

Response:

EPA disagrees that a sensitivity analysis for dioxin-like compounds is necessary to support a remedial decision for the lower 8.3 miles of the Lower Passaic River. This determination is based on the following factors:

- The 2010 EPA TEF document recommendation to conduct a sensitivity analysis was based on the more common scenario where TCDD is a minor (< 10 percent) component of the total TEQ. This is not the case for the Lower Passaic River where the congener 2,3,7,8-TCDD is a significant percentage of the total TEQ, as discussed below for fish and crab.
- A sensitivity analysis would be based on TEF uncertainty for the dioxin-like compounds and not 2,3,7,8-TCDD which has no TEF uncertainty by definition.
- Given the predominance of 2,3,7,8-TCDD in the TEQ, the analysis would only show the possible variation around 10 percent of the total effective concentration, which is a small contribution.

To further respond to the comment, EPA evaluated the relative percentage of individual dioxin-like compounds to total dioxin concentrations in fish and crab. The evaluation is based on the concentration of dioxin-like compounds in fish and crab expressed as TEQ to represent the toxicologically-effective concentration. The results of the analysis are provided below for fish and crab, respectively.

<u>Fish</u>

The congener 2,3,7,8-TCDD is the main contributor to the total TEQ in fish from the Lower Passaic River. The results of an evaluation to determine percent contribution of the concentrations of dioxin-like compounds in fish is provided in Table II.F.1.8 - 1. As shown in the table, 2,3,7,8-TCDD contributes 65.6 percent of the total TEQ. The next highest average contribution was 1,2,3,7,8-pentachlorodibenzo-p-dioxin (PeCDD) with 1.7 percent. Among DL-PCBs, the highest contributor was PCB-126 with 21.3 percent, PCB -118 with 4.0 percent, PCB-169 with 1.9 percent and PCB-105 with 1.6 percent. The remaining congeners contributed less than 5 percent of the total. These findings support EPA's initial determination that 2,3,7,8-TCDD is the main contributor to the overall dioxin-like compound concentration and that a sensitivity analysis was not needed.

Crab

A separate evaluation for crab found that 2,3,7,8-TCDD was the main contributor to the total TEQ in crab from the Lower Passaic River. The results of an evaluation to determine percent contribution of the concentrations of dioxin-like compounds in crab is provided in Table II.F.1.8 - 2. As shown in this Table, 2,3,7,8-TCDD contributes 78.8 percent of the total TEQ. The next highest contributors of dioxin-like compounds were 2,3,4,7,8- pentachlorodibenzofuran (PeCDF) (2.6 percent), 2,3,7,8-TCDF (1.3 percent), 1,2,3,7,8-PeCDD (1.4 percent) and 1,2,3,4,7,8-hexachlorodibenzofuran (HxCDF) (1.1 percent). The contributions from DL-PCBs were highest from PCB-126 (10.6 percent), PCB-118 (1.3 percent) and PCB-169 (1.1 percent). The remaining congeners contributed less than 2 percent to the total TEQ. These findings support EPA's initial determination that 2,3,7,8-TCDD is the main contributor to the overall dioxin-like compound concentration and that a sensitivity analysis was not needed.

Sensitivity Analysis

Consistent with the 2010 TEF guidance, EPA conducted a sensitivity analysis based on the Upper and Lower TEFs. The Upper and Lower TEFs were calculated by multiplying and dividing, respectively, its individual TEF value by half a log (i.e., 3.16). Figure II.F.1.8 - 1 shows the results of the sensitivity analysis compared to the TEF provided in the 2010 TEF document. As shown in the Figure, 2,3,7,8-TCDD remains the main contributor to the total TEQ.

Conclusions

The congener 2,3,7,8-TCDD is a primary contributor to the total dioxin TEQ in fish and crab. A sensitivity analysis where the Upper and Lower TEFs were calculated by multiplying and dividing, respectively, its individual TEF value by half a log (i.e., 3.16) still showed that the 2,3,7,8-TCDD was the main contributor to the total TEQ. The lower TEF found the contribution was 85 percent in fish and 92 percent in crab. The upper TEF found the contribution was 37 percent in fish and 53 percent in crab.

F.1.13 Comment: Alternative Deterministic and Probabilistic Risk Assessments

Commenters stated that exposure parameters used in the RI/FFS HHRA were not reasonable and were set at the upper end of the range of possible values, and without regard to site-specific conditions which resulted in overestimates of risk. In addition, commenters stated that EPA should have conducted a probabilistic risk assessment (PRA) for the RI/FFS to characterize the impact of compounded conservatism reflected in its calculated cancer risk and noncancer health hazard estimates, and to propagate variability and uncertainty. Commenters stated that, given the overly conservative assumptions employed in the RI/FFS HHRA, it is likely that the RME risks fall at the extreme upper end of the distribution of risks, and that by stopping at the first tier of risk analysis (the point estimate risk assessment), EPA has concluded that uncertainties in their calculated risks are low and the level of confidence in the RME current and future risk estimates is high. The CPG commenters stated that they had performed their own deterministic HHRA using site-specific data to provide a more reasonable estimate of upper bound risk. The TMO commenters stated that they completed a deterministic HHRA and a PRA that incorporated site-specific exposure parameters and toxicity criteria that they believe better represent the state-of-the-science, as well as exposure pathways and COPCs relevant to the LPR.

The PRA conducted by the TMO commenters concluded that DL-PCBs, followed by non-dioxin-like PCBs, are the drivers of cancer risk and noncancer hazard for fish and crab ingestion in the child receptor.

Response:

Deterministic Human Health Risk Assessments (HHRA)

EPA evaluated the HHRAs submitted by the CPG and TMO commenters. The evaluation considered how the HHRAs were conducted, whether the HHRAs contained adequate detail to recreate the results, and how the HHRAs differed from EPA's RI/FFS HHRA. EPA's evaluation found overall that the TMO and CPG HHRAs were not transparent and consistent with the need to evaluate exposures for the RME individual.

Using the CPG's HHRA approach, EPA was able to replicate the results. The percent contributions to total risk from PCB and dioxins calculated by EPA through this process were similar to the results in the FFS HHRA, with dioxins being responsible for the greatest proportion of risk, followed by PCBs. However, the resulting risks were less than the risks determined in the FFS HHRA because of the following factors:

- The CPG HHRA used a fish ingestion rate of 8.4 g/day, whereas EPA's RI/FFS HHRA used 34.6 g/day.
- The CPG HHRA employed some cooking loss in the RME calculations, whereas EPA's RI/FFS HHRA assumed zero percent cooking loss for RME calculations.
- The CPG HHRA used an ED of 15 years, whereas EPA's RI/FFS HHRA used an ED of 24 years.
- The CPG HHRA used 78 years as the averaging time of carcinogens, whereas EPA's RI/FFS HHRA used 70 years.
- The CPG HHRA used a BW of 80 kg, whereas EPA's RI/FFS HHRA used 70 kg.
- The CPG HHRA used a CSF of 130,000 per $(mg/kg\text{-}day)^{-1}$, whereas EPA's RI/FFS HHRA used 150,000 per $(mg/kg\text{-}day)^{-1}$.

Two factors used in the CPG HHRA were the primary reasons for the differences between the EPA and CPG risk results, namely fish ingestion rate and cooking loss. A fish ingestion rate of 8.4 g/day is an underestimation of fish consumption for RME anglers eating their catch (refer to Section III.A.1 for a detailed evaluation of the fish ingestion rate). As discussed in response to comment II.F.1.3, EPA assumes no cooking loss for the RME individual based on variability in preparation methods. The use of zero percent loss for RME individual is based on EPA's determination that contaminant losses from cooking may be a function of the cooking method (i.e., baking, frying, broiling, etc.), cooking duration, temperature during cooking, preparation techniques (i.e., trimmed versus untrimmed, with or without skin), lipid content of the fish, fish species, magnitude of contamination in the raw fish, extent to which lipids separated during cooking are consumed, reporting method, and/or experimental study design. In addition, angler preferences for various preparation and cooking methods and other related habits (such as consuming pan drippings) may result in consumption of contaminants that would otherwise be "lost" from the fish upon cooking. It is appropriate to consider cooking loss for the CTE scenario.

EPA could not recreate the results of the HHRA submitted by the TMO commenters, because exposure point concentrations evaluated in the HHRA were not provided. However, EPA determined that the TMO risk results were lower than RI/FFS HHRA risk results due to application of the following factors to the risk assessment:

- The TMO HHRA used a CSF of 9,700 per $(mg/kg\text{-}day)^{-1}$ for TCDD, whereas EPA's RI/FFS HHRA used 150,000 per $(mg/kg\text{-}day).^{-1}$

- The TMO HHRA used an oral RfD of 2.3×10^{-9} mg/kg-day for TCDD, whereas EPA's RI/FFS HHRA used 7×10^{-10} mg/kg-day.
- The TMO HHRA applied a fish ingestion rate of 8.9 g/day, whereas EPA's RI/FFS HHRA used 34.6 g/day.
- The TMO HHRA employed cooking loss in the RME calculations, whereas EPA's RI/FFS HHRA assumed zero percent cooking loss for RME calculations.
- The TMO HHRA used a BW of 80 kg, whereas EPA's RI/FFS HHRA used 70 kg.

The primary reason that the TMO HHRA shows a higher percentage contribution to the total risk from PCBs than from dioxin, which is contrary to EPA's conclusions, was TMO's use of the lower dioxin CSF value. Aside from the differences in exposure parameters (e.g., ingestion rate, body weight, etc.), it was the toxicity values used for the dioxins that resulted in such diverse risk results. As discussed above, the CSF of 9,700 mg/kg-day does not meet the criteria outlined in the OSWER Directive for toxicity values (see response to comment II.F.1.9 for a discussion of toxicity values).

The response to comment II.F.1.1 addresses the calculation and appropriateness of the fish ingestion rates and other exposure parameters used by the CPG and TMO commenters in their risk assessments, and their impact on risk estimates.

The response to comment II.F.1.5 addresses the use of the TCDD CSF and Oral RFD proposed by TMO.

Probabilistic Risk Assessment (PRA)

The TMO commenters' PRA was not presented in a manner or with sufficient information to allow EPA to recreate the analysis. Although probability distributions were provided, the underlying data for fish, crab, and sediment concentrations, as well as fish and crab ingestion rates were not provided. EPA could not determine if rates for consuming or non-consuming anglers, or a mix of both, were used. The TMO commenters' PRA was also conducted using approaches that are inconsistent with EPA guidance, guidelines and policies, especially those within the Superfund program, for obtaining toxicity values and RME assumptions. The commenters' PRA cancer risk results for the child ranged from 2×10^{-5} at the 50^{th} percentile of risk up to 2×10^{-4} at the 95^{th} percentile. For noncancer hazards for the child, the commenters' PRA results ranged between 6 and 68 for the 50^{th} and 95^{th} percentiles, respectively. The calculated cancer risks and noncancer hazards presented at the 95^{th} percentile exceed the NCP risk range and goal of protection of an HI equal to 1 for the child.

Application of the following factors to the TMO commenters' PRA result in major differences from the EPA FFS HHRA conclusions:

- The commenter's PRA used a fish ingestion rate of 8.9 g/day, whereas EPA's RI/FFS HHRA used 34.6 g/day
- The commenter's PRA employed cooking loss in the RME calculations, whereas the RI/FFS assumed zero percent cooking loss for the RME calculations.
- The commenter's PRA used a cancer toxicity value - CSF for TCDD of 9,700 per $(mg/kg\text{-}day)^{-1}$, whereas EPA's RI/FFS HHRA used 150,000 per $(mg/kg\text{-}day)^{-1}$
- The commenter's PRA used a noncancer toxicity value - RfD for TCDD of 2.3×10^{-9} per mg/kg-day, whereas EPA's RI/FFS HHRA used 7×10^{-10} per mg/kg-day.

EPA guidance (RAGS Part III) provides an option for evaluating risks using a PRA but does not require a PRA to support risk management decisions. For the RI/FFS, EPA's risk assessment included both RMEs and CTEs to inform decision making by describing the magnitude and range of exposure that might be associated with fish/crab ingestion for various age groups. EPA (1989) defines the RME as the highest exposure that is reasonably expected to occur at a site. According to EPA guidance (1989, 1995, and 2000c), the CTE is intended to reflect more typical estimates of exposure or dose. The objective of providing both the RME and CTE exposure cases is to set boundaries for the risk estimates, while recognizing that risk decisions are based on the RME consistent with the NCP (EPA, 1990). Provided in Figure II.F.1.9 – 1 are graphs depicting the RME and CTE cancer risk and noncancer hazards for the child receptor estimated in the RI/FFS HHRA. For both TMO's PRA and EPA's deterministic point estimate RI/FFS HHRA results, cancer risks are sometimes at the upper end of the NCP risk range (i.e., > 10^{-4}), or within the NCP risk range (i.e., 10^{-6} to 10^{-4}); however, in all cases the noncancer hazards remain above the EPA goal of protection of an HI equal to 1, which provides a basis for taking action. As such, the need for remedial action is supported both by the RME and CTE scenarios in the RI/FFS as well as the results of TMO's PRA.

The response to comment II.F.1.1 addresses the calculation and appropriateness of the fish ingestion rates determined by commenters and other exposure parameters and their impact on risk estimates. The response to comment II.F.1.5 addresses the use of the TCDD CSF and Oral RFD proposed by commenters.

F.2. Ecological Risk Assessment

F.2.1 Comment: Documentation of Values Used in Exposure and Ecological Effects Assessment Insufficient

Commenters asserted that EPA's documentation and basis for specific values in the data sets used to estimate ecological exposures and effects of the specific data were insufficient. Commenters further stated that the data reduction rules and process for deriving UCLs as well as the assumptions used to estimate wildlife dietary doses and calculate reconstituted whole body tissue concentrations and risk calculations were not clearly documented in the ERA. Specific exposure issues raised by commenters included identification of samples used to derive background sediment concentrations, whether the PCB EPC calculations included coplanar congeners and the lack of meristic data (e.g., length/weight) for fish samples used to estimate tissue concentrations. The documentation of toxicological studies considered in the selection of critical body residues (CBRs) and toxic reference value (TRVs) was critiqued as inadequate by commenters as well.

Response:

The procedures used to establish the ecological risk assessment data set and calculate 95 percent UCLs were documented with adequate detail in the RI/FFS BERA. To respond to the specific issues raised in this comment, additional information on the approaches for data reduction and deriving UCLs, assumptions for estimating wildlife dietary doses, and calculation of reconstituted whole body tissue concentrations is provided in the following paragraphs.

With regard to data reduction, data qualified with an "R" or "F" were not used in the risk assessment. Tentatively identified compounds, split samples and duplicates were also eliminated from quantitative use in the risk assessment. Field duplicates were not collected for biological samples. All other data were used in the BERA. No additional chemical screening was done because the contaminants contributing most substantially to ecological risk in the lower 8.3 miles of the Passaic River had been previously established in the Screening Level Risk Assessment (SLERA). EPA concluded that it was not necessary to estimate total LPR risk in the RI/FFS BERA, because the objective of the RI/FFS BERA was to determine whether ecological risks associated with exposure to COCs in the lower 8.3 miles were high enough to warrant taking action. Consistent with EPA's phased approach to addressing the Diamond Alkali Site, total LPR risks will be considered in the 17-mile RI/FS BERA.

Consistent with RAGS guidance regarding EPC quantification, EPA's ProUCL software was used for calculating the 95 percent UCL of the mean. In instances of non-detected chemicals, the Kaplan-Meier (KM) estimator was used in conjunction with the associated method detection limit. The KM estimator is a step function that determines the most likely value for contaminant concentrations below analytical MDLs based on probabilities determined from the observed detected data. Use of the KM estimator avoided the biases expected to occur with substitution approaches such as using zero or half the detection limit for non-detects.

Dietary exposure parameters for the wildlife receptors were primarily presented in Table 4-11 of Appendix D of the RI/FFS. Additional supporting information, as presented in the text of Appendix D, is summarized the following bullets for both the great blue heron and mink:

- Heron home range = 0.6 hectares, based on the feeding territory size for freshwater rookery in Oregon in fall (Bayer, 1978).
- Heron exposure duration = 213 days/year, based on being a summer resident, most migrating herons leave the breeding ground by October and return between February and April (EPA, 1993).
- Heron water ingestion rate = 0.10 L/day, based on an avian regression equation from Calder and Braun (1983).
- Mink home range = 8 hectares, based on the reported home range for adult females in Montana/riverine habitat containing heavy vegetation (Mitchell, 1961).
- Mink exposure duration = 365 days/year, based on a year-round active mink (EPA, 1993).
- Mink water ingestion rate = 0.060 L/day, based on a mammalian regression equation from Calder and Braun (1983).

Fish samples used to estimate ecological EPCs are identified in Appendix D (Attachment 1.1) of the RI/FFS. As discussed in Appendix D, whole-body tissue concentrations for 11 fish samples[35] were estimated by combining analytical results for fillet and offal samples. Reconstituted whole-body fish tissue concentrations were calculated by combining the weight normalized fillet and remaining offal (carcass) tissue concentrations and were calculated as follows:

$$C_{WB} = \left(C_{fillet} \times f_{fillet}\right) + \left(C_{offal} \times f_{offal}\right)$$

Where:

C_{WB}	=	chemical concentration in the whole-body tissue (mg/kg wet weight [ww])
C_{fillet}	=	chemical concentration in the fillet (mg/kg ww)
f_{fillet}	=	fraction of whole-body weight that is fillet
C_{offal}	=	chemical concentration in the offal (mg/kg ww)
f_{offal}	=	fraction of whole-body weight that is offal (non-fillet)

[35] Whole body tissue concentrations were estimated for 11 of the 35 fish samples used in the BERA; these included 2 American eel, 6 white catfish, 1 white perch, 1 white sucker and 1 smallmouth bass.

Total PCB concentrations were calculated as the sum of non-coplanar congeners to avoid overestimating the risks associated with the PCB congeners that exhibit dioxin-like toxicological effects. TCDD TEQs were calculated for both dioxin/furan and PCB congeners separately.

The RI/FFS, particularly Appendix E, provides a description of the background sediment data set used in the development of cleanup goals. The response to comment II.G.2.2 discusses the role of background in the RI/FFS BERA. The response to comment II.F.2.2 provides an analysis of the available length size categories of available fish tissue to demonstrate why meristic data were not used in the RI/FFS BERA. Assumptions regarding the use of alternative tissue matrices (e.g., cormorant egg plasma rather than egg tissue concentrations and use of "non-approved" or undocumented receptor taxa (e.g., cormorant, herring gull) in the RI/FFS BERA are discussed in the response to comment II.F.2.4. Finally, EPA disagrees that documentation of the selected CBR and TRV benchmarks is inadequate and addresses this in the response to comment II.F.2.8.

F.2.2 Comment: Use of Specific Fish Species and Aggregation of Multiple Species Unjustified

Commenters raised several issues related to the "generic fish" that EPA used as prey for the great blue heron and mink. Commenters argued that the "generic fish" exposure category should not have included species that do not occur throughout the entire lower 8.3-mile assessment area, and that there needed to be overlap of prey fish species and piscivores for exposure to occur. Commenters stated that risks should have been estimated for specific fish species, because different feeding guilds may have different tissue concentrations. Commenters stated the use of the "generic fish" resulted in prey fish sizes that were not realistic for the great blue heron and mink.

Response:

<u>Inclusion of Species that Do Not Range Throughout the Lower 8.3-Miles</u>

The RI/FFS BERA used tissue data from samples collected for the 17-mile LPRSA RI/FS in 2009 and 2010 between RM 0 and RM 8.3. The majority of fish samples included in the generic fish exposure category were species that range throughout the entire lower 8.3-mile assessment area: 59 percent were American eel and white perch collected from RM 1, RM 3, RM 5 and RM 7; 19 percent were white catfish collected from RM 3, RM 5 and RM 7. Other than the fish species collected only once or twice (brown bullhead, gizzard shad, smallmouth bass and white sucker), all fish samples included in the generic fish exposure category were collected as far downstream as RM 5. Inclusion of all fish samples (including those that do not range throughout the entire lower 8.3 miles) is appropriate for characterizing ecological risks to both the fish themselves as well as wildlife that prey on them.

EPA estimated exposures to both categories of receptors as the 95 percent UCL on the arithmetic mean (a measure of central tendency rather than maximum concentrations) as used in the SLERA. For wide ranging fish predators like the great blue heron and mink, which could prey on fish throughout the lower 8.3 miles, EPA assumed that the encounter rates of individual fish taxa will correlate with their relative abundance throughout the lower 8.3 miles. There is no rationale for excluding species due to limited range as suggested by the commenter; rather, the lower encounter rates used by EPA in the BERA will result in these taxa making a smaller contribution to the exposure estimate than they otherwise could have. Although it is possible that some individuals might forage primarily in the lower portion of the lower 8.3 miles, it is also likely that individual wildlife may focus their foraging activities in areas throughout the lower 8.3 miles where the taxa with limited range occur. Use of all of the fish data allowed for an integrated exposure estimate which is most relevant to the wildlife population-level assessment. In order to take an appropriately conservative approach to estimating exposures for the residue-based analysis (in which COPEC concentrations were compared to threshold residue levels for effects to the fish themselves), EPA used all fish samples in the derivation of the EPC terms.

Prey Size

Although use of the entire fish data set is appropriate for deriving conservative exposure estimates (i.e., all fish samples could potentially be consumed by wildlife receptors), an assessment of risks associated with consumptions of preferred prey sizes is reasonable for bounding wildlife risk estimates. As discussed in RI/FFS Appendix D, this exposure uncertainty was evaluated both quantitatively (assuming that herons fed only on small mummichogs) and qualitatively (discussed in the BERA uncertainty analysis in RI/FFS Appendix D).

In response to comments, EPA conducted a reanalysis of the fish EPCs for the "generic fish" based on various fish length groupings to evaluate the effect of this exposure assumption on the risk results. Table II.F.2.2 - 1 compares the number and species of fish that were used to calculate the fish tissue EPCs and the resulting EPCs for TEQ (PCBs), TEQ (D/F) and 2,3,7,8-TCDD for the RI/FFS BERA, commenters' submission and EPA re-evaluation to respond to the comment. Table II.F.2.2 - 2 summarizes the lengths of the fish collected in the lower 8.3 miles of the Passaic River and used in the RI/FFS BERA. The number of samples of each fish species within the different length categories are summarized in Table II.F.2.2 - 3. Fish were grouped into subsets based on sample lengths and the calculated EPCs within each length category were compared to EPCs based on the entire set of fish collected in the lower 8.3 miles of the Passaic River (generic fish used in the RI/FFS BERA). Risks to the great blue heron and mink were estimated based on ingestion exposures to the fish of different lengths. Fish were grouped by the following length categories:

1. ≤ 13 cm – Two fish samples (gizzard shad and white perch) were available in this grouping; as such, mean tissue concentrations were used for all analytes evaluated. The 95 percent UCL of the mean (95 percent UCL) was used for all other length groupings.
2. ≤ 17.5 cm – This is the mean great blue heron prey length identified by Henning et al. (1999). Eight fish samples fell within this binning category (one gizzard shad and seven white perch).
3. ≤ 30 cm – This is the maximum fish prey length for the great blue heron reported by Henning et al. (1999). Fifteen fish samples were available: one gizzard shad, one smallmouth bass, two brown bullhead and 11 white perch.
4. All fish lengths – This is the approach used in the RI/FFS BERA for fish ingestion exposures to the great blue heron and mink. Thirty-seven samples were available, except for lead for which there were fewer samples.

For composite fish samples, the mean fish length was used to assign fish to the above groupings. An overall observation is that when fish samples are segregated by length, the number of samples in each subset becomes small enough to raise concerns about the representativeness of the data.

Whereas the commenters compared their calculated 2,3,7,8-TCDD EPC of 44 ng/kg to EPA's RI/FFS BERA value of 240 ng/kg to make the point that the RI/FFS BERA risk calculations must have been overstated by approximately 5.5 times, EPA was unable to reproduce the 44 ng/kg value. Using all of the data sets described in Table II.F.2.2 - 1, EPA calculated a 2,3,7,8-TCDD EPC of 102 ng/kg for fish smaller than 13 cm, so that the generic fish EPC used in the RI/FFS BERA was just over twice that value, and use of an

EPC based on fish smaller than 13 cm would not have made a substantial difference in EPA's RI/FFS BERA results.

Risks to the great blue heron and mink were estimated based on ingestion exposures to fish of different lengths. Risk were generally estimated as described in the RI/FFS BERA, although only the fish consumption exposure pathway is evaluated in this analysis. Exposure parameters and fish intake calculations are provided in Tables II.F.2.2 - 4 and II.F.2.2 - 5, for the great blue heron and mink, respectively. The associated hazard quotients (based on the no observed adverse effect level [NOAEL] and lowest observed adverse effect level [LOAEL] TRVs developed for the RI/FFS BERA) for the great blue heron are presented in Tables II.F.2.2 - 6 through II.F.2.2 - 9 for the ingestion of fish ≤ 13 cm, ≤ 17.5 cm, ≤ 30 cm, and all fish lengths, respectively. The associated hazard quotients for mink were calculated based on the ingestion of fish ≤ 30 cm (Table II.F.2.2 - 10) and all fish lengths (Table II.F.2.2 - 11). Fish length categories less than 30 cm were not evaluated, because mink are unlikely to consume small fish, as noted in the RI/FFS BERA.

Great Blue Heron. Table II.F.2.2 - 12 and Figure II.F.2.2 – 1 summarize the estimated NOAEL-based HQs based on a diet represented by each of the evaluated fish length binning categories (copper and dieldrin HQs were all less than one, so were not included in the table and figure). Trends of increasing HQ with increasing fish length were not apparent for lead, HPAH or TCDD TEQ (PCBs), but increasing trends are apparent for mercury, Total DDX and TCDD TEQ (dioxins/furans). The risks estimated using the full fish sample set (i.e., equivalent to the generic fish scenario evaluated in the RI/FFS BERA) are 2.5, 3.3 and 2.3-fold higher than those for the <13 cm based EPCs for mercury, Total DDx and TCDD TEQ (D/F), respectively. Based on the work by Henning et al. (1999), fish size cutoffs of ≤ 17.5 cm and ≤ 30 cm appear to be more scientifically valid approaches than the ≤ 13 cm cutoff. For fish length groups limited to ≤ 17.5 cm, ≤ 30 cm, and all fish lengths, the risk estimates were even closer (within a factor of ≤ 1.9) for mercury, Total DDx and TCDD TEQ (D/F).

Mink. Table II.F.2.2 - 13 and Figure II.F.2.2 – 2 summarize the estimated NOAEL-based HQs based on a diet represented by each of the evaluated fish length binning categories (lead, PAHs, dieldrin and Total DDx HQs were all less than one, so were not included in the table and figure). For copper, the HQ was lower with all fish lengths (0.81) than with fish limited to ≤30 cm lengths (1.1). For all other COCs, the HQs were higher in the all fish group than in ≤30 cm group. The two binning categories differed by factors of 1.6, 1.2, 1.4 and 1.2 for mercury, Total PCBs , TCDD TEQs (D/F) and TCDD TEQs (PCBs), respectively.

EPA's analysis shows that for some, but not all COCs, including larger fish in the diet of piscivorous bird and mammal receptors may result in higher risks. The difference in risk between generic fish and smaller fish is estimated to be no greater than a factor of 3.3 (Total DDx) for heron and 1.6 (mercury) for mink. However, the overall conclusion that unacceptable risks to piscivorous wildlife populations are associated with the fish consumption pathway in the lower 8.3 miles of the Passaic River is unaffected by the use of a less-conservative measure of what constitutes a potential prey item (i.e., smaller sized fish). Exposures to TCDD TEQs (combined dioxin/furan and PCB congeners) were estimated to have NOAEL and LOAEL-based HQs of approximately 30 and 3 (heron – resident), 20 and 2 (heron – visitor) and 1000 and 30 (mink) (see RI/FFS Appendix D). Moreover, a conservative measure of exposure requires that all fish samples be included in the EPC calculation, because larger size categories will be captured (or scavenged) and consumed,[36] if available. There is also no technically defensible rationale for excluding common carp, which is a substantial component of the local fauna, in the diets of piscivorous wildlife local fauna. Ignoring most of the available fish tissue data set (information collected under EPA-approved QAPPs to support the 17-mile LPRSA ecological risk assessment) and assuming that great blue herons consume only forage fish (one gizzard shad along with the mummichog samples) to represent dietary exposures along 8.3 miles of the Passaic River introduces much greater uncertainty than does the use of the entire set of available tissue data. The RI/FFS BERA provided risk calculations based on heron consumption of only forage fish (mummichog) as well as the generic fish scenario to provide decision-makers with information bounding these different dietary assumptions.

F.2.3 Comment: Ecological CSM not Consistent with Ecology of Lower Passaic River

Commenters stated that the FFS ecological CSM was overly simplistic, was inconsistent with the ecology of the LPR, and failed to provide an adequate understanding of exposure relationships and trophic transfer. Commenters objected to the CSM's failure to account for differences in temperature and salinity tolerance in fish (e.g., salmonids) and the CSM's inclusion of wildlife receptors unlikely to exist in such a highly industrial area (e.g., mink). Commenters asked for qualitative discussion of the lack of sufficient suitable habitat for wildlife and presentation of the results of bird, mammal or wildlife surveys.

Commenters asserted that the use of generic and inappropriate exposure assumptions resulted in an overestimation of ecological risks. Of particular concern was the use of a single exposure area to represent exposures to sedentary organisms (e.g., benthos) and failure to consider habitat suitability (fish, wildlife). Instead of the FFS approach of characterizing the entire lower eight miles as a single exposure area, commenters recommended a more refined SWAC analysis using Thiessen polygons.

Response:

Consistent with EPA guidance, the purpose of the risk analysis is to estimate current and future risks. While EPA did consider the habitat surveys conducted by the CPG for the 17-mile RI/FS, EPA did not rely solely on those surveys to formulate the conceptual ecological model for the RI/FFS BERA. Because it is likely that contaminant and other stressors are limiting the ecological value and habitat suitability of the lower 8.3 miles of the Passaic River, snapshot surveys do not fully characterize all species that may use the LPRSA habitat or could use this resource absent the chemical contamination. It would be short-sighted to assume that only observations made during short-duration surveys in a highly impaired ecosystem are relevant for understanding ecological exposures now and in the future. Instead, EPA anticipates that the suitability of the LPRSA habitat will change over time and potentially include more sensitive species than are currently utilizing the habitat as various local, state and federal remediation/restoration initiatives are implemented.

The selection of sensitive species, such as salmonids or mammals observed further upstream of the lower 8.3 miles along the Lower Passaic River, provides a level of assurance that the risks to sensitive

[36]In the Kalamazoo River BERA (CDM, 2003), fish PCB concentrations representing dietary items for piscivorous predators were based on the 95 percent UCL on the mean PCB concentrations in whole body carp (rough fish), smallmouth bass (game fish) and white sucker (forage fish), for a given aquatic biota sampling area. PCB concentrations in whole body carp were approximately double those of small mouth bass and white sucker. The inclusion of whole body carp was based on evidence that large carp were consumed by mink, bald eagle, and great horned owl - all these receptors were observed scavenging dead carp that were left on riverbanks by fishermen. Adult carp were also commonly observed in very shallow waters in spring, during spawning. During this time they were readily available to numerous predators.

species will not be underestimated (see response to comment II.F.2.8 for further discussion). Commenters' assertion that the site use factor for the heron should be lower because of "inaccessibility" issues and the absence of heavy vegetation is not supported. In contrast, it is reasonable to assume that foraging birds such as the heron could meet their foraging needs within the lower 8.3 miles assessment area, with its miles of river edge habitat including multiple mudflats. In any case, EPA did evaluate a reduced site use factor (0.7) in the RI/FFS, and the BERA demonstrated an unacceptable risk associated even with this scenario.

The response to comment II.F.2.7 demonstrates the validity of the RI/FFS BERA approach for evaluating the benthic community assessment endpoint. As described, EPA's analysis of sediment quality triad (SQT) data shows that EPA correctly determined in the RI/FFS that the benthic community is impacted relative to urban reference condition, likely as a result of chemical contaminant exposure.

EPA's treatment of the lower 8.3 miles of the Passaic River as a single exposure point is consistent with the RI/FFS geochemical CSM that described elevated COC concentrations in sediment throughout the lower 8.3 miles, bank to bank. EPA found little or no trend in median surface sediment concentrations with river mile from RM 2 to RM 12 and an approximately equal probability of finding high surface sediment concentrations in the shoals as in the navigation channel in RM 0 to RM 8.3. In the RI/FFS, as a sensitivity analysis, EPA also calculated risks from exposures to mudflats. Whether the entire lower 8.3 miles was treated as a single exposure point or whether mudflats were treated as a separate exposure medium did not change the conclusion that contaminated sediments in the lower 8.3 miles present unacceptable risks to ecological receptors. While application of Thiessen polygons can offer a useful technique for integrating spatial heterogeneity, their use in developing EPCs is not consistent with EPA's RAGS guidance, which recommends that baseline risks be quantified using the 95 percent UCL on the arithmetic mean contaminant exposures. The response to comment II.F.2.1 provides further discussion regarding exposure assumptions employed in the RI/FFS BERA.

F.2.4 Comment: Bioaccumulation modeling assumptions unsupported

Commenters stated that the bioaccumulation modeling used in the BERA cannot be used to support a sediment remedial action due to flawed assumptions used in the analysis. Commenters stated that site-specific and receptor-appropriate assumptions should have been used to estimate fish and bird egg tissue concentrations rather than the generic assumptions used in the RI/FFS BERA. Specific concerns raised by commenters included the lack of fish-to-egg transfer factors for some COPECs and the use of elevated incidental sediment ingestion rates, which resulted in risks being under- and overestimated, respectively.

Response:

EPA did not require the collection of egg tissue data for the RI/FFS (or the 17-mile RI/FS), because such a program would be difficult to implement and potentially destructive to local populations. Absent site-specific egg tissue data, EPA instead relied on literature transfer factors between adult and egg tissue to estimate egg (embryo) exposures based on maternal tissue concentrations. To ensure that the analysis was sufficiently conservative and inclusive of most members of the Lower Passaic River fish community, the RI/FFS BERA did use a literature-derived lipid content for lake trout (Cooke et al., 2003) rather than site-specific mummichog egg lipid content to estimate mummichog egg tissue concentrations. The ratio of the literature-derived value (8.2 percent) used by EPA for the RI/FFS BERA and the average field measured value (3.3 percent) represents the degree of conservatism (2.5 fold factor) applied to ensure that the risk results are applicable to other components of the fish community that may have higher egg lipid content on average.

If EPA were to adjust the lower and upper bound risk estimates presented in the RI/FFS BERA for the generic fish and mummichog scenarios by the 2.5-fold factor, the calculations would still show that maternal transfer of COPECs (i.e., TCDD TEQ) would result in unacceptable embryolethality (e.g., blue-sac disease). The following table summarizes the risk calculations that would result from dividing the HQs presented in Attachment 5 of Appendix D of the RI/FFS) by the 2.5-fold factor:

Scenario	LCL	UCL
Generic fish	13.7	1.2
Mummichog	7.6	0.6

Other specific criticisms of the avian egg modeling presented in the RI/FFS BERA included the suggestion that EPA should have used the Shooter's Island egg data (Parsons, 2003) rather than modeling the egg concentrations and that, contrary to EPA's conclusions in the BERA, Parsons did not report reproductive effects in the cormorant study. As discussed in the RI/FFS BERA, the Parsons data set was not used directly to estimate potential embryological tissue concentrations for birds feeding exclusively in the LPR, because the Shooter's Island cormorants most likely foraged in Newark Bay and Arthur Kill and certainly did not forage entirely in the LPR. Modeling avian egg concentrations using LPR fish tissue provided EPA with a direct potential linkage to LPR sediment chemistry. Although the Shooter's Island data set and the RI/FFS BERA modeled concentrations were similar in magnitude (generally supporting use of the empirical data to validate the modeling approach), modeled concentrations for some congeners (including overall TEQs) used by EPA were higher than detected in the cormorant data set. This finding is consistent with the assumption that the typical fish prey consumed by the Shooter's Island cormorant population (based on foraging throughout Newark Bay and adjacent water bodies) had lower concentrations of some COPECs (i.e., those COPECs sourced in the Lower Passaic River) than those detected in the fish samples collected by the CPG in 2009 and 2010 from the LPR.

The commenters concern over risks being underestimated due to the lack of maternal tissue to egg transfer factors for some COPECs is noted. Inclusion of those risks would further strengthen EPA's conclusion in the RI/FFS BERA that contaminated sediments in the lower 8.3 miles present unacceptable risks to ecological receptors and that risks are high enough to require remedial action. In the RI/FFS BERA, the representative heron was assumed to consume sediment daily, equal to 5 percent of its total prey intake, which is not "elevated" as suggested by one commenter. The selected value is at the low end for aquatic birds (ranging from < 2 to 30 percent of soil and sediment in diet).[37] Not surprisingly, empirical data for sediment probing birds represent the higher end of the range; nonetheless, herons may use this foraging technique (i.e., sediment probing) on exposed mudflats when encountering large polychaetes or mollusks.

F.2.5 Comment: Ecological Risk Assessment Approach not Consistent with 17-mile RI/FS Approach

Commenters stated that the approaches employed in the BERA (related to the use of site-specific data, data reduction rules and assessment objectives) were not consistent with the approach agreed upon by

[37] See Table 4-4 of the Wildlife Exposure Factors Handbook (EPA, 1993).

EPA and the CPG, including documents approved by EPA to guide the conduct of the 17-mile RI/FS (e.g., benthic QAPP, Data Usability and Data Evaluation Plan).

Response:

Consistent with EPA's Ecological Risk Assessment Guidance for Superfund (ERAGS) [EPA, 1997c], the RI/FFS BERA followed a streamlined approach to determine whether potential ecological risks in the lower 8.3 miles of the Passaic River were sufficiently high to warrant remedial action. Although more precise risk estimates could have been derived if the RI/FFS BERA had incorporated all relevant information collected by the CPG for the 17-mile RI/FS, the additional analysis would not have altered the conclusion that current conditions within the lower 8.3 miles pose unacceptable ecological risk. Because the RI/FFS BERA had a different and more focused objective than the 17-mile BERA, the RI/FFS BERA did not adhere to the specific planning documents associated with the CPG 17-mile BERA evaluation, nor would that have been appropriate.

Specific comments received on the RI/FFS BERA are addressed below:

1. EPA agrees that sediment core samples LPRT03F and LPRT03G, which were removed as part of Phase I of the Tierra Removal in 2012, are not reflective of current conditions. However, their elimination from the data set used for the RI/FFS BERA would have had minimal effect on the EPCs evaluated in the BERA and would not affect overall risk conclusions.
2. All PCB congeners were evaluated in the RI/FFS BERA, with coplanar congeners evaluated by quantifying the TCDD toxic equivalencies and the remaining congeners summed to estimate the Total PCB COPEC EPC. Including the coplanar concentrations in the quantification of "Total" PCB quantifications would have effectively double-counted the exposures to these congeners. While it is true that the PCB exposure to invertebrates lacking the Ah receptor that mediates dioxin toxicity in vertebrates were slightly underestimated by this approach, given the relative magnitude of the PCB hazard estimates determined in the RI/FFS BERA, this uncertainty had no impact on either the conclusion that sediment exposure poses unacceptable risks to the benthic community or the importance of PCBs in contributing to those risks.
3. Replicate samples of a percentage of field-collected samples were collected to assess sample variability attributable to small-scale spatial variability as well as sample processing procedures. The RI/FFS used the "parent" sample in the quantification of EPCs and reviewed the "replicate" sample for consistency rather than averaging the two samples as advocated by the commenters. While use of the average of replicate pairs could have resulted in slightly more precise exposure estimates, this was considered secondary to the QC function of these samples due to the small percentage of replicates in the overall data set. In addition, the selection of "parent" and "replicate" designations was done prior to chemical characterization so no consistent bias would be expected based on consistent use of the parent sample to establish the EPC. Consequently, no effect on the conclusions drawn in the RI/FFS BERA attributable to how replicate samples were handled would be expected.

F.2.6 Comment: Ecological Risk Assessment was a Screening Level Analysis that Did Not Use Site-Specific Data

Commenters asserted that EPA's BERA was a conservative assessment largely reflective of a screening-level analysis. Commenters stated that the failure to conduct a thorough analysis of all available data and site-specific information combined with extremely conservative and generic exposure assumptions and screening benchmarks results in superficial analysis not adequate for remedial decision-making.

Commenters stated that EPA's evaluation of ecological risk, and benthic effects in particular, did not incorporate site-specific data, which led to risks being overestimated. Specific concerns included the focus on screening sediment benchmarks and the omission of site-specific data including benthic toxicity and community data as lines of evidence to evaluate benthic risks; the reliance on uptake modeling and generic lipid data rather than site-specific tissue data (including worm bioaccumulation and caged bivalve [mussel] data) to assess trophic transfer; the lack of discussion of population- and/or community-level impacts; and the failure to evaluate available surface water data and sediment data collected after 2010. In addition, commenters stated that EPA's BERA failed to adequately evaluate available fish and wildlife survey data. Commenters also stated that uncertainties in the BERA evaluation are too large to reasonably draw any conclusions regarding the need for remedial actions in the LPR.

Response:

The RI/FFS BERA was developed in accordance with the 8-step process outlined in EPA's ERAGS. The SLERA[38] (Steps 1 and 2) used conservative and simplifying assumptions to reach a conclusion[39] that more than *de minimus* ecological risks exist in the lower 8.3 miles of the Passaic River and provided a rationale for additional ecological risk characterization to refine the relevant spatial/temporal aspects of these risks. Consistent with EPA's ERAGS, the RI/FFS BERA (Steps 3 through 7) employed more technically defensible exposure and effect assumptions to generate more realistic and precise estimates of ecological risk to support informed decision-making. Some of the specific examples of the refined approach are summarized in Table II.F.2.6 - 1 and cover many aspects of the BERA, including calculation of EPCs, consideration of early life stages, evaluation of spatially explicit exposures and refinement of toxicological benchmarks.

Consistent with its ERAGS, EPA used site-specific data, where available, to generate more accurate measures of ecological *exposures* and *effects*, and ultimately draw conclusions in the BERA, as follows:

1. Tissue residue data collected in the LPRSA for the 17-mile RI/FS were used in the RI/FFS BERA to derive EPCs.
2. While the overall ecological risk-based protective tissue concentration for 2,3,7,8-TCDD was based on a fish tissue residue value found in the literature (1.1 pg/g), the site-specific protective tissue concentrations for 2,3,7,8-TCDD based on oyster reproductive effects data collected by local researchers and tabulated by the USFWS (Kubiak et al, 2007) is very close to that overall number (3.2 pg/g).
3. The uptake factors used in the RI/FFS BERA to estimate future wildlife and residue-based exposures were derived using tissue data specific to the LPR.
4. In response to comment II.F.2.7, EPA analyzed SQT data collected in the LPRSA for the 17-mile RI/FS and concluded that site-specific effects information supported the determination in the RI/FFS that the benthic community is impacted relative to urban reference condition, likely as a result of chemical contaminant exposure.

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[38] The SLERA consisted of the Pathways Analysis Report (Battelle, 2007), which identified exposure parameters, receptors, and exposure pathways (among other things), and the COPEC screening analysis (Attachment 2 to Appendix D of the RI/FFS).
[39] Other possible general outcomes from the SLERA include the decision that no actionable ecological risk exists at the site (i.e., because even the use of conservative assumptions failed to identify unacceptable ecological conditions) or that the decision for a specific remedial action could be made without further risk characterization. The latter conclusion is generally only reached in special situations where the SLERA screening identifies unambiguous risks and the risk manager determines that there would be no substantive benefits of having more accurate and refined risk estimates; EPA's ERAGS provides an example of a small contaminated pond as potentially falling in this outcome category.

Where site-specific data were not available, as in the evaluation of exposure in eggs of non-forage fish and birds, the RI/FFS BERA used uptake modeling. As further discussed in the response to comment II.F.2.4, EPA found that using a literature-derived lipid content value in the uptake modeling compared to using LPR field-measured values to estimate maternal transfer of COPECs did not change the conclusion that the transfer would result in unacceptable embryolethality.

The RI/FFS BERA was not conducted in an "extremely conservative" or "generic" fashion but appropriately adjusted various elements of the SLERA to develop more realistic risk estimates necessary to support decision making for the FFS. Although conservative assumptions (which EPA deemed necessary given the nature of uncertainties in complicated estuarine habitats such as the LPR) were employed in the assessment, the magnitude of the risk estimates indicates that a conclusion that unacceptable ecological risks exist in the LPR would be reached even if less conservative values had been employed. This conclusion is supported by various analyses that were conducted to "bound" the risk estimates (e.g., heron resident status and piscivorous wildlife prey size [see response to comment II.F.2]). Although the RI/FFS BERA did not include an evaluation at the level of a SQT, the analysis provided in response to comment II.F.2.7 supports a conclusion that the benthic community in the LPR has been impacted by contaminant exposure, as EPA previously concluded using individual sediment benchmarks.

F.2.7 Comment: Ecological Risk Assessment did not use Sediment Quality Triad Dataset

Commenters stated that conducting a BERA without using available site-specific data for an SQT resulted in an overestimation of benthic community risks. In particular, commenters stated that EPA should have integrated the sediment benchmarks considered in the RI/FFS BERA with the recent benthic survey data, which were caged bivalve and laboratory bioaccumulation and toxicity test data collected by the CPG for the 17-mile RI/FS. In addition, commenters stated that EPA made no attempt to compare benthic community structure to reference areas consistent with the EPA-approved benthic QAPP developed for the 17-mile RI/FS.

Response:

To respond to this comment, EPA analyzed the SQT data set collected in the LPRSA for the 17-mile RI/FS and concluded that site-specific effects information supported the determination in the RI/FFS that the benthic community is impacted relative to urban reference condition, likely as a result of chemical contaminant exposure.

In its analysis of the SQT data, EPA developed an approach that is consistent with that used to identify reference samples during the development of a Benthic Index Biotic Integrity (B-IBI) for the NY/NJ Harbor REMAP program (Weisberg et al., 1998). Available information on surficial sediment chemistry and various biological and physical parameters were compared to screening criteria to identify a subset of sampling locations within Jamaica Bay representative of the various environmental stressors other than chemical contaminants that could affect macroinvertebrate survival and community structure. EPA identified reference stations using the following criteria: (1) laboratory bioassay results > 80 percent of negative control, (2) no exceedances of Effect Range - Median (ER-M) benchmarks, (3) no more than 3 exceedances of Effect Range – Low (ER-L), (4) TOC less than 2.5 percent and (5) dissolved oxygen > 5 ppm) (Weisberg et al., 1998).

EPA compiled available SQT data collected at REMAP stations in Jamaica Bay sampled in 1993-1994, 1998 and 2003 and identified a subset of 21 samples based on screening using the laboratory bioassay and screening benchmark criteria applied in the B-IBI approach. The TOC and DO criteria were considered habitat-related parameters that should not be the basis for defining the reference set.[40] Table II.F.2.7 – 1 presents a statistical summary of the toxicity test and community metric data for both the complete and selected subsets of reference information. EPA selected the fifth percentile of the distribution of each parameter as the benchmark for comparison to the LPRSA results, consistent with benchmarks chosen at other Superfund sites (e.g., Calcasieu Bayou).

Table II.F.2.7 – 2 presents the results of statistical comparisons using the non-parametric Mann-Whitney U Test to determine whether the available LPRSA toxicity and benthic community metric data for the estuarine zone (RM 0 to RM 4) and that portion of the transitional zone (extending from RM 4 to RM 13) that falls within the lower 8.3 miles of the Passaic River are significantly less (i.e., one-sided test) than the reference subset results. The p-Values were adjusted for ties as necessary and the tests were calculated using ProUCL version 5.0.

With one exception, amphipod toxicity and all five benthic community metrics are significantly lower in both the estuarine and transitional zones; in most cases the differences are highly significant. Only the comparison of Pielou's J metric (a measure of "equitability" or degree of comparability in the number of detected taxa) in the estuarine zone to the reference subset resulted in a determination that the two sets were statistically indistinguishable.

Tables II.F.2.7 – 3 and II.F.2.7 - 4 summarize the comparison of the reference value benchmark for each of the benthic community metrics to the sampling station results in the estuarine (RM 0-4) and a portion of the transition zone (RM 4-13) within the lower 8.3 miles of the Passaic River. Individual results for LPRSA sampling locations that are less than the reference data set are identified by shading.

A majority of the LPRSA metrics are less than the reference benchmark values. Taxonomic richness is lower in all stations in both the estuarine and transition zone compared to the reference benchmark (17 taxa) indicating that the LPRSA benthos are characterized by a less diverse assemblage of taxa. The Shannon-Wiener H' statistic is lower than the reference benchmark in all transition zone (and 68 percent of estuarine zone) sampling locations.

Sampling Area	# Stations	Abundance (per m^2)	Taxa Richness	Shannon-Weiner H'	Pielou's J'	Swartz's Dominance
Estuarine (RM 0-4)	25	19 (76 percent)	25 (100 percent)	17 (68 percent)	3 (12 percent)	2 (8 percent)
Transitional (RM 4-8)	22	10 (45 percent)	22 (100 percent)	22 (100 percent)	4 (18 percent)	8 (36 percent)

The number of metrics that are lower than the reference benchmark at stations in the estuarine and transition zone portion of the lower 8.3 miles of the Passaic River is summarized in the following table. All SQT stations in the LPR (RM 0 – 8) had one or more benthic community metric results that were lower than the Jamaica Bay reference dataset threshold values. All but two estuarine locations had multiple metrics scores that are lower than reference with stations having three metrics scoring lower being the most frequent in both the estuarine and transitional zones. Evaluation of the 17-mile RI/FS benthic community component of the SQT is fully supportive of the lower 8.3-mile RI/FFS conclusion (based on COPEC sediment chemistry) that sediment quality in the LPR poses an unacceptable risk to the benthic community.

[40] Tables summarizing the reference data evaluated as well as the subset of sampling locations that passed screening criteria are provided as Attachment G.

Sampling Area	Number of Stations with Metric Results Less than Jamaica Bay Reference Set				
	1	2	3	4	5
Estuarine (RM 0-4)	2	8	13	1	1
Transitional (RM 4-8)	0	7	8	7	0

As noted above, LPR estuarine and transitional sediments were both significantly more toxic to amphipods than Jamaica Bay reference sediments. Although the RI/FFS BERA focused on the typical conditions throughout the study area rather than individual locations as done in a SQT analysis, the statistical analysis described above also supports the RI/FFS conclusion regarding benthic health. On a station by station basis, 13 of 24 estuarine[41] locations (54%) were determined to have reduced amphipod survival relative to the Jamaica Bay reference threshold value (Table II.F.2.7-3). As with the benthic community SQT information, available toxicity data also supports the conclusions reached in the RI/FFS BERA.

Where positive indicators of toxicity, chemistry and benthic community impairment exist, the standard SQT interpretation would result in a conclusion that ecological risk is present and that it is likely attributable to contaminant exposure.

F.2.8 Comment: Toxicological Benchmarks Used were Indefensible

Commenters stated that the EPA BERA used inappropriate and technically indefensible toxicity thresholds without justification or explanation of the basis for selection, and the full range of NOAEL and LOAEL data available in the literature should have been presented and reviewed. Commenters concluded that the use of generic and inappropriate effect thresholds (sediment thresholds, CBRs and TRVs) resulted in toxicity values with low overall confidence and in an overestimation of risks. In the case of TCDD, commenters stated that use of appropriate toxicity values for TCDD would have demonstrated that this COPEC does not pose a risk to ecological receptors in the LPR. Commenters also stated that the use of a residue-based approach to evaluate metals and PAHs in biological tissue was inappropriate.

Related to application of selection criteria, commenters raised criticisms about use of laboratory exposures involving topical applications and gavage exposures that the commenters did not consider relevant to estimating field conditions. In addition, commenters stated that the use of chicken reproductive data in general and fish CBR values for TCDD raised concerns about the appropriateness of the selected results. Commenters also criticized the use of field studies to derive CBR/TRV values (where cause-effect relationships between chemical and non-chemical stressors and adverse effects are difficult to identify) and the use of extrapolation factors to develop benchmarks lower than effect concentrations reported in the literature.

Response:

The toxicological benchmarks used in the RI/FFS BERA were appropriate and technically sound, consistent with the objective of the BERA, which was to determine whether baseline ecological exposures to chemical contaminants in the sediment of the lower 8.3 miles of the Passaic River pose a

[41] The 17-mile RI/FS study design included both estuarine and freshwater species in the toxicity testing program and toxicity data for the estuarine amphipod (*Ampelisca*) are only available for three transitional zone stations (Table II.F.2.7-3).

sufficient hazard to warrant consideration of a remedial action. The values were selected using a consensus-based process between EPA and state and federal partner agencies, which involved a rigorous evaluation of the literature, including consideration and selection, in some cases, of toxicological endpoints not directly based on, but linked to, standard survival, growth and reproductive effects. As explained in the BERA (Appendix D of the RI/FFS), EPA's identification of toxicological values focused on conservative but realistic effect threshold levels. Rather than derive toxicological benchmarks representative of the broad range of literature values, the RI/FFS BERA used best available conservative values. As explained in the response to comment II.F.2.7, a re-analysis of the appropriateness of the sediment benchmarks selected to evaluate the benthic community endpoint was conducted by EPA. This re-analysis demonstrated a reasonable degree of correspondence between predictions of toxicity based on benchmark exceedances and biological measures of effect (both laboratory toxicity and community metrics).

A number of comments related to the type of toxicological data selected to evaluate ecological effects in the RI/FFS BERA. EPA's selection and use of gavage studies or topical applications does assume that the exposure dose/concentration at the target organ(s) in the studies are meaningful in a natural environmental setting. Use of field study data with multiple potential chemical stressors potentially present assumes that the contaminant in question is responsible for a particular biological response. Also, the use of non-standard toxicological endpoints (e.g., behavioral taxis effects in fish) assumes that these are significant in terms of survival, growth or reproduction. While contributing uncertainty to the analysis, EPA's use of these types of studies was appropriate and consistent with the RI/FFS BERA objectives.

The criticism of EPA's use of extrapolation factors to identify toxicological thresholds lower than those reported in the literature implies that relevant and properly conducted toxicological studies concerning all relevant receptor/endpoint/exposure combinations are available in the literature; and that use of toxicological extrapolation is never warranted due to their associated uncertainties. However, for the RI/FFS, EPA determined that it was necessary and consistent with professional practice to use extrapolation factors to estimate a no-effect threshold dose or concentration when the most appropriate toxicological study failed to report a NOAEL estimate. Although this practice introduces some uncertainty, that uncertainly is outweighed by the benefit of providing bounding risk estimates important in risk management decision-making and PRG development.

The fish CBR selected for the TCDD TEQ COPEC was based on a study by Couillard et al. (2008) that involved the topical application of PCB-126 to mummichog eggs. Larval mummichog derived from eggs topically applied with 0.1 µL of 100 pg PCB-126/L had a tissue residue of 710 pg/g ww (Couillard et al. 2008). The study NOAEL and LOAEL are based on eggs treated with 25 pg/L and 50 pg/L, so assuming linear relationship between egg treatment and larval tissue residue, this equates to larval tissue residues of 180 and 360 pg PCB-126/g ww, respectively. Larval concentrations were converted to TCDD toxic equivalency by multiplying by the World Health Organization fish TEF (i.e., 0.005). No extrapolation factors were applied due to the conservative nature of the endpoint. The commenters objected to the use of the Couillard study, because the only dose-response effect observed was reduced prey capture ability in larval fish. EPA determined that the study was the most appropriate basis for CBR development, because the test species occurs in the LPRSA and had been selected by EPA as a representative species to evaluate risks to the forage fish trophic level in the RI/FFS BERA. As noted above, use of non-standard endpoints generally assumes that exposures also affect other population-relevant endpoints (which were not necessarily measured in a particular study).

Commenters also critiqued the use of chicken studies as the basis for toxicological thresholds for TRVs and CBRs (egg CBRs). Although both benchmarks were derived using robust meta-reviews of existing literature conducted by EPA and are based on ecologically important endpoints with obvious population-level significance, the commenters were concerned that the chicken is overly sensitive to dioxin-like effects and as a result is not suitable for estimating effects in native populations. This source of uncertainty was discussed in detail in the RI/FFS BERA along with a summary of recent studies that have evaluated the relationship between avian TCDD sensitivity and genotype differences in the AhR1 ligand-binding domain. Based on review of AhR1 genotypic variants in 86 avian species, three variant categories (1, 2, and 3) of decreasing sensitivity to dioxin-like compounds have been reported (Farmahin, 2013a). The domestic chicken (along with four other species) is Type 1, the ring-necked pheasant is Type 2 and species such as herring gull, double-crested cormorant and great blue heron (all potential avian receptors) are Type 3. For the starling, which is also Type 1, egg injection studies with PCB-126 confirmed a high sensitivity to the embryotoxic effects of dioxin-like compounds; the *in ovo* PCB-126 LD_{50} value was 5.6 ng/g for the starling compared to an average LD_{50} of 1.1 ng/g for the chicken (Eng et al., 2014). Using hepatocyte assays, starlings were found to be as sensitive as chickens to 2,3,7,8-TCDD, but the starlings were less sensitive than chickens to 2,3,4,7,8-pentachlorodibenzofuran (2,3,4,7,8-PeCDF) and 2,3,7,8-TCDF (Farmahin et al*.,* 2013b). The lack of obvious phylogenetic relationships among the Type 1 birds (chicken, starling, hummingbird and catbird) suggests that taxonomic relatedness is not necessarily a strong predictor of relative sensitivity. Fujisawa et al. (2013) studied relevant amino acid sequences of the aryl hydrocarbon receptors for 20 diverse avian species without finding a correlation between taxonomy or phylogeny, further suggesting that sensitivity to dioxin-like compounds is independent of avian taxonomy. Moreover, relative potencies of different dioxin-like compounds can vary unpredictably. Cohen-Barnhouse and coworkers (2011) performed egg-injection studies in which Japanese quail, common pheasant and chickens were exposed *in ovo* to TCDD, PeCDF and TCDF. LD_{50}-based relative potencies of PeCDF and TCDF were 6.1 and 2.0 picomole per gram (pmol/g) for quail, 5.7 and 2.9 pmol/g for pheasant, and 0.88 and 2.0 pmol/g for chicken, respectively. TCDD was not the most potent compound among the species tested, with PeCDF and TCDF being more potent than TCDD in the quail and pheasant. TCDF was the most potent in chicken. Species sensitivity was as expected for TCDD and TCDF, whereas for PeCDF, the chicken and pheasant were similar in sensitivity and both were more sensitive than the quail.

While avian sensitivity to compounds with dioxin-like properties may range over several orders of magnitude (EPA, 2003; Farmahin et al., 2013c), the developing appreciation of the complexity of the AhR system and its central role in both contaminant detoxification and vascular development in both endocrine and immune systems (Stevens et al., 2009; Vondracek et al., 2011) supports a conservative approach for developing dioxin effect thresholds. Risk uncertainties are exacerbated by the limited number of bird taxa that have been tested for embryological effects of dioxin exposures and the absence of apparent phylogenetic relationships in sensitivity. The limited toxicological data set on immunological threshold levels also supports a conservative basis for quantifying risks due to early life stage exposures. Grasman et al. (2013), who noted that there have been inexplicable declines in breeding waterbirds within western New York/New Jersey Harbor between 1996 and 2002, reported strong negative correlations with T lymphocyte function and dioxin and PCBs in herring gull livers and suggested that these chemicals were contributing to the immunosuppression in New York Harbor birds.

Commenters also provided detailed criticisms about other toxicological benchmarks:

1. Tissue-residue approach for metals – Although CBRs were based on technically-appropriate literature studies, greater uncertainty exists related to interpretation of CBR data for copper and lead, as compared to mercury. It is likely that the hazard quotients represent an upper

bound to the potential residue-based risks to fish receptors in the LPR. In consideration of these elevated uncertainties, neither copper and lead were included in EPA's remedial decision-making process, which was limited to mercury, Total DDx, total non-dioxin-like PCB congeners, 2,3,7,8-TCDD and TEQs based on dioxin/furan and coplanar PCB congeners.

2. Tissue-residue approach for PAHs in fish tissue – There is uncertainty associated with the interpretation of CBR data for PAHs in fish tissue due to metabolism concerns. Nonetheless, PAHs are known as potential tumor-inducing agents with survival and reproductive consequences in exposed fish populations. In addition, certain PAHs and their metabolic products are embryotoxic so to ignore these contaminants as commenters suggest is inappropriate. As noted above, EPA recognized the uncertainty associated with the use of these benchmarks and elected to derive ecological-based PRGs on the subset of COPECs for which the risks are of largest magnitude and most certain.
3. Use of non-standard endpoints – commenters indicated that use of ecological effect endpoints other than survival, growth or reproduction is inappropriate. EPA carefully considered this issue, and where "non-traditional" endpoints were selected, EPA concluded that a clear linkage was made to one of the three standard ecological endpoints with population-level significance. For example, commenters argued that selection of behavioral endpoints (such as preference by salmon smolt to migrate towards seawater) for PCBs, is not relevant to the selected assessment endpoints for the RI/FFS BERA. However, the loss of appropriate taxis response has obvious survival effects if juvenile fish do not reach estuarine habitat or are delayed in doing so.
4. Use of inappropriate receptor taxa or tissue media – commenters stated that individual studies were used to develop toxicological benchmarks. This critique assumed that only taxa that are expected to occur in the LPR should be the used for this purpose. Specific examples include use of tissue-residue effect data for salmonids (including lead, dieldrin and Total PCBs) and chickens (HMW PAHs and Total PCBs) and dose-response data for chickens (Total PCBs). Although these specific taxa may not be exposed to LPR sediment contaminants, they are representative of other sensitive receptors for which appropriate ecotoxicological data are lacking. Risk could be substantially underestimated for some receptors if only data for species that have been observed at the site were used in a risk assessment. Another commenter criticized use of cormorant egg tissue data to validate avian egg modeling conducted in the RI/FFS BERA because the cormorant was not a receptor included in the CPG Problem Formulation Document developed for the 17-mile RI/FS. This overlooks the questions of data availability and implies that only "perfect" information should be considered in the assessment.
5. The RI/FFS BERA relied on alternative species to represent certain receptor classes (most of which lack relevant toxicological data). Commenters argued that use of a quail study, which underwent extensive peer review during the process of being vetted for inclusion in the Ecological Soil Screening Level for lead (EPA, 2005b), was inappropriate because the species is not representative of effects in wild birds. The comment suggested that the only species that have been documented as occurring at the area under investigation would be appropriate for study selection. This comment, offered without technical justification, would eliminate the majority of ecotoxicological literature and is certainly not consistent with the use of laboratory animals to develop toxicity values in human health assessment. [42] On a similar note, while American eel does not spawn in the LPR, EPA appropriately used American eel lipid values to model fish embryo COPEC exposures in the generic fish scenario to ensure that the model

[42] The ideal toxicological data (matching the specifics of the evaluated exposure conditions and receptor characteristics – species, age, sex, health) are rarely available and in most cases the selected values will have various uncertainties that need to be acknowledged when interpreting the findings of the assessment.

estimates were representative of other species (including those that have above average lipid contents).

6. In some cases, EPA selected biological response data derived from empirical (field) studies (e.g., avian dietary TRV for Total DDx) for use in the BERA even though there was greater uncertainty in the nature of the relationship between the observed biological response and contaminant exposure and specific chemical stressors, compared to controlled laboratory studies. For the RI/FFS BERA, EPA concluded, based on best professional judgment, that the benefit of using relevant population-level biological responses based on empirical studies (where it is impossible to limit exposures to just a particular contaminant of interest) outweighed the uncertainty related to interactive effects and effects of multiple chemical stressors.
7. Contaminant exposure extrapolation – commenters noted that in some cases, EPA assumed that tissue residues in a tissue medium evaluated in the BERA could be inferred by available data for another tissue matrix. For instance, EPA used COPEC concentrations in the plasma of cormorant eggs collected from Shooter's Island to estimate whole egg concentrations for the purpose of validating modeled egg concentrations. This type of assumption is routinely used in Superfund BERAs (where analytical data are unavailable) and is valid and reasonable as long as the attendant uncertainties are acknowledged and considered when evaluating the analysis, as they were in the RI/FFS.

F.2.9 Comment: Sediment Benchmark for Dioxin for Oysters was Inappropriate

Commenters asserted that the sediment benchmark for 2,3,7,8-TCDD for oysters is flawed, misleading and inappropriate for characterizing risks to invertebrates. Commenters questioned whether the Wintermyer & Cooper study could be considered "site-specific." Commenters challenged both the appropriateness of invertebrate-based sediment benchmarks for TCDD as well as the robustness of the data set used in its derivation.

Response:

Oysters appear to be particularly sensitive to 2,3,7,8-TCDD, with laboratory studies indicating that significant reproductive effects (e.g., altered gonadal and embryonic development) result following exposure to 2 parts per trillion (Wintermyer and Cooper, 2003). Several hypotheses have been advanced to explain how 2,3,7,8-TCDD adversely affects gametogenesis in oysters, with the principal hypothesis being that 2,3,7,8-TCDD disrupts the cell cycle, causing alterations in cell division and ultimately development by an AhR-independent mechanism (Butler et al., 2004; Wintermyer et al., 2005). Wintermyer and Cooper (2007) suggest that a receptor or a heat shock protein could mediate the toxic effects of 2,3,7,8-TCDD during gonadal development. 2,3,7,8-TCDD preferentially accumulates into the gonad of bivalve mollusks such as *Crassostria virginica* and *Mya arenaria* and the sensitivity of the gonad maturation (i.e., differentiation) endpoint is posited to be due to disruption of crosstalk between highly conserved steroid, insulin and metabolic pathways (Cooper & Wintermyer, 2009). Therefore, there is no basis for the comment that dioxins/furans are not toxic to benthic invertebrates.

There is also no basis for the comment that restoration of oyster beds in areas downstream of the Passaic River, including Newark Bay, is unrealistic. Historically, the Eastern oyster was a dominant component of the benthic fauna throughout the New York/New Jersey Harbor Estuary in mid- to low-salinity zones, including tidal rivers such as the Lower Passaic River. In the 1880s, it was estimated that oysters covered an area of over 100,000 hectares. The Eastern oyster is still present in the Lower Passaic River (1 individual was collected in spring 2010 at Station 4A and a total of 8 individuals were collected at Stations 4A and 5B during summer 2010; Windward, 2014) and was observed during the 2014 NBSA

Reconnaissance Survey at the mouth of the Hackensack River in large numbers and immediately north of the Upper Bay Bridge above Port Newark. In addition to their historical importance in terms of numbers and biomass and their continued presence in the system, bivalves represent an important contaminant exposure pathway particularly relevant in high energy tidally-influenced rivers where a significant load of contaminant-bound suspended sediments is present in the water column.

The USFWS (Kubiak et al., 2007) derived a sediment benchmark of 3.2 pg/g for 2,3,7,8-TCDD based on reproductive effects in Eastern oyster using the following equation:

$$SB = \frac{\left(C_{oyst-lip} \times f_{soc}\right)}{\left(BSAF\right)}$$

Where:

SB	=	sediment benchmark
$C_{oyst\text{-}lip}$	=	lipid-normalized threshold effect concentration in oyster tissue
f_{soc}	=	fraction of organic carbon in sediment
BSAF	=	biota sediment accumulation factor (the ratio the lipid normalized concentration in oyster tissue to organic carbon normalized concentration in sediment)

The threshold effect concentration was estimated based on published data from Wintermyer and Cooper (2003), as shown in Section III.B.2. There is an order of magnitude range in the estimated sediment benchmarks presented in Table III.B.3 - 3 and the selected value used to estimate invertebrate risks in the RI/FFS BERA (i.e., 3.2 pg/g) is near the upper end of the range.

Sample size is the most obvious limitation of the study, but defining the appropriate measure of sediment exposure is another challenge. In the derivation of the sediment benchmark, the USFWS evaluated the Wintermyer and Cooper biological response data and combined this with sediment chemistry from nearby CARP sampling stations in the Arthur Kill, as shown in Section III.B.2. Although uncertainties are relatively high, the USFWS also calculated sediment benchmarks using suspended sediment data for Newark Bay and the Arthur Kill (also shown in Section III.B.2). The estimated sediment benchmark using the suspended sediment data was 3.7 pg/g, which is quite comparable to the value using bed sediment chemistry (3.2 pg/g). Although the Wintermyer & Cooper 2003 oyster tissues also accumulated other contaminants with potential reproductive effects, later studies of biological response in oysters under controlled laboratory settings (Wintermyer & Cooper, 2007) supported the assumptions that the field responses were due to 2,3,7,8-TCDD.

A follow-up study (Wintermyer and Cooper, 2007) evaluated the development toxicity of 2,3,7,8-TCDD to Eastern oyster under controlled laboratory exposures. This study determined that significant histopathological lesions that resulted in complete inhibition of gonadogenesis followed from whole body exposures of 10 pg/g in both male and female oysters. For perspective, another bivalve, soft-shell clam (*Mya arenaria*), was sampled from Newark Bay (Brown et al., 1994) in the late 1980s and contained 2,3,7,8-TCDD at concentrations ranging from 11 to 22 pg/g. While other dioxin-like compounds have been detected or are assumed to be present in field-deployed oysters, considerable uncertainty remains regarding the toxicological significance of these co-occurring contaminants because no uniform TEF have been generated with any invertebrate. Proteins similar to the vertebrate AhR in binding, but less so in structure, have been found to be abundant in the gills and gonads of several bivalve mollusks.

A body of literature supports the toxicological significance of exposure to dioxin and other lipophilic organic contaminants (e.g., PCBs and PAHs) in impairment of reproductive function in mollusk species (Brown, 1991; McDowell et al., 1999; Hwang et al., 2002; Hwang et al., 2008; Frouin et al., 2007). In a review of extant literature on effects of TCDD on mollusks, Wintermyer and Cooper (2007), argued that this taxon is as sensitive to dioxin effects on gonad development, embryonic development and lesion development in epithelial tissue as vertebrate species. It was suggested that the molluscan sensitivity of gonadal maturation was due to the ability of dioxin and other compounds with dioxin-like characteristics to disrupt interactions between highly conserved steroidal and metabolic pathways (Ohtake et al., 2008). Van Beneden and coworkers (Rhodes et al., 1997; Butler et al., 2001; Butler et al., 2004; Van Beneden et al., 1999) have studied the aryl hydrocarbon receptor (AhR)-independent genotoxic effects of 2,3,7,8-TCDD on softshell clam (*Mya arenaria*) reproductive tissue. Similar mechanisms are believed to provide the causal link between other contaminant classes (PAHs and PCBs) and reproductive effects in oysters (Geffard et al., 2002; Geffard et al., 2004; Jo et al., 2005; Jo et al., 2008; and other bivalves (Di et al., 2011; Frouin et al., 2007; Lehmann, 2006; Lehmann et al., 2007; Chu et al., 2003).

F.2.10 Comment: Editorial Comments on Ecological Risk Assessment Report

A commenter provided a number of non-substantive editorial comments on the text of the FFS ecological risk assessment, including replacing individual words with similes, moving tables from one page to another, suggesting different symbols for figures and similar changes.

Response:

EPA does not anticipate revising the BERA for stylistic reasons. The responsiveness summary generally responds to substantive comments.

G. Preliminary Remediation Goals, Remediation Goals and Background

G.1. Preliminary Remediation Goals and Remediation Goals

G.1.1 Comment: Derivation of PRGs for PCBs Inaccurate

Commenters stated that the approach used by EPA to calculate PRGs for PCBs using modeled fish and crab tissue COPC concentration estimates based on Aroclor sediment data has two shortcomings: a) it likely underestimates the actual Total PCB sediment and (by extension) fish and crab tissue concentrations; and b) it precludes an accurate analysis of Total PCB risk consistent with EPA guidance, whereby the risk and hazard of both dioxin-like and non-dioxin-like PCBs is calculated. Ultimately, the effect of these shortcomings is the derivation of PCB PRGs that are not protective of exposures to Total PCBs. The commenters suggested that EPA should update its PCB PRG calculations to accurately and completely account for the risk and hazard from Total PCBs.

Response:

EPA derived the risk-based tissue concentration for Total PCBs in accordance with the RAGS (EPA, 1991b) by rearranging the risk equations used in the HHRA to solve for the biota concentration that would result in the NCP target risk range of 10^{-4} to 10^{-6} and a target HQ for noncarcinogenic effects of 1 (based on the same exposure parameters as used in the HHRA). Then, sediment concentrations (i.e., PRGs) required for biota to meet the risk-based tissue concentrations were estimated using regression analysis (relationship between sediment and tissue COC concentrations) developed for the lower 8.3 miles (as discussed in DER No. 6 in Appendix A of the RI/FFS and response to comment II.D.4.2). The regression analysis used to determine the site-specific relationship between sediment and tissue COC concentrations was derived by using Aroclor data for both sediment and tissue.

EPA developed empirical regression-based relationships between sediment and tissue using site-specific data in conjunction with data obtained from the 1998 and 2003 NY/NJ Harbor EPA's REMAP program and from the 1998 to 2000 CARP program. Biota tissue samples from the CARP program were also obtained from these areas. These regions include Upper New York Bay (Upper Bay), the Hudson River off Manhattan, Jamaica Bay and Raritan Bay. These areas were chosen because there were sufficient numbers of samples for both biota and sediment in each area to be considered spatially representative and therefore appropriate for inclusion in the regression calculations. Combining Lower Passaic River data with that from the NY/NJ Harbor allowed the regression analyses to cover a wide range of exposure concentrations. Where the data sets were more limited or did not span a wide range of concentrations, a relationship was developed through the estimation of a BSAF.

PCB analytical chemistry results were available in a number of forms depending on the data set, including Aroclor, congener and homologue concentrations. Of the three forms, only Aroclor results were reported for nearly all samples considered (sediment and tissue) across all sampling programs. Only the 2003 REMAP sediment data set did not have Aroclor data. The use of this data set is addressed below. Since Aroclor-based results were available in all but one of the data sets used, Aroclor results provide an internally consistent basis for comparing fish tissue concentrations with those in sediment. Thus, the regressions to determine a BSAF for PCBs were run on the sum of Aroclors. The sum was defined as the sum of detected Aroclors. Non-detect results for individual Aroclors were not included in the sum. Data were compiled in this manner for both biota tissue and sediment. Thus, in the development of the BSAFs for PCBs, Aroclor concentrations in sediment were correlated to Aroclor concentrations in biota tissue.

Instead of using literature-based uptake factors, EPA developed site-specific tissue-sediment relationships to estimate bioaccumulation. (See response to comment II.D.4.4.) The use of Aroclor data, a more comprehensive data set than the available PCB congener data, reduced uncertainty in developing the PCB PRGs. The development of site-specific regression-based relationships is preferable over the use of generic literature values. Literature values may under or overestimate the extent of biological uptake because site conditions that affect contaminant bioavailability and uptake potential are not considered, cannot be easily measured, or cannot be reflected in non-site-specific relationships.

G.1.2 Comment: Deriving PRGs Using "Rule of Five" Inappropriate

Commenters stated that the use of the "rule of five"[43] as a justification for determining PRGs in order to use the geometric mean of the NOAEL and LOAEL (or high and low TRV value in some cases) to establish a PRG was not appropriate.

[43] The geometric mean is equivalent to the fourth node in a geometric progression consisting of seven elements; the "rule of five" methodology allows for derivation of alternative PRGs by selecting different nodal values depending on risk management requirements. See EPA, 2007 for more information.

Response:

EPA disagrees that the use of geometric means (e.g., of NOAEL and LOAEL-based TRVs) in back-calculations to derive risk-based remediation goals is inappropriate. The comment fails to describe why such an approach might be inappropriate. Geometric means have often been used in developing threshold estimates. For example, in providing guidelines on the development of national water quality criteria, Stephen et al. (1985) noted that chronic values could be obtained by calculating the geometric mean of the lower and upper limits from a chronic test. The maximum acceptable toxicant concentration, which is based on the geometric mean of LOEC and NOEC type toxicity tests results, has been used in ecological risk assessments including Cleveland et al. (2002), Fuchsman et al. (2010), and Jepson et al. (2014).

EPA's Greenberg and Charters (EPA, 2007) have previously noted that it is inappropriate to base a clean-up goal on either an NOAEL or LOAEL-based value. These authors recommend using one of the five "points" between the NOAEL or LOAEL value, based on a geometric progression, as was done for the RI/FFS BERA. More specifically, if the NOAEL and LOAEL values are based on sub-lethal chronic effects, the third point above the NOAEL value should be used, which is equivalent to the geometric mean. Geometric means relative to arithmetic means are biased toward the NOAEL values, which can be viewed as being "appropriately conservative" and providing an "intended level of protection from a regulatory perspective."

G.1.3 Comment: PRGs Were Inappropriately Low Due to Overly Conservative Assumptions

Commenters stated that tissue PRGs were inappropriately low due to the overly conservative RME and toxicity assumptions that were used (in the RI/FFS HHRA) and consequently, these PRGs are not attainable, especially for PCBs and methyl mercury because levels of PCBs and methyl mercury in fish collected from the background area above Dundee Dam exceed even the highest (least stringent) PRGs developed by EPA. In addition, commenters stated that EPA did not include PRGs based on the "average" (or CTE) consumer of fish or crab, resulting in an incomplete and overly stringent set of PRGs.

The commenters noted that the fish species selected in the FFS for the development of tissue PRGs (white perch and American eel) resulted in lower sediment PRGs than those calculated using the four species that EPA has directed the CPG to use in the 17-mile RI/FS (white perch, American eel, bass, and catfish). In addition, commenters stated that because many consumers eat only crab muscle, goals based on the ingestion of just muscle should also be presented and the time to achieve these goals should be estimated for each alternative.

Commenters stated that EPA developed sediment PRGs based on incorrect assumptions and erroneous calculations and did not present a clear methodology. They stated that it appears that the sediment PRG calculated for TCDD TEQ by EPA is incorrect by a factor of 2 (7.1 pg/g vs. 14 pg/g for fish consumption, using the methods described in EPA's LPR FFS PRG document), and that EPA should revise its PRG using the correct calculations.

Finally, the commenters stated that EPA selected risk-based PRGs for sediment that are lower than the background levels established for sediment, which is inconsistent with guidance that states that cleanup below background levels is not required under CERCLA (EPA, 2002a).

Response:

EPA does not agree with the commenter's statements regarding the overly conservative nature of the PRG levels. Consistent with OSWER Directive 9355.0-30 (EPA, 1991c), the need for remedial action is based on the results of the RME scenario. As such, remediation goals should be based on RME, not CTE, assumptions. The exposure assumptions and toxicity values employed in the RI/FFS HHRA were used in the calculation of the risk-based biota tissue concentrations. For more discussion of issues regarding the conservative nature of the exposure parameters and toxicity values employed by EPA, the reader is referred to responses to comments II.F.1.1 and II.F.1.9, respectively. For a discussion of the use of fish data from above Dundee Dam, see response to comment II.G.2.2.

The sediment PRGs identified in the RI/FFS and the 17-mile RI/FS were determined using two different models. For the RI/FFS, sediment PRGs were derived using empirical regression-based relationships between sediment and tissue; where the data sets were more limited or did not span a wide range of concentrations, a relationship was developed through the estimation of a BSAF. For the 17-mile RI/FS, a bioaccumulation-based mechanistic model is being used in lieu of the sediment-tissue regression relationships. The commenters' (CPG's) bioaccumulation model is still in development as part of the 17-mile RI/FS and as of February 2016 has not been approved by EPA for use. However, the use of the less conservative exposure parameters and toxicity values by the commenters in calculating their PRGs may be sufficient to explain how the commenters reached such different magnitudes in PRGs, regardless of the different biota/tissue relationships identified for each of the investigations.

Fish species selected for PRG development hinged on the availability of the necessary data, as well as the importance to human consumption. The four species evaluated in the RI/FFS HHRA and identified for detailed analysis were selected based on the spatial and temporal availability of measurements, their importance to human consumption and their trophic level; the latter criterion in order to represent the Lower Passaic River estuarine food web. A species' trophic position such as detritivore, benthivore, and piscivore strongly influences the nature of environmental exposures encountered by organisms and ultimately the accumulation of bioavailable compounds in their tissues. In the end, the four species (i.e., blue crab, mummichog, white perch, and American eel) with the greatest number of samples (ranging from 72 to 169 samples) were selected since they spanned a broad range of trophic levels while also having a large number of samples to support both spatial and temporal analyses.

Derivation of the risk-based tissue concentration for blue crab was based on ingestion of both hepatopancreas and muscle primarily because PRGs must be protective of the RME individual, which as evaluated in the RI/FFS HHRA, was an individual consuming both tissue types. In addition, EPA's assumptions were appropriately consistent with the assumptions used by NJDEP to develop advisories for crab consumption. Even though NJDEP's advisories for crab consumption include narrative recommendations for cooking practices to remove the hepatopancreas to reduce potential exposure, the advisories themselves are calculated based on consumption of the whole crab. A review of EPA guidance on fish and shellfish consumption advisories indicates that NJDEP's approach with respect to crab consumption is consistent with most other states' shellfish consumption advisories. Since NJDEP is unlikely to issue advisories specifically for consumption of crab muscle, it is inappropriate to establish PRGs based on ingestion of only crab muscle.

The comment that the TCDD TEQ sediment concentration calculated by EPA is incorrect by a factor of 2 (7.1 pg/g vs. 14 pg/g for fish consumption) is inaccurate. The step by step instructions below explain how a sediment value of 7.1 pg/g was calculated. The table provides a summary of the input parameters used to derive the sediment PRG determined for the noncancer endpoint for TCDD TEQ. Note that while this response addresses a comment that specifically referred to a remediation goal of 7.1 pg/g as provided in the Proposed Plan, EPA's recalculation of the PRGs based on updated default exposure parameters (as discussed in response to comment II.F.1.5) has resulted in a dioxin remediation goal of 8 pg/g.

Steps followed to calculate a sediment PRG are:

1. Sediment concentrations are entered so that the calculated tissue concentrations when averaged come as close to the TCDD TEQ fish tissue concentration of 1.4 ng/kg as possible.

2. Tissue concentrations are calculated using this equation based on the regression analysis for both American eel and white perch:

$$\text{Calculated Tissue Concentration} = e^{\wedge}\left[\beta_0+\beta_1\times\ln\left(\frac{sed\ conc}{foc}\right)+\beta_2\times\ln(f_L)\right]$$

3. For purposes of developing sediment PRGs, it is assumed that tissue concentrations are based on target fillet tissue concentrations rather than whole fish tissue concentrations for the white perch and American eel. The regression analyses for the American eel, however, were conducted using whole body samples because the number of fillet samples was not sufficient to develop a robust relationship between sediment and tissue concentrations. Therefore, chemical-specific "fillet multipliers" are applied to the American eel tissue concentrations to convert the whole tissue concentrations to fillet tissue concentrations. The American eel TCDD TEQ adjustment factor is 0.6.
4. Similar to step one, the calculated tissue concentrations (highlighted in yellow) are averaged as the sediment concentrations are input in order to come as close as possible to the fish tissue concentrations of 1.4 ng/kg (Table 1-8 in Appendix E of the RI/FFS). The sediment concentration that equates to average calculated tissue concentrations equaling 1.4 is the PRG for sediment.

Target Level	Species	$ß_0$	$ß_1$	$ß_2$	Sediment Concentration (ng/kg)	f_{OC} unitless	f_L unitless	Calculated Tissue Concentration (ng/kg)	Application of the Fillet Multiplier(b) (ng/kg)	Average AE and WP Tissue Concentration (ng/kg)	TCDD TEQ PRG_{Tissue} (ng/kg)
HQ=1	AE	0.0916	0.6344	1.1817	7.10	0.047	0.067	1.09	0.65	1.4	1.4
	WP	-0.0039	0.9537	1.3431	7.10	0.047	0.050	2.15	N/A		

AE – American eel
WP – white perch
β terms represent exponents on the various factors (i.e., regression coefficients).
f_{OC} – fraction of total organic carbon in the sediment in g organic carbon/ g sediment.
f_L – fraction of lipid in the animal (unitless).
HQ- hazard quotient.
ng/kg – nanogram per kilogram, or parts per trillion (ppt), or pg/g.
PRG_{Tissue} – concentration in tissue.

The Dundee Dam (RM 17.4) physically isolates Dundee Lake and other Upper Passaic River sediments from Lower Passaic River influences. Conditions above Dundee Dam meet EPA's definition of "background" as constituents or locations that are not influenced by releases from the site, including both anthropogenic and naturally derived substances. While the Superfund program generally does not clean up to concentrations below natural or anthropogenic background levels, in the Lower Passaic River, the flow of water and suspended sediment over Dundee Dam is just one of many contributors of surface water and sediment to the lower 8.3 miles. Sediment particles coming from above Dundee Dam make up about one third of particles in the lower 8.3-mile water column. When those particles flow down to the lower 8.3 miles, they mix with the other particles in the system (including cleaner particles in the water column that would result from a remediated lower 8.3 miles); after they are deposited, they also mix with the clean material placed on the river bed as part of remediation. So contamination in the top six inches (the BAZ can end up being less than the background concentrations coming over Dundee Dam, as predicted by the mechanistic model developed by EPA to support its analyses in the RI/FFS and Proposed Plan and the model updated in response to comments (see Attachment E) to support the ROD.

While COCs (particularly PCBs) entering the lower 8.3 miles from above the dam and other incoming COCs, such as from Newark Bay and the Lower Passaic River above RM 8.3, are relatively small contributors of COCs to the recently deposited surface sediments of the lower 8.3 miles, as compared to the resuspension of lower 8.3-mile sediments, they will be more important contributors to recontamination of an implemented remedy for the lower 8.3 miles, particularly in the case of the selected remedy. EPA expects that overall COC concentrations will decline over time as the Lower Passaic River above RM 8.3 and Newark Bay are remediated through actions selected after the completion of the 17-mile RI/FS and Newark Bay RI/FS, respectively. Furthermore, EPA expects that actions taken under the Clean Water Act will address PCBs and other COCs above Dundee Dam by working with NJDEP to identify and mitigate these loadings. Such actions, taken while the remedy for the lower 8.3 miles is being designed and implemented, will reduce the incoming COCs and minimize the degree of recontamination, allowing the selected remedy to achieve protectiveness.

G.1.4 Comment: Alternative PRGs

Purporting to improve on what they described as the overly simplistic approach used by EPA to derive PRGs, the TMO commenters derived PRGs protective of human health using a self-described “state-of the- science approach.” The TMO commenters stated that they used an empirical bioaccumulation model to estimate current and future fish tissue concentrations of TCDD or PCBs based on various TCDD or PCB concentrations in sediment that represented candidate PRG values. The TMO commenters used an iterative approach to evaluate candidate PRG values to identify fish tissue concentrations that resulted in cancer risks equal to or less than 1×10^{-4} and noncancer hazard estimates less than 1.0. The commenters’ approach included a probabilistic component for deriving protective fish tissue concentrations for the consumption exposure route. The TMO commenters stated that their analyses showed that a sediment PRG of 1 ppb for TCDD is protective for cancer risks and noncancer hazards associated with fish and crab consumption. Conducting a similar analysis but focusing on PCB-containing sediments, the TMO commenters proposed a Total PCB sediment PRG of 0.7 ppm as health protective. The TMO commenters also submitted a spatial analysis purporting to show a sediment remediation scenario based on a PRG of 1 ppb TCDD that would require remediation of only 9% of the sediment area from RM 0-8.

Response:

The PRA component of the TMO commenters’ evaluation relied on assumptions for fish ingestion rates and cooking loss that are significantly different from the assumptions EPA used in the RI/FFS HHRA. The commenters’ assumptions were inconsistent with EPA’s guidance, policies and guidelines for developing PRGs for the RME individual for the following reasons:

- Ingestion rates – the TMO commenters used 8.9 g/day vs. EPA's 34.6 g/day (which equates to approximately 14.3 meals per year vs. the 56 meals per year that EPA determined is the appropriate value for the RME individual).
- Cooking loss – the TMO commenters assumed cooking loss, while EPA does not assume cooking loss for RME scenarios based on the variability and uncertainties associated with the individual cooking practices.

In addition, the toxicity values used by the commenters for TCDD also substantially contributed to the difference between the TMO commenters' PRGs and those calculated by EPA for the RI/FFS:

- Cancer Toxicity values – for TCDD, the TMO commenters used a CSF of 9,700 per $(mg/kg\text{-}day)^{-1}$, while EPA used 150,000 per $(mg/kg\text{-}day)^{-1}$. The cancer slope factor used in TMO commenters' PRA does not meet the criteria outlined in OSWER Directive 9285.7-53 (EPA, 2003).
- Noncancer Toxicity values - for TCDD, the TMO commenters used a RfD of 2.3×10^{-9} mg/kg-day, while EPA used 7×10^{-10} mg/kg-day. EPA relied on a Tier 1 toxicity value from the IRIS database as identified in the OSWER Directive in the selection of the oral RfD.

The use of these alternate key parameters by the TMO commenters is inconsistent with EPA Superfund risk assessment guidance, guidelines and policy. EPA provides a thorough explanation as to why the commenters' proposed cancer and noncancer toxicity values described above are not acceptable for use in the HHRA in response to comment II.F.1.9. The use of the commenters' proposed ingestion rate and cooking loss to compute the PRG are not acceptable to EPA as discussed in detail in responses to comments II.F.1.1 and II.F.1.3, respectively. EPA's review of the PRA is discussed in response to comment II.F.1.13.

Since the sediment PRGs of 1 ppb for 2,3,7,8-TCDD and of 0.7 ppm for Total PCBs derived by the TMO commenters were not calculated following EPA Superfund guidance, guidelines and policy, it follows that the spatial analysis conducted by the TMO commenters that concluded that only 9 percent of TCDD-contaminated sediment and 71 percent of PCB impacted sediment would require remediation based on those PRGs cannot be relied on to assess the extent of contamination.

G.1.5 Comment: Derivation and Use of Interim Biota Tissue PRGs Unclear

A commenter states that EPA did not adequately explain the derivation, utility, or plan associated with the interim biota tissue PRGs, and that such discussion must be significantly more robust, including specific information as to why this is useful in the context of the FFS.

Response:

EPA disagrees with this comment. Text in the RI/FFS and its Appendix E provide an explanation as to how the tissue concentrations were calculated. More detailed information of risk-based tissue concentration calculations is further provided in Section 1.3 of RI/FFS Appendix E, which explains that tissue concentrations were developed for 12 meals per year to provide a comparison to NJDEP's fish consumption advisories. These concentrations are interim milestones that may be used during monitoring after remedy implementation to evaluate if contaminant concentrations in fish and crab tissue are decreasing as expected. EPA will share monitoring data and consult with NJDEP about whether prohibitions on fish and shellfish consumption can be lifted or adjusted to allow for increased consumption as contaminant levels decline.

G.1.6 Comment: Selected Remedy Should have Ecological Targets, not just Targets Based on Contaminant Levels in Sediments or Fish Tissue

Commenters urged that the final cleanup plan have ecological targets, not just targets for contaminant levels in sediments or fish tissue.

Response:

The targets for contaminant levels in sediments or biota tissue included in the selected remedy are ecological targets, in that EPA uses them to evaluate whether RAOs established to protect ecological receptors (as well as human receptors) are achieved after implementation. Under Superfund law, EPA undertakes clean up actions to reduce risks to human health and the environment from exposure to hazardous substances to target ranges defined in the law. Consistent with EPA's authority under the Superfund law, the selected remedy includes a RAO to protect ecological receptors. After implementation of the selected remedy, EPA will evaluate progress toward achieving the RAO by measuring contaminant levels in sediment, because those contaminants cause risks to ecological receptors. EPA set the targets for contaminant levels in sediment based on levels that are protective of ecological receptors such as benthic invertebrates (including crab), fish, birds or mammals.

G.2. Background

G.2.1 Comment: Reference Information was not Considered in the Ecological Risk Assessment

A commenter asserted that the BERA overestimated ecological risks due to a failure to consider reference information in the analysis.

Response:

EPA does not agree that ecological risks were overestimated due to a failure to consider reference information. Consistent with RAGS, the RI/FFS BERA quantified risks as the total exposure to COPECs in the lower 8.3 miles without consideration of the contribution of background to those exposures. Nonetheless, EPA considered background conditions when it set the remediation goals, as discussed in the response to comment II.G.2.2.

G.2.2 Comment: Background Evaluation Did not use Site-Specific Fish Data and Estuarine Regional Data

Commenters stated that the background evaluation was incomplete because the BERA did not use site-specific fish data available for above Dundee Dam and ignored estuarine background regional data identified by EPA for the 17-mile LPRSA risk assessment.

Response:

The commenters are correct in noting that EPA did not use the fish tissue data obtained above Dundee Dam in preparing the BSAF analyses in DER No. 6 in Appendix A of the RI/FFS. There are a number of potential concerns with the use of these data, such as differences in habitat (including freshwater versus estuarine and transition zone). However, the largest impediment is that they primarily encompass species not found in the Lower Passaic River and thus, for the most part, cannot be considered in relating tissue and sediment concentrations. Specifically, each species has its own mechanisms for uptake and bioaccumulation and, as a result, the BSAF and BAF relationships are generally unique to each species. For a simple example, see the copper BAFs developed for mummichog, American eel and white perch (Table 3-4 of DER No. 6). The values vary by nearly an order of magnitude, from 6.08 x10^{-5} to 5.30 x 10^{-4}. This variability is due to many species-specific factors. Thus, data for species other than the four presented were not used in determining the species-specific BSAF or BAF relationships for the Lower Passaic River.

The commenters' other assertion that EPA ignored background regional data is incorrect. EPA has made extensive use of the sediment data from above Dundee Dam in its geochemical modeling analyses, including the EMBM and the mechanistic model. Additionally, reference data from Jamaica Bay were used whenever possible in the BSAF and BAF calculations. For any data set to be used, however, both tissue and representative sediment data must be available. While tissue data are available from the Mullica River for some of the species evaluated in DER No. 6, the data for both tissue and sediments are largely non-detect and as such are not useful in a log-based regression analysis intended to determine the effective ratio between sediment and tissue concentrations. This is because both values in non-detect pairs are too uncertain (i.e*.,* they only have an upper bound estimate of the actual concentration) and provide little constraint on the concentration ratio. Thus, Mullica River data were not included in EPA's BSAF and BAF calculations.

Although most of the fish tissue data obtained above Dundee Dam could not be used in the BSAF and BAF calculations, there were data for American eel and white perch – species also found in the Lower Passaic River. Although these specimens were not included in the analysis presented in DER No. 6, to respond to these comments, EPA used these data as a validation data set for the BSAF regression models presented in DER No. 6. Validation is a process in modeling in which some data are reserved from an analysis (like calculation of a BSAF) and then used to check the model calculations. In this instance the model estimates of tissue concentrations associated with the new sediment data are compared with the new actual measurements of tissue concentrations. Both the new sediment and new tissue data were not considered in the original model development (i.e., the Dundee Dam tissue and sediment samples). The results of the validation exercise are described below.

Validation of the BSAF Analyses for American Eel and White Perch.

In general, validation of a model provides greater confidence in its application and reduces the uncertainty associated with the model. Essentially, validation is a test of the model's behavior when supplied with new information. If the existing data were accurately represented by the model and the model's structure is sufficiently robust, then the model should be able to predict the behavior of new data, representing conditions not included in the original data.

The criteria used in validation were as follows. The new data must at least be partially contained within the 95 percent confidence intervals about the regression curve.[44] Some data may fall outside the confidence interval, but those data which the model best fits would display symmetrically about the interval. In addition, the median value for the new data should be contained within or fall very close to

[44] Note that these intervals are confidence intervals for the curve and not the prediction intervals for the individual points. The prediction intervals for the points would be much wider and therefore provide a less stringent criterion for validation.

the 95 percent confidence interval as well. Display of the data in accordance with these criteria would indicate that the model is capturing the central tendency (i.e., "the middle") of the data.

The available data from above Dundee Dam provide a basis to evaluate and validate eight tissue-sediment relationships developed in DER No. 6. Although this represents only a portion of all the regressions developed, these relationships are among the most important. Specifically, American eel and white perch regressions were used to set the PRGs for 2,3,7,8-TCDD and Total PCBs, two of the four compounds for which PRGs were established. Regressions for the other two COPCs (mercury and Total DDx) are incorporated in the ecological exposure models. (Mercury does contribute to human health risk but the PRG for mercury was developed based on ecological risk.)

The results for validation of the American eel and white perch regressions for 2,3,7,8-TCDD are shown in Figures II.G.2.2 - 1 and II.G.2.2 - 2. In these figures, the new data are represented by the light blue triangles. The red cross is centered on the median of the new sediment and fish tissue concentrations, while the length of the red lines spans the range. In both diagrams, it is clear that the new data largely fall within the 95 percent confidence intervals, and the display readily meets the two criteria identified above, thus validating both regressions. In both instances, the new data not only validate the regressions but also confirm the reliable extrapolation of these regression models to concentrations an order of magnitude lower than those used in the development of the regressions. This provides added confidence in the use of these models, and provides further support to their application by EPA in setting sediment PRGs.

The results for the mercury regressions are shown in Figures II.G.2.2 - 3 and II.G.2.2 - 4, again for American eel and white perch. In these instances, the mercury levels in sediment and tissue from above Dundee Dam fall within the range of concentrations used in the original development of the regressions. In both instances, portions of the new data fall within the confidence curves. The median value in each case falls just outside the confidence intervals and is considered to be sufficiently close that the new data serve to validate the mercury regressions. Note that these new data also confirm the use of iron-normalization in the regression models for mercury.

The Total PCB validation results for American eel and white perch are shown in Figures II.G.2.2 - 5 and II.G.2.2 - 6. In the case of American eel, the data from above Dundee Dam do not validate the regression developed in DER No. 6. The data from above Dundee Dam lie clearly to the left of the regression line and are sufficiently far away from the curve to indicate that the new data set is not well represented by the regression. This indicates that the original regression has a higher degree of uncertainty than defined by the 95 percent confidence limits shown in the figure. This greater uncertainty has implications for the derivation of a PRG based on American eel for Total PCBs. This is discussed further below.

Unlike the results for American eel, the regression for white perch is validated by the new data. Although the new data have a wide range, they are centered close to the curve (as shown by the median) and some values are included within the 95 percent confidence limits on the regression. Like the 2,3,7,8-TCDD regressions, the results for white perch also confirm the reliable extrapolation of the regression model to conditions less contaminated than those used in the development of the regression.

The last COPC for which a PRG was established is Total DDx. The regression models and validation results for American eel and white perch are shown in Figures II.G.2.2 - 7 and II.G.2.2 - 8, respectively. The results parallel those for Total PCBs. That is, the white perch model is validated by the new data while the American eel model is not. Similar to the Total PCB results, the new DDx data for American eel fall to the left of the curve, again indicating that the regression is subject to greater uncertainty than defined by the confidence interval curves.

Application of the Validation Results

The analyses presented above confirm the use of the American eel and white perch regression analyses for 2,3,7,8-TCDD and mercury. Thus, the PRGs established for these two compounds based on these regressions are well supported by the new data and no adjustments are warranted.

Based on the validation analysis, the American eel regression models for Total PCBs and Total DDx are considered too uncertain to support PRGs, whereas the white perch regression models were well supported by the new data. The reasons for the differences between the regression model curves and the new data are unclear, but these differences may be attributable to influences of habitat, diet, or the movement of the specimens across Dundee Dam.[45] As a result, EPA reviewed its PRG calculations for Total PCBs and Total DDx. For Total DDx, ecological exposure was the primary pathway used to determine the sediment PRG. In this instance, however, blue crab is the most sensitive receptor and forms the basis for the ecological PRG. A reanalysis of the ecological risk calculation while excluding the American eel confirmed the PRG of 0.30 ng/g for Total DDx.

For Total PCBs, the results from the American eel and white perch regression models were combined to yield the PRG of 44 ng/g stated in the Proposed Plan. This calculation is described in Appendix E of the RI/FFS. Using updated default exposure parameters described in response to comment II.F.1.5, EPA's revised calculation yielded a PRG for Total PCBs of 50 ng/g. EPA has used the revised value in the ROD.

In the above analysis, EPA has made optimal use of the available data. The data collected above Dundee Dam have served to validate six of the eight models tested. For the PRGs based on human exposure to contamination via fish consumption, the regression models for 2,3,7,8-TCDD and Total PCBs have been validated. Of the contaminants for which PRGs were developed based on ecological risk, the regression models for mercury for two of the four species used in the calculation (white perch and American eel) have been validated. As for Total DDx, the regression model for white perch has been validated, although blue crab is the main impacted species.

Overall the development of validated regression models provides a very sound basis for the use of these models in setting the final list of remediation goals for the ROD. These models provide sound evidence that tissue concentrations will decrease to the desired levels if sediment concentrations are reduced to the stated PRGs.

G.2.3 Comment: PRGs were Set Below Anthropogenic Background

Commenters stated that EPA's decision to set PRGs below anthropogenic background was contrary to EPA's CERCLA Background Guidance and the Sediment Guidance. Commenters stated that EPA had failed to provide a full and complete evaluation of the impact of background conditions and further failed to justify its departure from the 2007 draft FFS where PRGs were set at background concentrations. Thus, EPA arbitrarily and capriciously changed its decision from the 2007 draft FFS.

[45] While Dundee Dam appears to represent a significant barrier to fish migration, the capture of American eel specimens above the dam suggests that such migration is (or was at some period) possible. This is because American eel do not reproduce in freshwater and all specimens caught above Dundee Dam had to have been born in the ocean.

Response:

The draft FFS represented just that – a draft, not a "decision." EPA undertook years of analysis and modeling between the time that the draft 2007 FFS was prepared and the completion of the RI/FFS. In the RI/FFS and Proposed Plan, EPA fully explained the selection of remediation goals and how it considered the effect that background contaminant concentrations will have on post-remedy conditions in the lower 8.3 miles, in accordance with OSWER Directive No. 9285.6-07P (EPA, 2002a, Background Guidance) and OSWER Directive No. 9355.0-85 (EPA, 2005a, Contaminated Sediment Guidance).

The Background Guidance explains that if background concentrations are high relative to concentrations of site-related hazardous substances, a comparison of background and site concentrations may help EPA risk managers make decisions concerning remedial actions. Similarly, the Contaminated Sediment Guidance states that project managers should consider background contributions to sites to adequately understand contaminant sources and establish realistic risk reduction goals. The two guidance documents recognize that generally, for reasons of cost-effectiveness, technical practicability and the potential for recontamination of remediated areas by surrounding areas with elevated background concentrations, it may not be appropriate to select cleanup levels at concentrations below natural or anthropogenic levels.

The risk-based PRG for dioxin that EPA selected is above background concentrations. For the other COCs, while the Superfund program generally does not clean up to concentrations below natural or anthropogenic background levels, in the Lower Passaic River, the flow of water and suspended sediment over Dundee Dam is just one of many contributors of surface water and sediment into the lower 8.3 miles. Sediment particles coming from above Dundee Dam make up about one third of particles in the lower 8.3-mile water column. When those particles flow down to the lower 8.3 miles, they mix with the other particles in the system (including cleaner particles in the water column that would result from a remediated lower 8.3 miles); after they are deposited, they also mix with the clean material placed on the river bed as part of remediation. So contamination in the top six inches (the bioactive zone) can end up being less than the background concentrations coming over Dundee Dam as predicted by the mechanistic model developed by EPA to support its analyses in the RI/FFS and the Proposed Plan and the model updated in response to comments to support the ROD (see Attachment E).

While COCs (particularly PCBs) entering the lower 8.3 miles from above the dam and other incoming COCs, such as from Newark Bay and the Lower Passaic River above RM 8.3, are relatively small contributors of COCs to the recently deposited surface sediments of the lower 8.3 miles, as compared to the resuspension of lower 8.3-mile sediments, they will be more important contributors to recontamination of an implemented remedy for the lower 8.3 miles, particularly in the case of the selected remedy. EPA expects that overall COC concentrations will decline over time as the Lower Passaic River above RM 8.3 and Newark Bay are remediated through actions selected after the completion of the 17-mile RI/FS and Newark Bay RI/FS. Furthermore, EPA expects that the Clean Water Act programs will address PCBs and other COCs above Dundee Dam by working with NJDEP to identify and mitigate these loadings. Such actions, taken while the remedy for the lower 8.3 miles is being designed and implemented, will reduce the incoming COCs and minimize the degree of recontamination, allowing the selected remedy to achieve protectiveness.

G.2.4 Comment: EMBM Shows that PRGs are not Attainable because they are Set Below Background

Commenters stated that contrary to EPA guidance, EPA selected remediation goals for several key COCs that are 1 to 2 orders of magnitude less than background concentrations in the Upper Passaic River. As a result, over the long-term, EPA's own EMBM demonstrates that the Lower Passaic River will become recontaminated, concentrations of many of the site COCs will approach Upper Passaic River concentrations, and mercury, Total PCBs, and Total DDT will stabilize at 1 or 2 orders of magnitude greater than the remediation goals for the lower 8.3 miles.

Response:

When the EMBM was originally developed, surface sediment concentrations for the COCs in the Lower Passaic River were modeled using an empirical function derived from the decline of surface sediment concentrations estimated from high resolution cores collected within the 17 miles using Cs-137 radiometric dating. This model assumed that the rate of decline of surface sediment concentrations estimated from high resolution cores collected from external sources of sediments (i.e., above Dundee Dam, Newark Bay, and the tributaries) for these COCs would be the same as that observed for high resolution cores collected from the lower 17 miles. During the 2008 peer review, peer reviewers noted that this assumption was not necessarily true and recommended that EPA focus on the excess chemical concentrations in Lower Passaic River sediments that could not be ascribed to the external sources (defined as the surface sediment concentrations above the baseline).

Based on the peer reviewers' recommendation, the EMBM was revised with a focus on determining changes in the excess chemical concentrations for the COCs in the lower 8.3 miles of the Passaic River. To do this, the EMBM used the high resolution cores collected in the LPRSA and subtracted out the baseline concentrations that could be ascribed to the external sources, yielding the variation in the excess chemical concentrations for the COCs over time. After estimating the changes in excess chemical concentrations that would result from each of the remedial alternates, the EMBM then combined the excess chemical changes with the unattenuated baseline concentrations that were originally subtracted from the calculations. Since the EMBM used unattenuated external sources, it was conservative in its prediction of future surface sediment concentrations for the three active remedial alternatives, and therefore it is not surprising that it predicted higher levels of recontamination than the mechanistic model predictions. However, as discussed in the response to comment II.E.4.1, the results from the EMBM are generally consistent with those of the mechanistic model.

EPA used the EMBM and mechanistic model to show that, while the Superfund program generally does not clean up to concentrations below natural or anthropogenic background levels, in the Lower Passaic River, the flow of water and suspended sediment over Dundee Dam is just one of many contributors of surface water and sediment to the lower 8.3 miles. Sediment particles coming from above Dundee Dam make up about one third of particles in the lower 8.3-mile water column. When those particles flow down to the lower 8.3 miles, they mix with the other particles in the system (including cleaner particles in the water column that would result from a remediated lower 8.3 miles); after they are deposited, they also mix with the clean material placed on the river bed as part of remediation. So contamination in the top six inches (the bioactive zone) can end up being less than the background concentrations coming over Dundee Dam.

The selected remedy will replace the highly contaminated riverbed of the lower 8.3 miles with effectively clean material (sand), bank to bank. There is no more comprehensive way to remediate the sediments of the lower 8.3 miles. EPA's modeling results show that, after the sand is placed bank-to-bank in the lower 8.3 miles, incoming COCs from above Dundee Dam, from Newark Bay and from the Lower Passaic River above RM 8.3 will gradually recontaminate the new riverbed surface. EPA's model underestimates the effectiveness of the bank-to-bank remedies because, while the model assumes that the incoming COCs will remain constant until the end of the simulation period (until the early 2060s), EPA expects that those COCs will decline over time as the Lower Passaic River above RM 8.3 and Newark Bay are remediated through actions selected under CERCLA. Furthermore, EPA expects that Clean Water Act programs will address COCs coming in from above Dundee Dam. Such actions, taken while the remedy for the lower 8.3 miles is being designed and implemented, will reduce the incoming COCs and minimize the degree of recontamination, allowing the selected remedy to achieve protectiveness.

G.2.5 Comment: Contaminants from Background Sources and from Resuspension During Remedy Implementation will Recontaminate the Engineered Cap

Commenters stated that the Proposed Plan should set PRGs consistent with background conditions. Sediments coming from upstream of Dundee Dam have a significant contribution on the bed composition in the Lower Passaic River and influence the extent to which remediation can achieve reductions in COC concentrations. Commenters stated that recontamination of the lower 8.3-mile sediments to background levels is certain to occur and the Proposed Plan is not likely to achieve long-term benefits for the COCs in the lower 8.3 miles, with the possible exception of TCDD. Commenters stated that the Proposed Plan failed to recognize that deposition of contaminated sediment from background sources would recontaminate a "clean" cap in the post-remediation LPRSA, and that resuspension of dredged materials and sediments from un-remediated portions of the LPRSA and Newark Bay would recontaminate capped areas. Commenters asserted that there is a high likelihood that the very costly remedy would be completely negated by the on-going contaminant sources such as those described above, and the proposed remedial action should not be implemented.

Response:

In its April 1, 2008 memorandum to EPA Region 2, EPA's CSTAG recommended under Principle #1, Control Sources Early, that EPA Region 2 evaluate more quantitatively the relative contribution of risks from dioxin and PCBs entering from over Dundee Dam, tributaries, CSOs-SWOs and instream sediments above RM 8 and Newark Bay. In 2008, EPA Region 2 completed a sampling program targeting those sources into the lower 8.3 miles, including all of the COCs, not just dioxins and PCBs.

EPA used these data, as well as data subsequently collected as part of the 17-mile RI/FS, to quantify the relative contribution of contaminants from sources entering the lower 8.3 miles. Those evaluations showed that, when compared to the resuspension of the major COCs (dioxins, PCBs, mercury and DDT) in the main stem of the Lower Passaic River, the tributaries and CSOs-SWOs are minor contributors of those COCs (< 4 percent), and the Upper Passaic River and Newark Bay are small contributors of those COCs (< 14 percent). The remedy selection process for the lower 8.3 miles correctly focuses on remediating the contaminated sediments in the main stem of the lower 8.3 miles of the Lower Passaic River as a major on-going source of COCs in the system.

The mechanistic model for the Lower Passaic River incorporated all of the data characterizing the contributors of COCs entering the lower 8.3 miles into its predictions of surface sediment concentrations post-remediation, and EPA used it to evaluate the selected remedy's protectiveness. The selected remedy will replace the highly contaminated riverbed of the lower 8.3 miles with effectively clean material (sand), bank to bank. There is no more comprehensive way to remediate the sediments of the lower 8.3 miles. EPA's modeling results show that, after the sand is placed bank-to-bank in the lower 8.3 miles, incoming COCs from above Dundee Dam, from Newark Bay and from the Lower Passaic River above RM 8.3 will gradually recontaminate the new riverbed surface. EPA's model underestimates the effectiveness of the bank-to-bank remedies because, while the model assumes that the incoming COCs will remain constant until the end of the simulation period (until the early 2060s), EPA expects that those COCs will decline over time as the Lower Passaic River above RM 8.3 and Newark Bay are remediated through actions selected under CERCLA. Furthermore, EPA expects that Clean Water Act programs will address COCs coming in from above Dundee Dam. Such actions, taken while the remedy for the lower 8.3 miles is being designed and implemented, will reduce the incoming COCs and minimize the degree of recontamination, allowing the selected remedy to achieve protectiveness.

H. Engineering Alternatives and Comparative Analyses

H.1. Remedial Technologies and Alternative Screening

H.1.1 Comment: Bioremediation

Commenters asked whether bioremediation technology could be used to clean up the Passaic River and whether PRPs would implement that approach. Commenters recommended bioremediation as a better choice for cleaning up river sediments and cited examples of bioremediation projects in India. Commenters sent bioremediation research papers as part of their comments. Some commenters thought that if bioremediation could work to clean up the river, it would be a cheap and effective alternative for future projects. Commenters stated that the FFS incorrectly screened out bioremediation and other potential *in-situ* treatment approaches without conducting the necessary evaluation required by the NCP. Other commenters expressed opposition to bioremediation, because they thought that the PRPs should not be allowed to implement a less expensive and untested technology. Commenters noted that despite successful bioremediation projects at terrestrial sites like the former New England Log Homes site in Great Barrington, Massachusetts, it is important to note that bioremediation has not yet been applied *in-situ* to a riverbed, so that any bioremediation plans for the Passaic (such as the pilot study proposed by TMO) must take into account the tidal nature of the Passaic River as well as the difference between riverine/estuarine and terrestrial sediments.

Response:

EPA evaluated bioremediation in the RI/FFS, but did not include it in the preferred alternative (or any of the *ex-situ* treatment technologies evaluated against the NCP criteria), because there is such a mixture of contaminants in Lower Passaic River sediments, with most either not biodegradable (particularly heavy metals) or very persistent in the environment, that any of the established bioremediation technologies would not be feasible or effective. In addition, EPA concluded that bioremediation at sediment sites is an unproven technology and thus should not be proposed to address a large scale, complex remediation given the uncertainty about protectiveness, long-term effectiveness, implementability and cost.

As part of the work under the Newark Bay RI/FS, TMO is currently developing a bioremediation pilot project. Although the results of this study will not be available for some time, the information gained by the study may provide insight into options for sediment treatment in the future.

H.1.2 Comment: General Response Actions in 2014 FFS were the Same as those in 2007 Draft FFS and MNR was not Properly Evaluated

Commenters indicated that the 2014 FFS presentation of general response actions was nearly identical to the 2007 presentation and that the revised text included a bulleted list of factors that should be used to determine whether MNR was "reasonable" (e.g., timeframe, likelihood of receptor exposure during recovery timeframe, future use, uncertainty). Commenters stated that the FFS did not properly evaluate MNR and its ability to achieve risk-based goals.

Response:

EPA evaluated MNR throughout the RI/FFS process. EPA compared data collected prior to 2004 to data collected as part of the 17-mile RI/FS to evaluate trends in surface sediment concentrations of COCs over time, as a line of evidence to evaluate MNR as a remedial option. Data sets used in trends analyses were all collected under EPA-approved QAPPs, including data collected in 1995 for the 6-mile Passaic River Study Area RI conducted by TMO under EPA oversight, in 2007-2008 as part of the expanded 17-mile RI initiated by EPA with CPG funding and in 2008-2012, after the CPG assumed the lead role under EPA oversight.

In accordance with EPA's 2005 Contaminated Sediment Remediation Guidance for Hazardous Waste Sites, one of the goals of the RI/FFS for the Lower Passaic River was to collect data necessary to evaluate the potential effectiveness of natural recovery, *in-situ* capping, sediment removal and promising innovative technologies. As described on Pages 2-22 and 2-23 of the RI Report, EPA analyzed bathymetric, hydrodynamic, sediment core, surface sediment and water column contaminant load data to evaluate the potential for natural recovery with regard to sediment stability and contaminant fate and transport.

The lateral extent and temporal trend of surface sediment concentrations for 2,3,7,8-TCDD are shown in Figure 4-4 and discussed on Page 4-5 in Section 4.1.1 of the RI Report. The data from sediment surveys conducted between 1995 and 2012 show that the main part of the lower 8.3 miles between RM 1 and RM 7 has widely varying sediment concentrations, but a strong central tendency to the concentrations of 2,3,7,8-TCDD that is virtually unchanged across the various surveys. Also, all three horizontal lines in Figure 4-4 which represent the medians 2,3,7,8-TCDD surface sediment concentration for each survey (1995, 2008-2010 and 2012) have almost the same value (280 pg/g ± 10 pg/g). The virtual lack of change in this region over time suggests little recovery is occurring. Additionally, the 2012 data represent samples collected after Hurricane Irene, a 1-in-90 year flow event. Despite the scale of this event, median concentrations remain unchanged. Similar plots for other COCs are shown and discussed in Chapter 4 of the RI Report. Based on this extensive data-set, MNR was screened out of consideration as a stand-alone remedial alternative and incorporated as a component of alternatives comprising active remedial measures.

As discussed in Section 4.4 in Chapter 4 of the FFS Report, MNR is part of each active remedial alternative (i.e., Alternatives 2, 3, and 4). For Alternatives 2 and 3, following completion of remedy construction, MNR, along with remedial actions selected through CERCLA for the Lower Passaic River above RM 8.3 and Newark Bay, and with Clean Water Act programs to address COCs coming in from above Dundee Dam, would minimize the degree of recontamination after the remedies were implemented, allowing those bank-to-bank alternatives to achieve protectiveness. In contrast, under Alternative 4, even with MNR and actions or programs to reduce incoming COCs post-remediation, the effect of recontamination on the protectiveness of that focused or "hotspot" alternative includes and is greatly increased by the resuspension of highly contaminated sediments from the unremediated two-thirds of the lower 8.3 miles riverbed redepositing on adjacent capped areas that would continue unabated.

H.1.3 Comment: Engineered Cap is not Thick Enough to Withstand Storms and Tides

Commenters asserted that a two-foot sand cap would not be substantial enough for storm events and would present challenges in maintaining the navigational channel in the 2.2 miles closest to Newark Bay. Commenters further noted that capping must account for the fact that the tide flows in both directions and that the salt wedge location changes depending on storm events and freshwater influx.

Response:

EPA's cap design for the selected remedy is based on USACE and EPA capping guidance and consists of a 2-foot thick engineered sand cap with a 0.5 foot thick layer of armor stone where necessary (see Figure 2-1 in Appendix F of the RI/FFS [which shows the component thicknesses of the various cap layers that were included in the conceptual design] and Section 2.3 in Appendix F of the RI/FFS for details). EPA's design for this cap has accounted for the fact that the lower 8.3 miles of the Passaic River is a tidal estuary. The Reible Steady-State Cap Analytical Model (Version 1.18) (Reible, 2011) was used to estimate the required thickness of the chemical isolation layer. The steady-state model was used to predict concentrations that would exist after contaminants have traveled upwards into the cap and an equilibrium condition becomes established between advective and diffusive transport, and exchange with the overlying water column.

In the conceptual design developed by EPA for purposes of the RI/FFS, the minimum thickness of the chemical isolation layer was estimated with the goal that the concentrations in the BAZ (top 15 cm) would remain below the sediment remediation goals for contaminants that are risk drivers. It was also assumed that the chemical isolation layer would be composed of a granular material such as sand with minimal organic carbon. EPA performed simulations for 2,3,7,8-TCDD, Total PCBs, Total DDx, and mercury. These contaminants were selected to represent the range of sediment-pore water partitioning in the river. The lower 8.3 miles of the river was divided into 2-mile reaches, and the chemical concentrations of each contaminant in the sediments below the cap material was conservatively estimated as the upper confidence interval of the mean concentration for each reach. The modeled cap thickness was set at 12 inches for the chemical isolation layer. For the modeled contaminants, the simulated steady state concentrations in the BAZ (15 cm) were generally less than their corresponding sediment remediation goals concentrations except locally for Total DDx between RM 2 and RM 4. It is anticipated that during the design phase, adjustments such as the addition of organic carbon to the cap and changes in cap thickness will be evaluated to address such localized areas where simulations indicate that a 12-inch layer thickness would not sufficiently isolate contaminants.

The cap has been conservatively designed to withstand the erosional forces that would be generated by a 100-year storm event. Hydrodynamic and sediment transport modeling showed that capped areas in the lower 8.3 miles would be subject to less than 3 inches of erosion during such an event. This modeling is described in detail in RI/FFS Appendix B.I. The hydrograph and simulations for EPA's hydrodynamic and sediment transport model includes Hurricane Irene, which occurred in August 2011 and is considered to be a 1 in 90 year storm event. Based on these modeling results, it is unlikely that the integrity of the cap would be compromised during a storm event. Nevertheless, an armor layer was included as part of the cap. The armor thickness and locations were determined using 100-year storm bottom velocities as described in Section 2.3.3 of RI/FFS Appendix F. The updates made to the model in response to comments did not affect the cap and armor evaluation.

H.1.4 Comment: Could Engineered Cap be Implemented without First Dredging Bank-to-Bank?

Commenters asked whether capping would be sufficient without bank-to-bank dredging first being performed.

Response:

Bank-to-bank capping in the absence of dredging might be sufficient to isolate the contaminated sediments and thus protect human health and the environment. However, computer modeling performed as part of the RI/FFS showed that installing a two-foot sand cap without first dredging approximately 2.5 feet would exacerbate existing flooding conditions, causing potentially severe impacts to communities along the Lower Passaic River and potentially contravening the New Jersey Flood Hazard Control Act, which restricts placement of fill material in the floodway. Therefore, in developing Alternative 3, the selected remedy, EPA incorporated approximately 2.5 feet of bank-to-bank dredging before installation of the bank-to-bank cap, so that the remedy will not make flooding worse. During remedial design, EPA will evaluate enhanced capping technologies, such as the use of additives (e.g., activated carbon or organoclay) to create a reactive cap or thin-layer capping technologies where conditions are conducive to such approaches. If EPA determines that a thinner cap would provide the same level of performance as the cap evaluated in the FFS, this could lead to a reduced amount of dredging in the portions of the river conducive to the thinner cap. However, the final depth of the river after capping would still be the same as the depths called for in the ROD.

H.1.5 Comment: Long-Term Effect of Engineered Cap on the Environment

Commenters asked whether some portions of the Passaic could be left without being dredged or capped, to serve as refuges from which benthic organisms could colonize regions that require dredging. Commenters thought that most benthic organisms could not survive on hardened caps or caps maintained in perpetuity.

Response:

As described in the RI/FFS and Proposed Plan, data show that elevated concentrations of COCs above EPA's protective goals are ubiquitous in surface sediments of the lower 8.3 miles of the Passaic River, bank-to-bank. These conditions support the need for remediation in the form of capping the lower 8.3 miles, bank-to-bank. As for the dredging component, EPA's computer model predicted that placing a two-foot sand cap on the river bed without first dredging would exacerbate the flooding along the Lower Passaic River. Therefore, Alternative 3, the selected remedy, provides for dredging approximately 2.5 feet before cap placement. As each section of river is being dredged and capped, benthic organisms would experience short-term adverse impacts. Studies of dredged areas show that recovery, or restoration of the original benthic community, could occur within one to five years (Newell et al., 1998). Monitoring of caps placed over Superfund sites around the country, including armored caps such as the cap selected for the lower 8.3 miles, shows that benthic habitat and organisms do re-establish themselves and survive on caps that are well maintained (Palmerton, 2003).

H.1.6 Comment: Net Environmental Benefits Analysis

Commenters stated that the FFS overstates the future benefits and understates the potential risks associated with the Proposed Plan. Commenters stated that while EPA's website has identified net environmental benefits analysis (NEBA) as an important decision-making tool, it was not employed by EPA in its decision-making process for the lower 8.3 miles; the Proposed Plan does not address quality-of-life impacts on affected communities that will be imposed by the extensive dredging, materials handling, and trucking associated with the selected remedy. Commenters also stated that a NEBA approach provides a framework for identifying the environmental and social requirements important to stakeholders and systematically identifies the desirable technical aspects of a remedial strategy (e.g., dredging controls, air emissions, solids and water treatment and disposal) that must satisfy the essential environmental, economic and social requirements. Commenters stated that EPA's decision regarding the preferred remedy will benefit greatly from a NEBA framework that focuses on optimizing the net benefits of the individual actions comprising the preferred remedy and associated strategy.

Response:

EPA administers many programs as part of its mission. EPA may use the concept of the "net environmental benefit analysis" in certain contexts. However, EPA's decision making process under Superfund applies the NCP criteria, consistent with applicable EPA Superfund guidance and policy – it does not incorporate a "net environmental benefit analysis" as contemplated by the commenters. The NCP evaluation results in selection of a remedy that meets the threshold requirements of CERCLA, the Superfund law, and the NCP, and also balances the other criteria including short-term effectiveness, where the analysis addresses the quality of life impacts on affected communities pointed to by the commenter.

Under Superfund law, EPA's purpose for cleaning up Superfund sites is to reduce risks to human health and the environment from exposure to hazardous substances to acceptable target risk ranges defined in the law. EPA's experience at other Superfund sites[46] is that, after remediation, the cleaner site often encourages local municipalities and private entities to develop more public access to and from the water for recreational purposes than when the river was contaminated. For more detailed discussion of how EPA has considered quality of life impacts, see responses to comments II.H.6.1 to II.H.6.5.

H.1.7 Comment: Long-Term Monitoring Program

Commenters recommended establishing long-term and comprehensive monitoring and maintenance programs to assess environmental conditions prior to, during and post-remediation and to ensure that the remediation is effective and remains protective.

Response:

As described in the RI/FFS and Proposed Plan, all of the active alternatives included long-term monitoring and maintenance plans. The Proposed Plan specified that the cap in Alternative 3, the

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[46] Examples include portions of the Grand Calumet River and Indiana Harbor Ship Canal, where remediation has been completed over the past 10 years; the Hudson River, where dredging is expected to be completed in the summer of 2015; and, the Fox River, where remediation is expected to be completed in 2017.

selected remedy, will need to be monitored and maintained in perpetuity for the alternative to be effective in the long-term. The cost estimate in the RI/FFS included costs for conducting long-term monitoring of contamination in the sediment, biota and water column, as well as cap monitoring and maintenance. Final details and costs of long-term monitoring and maintenance plans will be determined during remedial design.

H.1.8 Comment: Effects of Resuspension and Releases During Remedy Implementation

Commenters indicated that the FFS and Proposed Plan failed to appropriately evaluate the impact on remedy effectiveness of risks from resuspension and releases. Commenters expressed that resuspension of contaminated sediments due to dredging in the lower 8.3 miles of the Passaic River would migrate upstream and downstream with the tide. Commenters asked how EPA would prevent that contamination from settling in the river above RM 8.3 and in the recently remediated sediments of the Hackensack River.

Response:

Dredging operations will result in some sediment resuspension, which may be re-deposited within the Lower Passaic River, or transported above RM 8.3 or downstream to Newark Bay. Resuspension rates for environmental dredging projects are reported in literature to range from less than 0.1 percent to over 5 percent of the mass removed (USACE, 2008). The mechanistic model conservatively included resuspension due to dredging at 3 percent of the mass dredged, which is based on the results of the Environmental Dredging Pilot Study (LBG, 2012) performed in the Lower Passaic River and similar measurements from other dredging projects. The model has enabled EPA to evaluate the impact on remedy effectiveness of risks from dredging resuspension and releases. The RI/FFS (Appendix F) describes some of the engineering and operational controls that could be implemented to minimize adverse environmental impacts due to dredging, including, but not limited to, the following:

- Use of a closed, watertight clamshell dredge or hydraulic dredge with appropriate controls;
- Appropriate maintenance and operation on equipment or machinery, including adequate training, staffing and working procedures;
- Minimizing the number of passes needed to dredge a particular volume of sediment;
- Slowly withdrawing the clamshell through the water column;
- Minimizing vessel movement within the dredging area.

During remedial design of the lower 8.3 mile action, these and other controls will be specified in more detail to minimize resuspension of contaminated sediments due to dredging.

H.1.9 Comment: Development and Screening of Alternatives

Commenters stated that EPA's development and screening of remedial alternatives in the FFS was deficient, technically flawed, and inconsistent with the NCP. The commenters felt that the FFS and the Proposed Plan do not satisfy the NCP requirement to develop and evaluate an appropriate set of remedial alternatives (40 C.F.R. § 300.430(e)(1)), because except for a brief description of CERCLA's requirements that must be considered, no explanation was provided as to how the four alternatives were developed and these technical deficiencies resulted in a defective, incomplete and biased set of remedial alternatives being retained for detailed evaluation.

Response:

Contrary to the assertions made in the comment, EPA's development and screening of alternatives is described in detail in Chapter 4 of the FFS Report. This development and screening of alternatives fully complies with the requirements of the NCP in 40 C.F.R. § 300.430(e) and EPA's 1988 RI/FS guidance and includes a full range of dredging, capping and monitored natural recovery alternatives, as required in EPA's 2005 Contaminated Sediment guidance. EPA developed and screened a No Action alternative (Alternative 1), a bank-to-bank alternative that includes complete removal of all contaminated sediments in the lower 8.3 miles of the LPR (Alternative 2), another bank-to-bank alternative that includes both dredging for flood control and navigation and capping of remaining sediments (Alternative 3), and a focused alternative that includes a limited amount dredging and capping in areas where sediment releases the most contaminants into the water column (Alternative 4). The screening criteria included effectiveness, implementability, and relative cost. The remedial alternatives that were retained for detailed evaluation in Chapter 5 after the screening performed in Chapter 4 are neither defective nor biased and are consistent with EPA's 2005 Contaminated Sediment guidance.

H.1.10 Comment: EPA's Design of Focused Capping Alternative was Flawed

Commenters stated that EPA's design of the Focused Capping alternative (Alternative 4) was flawed, designed to under predict the benefits of a targeted remedy, and guaranteed to fail because it ignored the risk reduction that could be achieved with targeted remediation. In particular, commenters stated that the Focused Capping Alternative did not address hot spots of risk-driving contaminants throughout the entire river, and therefore left in place many areas with elevated 2,3,7,8-TCDD concentrations in surface sediment. Commenters also stated that Alternative 4 did not consider the whole river; it was designed with one set of criteria (chemical flux) and assessed with another (predicted surface concentrations). With regard to the modeling performed to evaluate the ability of Alternative 4 to achieve remediation goals, commenters questioned EPA's use of modeled initial conditions rather than measured concentrations, leading to a misrepresentation of actual surface contaminant concentrations.

Response:

Alternative 4 was developed to evaluate a remedy that is less than bank to bank in scope. It consisted of dredging and capping discrete or targeted areas of the lower 8.3 miles with the highest gross and net fluxes of COCs, thus accounting for the stability of the sediment bed and the mobility of contaminants within it, in accordance with EPA's December 2005 *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*. Alternative 4, like all the alternatives in the RI/FFS and Proposed Plan, addressed only the lower 8.3 miles of the Passaic River because of EPA's conclusion that the great majority of the contaminated sediments are present in this part of the river. EPA therefore focused on selecting a remedy for the sediment in just this portion. Areas with elevated concentrations of COCs in the upper portion of the LPR will be addressed in the 17-mile RI/FS. A detailed discussion of the modeling performed to evaluate Alternative 4, including use of modeled initial conditions rather than measured concentrations, and updates to the model that address this comment, is provided in the response to comment II.E.2.8.

All of the alternatives were evaluated based on predicted surface sediment concentrations that formed the basis for the exposure point concentrations used in risk calculations, consistent with EPA risk assessment guidance. In response to this and other comments, EPA used the mechanistic model to simulate an Alternative 4 that consisted of dredging and capping discrete or targeted areas of the lower 8.3 miles with the highest concentrations of COCs (see Attachment E for further discussion of this simulation). As shown in Figure II.H.1.10 – 1, this formulation of Alternative 4 did not result in lower surface sediment concentrations than those achieved under the flux-based Alternative 4 evaluated in the RI/FFS, Proposed Plan and ROD.

Finally, EPA did not select Alternative 4, because it would not reduce risks enough to meet the threshold NCP criterion of overall protection of human health and the environment and would offer much less long-term effectiveness and permanence than the selected remedy. Additional issues of implementability are discussed in the response to comment II.C.4.9.

H.1.11 Comment: Relative Costs and Benefits and Proportionality Requirements were not Considered in Screening of Alternatives

Commenters stated that EPA's screening of alternatives failed to adequately evaluate and compare relative costs and benefits (i.e., cost-effectiveness). To support their argument, commenters cited the NCP at 40 C.F.R. § 300.430(f)(1)(ii)(D) and § 300.430(f)(1)(i)(B) leading to the statement that a remedy shall be cost-effective if its costs are proportional to its overall effectiveness. Commenters stated that the proportionality requirements were reiterated in EPA's sediment guidance (EPA, 2005a). Further, commenters cited EPA's cost guidance for feasibility studies (EPA, 2000d) and the NCP at 40 C.F.R. § 300.430(e)(7)(iii) to argue that in the absence of any substantive incremental benefits between Alternatives 2 and 3, Alternative 2 should have been screened out of the FFS on the basis of disproportionate cost.

Response:

The commenter suggested that Alternative 2, DMM Scenario B (Deep Dredging with Backfill and off-site disposal), need not have been carried through the analysis because its cost was higher than Alternative 3, DMM Scenario B, without sufficient "environmental benefits." This misstates the nature of the NCP analysis. The analysis does not consist of a simple comparison of cost to "environmental benefits."

Under the NCP, the analysis first considers the threshold criteria of protectiveness and compliance with ARARs (unless a specific ARAR is waived). Once the threshold criteria are met, the NCP analysis is a balancing process. This balancing emphasizes two of the five criteria (long-term effectiveness and permanence, and reduction of toxicity, mobility and volume through treatment) (40 C.F.R. § 300.430(f)(1)(ii)(E)), followed by cost-effectiveness, implementability and short-term effectiveness. "Environmental benefits" is not a criterion.

By including cost-effectiveness, the analysis is intended to select a cost-effective remedy, which, according to the NCP, means "costs are proportional to its overall effectiveness" *(*40 C.F.R. § 300.430(f)(1)(ii)(D)). Overall effectiveness of a remedial alternative is determined by evaluating long-term effectiveness and permanence; reduction in toxicity, mobility and volume through treatment; and short-term effectiveness. Overall effectiveness is then compared to cost to determine whether the remedy is cost-effective.

As EPA explained in the preamble to the final NCP, EPA uses the term "proportional" because it intends that in determining whether a remedy is cost-effective, the decision-maker should both compare the cost to effectiveness of each alternative individually and compare the cost and effectiveness of alternatives in relation to one another (see 53 FR 51427-28). In analyzing an individual alternative, the decision-maker should compare, using best professional judgment, the relative magnitude of cost to effectiveness of that alternative. In comparing alternatives to one another, the decision-maker should examine incremental cost differences in relation to incremental differences in effectiveness. Thus, for example, if the difference in effectiveness is small but the difference in cost is very large, a proportional relationship between the alternatives does not exist. The more expensive remedy may not be cost-effective. EPA does not intend, however, that a strict mathematical proportionality be applied because generally there is no known or given cost-effective alternative to be used as a baseline. EPA believes, however, that it is useful for the decision-maker to analyze among alternatives, looking at incremental differences. (NCP preamble, 55 FR 8728.)

Consistent with the NCP, EPA correctly carried Alternative 2, DMM Scenario B and Alternative 3, DMM Scenario B, through the analysis. Doing so allowed EPA to fully evaluate the three active alternatives. As explained in detail in the RI/FFS, Proposed Plan and ROD, while Alternative 2 and Alternative 3 both meet the threshold criteria, on balance Alternative 3 provides the best balance of tradeoffs among the alternatives with respect to the balancing and modifying criteria.

H.1.12 Comment: Evaluation of Hydraulic Dredging

Commenters indicated that a complete evaluation of hydraulic dredging should be prepared. Commenters stated that hydraulic dredging and mechanical dredging are too dissimilar to assume mechanical dredging as the representative process option; the FFS should be revised to adequately evaluate hydraulic dredging.

Response:

During the preparation of the FFS, EPA did evaluate the use of hydraulic dredging in the lower 8.3 miles of the Lower Passaic River. During the initial screening of technology types for the Sediment Removal General Response Action in Section 3.3 of the FFS, two potential technologies were identified: excavation and dredging. The description of dredging presented in Table 3.1 of the FFS included hydraulic removal options. In Section 3.4, the retained technologies (including hydraulic dredging) were screened based on effectiveness, implementability and cost (see Table 3-2 of the FFS). In Section 3.6, hydraulic dredging was included in the summary of technologies and process options that were retained for further evaluation.

In Section 5 of the FFS, estimated costs were presented for each of the alternatives and DMM scenarios. The FFS cost estimates assumed mechanical dredging would be used for sediment removal. Although the FFS did not provide detailed information on the cost of hydraulic dredging, the present value was provided for DMM Scenarios B and C for each of the alternatives assuming the use of hydraulic dredging. As noted in the FFS, the cost for hydraulic dredging was not estimated for Scenario A due to the complexity of maintaining a pumping line down the length of the lower 8.3 miles and crossing the federally-authorized navigation channel one or more times.

Both mechanical and hydraulic dredging systems are suitable for environmental dredging and no single equipment type or design is best suited for all site conditions. There are advantages and disadvantages associated with each type of system. For many projects, multiple dredge types may be used to optimize operations, e.g., one dredge for production cuts and another dredge for thin cuts or residuals passes (see USACE, 2008); the selection of dredging equipment is highly site-specific. Additional information will be gathered during predesign investigations which will allow for a determination of the appropriate dredging equipment. See Tables II.H.1.12 - 1 and II.H.1.12 - 2 for more details on hydraulic dredging equipment. It is anticipated that the design process will include discussions with equipment suppliers and dredging contractors familiar with site conditions and equipment options. The use of mechanical dredging as the process option for purposes of evaluating sediment removal in the RI/FFS represented a conservative approach to the technology analysis. If site conditions allow use of hydraulic dredging and it would reduce the project schedule and overall project costs (or both), based on potentially higher productivity rates, there is no reason that hydraulic dredging could not be incorporated into the project. As stated in the Proposed Plan, EPA anticipates that the most appropriate and effective equipment would be determined during the design phase and used during construction.

In response to this and other comments, EPA recalculated the costs for the remedial alternatives and provided additional detail supporting the cost estimate for hydraulic dredging included in the RI/FFS. Revised cost estimates for mechanical dredging are presented in Section III.D.1. Revised cost estimates for hydraulic dredging are presented in Table II.H.1.12 - 3.

H.1.13 Comment: Assessment of Erosion of Capping Material

Commenters stated that use of a coarse armor layer of 6-inch diameter stone was likely to cause infiltration of sediment into the interstices of the gravel and could induce liquefaction to cause cap instability. Commenters stated that the loss of that sediment and any preferential accumulation of fines within the armored cap had also not been assessed. Based on these issues, commenters questioned whether the analysis of sediment entrainment from the engineered cap using the UBS and presented in the FFS was reasonable. Commenters stated that capping as a remedial action thus needed to be re-considered, since the material to be used, as well as the cost and construction of the cap, could result in a remedial action that was not truly viable from a technical and economic point of view.

Response:

Commenters' references to the use of 6-inch armor stone appear to be based on review of the Capping/Armoring Analyses presented in RI/FFS Appendix BI, without recognition of the final capping concepts in the RI/FFS. The analyses presented in Appendix BI were intended to evaluate options for sand cap material, determine areas where an armor layer would be needed to stabilize the sand cap, and evaluate if cap placement would increase flooding adjacent to the LPR. Subsequent to that modeling evaluation, EPA performed engineering calculations using the hydrodynamic model output to refine the cap design as described in the RI/FFS. While the final decisions about cap thickness, capping materials, armoring methods, and other elements of the cap will be made in remedial design, for purposes of evaluating remedial alternatives, the RI/FFS assumed a 2-foot thick engineered sand cap with 0.5 foot thick layer of armor stone (see Figure 2-1 in Appendix F of the RI/FFS). The D_{50} (median stone diameter) for the armor stone is 2 inches and the thickness of the armor layer is 6 inches. On page 2-5 of RI/FFS Appendix F, EPA stated that the armor would be composed of a poorly-graded stone, with a gradation such that a filter layer between the cap and armor would not be necessary. Stone would be placed with a minimum thickness of three times the D_{50} size when a filter layer is not used (as per New Jersey Soil Erosion and Sediment Control Standards [NJDOT, 2008]). Therefore, the thickness of the armor layer was assumed to be 6 inches. It is anticipated that some infiltration of sediment into the interstices of the gravel from ongoing deposition within the river will occur. However, this infiltration will not impact the performance of the armor stone layer or the engineered cap.

H.1.14 Comment: Dredging Volume Calculations Unclear

Commenters stated that the RI/FFS did not provide the calculations that were used to arrive at the dredging volumes associated with the alternatives. In particular, commenters claimed there were no detailed explanations of how dredging inaccuracies were accounted for in the dredging volume estimates. Commenters stated that the absence of the calculations and assumptions that support the dredging volume, its associated areas (horizontal extents), and the anticipated overdredge allowance introduces uncertainty in the overall volume estimate.

Response:

The calculations of the dredging volumes for the alternatives was explained in detail in Section 1 of Appendix G of the RI/FFS. The volumes were estimated based on the conceptual designs for Alternatives 2, 3, and 4, which are presented in Figures 4-5, 4-6, and 4-7, respectively, of the FFS Report. The cross-sectional areas of the contaminated sediment to be removed are shown at various transects along the river. The dredging extents were based on the following information, and as described in Section 1 of Appendix G (overdredge allowance is also included in each alternative, as discussed in the next paragraph):

Alternative	Basis for Horizontal Dredging Extent	Basis for Vertical Dredging Extent
Alternative 2	Nature and extent of sediment contamination (Chapter 4 of the RI Report and DER No. 5 of Appendix A of the RI/FFS)	Depth of contamination (Attachment A of DER No. 5 of Appendix A of the RI/FFS)
Alternative 3	Nature and extent of sediment contamination (Chapter 4 of the RI Report and DER No. 5 of Appendix A of the RI/FFS)	Thickness of the cap (Section 2 of Appendix F) and reasonably-anticipated future use of the river (Chapter 4 of FFS and response to comment II.H.3.3)
Alternative 4	Modeling results showing the highest gross or net contaminant flux in the sediment (Section 1 of Appendix G of RI/FFS)	Thickness of the cap (Section 2 of Appendix F)

The dredging depth accuracy used by EPA to estimate removal volumes for each active remedial alternative was discussed in Section 4.2.3 of the FFS Report and in Section 2.4.2 of Appendix F of the RI/FFS. When the existing federally-authorized navigation channel was constructed in the late 19th and early 20th centuries, dredging accuracy was more typically one foot with an over-dredging allowance of two feet (USACE, 2010). Where dredging depths coincided with the federally-authorized navigation channel, the RI/FFS calculations included an additional three feet in the volume estimates to account for historical dredging accuracy and over-dredging. Where future use dredging depths are shallower than the authorized channel, EPA included an additional 5.5 feet in the volume estimates to accommodate an engineered cap (including provisions for a cap protection buffer and allowance for future maintenance dredging including overdredging). The estimated removal volumes were calculated using an average-end method and geographic information systems (GIS) software; this methodology was explained in detail in Section 1 of Appendix G of the RI/FFS. In response to comments, Section III.C.4 presents an update of the volume estimates based on the latest 2012 bathymetric survey and the adjusted navigation channel depths for Alternative 3 discussed in the response to comment II.H.3.3.

H.1.15 Comment: Submerged Debris and Obstructions not Appropriately Evaluated

Commenters stated that submerged debris and obstructions were not appropriately evaluated, since Appendix J of the FFS only estimated between 2,000 and 8,000 tons of debris removed. Commenters stated that the anticipated cost impacts of the presence of debris should be estimated since a significant debris problem could result in increased costs in the hundreds of millions of dollars.

Response:

The commenters' critique appears to be based on the 2007 draft of the FFS, in which the cost estimates were presented in Appendix J. Submerged debris and obstructions were evaluated in more detail for the 2014 final version of the RI/FFS, and the results were included in the cost estimates presented in Appendix H. Debris was broken down into three categories as described in the response to comment II.H.4.9. In response to comments (see II.H.3.3), EPA adjusted the navigation channel depths included in Alternative 3, the selected remedy. The table below summarizes the costs associated with debris management for EPA's selected remedy, with adjusted navigation channel depths:

Debris Type	Quantity[1]	2015 Capital Costs for Debris Management[2]
Large	6,000 tons	$ 1,200,000
Medium	195,000 cy (equivalent to approximately 232,000 tons)	$ 39,000,000
Small	20,000 tons	$ 4,600,000
Total	**258,000 tons**	**$ 44,800,000**

1. Costs do not include construction management or contingency factors.
2. Medium and small debris quantities are dependent on the volume of sediment removed. Volume estimates were updated as described in Section III.C.4; therefore, quantities presented in this table are slightly different from those presented in Appendix H of the RI/FFS.
3. The cost for a video survey for debris identification as well as a debris removal program is not included in the cost summarized above. For more information refer to Appendix H of the RI/FFS.

H.1.16 Comment: Technology Screening Inadequate

Commenters asserted that the technology screening conducted in the FFS did not consider a range of technologies needed to conduct a cleanup for the lower 8.3 miles. They stated that identification of a single representative process option prematurely eliminated a number of technologies that should have been evaluated and considered in the detailed analysis (e.g., enhanced natural recovery was not considered). Commenters also indicated that EPA's stated rationale for dredging prior to capping for flood control and navigation was incorrect because alternate methods of flood control, either in-water or at a basin-wide level, and other methods of capping that do not require prior dredging (e.g., geotextile liners or grout mats) should have been evaluated.

Response:

In screening technologies and selecting representative process options (see Chapter 3 of the FFS Report), EPA followed a stepwise process that is outlined in the NCP and in EPA's 1988 RI/FS Guidance document (EPA, 1988). This stepwise process started with an evaluation of a full range of general response actions and then further identified, described and evaluated a full range of in-situ and ex-situ technologies. The technology screening process is described in Sections 3.3 and 3.4 as well as in Tables 3-1 and 3-2 of the FFS Report. It should be noted that selection of a representative process option for cost estimation purposes was performed at the very end of Chapter 3 (i.e., in Section 3.7) and therefore suitable technologies were not prematurely eliminated. Also a full range of cap materials and capping technologies were identified, described and evaluated (see pages 2 through 4 of 10 in Table 3-2). These include engineered caps, armored caps, active caps, geotextile caps, clay caps and thin layer caps. The screening of capping technologies in the FFS Report also included consideration of capping without prior dredging but this was eliminated for all of the technical reasons stated on Page 2 of Table 3-2. EPA's experience with geotextile liners or grout mats indicates that there would still need to be dredging before they are installed to make room for materials such as sand to be placed on top of the liners or mats to hold them in place. EPA concluded that a bank-to-bank thin cap that stretches over the entire lower 8.3 miles would not be feasible or practical (see Table 3-2 of the FFS). However, EPA does agree that there may be some select areas for which a thin cap, which does not require significant prior removal of sediment, should be evaluated during the design. Incorporation into the design would be based on and justified by collection of relevant additional physical, chemical and geotechnical data.

EPA did not evaluate basin-wide flood control measures as an alternative to dredging prior to installing the cap. Flooding in the Passaic River Basin is already a chronic problem and USACE, the federal agency with authority to address flood control, is already evaluating such measures in the absence of capping.

See response to comment II.H.1.2 for an explanation of why a remedy based solely on monitored natural recovery would not be protective for the lower 8.3 miles and therefore was not evaluated in the FFS and Proposed Plan as a stand-alone remedial alternative.

H.1.17 Comment: Net Risk Reduction

Commenters stated that the Proposed Plan should have included an evaluation of the expected comparative net risk reduction of the various sediment management options, including a realistic evaluation of their respective advantages and site-specific limitations. Commenters stated that EPA should have evaluated not only the risk reduction associated with reduced human and ecological exposure to contaminants, but also risks introduced by implementing the alternatives, such as contaminant releases during dredging or capping, continued exposure to contaminants currently in the food chain, community impacts (accidents or noise), worker risks, residual contamination following dredging, releases from contaminants remaining outside dredged areas and disruption of the benthic community.

Response:

In the RI/FFS, EPA followed the NCP's nine criteria remedy selection process which ensured that both the risk reduction associated with reduced human and ecological exposure to COCs and the risks introduced by implementation of the alternatives were fully evaluated. Risk reduction associated with reduced human and ecological exposure to COCs was evaluated under the threshold criterion of overall protection of human health and the environment. Contaminant releases during dredging or capping were evaluated by including in the mechanistic model a conservative rate of dredging resuspension of 3 percent of the mass dredged (see response to comment II.H.6.1). Continued exposure to contaminants currently in the food chain and releases from contaminants remaining outside dredged areas was accounted for by incorporating current sediment COC concentration data into the mechanistic model (see response to comment II.E.2.6). Community impacts (accidents, noise), worker impacts and disruption of benthic community are evaluated under the balancing criterion of short-term effectiveness (RI/FFS Appendix F). Residual contamination following dredging was evaluated by incorporating sediment COC concentrations at depth in the mechanistic model.

H.2. Dredged Material Management

H.2.1 Comment: CAD should not have been Excluded

Commenters stated that CAD/CDF-based approaches are more implementable, environmentally protective, efficient and cost-effective compared to off-site disposal. Commenters stated that CADs/CDFs are a proven, effective option and of all the CAD and CDF sites in use today, none have failed. Commenters asserted that CAD facilities are similar to EPA's proposed remedial alternative of capping contaminated sediment; therefore, there was no valid basis to screen out this disposal scenario. Citing 40 C.F.R. § 300.515(e)(2)(ii) and 40 C.F.R. § 300.515(e)(2)(ii), commenters asserted that EPA has the authority to mandate a CAD over state and local objections and need not accede to New Jersey's view on this issue. Commenters concluded that the Proposed Plan improperly excluded consideration of the use of a CAD facility.

Response:

DMM Scenario A (CAD) was not included in the selected remedy, because of administrative infeasibility issues discussed in the RI/FFS, Proposed Plan and below.

A CAD facility in Newark Bay was fully evaluated in the RI/FFS and Proposed Plan using the NCP's evaluation criteria. EPA found that CAD sites are technically feasible, since CAD sites have been successfully implemented at other Superfund Sites, and one had already been built, operated and closed in Newark Bay (see Table 6-3 of Appendix G in the RI/FFS). The RI/FFS and Proposed Plan discussed that CAD cells in Newark Bay would minimize on-land impacts to the community, but increase traffic (and potential waterborne commerce accidents) in the bay; and that CAD cells in Newark Bay would be less costly than the other DMM Scenarios evaluated within each active alternative. However, EPA also found that DMM Scenario A (CAD) offers less long-term permanence and less reduction in toxicity, mobility or volume through treatment than the other DMM Scenarios. In addition, construction and operation of CAD cells in Newark Bay would have more substantial impact on the aquatic environment than the other DMM Scenarios, although some of that could be lessened through engineering controls.

In this case, DMM Scenario A (CAD) faces unique and significant administrative and legal impediments, because the State of New Jersey has asserted ownership of the bay bottom and strongly opposes construction of a CAD site in Newark Bay, citing the high concentrations of dioxin in Lower Passaic River sediments and unprecedented volume of contaminated sediment as primary reasons it should not be disposed of in the aquatic environment. The State's position is articulated in letters dated November 28, 2012 from Governor Chris Christie to former EPA Administrator Lisa Jackson (NJDEP, 2012) and March 12, 2014 from NJDEP Commissioner Martin to EPA Administrator Gina McCarthy (NJDEP, 2014). While EPA has authority to acquire property interests when needed to conduct a remedial action under Section 104(j)(1) of CERCLA, including by condemnation if necessary, Section 104(j)(2) requires prior State agreement that the State will accept the property interest when the remedial action is complete. In the March 12, 2014 letter, NJDEP stated that it will not provide the assurance required by Section 104(j)(2). Therefore, the State's opposition is likely to make DMM Scenario A administratively infeasible. Given the State's position, DMM Scenario A (CAD) is unlikely to satisfy the NCP balancing criterion of implementability and the modifying criterion of state acceptance.

The commenters' citations [40 C.F.R § 300.515(e)(2)(ii) and 40 C.F.R. § 300.515(e)(2)(ii)] refer to a section in the Code of Federal Regulations addressing the role of the state as support agency. While commenters described the latter citation as "EPA right of entry to construct or maintain remedial action," neither citation addresses right of entry, so in this response, EPA has assumed that the commenters meant to refer to 40 C.F.R. § 300.400(d)(2), which does. However, none of these citations addresses EPA's ability to take a property interest under CERCLA Section 104(j), which requires the state to agree to accept the property interest upon completion of the remedial action, addressed in 40 C.F.R. § 300.510(f). As discussed above, the State of New Jersey will not agree to accept the property interest, which is likely to make DMM Scenario A administratively infeasible.

H.2.2 Comment: CAD in Newark Bay will have Adverse Ecological and Human Health Effects

Commenters stated that construction of a CAD cell in Newark Bay will have adverse ecological and human health impacts over an estimated five year construction period or longer. Commenters pointed out that Newark Bay is designated by NOAA as Essential Fish Habitat, that many areas provide food, refuge and spawning grounds for declining sensitive aquatic populations and that there are many examples of species that are under pressure or run the risk of extirpation. Commenters stated that due to years of contamination from the Lower Passaic River, the Newark Bay ecosystem is already particularly susceptible to the negative impacts of construction and that long-term construction of a CAD in Newark Bay would lead to the decline of sensitive aquatic populations. Commenters further said that people traveling by boat in Newark Bay will have a higher risk of contacting toxic substances present in the contaminated sediments resuspended during CAD construction and operation, and that increased vessel traffic during CAD site construction could interfere with commercial traffic in Newark Bay and increase chances for boat accidents. Finally, commenters said that disposal of excavated clay from the CAD cells in an ocean disposal area risks deposition and dispersal of contaminated sediments offshore and increases traffic.

Response:

DMM Scenario A (CAD) was not included in the preferred alternative or selected remedy, because of administrative infeasibility issues discussed in the RI/FFS, Proposed Plan, ROD and response to comment II.H.2.1.

However, as described in the Proposed Plan and FFS Report, under Alternatives 2, 3 and 4, if DMM Scenario A (CAD) were selected, an engineered cap would have been placed over the filled CAD cells in Newark Bay and the cap would have been monitored and maintained in perpetuity. EPA assumed that the CAD cells would be sited in the part of Newark Bay where the thickest layer of clay (approximately 60 feet) is likely to be found. Dredged materials from the lower 8.3 miles of the Passaic River would have been barged to the Newark Bay CAD site so that an upland sediment processing facility on the banks of the Lower Passaic River or Newark Bay would not have been necessary. This would have minimized on-land impacts to the community, but increased traffic in the bay. Since major container terminals are located in Newark Bay near the potential CAD sites that EPA considered in the FFS (see FFS Figure 4-1), increased barge traffic to and from the CAD site might have interfered with existing port commercial traffic and increased the potential for waterborne commerce accidents. However, through use of navigation safety best management practices, such risks could have been minimized. Pages 34 through 36 of the Proposed Plan describe how the proposed CAD cells would have been constructed and operated and short-term impacts that would have resulted from disposal of dredged material in these CAD cells.

The commenters' concern over risks posed by resuspended contaminated sediments to people traveling by boats is unwarranted. Under DMM Scenario A, the disposal of dredged materials in the CAD cells was designed to be performed inside sheet pile walls, with a silt curtain across the entrance channel, so it is highly unlikely that people travelling by boats (which would be outside this enclosed area) would be exposed to contaminated resuspended sediments in Newark Bay. While it is possible that some dissolved phase contamination might escape the sheet pile walls and the silt curtain, the primary COCs from the Lower Passaic River are dioxins and PCBs, which are tightly bound to the sediment. The commenter's concern over ocean disposal of excavated clay from the construction of the CAD cells is also likely to be unwarranted. The deep clays underlying Newark Bay that would be excavated to create the CAD cells are relatively clean materials and would not be expected to pose any risks during ocean disposal.

H.2.3 Comment: CAD is more Inefficient and Costly, and has more Short-Term Effects than Off-Site Disposal

Commenters stated that the Newark Bay CAD site for Alternative 3, estimated at 80 acres, would be twice as large as the Puget Sound CAD site and almost ten times as large as the New Bedford Harbor CAD site. Commenters added that the concentration of contaminants and the volume of dredged material for the lower 8.3 miles of the Passaic River are both higher than at most other CAD sites. Commenters asserted that the Proposed Plan does not account for monitoring leakage of contaminants from the CAD cells over the long-term or explain how the monitoring in perpetuity would be performed. Commenters stated that because the waters of Newark Bay are already polluted, it may almost be impossible to discern leakage from the CAD cells. Commenters stated that the performance of CAD cells is unknown and the study by Palermo and Bosworth (2008) primarily addresses CDFs. Commenters also stated that constructing the CAD site will be largely inefficient; rather than one large CAD cell, multiple CAD cells will actually be excavated. Commenters stated that in the long run, the cost for off-site disposal of contaminated sediments may very well be cheaper than the cost of maintaining the CAD cells in perpetuity. Commenters asserted that construction of the CAD cells would require five years or more of increased boat traffic in Newark Bay, whereas removing the dredged material by truck and by rail would increase road and rail traffic for a much shorter period of time; and that the risks of climate change pose more threats to CAD cells than to off-site disposal.

Response:

DMM Scenario A (CAD) was not included in the selected remedy, because of administrative infeasibility issues discussed in the RI/FFS, Proposed Plan, ROD and response to comment II.H.2.1.

In the RI/FFS and Proposed Plan, EPA evaluated the size of a CAD site in Newark Bay, and the concentration and volume of dredged materials to be disposed of in the CAD site as part of the short-term effectiveness criterion. EPA concluded that a temporary sheet pile wall with a silt curtain across the entrance would be needed to reduce contaminant loss during CAD site operation, although some of the dissolved-phase contamination could still escape during dredged material disposal.
For RI/FFS cost estimation purposes, the CAD site was assumed to be sited in the part of Newark Bay with the thickest layer of impermeable clay and, at the end of the project, was assumed to be covered with an engineered cap designed to prevent leakage of COCs. The cost of long-term monitoring the CAD cells for leakage of contaminants was included in the RI/FFS cost estimate (see RI/FFS Appendix H), contrary to the commenters' assertion that it was not. The monitoring assumed for RI/FFS cost estimation purposes included sampling of the CAD cell caps, where contamination seeping in from

below would likely be detectable even if the waters of Newark Bay above the cap are polluted. Specific elements of the monitoring program would have been detailed during the design phase.

Section 6 in Appendix G to the FFS Report explains why multiple CAD cells are part of EPA's conceptual design. The contaminated sediment layer above the clay that would need to be excavated to construct the first cell was assumed to be disposed of in an off-site, upland facility. The contaminated sediment layer of successive CAD cells would be disposed of in existing cells before closure. This would minimize the amount of contaminated sediment being disposed of in off-site landfills. Multiple smaller cells, constructed as needed over the 6 years of implementation of the selected remedy, would minimize the surface area of the total CAD site that remained open at any given time, thus minimizing impacts of the CAD site on Newark Bay.

EPA included the cost of O&M over 30 years for the CAD site in its cost estimate for alternatives that included DMM Scenario A (CAD). In response to comment II.C.4.5, EPA estimated the present value for Alternative 3 with DMM Scenarios A (CAD) and B (Off-Site) with O&M for 100 years (updated cost estimates are presented in Section III.D.1 and included in the ROD as Table 26 in Appendix II). Table II.C.4.5 - 1 shows that for both 30 and 100 years of O&M for the CAD site, the total cost of Alternative 3 with DMM Scenario A is less than the total cost of Alternative 3 with DMM Scenario B, contrary to the commenter's assertion.

The duration for transportation of dredged materials is directly related to the volume of targeted contaminated sediments. Therefore, regardless of whether transportation is by marine operations or road and rail operations, the duration is approximately the same. The commenter did not articulate any technical basis for asserting that the risks of climate change pose more threats to CAD cells than to off-site disposal, nor is EPA aware of any. Increased traffic from barge transport of dredged materials from the lower 8.3 miles to and from a CAD site in Newark Bay is discussed under the short-term effectiveness criterion in the Proposed Plan and ROD. Since major container terminals are located in Newark Bay near the CAD sites that EPA considered in the RI/FFS, increased barge traffic to and from the CAD site may interfere with existing port commercial traffic and increase the potential for waterborne commerce accidents. In response to comments, EPA estimated that, depending on the alternative, approximately 2 to 4 barges a day would be needed to transport dredged materials from the lower 8.3 miles of the LPR to a CAD site in Newark Bay, which would increase vessel traffic from the LPR to and from Newark Bay by approximately 50 percent compared to current conditions documented in USACE's *Waterborne Commerce Statistics* (see Section III.C.5 for more details).

H.2.4 Comment: Dredged Material Characterization, Storage and Handling Schedule Incorrectly Analyzed

Commenters stated that the assumptions made regarding the estimated volume of dredged material characterized as hazardous and requiring thermal treatment prior to disposal, beneficial reuse of the sand fraction, and temporary storage of hazardous waste are incorrect and ill-founded, and as such, the FFS should be revised accordingly. Commenters observed that during Phase I of the Tierra Removal, the sand fraction exhibited chemistry that was similar to that of the finer sediments due to the presence of organic matter which would prevent beneficial reuse and result in increased costs for transportation, treatment and/or disposal due to the corresponding change in waste classification. Commenters also stated that the capacity of existing incinerators appeared to be sufficient to manage the immediate handling of the estimated tonnage of hazardous waste generated from the dewatering operations, assuming proper rail loadout and transportation logistics and therefore, the need to store hazardous waste for six months was not justified.

Commenters stated that correlations developed between analytical chemistry data and TCLP values were extracted from a small section of the river that represented unique localized relationships that may or may not be appropriate for the rest of the lower 8.3 miles. Commenters stated that based on its correlation to the TCLP data, EPA had incorrectly and conservatively assumed that 59 samples exceeded the threshold for thermal treatment, when in fact, only 14 samples exceeded both the RCRA TCLP criteria and the universal treatment standard (UTS) threshold by the requisite factor of 10. Using these 14 values and interpolating between data points, commenters calculated that approximately 28,000 cy, or about 1 percent of the proposed removal volume would require thermal treatment in contrast to EPA's value of 301,000 cy, or 7 percent of the proposed removal volume. Commenters also stated that based on the lessons learned during Phase I of the Tierra Removal, EPA's RI/FFS failed to address logistics and implementability concerns as they relate to transitioning between different in-situ waste categories during dredging and processing.

Response:

EPA's assumptions regarding the estimated volume of dredged material that could be characterized as hazardous and require thermal treatment prior to disposal, beneficial reuse of the sand fraction and temporary storage of hazardous waste are based on currently available data, including that obtained during Phase I of the Tierra Removal. This information will be updated during pre-design investigations and assumptions modified as appropriate. EPA recognizes that concentrations of COCs in the sediment (and the reclaimed sand) adjacent to the former Diamond Alkali facility (i.e., within Phase I and Phase II of the Tierra Removal) may be different than in the rest of the lower 8.3 miles; additional data will be gathered during the pre-design investigation to further evaluate this issue.

While it is possible that some of the sand may not be suitable for beneficial reuse, granular soils are typically less chemically and biologically active than fine-grained materials and are generally not associated with chemical contamination (New York State Department of Environmental Conservation, 2014). Section 3.2.4 of Appendix H to the RI/FFS Report shows that EPA's cost estimate conservatively included a cost of $50/ton for processing, transport and beneficial reuse for an estimated 600,000 tons of reclaimed sand (following the adjustment to the navigation channel depths in Alternative 3 described in response to comment II.H.3.3, the amount of reclaimed sand included in the cost estimate supporting the ROD is 500,000 tons); it was also assumed that no revenue would be generated from beneficial reuse of the sand. In addition, Table 1-6 (Alternative 3 with DMM Scenario B) in Appendix H shows that a cost of $230/ton was included in the estimate of the selected remedy for transport and disposal in an off-site RCRA Subtitle C landfill for an estimated 2,460,000 tons of dewatered sediment (updated to 2,070,000 tons in the ROD cost estimate).

Six months of storage was assumed as a contingency to allow for the possibility that rail shipments of dewatered dredged materials from the upland sediment processing facility could be unexpectedly disrupted and/or that disruptions at either the incinerator(s) or landfill(s) would limit the amount of material that could be handled in a timely manner. If such an event were to occur, the additional storage would allow dredging operations in the lower 8.3 miles to continue without interruption. If the disruption were severe enough to last for more than 90 days, EPA anticipates that alternate arrangements for thermal treatment and landfill disposal (e.g., use of alternative sites or different shipping methods) could be made. It is not anticipated that routine operations would require storage of dewatered dredged materials at the upland sediment processing facility beyond the 90-day period allowed under RCRA.

For RI/FFS cost estimation purposes, EPA estimated that the material requiring incineration would be 10, 7 and 4 percent for Alternatives 2, 3 and 4, respectively. These were conservative but reasonable numbers considering that over 20 percent of dredged material were incinerated in Phase I of the Tierra Removal. A review of the Tierra Removal waste characterization data conducted for the RI/FFS showed that there were no samples exceeding the RCRA criteria that did not also exceed 10 times the UTS, supporting EPA's assumption that in cases where TCLP exceedances did occur, underlying hazardous constituents would also be present above 10 times the UTS and this material would thus require incineration. Nevertheless, EPA revisited the waste characterization evaluation to address this comment. The table below shows a summary of revised waste characterization data and the results of this updated evaluation. Details on the data sets used and the methodology are presented in Appendix G of the RI/FFS, with a few important distinctions, as follows:

- Revised calculations included one additional core location around RM 5.6 (Core ID 08A-034) that was inadvertently omitted from the original calculations;
- All co-located sample locations and overlapping sample intervals were averaged, rather than just the intervals for which the depths were an exact match;
- Area of influence for each core location was revised to better characterize the co-located locations;
- In response to comments (see II.H.3.3), EPA adjusted the navigation channel depths included in Alternative 3.

Description	Alternative 2	Alternative 3	Alternative 4
Total Number of Core Locations	153		
Number of Co-located Locations	25		
Total Number of Samples	1040		
Number of Averaged Samples[1]	848		
Samples Intervals within Alternative Dredging Depth	750	459	233
Sample Intervals Exceeding Both RCRA Criteria and 10xUTS	32	10	6
Sample Intervals Exceeding RCRA Criteria	58	25	10
Percent Volume Exceeding Both RCRA Criteria and 10xUTS	4 percent	2 percent	2 percent
Percent Volume Exceeding RCRA Criteria (Revised for Responsiveness Summary)	7 percent	5 percent	3 percent
Percent Volume Exceeding RCRA Criteria (RI/FFS - April 2014)	10 percent	7 percent	4 percent

1. Co-located sample locations and overlapping samples were binned into representative sample intervals. Concentrations were calculated using length-weighted averages

Based on the revised waste characterization analysis, for EPA's selected remedy (Alternative 3), the volume exceeding both the RCRA criteria and 10 times the UTS is 2 percent, whereas the volume exceeding just the RCRA criteria is 5 percent. The difference in these volume percentages correspond to a change in the cost of approximately 4 percent. Due to the uncertainty in the data (since the Tierra Removal Phase I area may not be representative of the rest of the lower 8.3 miles) and the relatively minor difference in the cost, EPA has decided to retain the assumption that where TCLP exceedances occur, underlying hazardous constituents are also present at concentrations above 10 times the UTS. The resulting percentages of material requiring incineration are 7, 5 and 3 percent for Alternatives 2, 3 and 4, respectively.

EPA has substantial experience with dredging and processing of contaminated sediments as a result of the Hudson River PCBs and Fox River Superfund Sites, among others, in which logistics and implementability of transitioning between different in-situ waste categories (e.g., sediments classified as subject to Toxic Substances Control Act and those not subject to Toxic Substances Control Act) have been considered and factored into the estimated costs and projected schedule for EPA's conceptual design. After additional data are gathered during the pre-design investigation, the logistics of transitioning between different in-situ waste categories will be reviewed and re-evaluated. Based on both the RI/FFS evaluation and EPA's updated evaluation performed in response to this comment, the volumes that are likely to be considered hazardous (on an in-situ basis) and require incineration are a minor part of the sediment targeted for removal and therefore the need for transitioning is limited. Separate barges can be used to transport dredged materials with different waste classifications. These barges, along with equipment in the treatment process train in the upland sediment processing facility, will undergo appropriate decontamination procedures after handling materials classified as hazardous to avoid comingling with materials classified as non-hazardous. The dredge bucket and associated equipment that come into contact with hazardous materials will also be subject to similar decontamination procedures to avoid cross-contamination.

H.2.5 Comment: How will Sediments be Dewatered?

Commenters asked how the contaminated sediment would be dewatered and what chemical additives would be used to accelerate dewatering.

Response:

In the RI/FFS, mechanical dewatering was evaluated for cost estimation purposes. EPA's experience with mechanical dewatering during Phase 1 of the Tierra Removal was that a cationic polymer was used to improve the dewatering process. The choice of a dewatering technology will be made during remedial design, along with details of any necessary chemical additives.

H.2.6 Comment: Transport by Barge for Disposal

Commenters asked EPA to consider both rail and barge transport of dredged material off-site for land disposal or incineration. Commenters suggested that water transportation may often be the least expensive and safest method of transport.

Response:

EPA evaluated transport of dredged materials by rail for cost estimation purposes, but has not ruled out other forms of transport, such as barge. The best method of transport will be determined during remedy design. EPA will provide opportunities for input from the affected communities.

H.2.7 Comment: What Contaminants are in the Sediment that needs Thermal Treatment? And how did EPA Estimate Percentage Requiring Incineration?

Commenters asked what portion of the dredged materials designated for land disposal in a RCRA Subtitle C facility in EPA's preferred alternative would be eligible for incineration or an existing thermal desorption method. Other commenters asked for the basis for EPA's evaluation that a portion of the sediments dredged out of the lower 8.3 miles of the Passaic River will need to be incinerated.

Response:

As discussed in the Proposed Plan and updated for the ROD to account for adjustments in the navigation channel depths included in the selected remedy, EPA estimated that less than 10 percent of the dredged volume (about 130,000 in situ cubic yards based on the selected remedy) will require incineration at facilities in the United States or Canada, with the ash being disposed of in a RCRA Subtitle C landfill, and the other approximately 90 percent going directly to regulated landfills in the United States or Canada. As described in the RI/FFS, Proposed Plan and ROD, this is because, in DMM Scenario B (Off-Site Disposal), some lower 8.3-mile sediments have the potential to be characterized as hazardous under RCRA regulations. At this time, incineration is the only technology known to be able to treat sediments to the applicable RCRA standards if those sediments are characterized as hazardous under RCRA and contain dioxin as an underlying hazardous constituent at concentrations requiring treatment. For cost-estimation purposes, EPA conservatively assumed that the sediment not requiring incineration would be disposed of in a RCRA Subtitle C landfill was, since that was the disposal method selected by private parties performing both the Phase 1 Tierra Removal and RM 10.9 Removal.

H.2.8 Comment: Feasibility of Local Decontamination

Commenters asked whether the FFS evaluated the feasibility and cost of local thermal decontamination technologies.

Response:

The feasibility and cost of local decontamination technologies were evaluated in Appendix G of the RI/FFS, and the results were incorporated in the analysis of DMM Scenario C (Local Decontamination with Beneficial Reuse). Three types of treatment technologies were evaluated: solidification/ stabilization, sediment washing and thermal treatment. Under thermal treatment, four technologies were evaluated: Cement-Lock Technology, JCI/Upcycle Associates LLC's Rotary Kiln, Minergy's Glass Furnace Technology and Westinghouse Plasma Corporation's Vitrification Technology. The first two technologies were pilot-tested on Lower Passaic River-Newark Bay sediments.

Based on EPA's evaluation, none of the sediment washing or thermal treatment technologies evaluated in the RI/FFS were proven to be implementable on a commercial scale, particularly with the large volumes contemplated by any of the active alternatives and the mixture of contaminants in the sediment. As discussed in the Proposed Plan and ROD, should one or more vendors succeed in siting and constructing a local decontamination technology facility during the remedy design phase, EPA could modify the selected remedy through a ROD amendment or Explanation of Significant Differences to allow for local decontamination and beneficial use of all or a portion of the lower 8.3 mile Passaic River sediment. Such a modification would be appropriate only if EPA determined that the technology could reliably lower concentrations of contaminants in the sediment to levels that would be protective for beneficial re-use.

H.2.9 Comment: Thermal decontamination Technology Meets Nine Criteria

Commenters stated that Cement-Lock® manufacturing technology with design enhancements by Foster Wheeler Corporation delivers sustainable, integrated, and cost-effective sediment management, and meets the evaluation criteria for treatment/disposal established in the FFS and Proposed Plan including (according to the commenters): long-term effectiveness and permanence; short-term effectiveness; reduction of toxicity, mobility or volume through treatment; implementability; cost; acceptance and sustainability. Commenters supported EPA's preferred alternative provided that viable treatment alternatives (like Cement-Lock®) to out-of-region incineration with long-haul transport will have the opportunity to demonstrate site control and other approvals necessary to construct and operate a regional treatment facility during the remedial design phase.

Response:

During preparation of the RI/FFS, EPA thoroughly assessed opportunities to use local decontamination and beneficial reuse technologies for dredged material management. While local decontamination processes such as the Cement-Lock® manufacturing technology show some promise for addressing contaminated sediment, to date the Cement-Lock® process has not been implemented on a commercial scale (see Appendix G Section 5.4 of the FFS) and as of February 2016 there are no operating Cement-Lock® facilities that are permitted to accept material from the Lower Passaic River. Note that "sustainability" is not an NCP criterion.

As discussed in the Proposed Plan and ROD, should one or more vendors succeed in siting and constructing a local decontamination technology facility capable of processing the volume of dredged material that will be generated as a result of the remedy for the lower 8.3 miles during the remedy design phase, EPA could modify the selected remedy through a Record of Decision amendment or Explanation of Significant Differences to allow for local decontamination and beneficial use of all or a portion of the sediment to be dredged from the lower 8.3 miles of the Passaic River.

H.2.10 Comment: Evaluation of Potential Sites for Sediment Processing Facility is Outdated and Analysis of Rail Infrastructure Needed to Transport Dewatered Dredged Material for Disposal was Inadequate

Commenters noted that potential sites identified in the FFS for the processing facility were based on an August 2007 report by USACE, which commenters characterized as out of date. Commenters recommended that new analyses regarding the current rail capability and availability of potential processing sites be undertaken to determine the feasibility of off-site disposal and stated that such analyses should not be deferred to remedial design. Also, commenters indicated that the FFS failed to demonstrate the feasibility of securing, developing and operating the rail infrastructure required to implement the dredged materials cleanup and disposal. In addition, commenters stated that the amount of dredged materials that would be the output of the processing facility should have been estimated on a daily or weekly basis which will determine the number of rail cars required.

Response:

The level of analysis provided in the RI/FFS and Proposed Plan was appropriate for its intended use; a full site selection and evaluation process will be conducted during the design phase. However, to respond to this comment and to confirm the availability of potentially suitable sites for the sediment processing facility, EPA prepared an updated siting study based on the siting criteria established in Appendix G of the FFS. Four sites meeting the criteria and on the market as of March 2015 were identified between RM 3 and the upper portion of Newark Bay; in addition, several other sites meeting the criteria were identified somewhat beyond the preferred project location. See Section III.C.2 for results of this analysis. This evaluation reflects conditions in the selected area as of March 2015 and is subject to change over time. Sites that are currently available may go off the market and new properties may become available. Since suitable sites for a sediment processing facility were identified first in the RI/FFS issued in April 2014 and again in response to this comment over a year later, it is reasonable to anticipate that suitable sites will continue to be available in the future.

There are a number of options for incorporating rail transport from the proposed processing facility to the ultimate disposal site(s), ranging from on-site storage and loading for rail cars, to use of an off-site intermodal transfer point. The final approach will be selected during the design phase, factoring in site conditions and rail access at the processing facility as well as at the selected disposal facilities. For RI/FFS site selection and cost estimating purposes, the required storage space for rail cars was estimated based on the use of 100-ton gondola cars (i.e., CSX 65.5 Gondola). Rail line spacing was based on Michigan Department of Transportation guidelines for rail yards. Sufficient rail storage capacity for approximately 4 weeks of sediment production was assumed. For the selected remedy, this yielded approximately 50 trains per year or 1 train per week.[47] By comparison, over the past few years, the Hudson River PCBs Superfund Site remedy has generated 60 to 80 trains per construction season (typically 2 to 3 trains per week during peak periods).

Rail car storage was included in the space requirements for the sediment processing facility as presented in Section III.C.2. The identified sites currently have rail access on-site or adjacent to the property with space to construct adequate rail car storage. The cost estimates for the various alternatives (Appendix H of the RI/FFS) included construction of up to five miles of rail lines.

H.2.11 Comment: Sediment Processing Facility Size Underestimated and Potential Locations Unsuitable

Commenters asserted that EPA's assumptions for the processing of dredged material did not match the assumed throughput rate, because the upland processing facility proposed in the FFS appeared to be based on projects of size and dredging rates similar to those for the Hudson River project, and that using the Hudson River processing facility size and throughput rate should have resulted in a longer time to completion than claimed in the Proposed Plan and FFS. In addition, commenters stated that the processing facility described in the FFS was much smaller than the Hudson River facility. Commenters also noted that the 12 potential sites for the upland processing facility identified in the FFS-level survey appeared to be 10 to 20 miles away from the mouth of river and had many limiting factors (like lack of waterfront to develop, lack of rail access, and insufficient size). Commenters stated that EPA should put in a greater effort to locate a suitable site along the Lower Passaic River because this directly affects the project cost and duration.

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[47] Rail transport has been assumed to occur year round, since it is not affected by the 17-week fish window or other downtimes such as weather-related or other equipment issues (estimated at 3 weeks per year). Sufficient storage for both hazardous and non-hazardous dewatered materials has been assumed at the sediment processing facility (see Table 3-4 of Appendix G of the RI/FFS). For EPA's selected remedy, given the sediment processing rate calculated for cost-estimation purposes, an estimated 50 trains (with up to 90 rail cars of 100 tons each) are needed annually for transport of dewatered materials to incinerators and landfills. If materials were only transported during the construction season (a maximum of 35 weeks per year if no additional downtime is assumed), an additional train would have to be hauled off-site every other week (2 instead of 1).

Response:

The sediment processing facility evaluated in the RI/FFS for cost estimating purposes was based on EPA's experience at a number of Superfund sediment sites, including the Hudson River and Fox River. The average weekly production rate[48] assumed in the RI/FFS was approximately 24,000 cy and the rate re-calculated in response to comments (as described in Section III.C.3) is approximately 23,100 cy. Both rates fall within the range of average weekly production rates achieved by the Hudson River (21,600 cy to 23,700 cy in 2012 to 2014) and the Fox River (17,000 cy to 25,500 cy in 2012 to 2014). Therefore, EPA could have based the sediment processing facility sizing and estimated cost on either the Hudson River or Fox River. The size of the Fox River sediment processing facility was more compatible with the size of the sites available on the shores of the Lower Passaic River and Newark Bay, so the size and cost estimate for the sediment processing facility developed for the FFS were based on input from the same contractors who supplied the equipment for the Fox River project. The final configuration of the sediment processing facility will be developed during the design phase based on site-specific characteristics.

The final site selection and evaluation process will be conducted during the design phase of the project. However, as discussed in the response to comment II.H.2.10, four potential sites were identified between RM 3 and the upper portion of Newark Bay, which, if developed, would result in barge hauling or pumping distances of less than 10 miles, similar to the Hudson River (barge transport) and Fox River (pumping with booster pump stations) projects. Based on input from dredging contractors, the general locations identified appear suitable for use with either mechanical or hydraulic dredging options. See III.C.2 for results of siting study.

H.2.12 Comment: 2014 FFS Screened Out Upland CDFs and Retained In-Water CAD while 2007 Draft FFS Presented the Reverse Conclusion

Commenters indicated that the 2014 FFS presents a slightly less streamlined technology screening process than the 2007 draft FFS. Commenters stated that where the 2007 draft FFS presented a summary of the screening process and list of retained technologies, the 2014 FFS summarized a two-step screening process that culminated in very similar results, with one notable exception: the 2014 FFS screened out upland CDFs as a disposal technology and retained in-water CAD cells. Commenters noted that the 2007 draft FFS presented the reverse conclusion on CAD cells and CDFs.

Response:

During EPA's initial screening of technologies, outlined in Table 3-1 of the FFS Report, both upland CDFs and CAD cells were determined to be technically feasible and were retained for further evaluation in Table 3-2. However, as a result of the evaluation of effectiveness, implementability and cost performed in Table 3-2, upland CDFs were eliminated based on the conclusion that implementability of this land disposal process option would be severely hindered by siting challenges. During the technology screening process, and after consideration of the Clean Water Act Section 404(b)(1) guidelines, EPA decided that CAD cells in Newark Bay would be retained. However, as discussed in the ROD and

[48] Commenters compared the annual production rate assumed in the RI/FFS to annualized production rates for the Hudson River. However, annual production rates are highly dependent on the duration of the construction season, which is much shorter in the colder climes of Wisconsin and upstate New York than it is in New Jersey. Average weekly production rates are compared in response to this comment.

response to comment II.H.2.1, DMM Scenario A (CAD) was not included in the selected remedy, because of administrative infeasibility issues.

H.3. Navigational Channel Dredging

H.3.1 Comment: Cost-Benefit Analysis of Navigational Dredging

Some commenters asked EPA to produce an economic analysis to support the extent of dredging in the navigation channel "upriver." Other commenters said that navigational dredging should be dropped as an element of Alternative 3, unless the navigation dredging component can be shown to be worthwhile, consistent with requirements of established principles for federal water resources projects. Commenters cited the Principles and Guidelines for the USACE as requiring that navigational dredging projects be subject to established principles of benefit-cost analysis, incremental analysis and cost sharing. Commenters also cited Executive Order 12893 as requiring that benefits and costs be quantified and monetized to the maximum extent practicable.

Response:

CERCLA and the NCP do not provide for a study of economic benefits, or a cost-benefit analysis, of an element of a proposed remedy. EPA incorporated the navigation channel consistent with the requirements of Section 10 of the Rivers and Harbors Act of 1899 (a location-specific ARAR), the navigation depths authorized by Congress, and EPA policy to take into account the "reasonably anticipated future land use" even where attainment of that use may result in a higher cost of remediation. Thus, for example, for on-land sites that will, in the future, be used for residential purposes, EPA may require more extensive and expensive cleanup than for sites that will be used for industrial or commercial purposes.

As discussed in the response to comment II.H.3.3, the USACE issued a report in 2010 that demonstrated commercial navigational use of the federal navigation channel in the lower 1.7 miles. A 2009 survey of commercial users, included in the 2010 report, showed potential future commercial use of the channel up to RM 2.2. However, EPA has not identified or received any information about actual commercial use of the channel above RM 1.7. The USACE has advised that it will support a recommendation for Congressional action to deauthorize the authorized navigation channel in RM 1.7 to RM 8.3, and modify the authorized depth between RM 0.6 and RM 1.7 to the depths included in the selected remedy. There is no basis in the record to support deauthorization below RM 1.7.

H.3.2 Comment: Cost-Benefit Analysis of Future Maintenance Dredging of Navigation Channel

Commenters stated that the costs and benefits of any future maintenance dredging projects in the Lower Passaic River have to be assessed and compared with the costs and benefits of other competing navigation channel dredging projects, such as those for the nearby Port Newark-Elizabeth Marine Terminal. Commenters asserted that since it is unlikely that the net benefits (benefits minus costs) of any maintenance dredging for the navigation channel in the Lower Passaic River will exceed those for the Port Newark-Elizabeth Marine Terminal, there is no guarantee that it would receive federal funding.

Response:

As noted in the response to comment II.H.3.1, CERCLA and the NCP do not provide for a study of economic benefits, or a cost-benefit analysis of an element of a proposed remedy. EPA incorporated the navigation channel consistent with the requirements of the Section 10 of the Rivers and Harbors Act (33 U.S.C. § 403), the navigation depths authorized by Congress, and EPA policy to take into account the "reasonably anticipated future land use" even where attainment of that use may result in a higher cost of remediation. Whether or not funding will be available for maintenance dredging in the future is unknown. However, USACE is the federal agency that determines the need for maintenance dredging of a federally authorized navigation channel. In a February 6, 2014 letter, USACE confirmed that "USEPA's remedial action is critical to restoring the navigation channel for the viability and economic sustainability of the area and its users" and stated "the current and projected future level of commercial traffic is sufficient to justify maintenance dredging of the channel should it be required, subject to budget limitations."

H.3.3 Comment: Preferred Remedy should not Include Additional Dredging in Navigation Channel

Commenters raised several issues concerning dredging for navigation, including that: (a) restoration of the federal navigation channel was not within the scope of EPA's authority under CERCLA; (b) the 2014 FFS failed to present critical information about the navigational dredging component of the preferred alternative, including that channel deepening below RM 2.2 accounted for nearly half the dredging volume and remedy cost, and would not result in any additional risk reduction; and, (c) EPA had failed to provide economic justification for the additional dredging to support navigational needs. Commenters stated that the 2010 Navigational Analysis should be updated to include the latest data on navigation (waterborne commerce statistics) in the Lower Passaic River. Commenters stated that the tonnage of material transported via the river dropped between 2006 and 2011 by 36 percent. Commenters concluded that navigation in the Lower Passaic River was not a promising enterprise and investments in navigational dredging could not be justified.

Commenters stated that EPA's failure to evaluate one obvious alternative (i.e., a bank-to-bank alternative without navigational dredging from RM 0 to RM 2.2) was inconsistent with the NCP, because its absence made it impossible for a decision-maker to consider the cost-benefit tradeoffs associated with navigational channel restoration and, therefore, to have a sufficient basis to justify the selection of an appropriate remedy.

Commenters also stated that the Proposed Plan should not include navigational dredging, which is unwarranted for commercial reasons and increases the implementation risk, environmental and community impact, and cost of the proposed remedy. Commenters noted that the FFS did not provide any analysis of reasonably anticipated recreational future uses above RM 2.2 that would result in a need to deepen the navigation channel. Commenters noted that filling in of navigation channels over time is the result of natural sedimentation, and is not an injury associated with release of hazardous substances. Therefore, commenters concluded that responsible parties are not liable for the navigational component of dredging operations, but only for the incremental costs associated with the release of hazardous substances. Commenters remarked that navigational dredging is not even included among the RAOs. Commenters also stated that EPA's FFS did not address CSTAG's recommendation to consider developing an alternative that addresses additional dredging for flood control but not for navigational purposes in the lower two miles and to use the information on differences in cost, short-term effectiveness and implementability in evaluating cleanup options.

Response:

As described in the RI/FFS, Proposed Plan and ROD, Section 10 of the Rivers and Harbors Act of 1988 (33 USC § 403) is a location-specific ARAR with which the remedy for the lower 8.3 miles will comply. Section 10 of the Rivers and Harbors Act prohibits creation of any obstruction to the navigable capacity of any waters of the United States without Congressional authorization, subject to the USACE permitting authority with respect to work in or affecting navigable waters, such as excavating or discharge of dredged or fill material. In addition, as explained in the RI/FFS, Proposed Plan and ROD, it is EPA policy to consider reasonably anticipated future land and waterway uses during development of remedial alternatives and during remedy selection.

Congress authorized construction of a navigation channel in the Lower Passaic River, from the mouth of the river upstream to RM 15.4. The first federal legislation providing for the navigation channel dates to the late 19th century. Additional legislation was passed in the first three decades of the 20th century. In the Rivers and Harbors Act of 1930, Pub. L. 520, Congress authorized a 30 foot depth between RM 0 and RM 2.6 in 1932. By 1932, the channel had been constructed to its maximum depths: 30 feet from RM 0 to RM 2.6; 20 feet from RM 2.6 to RM 4.6 (authorized in the Rivers and Harbors Act of 1912); 16 feet from RM 4.6 to RM 8.1 (authorized in the Rivers and Harbors Act of 1907); and 10 feet from RM 8.1 to RM 15.4 (authorized in the Rivers and Harbors Act of 1927). Only Congress can change these current authorized channel depths, and it has not done so, nor is EPA aware that any de-authorization process is underway. However, maintenance dredging last occurred between RM 0 and RM 1.9 in 1983. For the reaches from RM 1.9 to RM 8.3, maintenance dredging occurred, variously, between 1930 and 1950.

In order to select a capping remedy that would not permanently obstruct the navigable capacity of the Lower Passaic River in contravention of Section 10 of the Rivers and Harbors Act of 1899 and to accommodate reasonably anticipated future commercial navigational use, EPA evaluated USACE's 2010 Lower Passaic River Commercial Navigation Analysis Report (USACE, 2010), which assessed the current and potential future status of commercial navigation on the Lower Passaic River, as well as information submitted during the public comment period for the Proposed Plan.

The USACE report concluded that, despite constraints such as limited horizontal and vertical bridge clearances, limited channel width, lack of maintenance dredging in recent decades and presence of competing docking facilities in Newark Bay, the Lower Passaic River navigation channel is currently used to transport petroleum products to and from facilities located below RM 1.7. The report also noted potential future commercial use of the channel up to RM 2.2 and provided the results of a survey of commercial users conducted in 2009, including information on projected future commercial navigation needs, as follows:

- RM 0: Motiva Enterprises dredged its berth to 20 ft in 2007.
- RM 0.2: Apex Oil Company applied for a USACE permit to dredge its berth to 22 ft.
- RM 0.5: PVSC dredged its berth to 23 ft in 2010. In response to the 2009 USACE survey, PVSC provided the names and dimensions of the vessels that use its berth (drafts ranged from 14 feet to 18 feet).
- RM 0.6: Darling International applied for a USACE permit to dredge its berth to 31 feet.[49]

[49] Darling International withdrew the USACE permit in September 2010.

- RM 0.8: Sunoco applied for a USACE permit to dredge its berth to 20 feet.
- RM 1.4: Harms Construction provided a general statement that, in the future, the types of vessels that might use its berth would draft 4.5 feet to 18 feet. Harms also stated that the channel should be maintained at a 25-foot depth without providing any specific support for the statement.
- RM 1.7: Getty provided the name of a barge that currently uses its berth (with a draft of 12.5 feet). Getty stated that, in the future, the deepest barge that it planned to use would draft 22 feet.
- RM 1.9: Disch Construction provided the names and dimensions of the vessels that, in the future, might use its berth (drafts ranging from 4.5 feet to 16 feet).
- RM 2.2: Clean Earth of NJ provided a general statement that, in the future, the types of vessels that might use its berth would draft 13 feet to 17 feet.

In addition to the 2010 USACE report, in a letter from Colonel John Boulé, USACE-NY Commander to former Congressman Donald M. Payne, dated May 5, 2010, USACE documented berth maintenance dredging by Motiva Enterprises at RM 0, Apex Oil at RM 0.2 and Sunoco Terminal at RM 0.8. In June to August 2010, Darling International and Congressman Payne met at least twice with EPA and USACE to advocate for dredging the navigation channel from RM 0 to RM 1.7 to 30 feet.

EPA, in consultation with USACE and NJDEP, evaluated the survey results and other information received during the RI/FFS to develop the navigation channel depths incorporated into Alternative 3 (Capping with Dredging for Flooding and Navigation), as presented in the Proposed Plan.

During the comment period, commenters stated that the analysis in the 2010 USACE report should be updated to include the latest data on navigation (waterborne commerce statistics) in the Lower Passaic River, asserting that the tonnage of material transported via the river dropped between 2006 and 2011 by 36 percent (see comment II.H.3.5). By letter dated February 6, 2014, the USACE NY District confirmed that 2011 Waterborne Commerce Data (the last year analyzed as of the writing of the letter) indicated a significant volume of waterborne commerce was transported that year within the Lower Passaic River, consistent with its prior analysis of 1997-2006 data. The letter also stated that "The current and projected future level of commercial traffic is sufficient to justify maintenance dredging of the channel should it be required, subject to budget limitations."

To address comments and continue to evaluate commercial navigation in recent years, EPA, in consultation with USACE and NJDEP, reexamined available information pertaining to current and future commercial uses of the Lower Passaic River navigation channel submitted and obtained during the public comment period, including:

- RM 0.5: In its August 20, 2014 comments on the Proposed Plan, PVSC provided a table showing increasing annual cargo tonnage (liquid sludge) arriving at its berth from 2009 to 2013 (consistent with the berth dredging that it undertook in 2010) and expressed strong support for dredging and maintenance of the navigation channel.
- RM 0.6: During the Proposed Plan public comment period, Darling International participated in the NJIT Forum on July 22, 2014 and described how the lack of maintenance dredging in the Lower Passaic River navigation channel has constrained its ability to conduct business and expand in the future. In its August 11, 2014 comments on the Proposed Plan, Darling International detailed the constraints imposed on its vessel operations by the shallow, unmaintained channel, including a two-barge loading arrangement (transferring product from a

deep barge to a shallower barge) to overcome siltation closer to the berth; timing the arrival and departure of ocean-going tankers that draft 26 feet to 30 feet with the tides to maximize water depth; using vessels that are not fully loaded to minimize draft; and paying for larger vessels to moor in Port Newark and trucking materials from there to the Darling facility. Darling International strongly supported dredging the navigation channel from RM 0 to RM 1.2 to 30 feet.

- RM 1.4: During the Proposed Plan public comment period, Rob Harms of Harms Construction Company participated in the NJIT Forum and stated that the company had applied for permits from USACE to build a heavy wharf structure with 275 feet of river frontage on Doremus Avenue and that navigation channel depths will ultimately affect that construction.
- RM 1.9: In 2014, Disch Construction went out of business.
- RM 2.2: Steve Sands of Clean Earth of NJ participated in the NJIT Forum and stated that Clean Earth of NJ had started implementing plans for a multi-model waste handling facility with the installation of rail service, but that the portion of the plans that involved marine transport facilities could not be implemented due to insufficient water depth in the navigation channel.

Based on its evaluation of the comments on the Proposed Plan and the additional information on commercial use in the Lower Passaic River available since the 2010 USACE report, in consultation with USACE and NJDEP, EPA has adjusted the depths of the navigation channel included in the selected remedy as follows:

- RM 0 to RM 0.6: The selected remedy includes dredging to 30 feet in this section of the authorized navigation channel. As documented in the 2010 USACE report and subsequently, the operations of Darling International show ongoing current commercial use and planning for future use of a 30-foot navigation channel. In addition, PVSC, Apex Oil and Motiva have dredged their berths to depths that are not inconsistent with use of a 30-foot channel.
- RM 0.6 to RM 1.7: The selected remedy includes dredging sufficient to cap the river in this section of the authorized navigation channel at a depth of 20 feet. The current commercial use of Sunoco and Getty are accommodated by a 20-foot navigation channel, which is the depth that EPA is including in the selected remedy. In addition, Harms Construction's response to the 2009 USACE survey is consistent with use of a 20-foot navigation channel.
- RM 1.7 to RM 2.2: The selected remedy does not include any dredging in this section of the river except as needed to accommodate the engineered cap. Clean Earth of NJ does not currently use waterborne vessels for its operations. While it stated during the NJIT Forum that it had started construction of multi-modal facilities with rail service, no such construction had occurred for marine transport. With Disch Construction out of business, the record no longer establishes current commercial navigational use or future use that would require or support a deeper navigation channel than currently exists in this stretch of the river.

Since the selected remedy anticipates that from RM 0.6 to RM 8.3, the Lower Passaic River will be permanently capped at depths shallower than the federally authorized navigation channel depths, it will be necessary to pursue modification of the authorized depth (in RM 0.6 to RM 1.7) and deauthorization (in RM 1.7 to RM 8.3) of the federal navigation channel through Congressional action. USACE has advised that it will support those modification and deauthorization recommendations to Congress.

Other Issues Raised by Commenters

Consistent with EPA policy, use of the navigation channel was addressed in the "Remedial Action Objectives" section of the Proposed Plan, in a paragraph on reasonably-anticipated future use following the RAOs. Use of the navigation channel was not included as an RAO, because, as explained in the Proposed Plan and ROD, RAOs are aimed at protecting human health and the environment, and specify COCs and exposure routes and receptors.

In addition to the commercial use discussed above, EPA also considered local master plans and the results of a 2007 State of New Jersey study, which indicated that the communities along the banks of the LPR have included future increases in recreational access to the river in their master planning processes. According to that study, reasonably-anticipated future land and water uses are primarily recreational (rowing and boating) and light commercial (water taxis) uses such that water depths of about 10 feet are sufficient. In April and July 2007, EPA convened meetings with representatives of municipalities in the lower 8.3 miles of the river to discuss reasonably anticipated future use of the waterway. The results of these studies were taken into account in the development of EPA's selected remedy, which includes, for RM 1.7 to RM 8.3, some smoothing out of a few areas to achieve at least 10 feet below MLW to accommodate reasonably anticipated future recreational uses.

In 2008, CSTAG recommended that EPA consider developing an alternative that addresses additional dredging for flood control but not for navigational purposes in the lower two miles. CSTAG also recommended that EPA coordinate with local and state governments to understand what the realistic and reasonable anticipated future land uses will be for the LPR. In consideration of CSTAG's recommendations concerning Sediment Management Principle #3, EPA met with USACE, NJDEP, and local government official (also see response to comment II.A.2.1). In 2013-2014, EPA briefed local government officials (as described in Section I.A. above) on the lower 8.3-mile RI/FFS, discussing with them the proposed extent and depth of dredging in the navigation channel included in Alternative 3 and the reasonably-anticipated recreational uses above RM 2.2. As documented in the administrative record, EPA also reviewed a number of municipal Master Plans during the development of the RI/FFS.

While EPA did not perform a detailed, cost analysis of bank-to-bank capping without any dredging to accommodate the federal navigation channel, in response to this comment, an estimate of the volume and cost associated with a bank-to-bank capping alternative without a navigation channel is presented in the table below. Since the administrative record documents current commercial navigation in the lower 1.7 miles of the river, EPA assumed that the capping alternative without a navigation channel would need to incorporate a thicker cap to ensure protectiveness (EPA assumed a four-foot cap to respond to this comment).

Item	Volume (cy)	2014 Present Value Cost
Alternative 3B (Capping with Dredging for Flooding and Navigation, with Off-Site Disposal)	3,542,000	$1,382,000,000
Capping Alternative with Dredging for Flooding only (no navigation), with Off-Site Disposal (assuming a 4-ft cap)	2,619,000	$1,232,000,000

During the development of the RI/FFS, EPA evaluated a bank-to-bank capping alternative with dredging for flood control, but without accounting for navigational use of the authorized channel. However, based on the surveys of waterway usage discussed in the previous paragraphs, EPA determined that dredging to address the use of the navigation channel in the lower 2.2 miles of the river would be necessary. Therefore, the bank-to-bank capping alternative with dredging for flood control but not for navigation was not included in the final FFS or Proposed Plan.

H.3.4 Comment: Constraints on Commercial Navigation

Commenters indicated that according to USACE's 2010 commercial navigation analysis (USACE, 2010), the Lower Passaic River is constrained by certain man-made and natural elements that would remain after the proposed deepening of the navigational channel, including natural sedimentation, restrictions on vessel size (draft, beam and vertical clearance) imposed by existing bridges and the requirement for turning basins to have a diameter of at least 1.2 times the length of the vessel.

Response:

The USACE report cited by the commenters goes on to say that despite these constraints, companies have established commercial navigation, particularly in the lower 1.7 miles of the Lower Passaic River. The continued existence of commercial navigation, despite constraints, and reasonably anticipated future use shown in the 2010 USACE survey of commercial users are the underlying reasons that reconstruction of the navigational channel to various depths in the lower 1.7 miles of the Passaic River as described in the ROD and in response II.H.3.3 is appropriate under CERCLA and that the selected remedy includes sufficient dredging to accomplish that reconstruction.

H.3.5 Comment: Support for Additional Dredging in Navigation Channel and Detailed Implementation Questions

Commenters who are active users of the navigation channel strongly supported the dredging and maintenance of the navigation channel in the Lower Passaic River, and asked a number of questions about the details of dredging depths, cap material, future sedimentation and maintenance in specific areas of the lower 8.3 miles of the Passaic River, such as the following: what is the proposed depth between the existing docks and the channel; what type of capping is proposed between the dock and the channel; will future sediment infilling rates be modeled; will sedimentation rates increase after dredging activities; who will pay for additional maintenance that might be needed at the docks if future sedimentation rates increase after remedy implementation; who will restore the cap after maintenance dredging activities; who will pay for reinforcing the dock structure if the depth of the channel is greater than the depth for which the dock was designed. Other commenters asked for an explanation of how maintenance dredging will be performed for the navigation channel with the cap in place, and what plan would be in place for removing contaminated material during maintenance dredging.

Response:

EPA's selected remedy includes dredging approximately 2.5 feet below the sediment surface prior to installing an approximately two-foot engineered cap in the lower 8.3 miles of the river, except for additional dredging to be conducted in the navigation channel in RM 0 to RM 1.7. The exact depths to be achieved outside of the navigation channel will be determined during remedial design, and will depend on such factors as the final thickness of the cap and amount of dredging needed to prevent additional flooding after cap installation. The selected remedy provides for a sand cap, although other materials that provide effective sequestration of the contaminated sediments may be evaluated during remedial design.

EPA expects to model future sediment infilling rates as part of the remedial design, to confirm the amount of dredging necessary to ensure that installation of the cap does not cause additional flooding. Hydrodynamic and sediment transport principles show that sedimentation rates generally increase after a waterway is deepened.

Channel maintenance activities are not expected to affect the cap, since the dredging depths in the navigation channel in RM 0 to RM 1.7 include a cap protection buffer to prevent damage to the cap during maintenance dredging. As discussed in the response to comment II.C.4.5, monitoring and maintenance of the cap will be required as part of the implementation of the remedy. The mechanism for assuring monitoring and maintenance will be determined during future discussions regarding implementation. The purpose of the Responsiveness Summary is to respond to significant public comments on the alternatives evaluated in the RI/FFS and Proposed Plan, not to address questions of sources of remedial funding or liability.

Post-remediation, the USACE will have the responsibility for maintaining the navigation channel. USACE has experience in maintaining navigation channels with caps in place. EPA anticipates that the USACE will properly dispose of any contaminated material removed during maintenance dredging, as USACE currently does in its maintenance of navigation channels in any other urban waterway, such as Newark Bay.

The costs of dock maintenance will continue to be paid by those that are currently responsible for the docks. Similarly, since the final depth of the channel will be the current authorized navigation channel from RM 0 to RM 0.6, and the depth from RM 0.6 to 1.7 will be the newly modified depth, once Congressional authorization has been obtained, any costs associated with reinforcing dock structures to conform to these depths will be borne by those responsible for the docks.

H.3.6 Comment: Conceptual Design of Additional Dredging in Navigation Channel did not Include Margin of Safety

With reference to the preferred alternative, commenters stated that it may not have included the three-foot margin of safety beyond the navigation channel depth that USACE typically factors into the dredging depth to avoid disturbing the cap or backfill during future maintenance dredging.

Response:

EPA's selected remedy (Alternative 3) includes over-dredging allowances within the existing 300-foot wide federally authorized navigation channel to accommodate the continued and reasonably-anticipated future use depths between RM 0 and RM 1.7. Where dredging depths coincide with the authorized navigation channel between RM 0 and RM 0.6, an additional three feet will be dredged to account for historical dredging accuracy and over-dredging as recommended in USACE guidance (USACE, 2006) followed by placement of 2 feet of backfill. Where dredging depths are shallower than the authorized channel between RM 0.6 and RM 1.7, an additional 5.5 feet will be dredged to accommodate an engineered cap (to account for maintenance dredging, future over-dredging allowance for channel maintenance and cap construction, cap protection buffer and engineered cap as recommended in USACE and EPA guidance [USACE, 2006 and EPA, 1998]). The planned sediment removal depths are 33 feet MLW from RM 0 to RM 0.6 (resulting in a 30-foot deep navigation channel), and 25.5 feet MLW from RM 0.6 to RM 1.7 (resulting in a 20-foot deep channel). These details will be further developed during remedial design.

H.4. Implementation Schedule and Duration

H.4.1 Comment: Implementability Evaluation Included Unrealistic Estimates of Bridge Openings, Fish Windows, Utilities, Rail Access and Dredging Production Rates

Commenters indicated that the evaluation of implementability of the remedial alternatives was technically deficient, poorly supported, and did not provide an adequate basis for an NCP-compliant evaluation of the alternatives. The commenters indicated that unrealistic time estimates for bridge openings, fish windows, utilities, rail access, dredging production rates and siting of either a CAD unit or an upland sediment processing facility made the alternatives in the Proposed Plan not implementable in the time estimated. As a result, commenters stated that EPA's claim that its preferred alternative could be implemented in 5 years was misleading, unsupportable and inconsistent with experience at other sites, particularly its oversight experience in the design and conduct of the RM 10.9 Removal.

Response:

The implementability evaluation in the RI/FFS and Proposed Plan was consistent with EPA guidance for such evaluations and included realistic estimates of the factors necessary for the comparison of remedial alternatives required under CERCLA and the NCP.

To respond to this and other comments on the Proposed Plan, EPA re-evaluated the various factors affecting dredging productivity and duration for all three active remedial alternatives, as described in Sections III.C.1, III.C.2 and III.C.3.

The re-evaluation included:

- Incorporation of a 17-week fish window;
- Allowance for an additional three weeks of downtime for extreme weather events and other miscellaneous reasons, such as equipment breakdown and replacement;
- Identifying currently available properties along the Lower Passaic River and Newark Bay with rail access as potential target locations for a dredged material processing facility to confirm implementability;
- Identifying alternative engineering solutions that significantly reduce the need for bridge openings. These solutions include, among others:
  - High-solids bypass pumping of dredged material around bridges with the lowest vertical clearances;
  - Use of low profile tugs and barges;
  - Use of hydraulic dredging with booster pump systems and prior removal of large debris;
- Evaluation of dredging offsets for shoreline structures, bridge abutments, piers, and submerged utilities.

The Reach-by Reach analysis described in the FFS Report and Appendix F was also revised and updated.

These revisions and re-evaluations resulted in extensions in the estimated duration of implementation for the active remedies (from 11 to 14 years for Alternative 2, from 5 to 6 years for Alternative 3 [EPA's selected remedy], and from 2 to 2.5 years for Alternative 4) while demonstrating that the need for most bridge openings can be eliminated with engineering solutions and planning, although periodic openings would still be required for moving over-sized equipment between reaches and to handle large debris.

These small extensions did not change the relative durations among alternatives, and so did not change EPA's comparative analysis results from the RI/FFS and Proposed Plan. As explained in the RI/FFS and Proposed Plan, this implementation time frame does not include remedial design.

H.4.2 Comment: Bridge Openings will Affect Construction Duration

Commenters indicated that delayed bridge openings due to operational or mechanical issues will impede barge movement up and down the river, extending the duration of the dredging and capping activities. Commenters stated that four bridges have vertical clearances (i.e., the distance between the water surface and the bridge infrastructure) of 13 feet or less, which would restrict the size of vessels on the river. Commenters stated that channel width and depth as well as bridge clearance constraints limit the size and number of dredges and barges that can operate on the LPR above RM 4.6 and, together with the tugboat horsepower requirements, limit the opportunities to use specialized or custom equipment.

Response:

To respond to comments concerning the potential impact that numerous bridge openings would have on the bridge operators and local community, EPA evaluated options for minimizing the number of openings needed during the dredging process. Based on this analysis, presented in Section III.C.1, EPA concluded that bridge openings will not be needed on a daily basis for transporting dredged or capping material. EPA then re-calculated dredging durations to account for the revised equipment sizing, as presented in Section III.C.3. The re-evaluations resulted in an extension in the duration of implementation for the selected remedy, from 5 to 6 years, while demonstrating that the need for most bridge openings can be eliminated with engineering solutions and planning, although periodic openings will still be required to move over-sized equipment or to handle large debris.

<u>Bridges with limited vertical clearances</u>

In response to this comment, EPA conducted an on-water inspection of the bridges along the Lower Passaic River to evaluate potential implementation issues. Of the 13 bridges in the lower 8.3 miles, one has had its swing span removed and one is being maintained in the open position. Of the remaining 11 bridges generally maintained in the closed position, six have vertical clearances greater than 20 feet at high tide and another three have vertical clearances greater than 20 feet at low tide. During dredging for the Hudson River PCBs Superfund Site, tugs with twin 400 or 600 horsepower engines were used to access areas with low bridge clearances. These tugs have telescoping cabins and masts, and an air draft of approximately 15 feet. Based on this Hudson River experience, EPA expects that bridges with vertical clearances greater than 18 feet will be navigable without being opened, although additional logistical planning may be needed to confirm the availability of equipment such as the tugs, and to stage and schedule barge movement with the tides when navigating the three bridges with vertical clearances at low tide of approximately 20 feet.

The two bridges that present the greatest challenges to navigation as a result of vertical clearances of less than 18 feet handle vehicular traffic. They are located in the upper portion of the lower 8.3 miles, at RM 5.7 and RM 6.1. Accordingly, the amount of dredged material that will be moved past these bridges will be far less than the total of 3.5 million cubic yards addressed by the selected remedy. To address the restriction posed by these two low bridges, EPA evaluated alternative transport mechanisms as presented in Section III.C.1, with bypass pumping between RM 5.7 and RM 6.1 selected for additional evaluation and inclusion in the cost estimate. The final decision on the approach to be taken will be addressed during the remedial design phase.

Bridges with horizontal openings that would restrict the size of barges

In general, within the federal navigation channel, the USACE recommends a horizontal clearance (i.e., the distance between the vertical supports [piers]) of approximately 3 times the vessel beam (for one-way ship traffic, recommended values vary from approximately 2.5 to 5.5 times the ship beam depending on the channel cross-sections and maximum current; USACE, 2006). Between RM 2.6 and RM 8, the minimum horizontal clearance is 72 feet. Based on specifications provided by marine equipment suppliers, this clearance would be 2 to 3 times the beam for the range of typically available 1,100 cubic yard barges (based on the revised equipment sizing as discussed in Section III.C.3). Therefore, finding equipment with a suitable clearance is feasible. Below RM 2.6, the minimum horizontal clearance is more than 100 feet and does not impose a restriction on vessel sizing.

The New Jersey Transit Rail Operations (NJTRO) West Arlington Bridge at RM 8.1 has a horizontal clearance of only 48 feet. The small-sized equipment that EPA's reevaluation assumed would operate between RM 8.1 and RM 8.3 will have no difficulty safely navigating through this bridge and given the minimal volume of material to be removed above RM 8.1, EPA does not anticipate that the physical constraints will impact the project schedule.

Overall channel width upstream of RM 4.6 that would restrict operations

For the majority of its length above RM 4.6 (to RM 8.3), the river is several hundred feet wide with an average depth of 15.5 feet. EPA's conceptual design anticipates that only one dredge would be operating in any reach (above RM 2.6) the majority of the time. In the reaches between RM 6.1 and RM 8.1, and between RM 2.6 and RM 5.7, it is possible that a small 500 cy-per-day dredge platform would be used for limited periods in conjunction with the 1,100 cy-per-day dredge platform to address sediment in shallow areas and around obstructions. Adequate space and depth exist in those reaches of the river for multiple dredging operations and to allow barges to pass an operating dredge platform. Coordination of dredging operations would be the responsibility of the contractor to ensure maintenance of access to the river for other vessels. As discussed in Section III.E.3, EPA's reevaluation assumed that for work between RM 8.1 and RM 8.3, and between RM 5.7 to RM 6.1, where low or narrow bridges would restrict operations, equipment sized for a 500 cy daily production rate would be used.

Water depth that limits the vessel draft to 10 feet

As presented in Section III.C.3, for cost estimation purposes, the assumed maximum sized equipment for dredging operations above RM 2.6 was 1,100 cy. A typical 1,100-cy barge and associated tug draft less than 10 feet when full.

High water velocities that require sufficiently powered tugboats

As noted previously, tugs with twin 400 to 600 horsepower engines are available that meet the other physical restrictions on the river. While suitably sized equipment is available, the design engineer and contractor will make the final equipment selection during design under EPA oversight. The contractor will be responsible for coordinating in-water work with the U.S. Coast Guard, USACE and other stakeholders to ensure that other commercial and recreational users of the waterway are aware of dredging and capping operations.

H.4.3 Comment: Fish Windows not Taken into Account

Commenters stated that EPA failed to account for how fish windows would affect the FFS estimates of project duration, including a window for flat fish and another for anadromous fish covering 5 months from February to late June where absolutely no in-water construction is allowed. The commenters concluded that dredging could only occur for 23 weeks to account for both winter shutdown and the 17-week fish window; fish window restrictions would nearly double the total project duration.

Response:

The RI/FFS did address the issue of fish windows and their impact on construction duration. However, to respond to these comments, EPA evaluated whether the longer fish windows and other potential periodic downtime suggested by the commenters would significantly lengthen the construction durations beyond the RI/FFS estimates.

The construction duration estimated for the RI/FFS assumed that dredging would occur 40 weeks per year, with a 12 week allowance for fish windows and other downtime. Based on comments and a review of fish windows recommended by NJDEP and NOAA's National Marine Fisheries Service during the Tierra Phase 1 Removal and RM 10.9 Removal work, EPA adjusted the fish window to 17 consecutive weeks, anticipated to occur from about March 1st to June 30th.

In addition, EPA estimated there would be three weeks of weather-related or equipment maintenance delays. Weather-related delays may be due to low temperatures and extreme weather preventing the opening of bridges or proper functioning of marine equipment, as well as icing on support vessels and in shallow removal areas such as mudflats, which are exposed at low tide and are prone to icing. EPA's re-evaluation allows winter weather impacts in the lower 8.3 miles to be minimized since fewer bridge openings are anticipated as discussed in the response to comment II.H.4.2 (also see evaluations in Sections III.C.1 and III.C.3). In the selected remedy, mudflats only constitute 16 percent of the removal area. During winter months, delays can be minimized by dredging in locations not prone to icing. During the Environmental Dredging Pilot Study, which took place during the month of December in 2005, there was one weather-related delay during which it was noted that "the dredging contractor was prepared to work" (LBG, 2012).

Accounting for a longer fish window and weather-related or equipment maintenance delays, resulted in a total of 20 weeks of downtime per year, reducing the dredging production estimated in the RI/FFS to 32 weeks per year. As shown in the response to comment II.H.4.1, the construction durations calculated for the RI/FFS versus the revised construction durations developed for the ROD were: for Alternative 2, 11 years versus 14 years; for Alternative 3, the selected alternative, 5 years versus 6 years; for Alternative 4, 2 years versus 2.5 years. The change in the estimated downtime resulted in construction durations for the ROD very similar to those estimated for the RI/FFS and did not change EPA's comparative analysis of alternatives performed in the RI/FFS.

H.4.4 Comment: Production Rates from Other Sites or Other Projects cannot be used without Careful Consideration

Commenters indicated that projecting design and production information from the Environmental Dredging Pilot Study on the Lower Passaic River or from disparate and unrelated sites like the Hudson River or Fox River without careful consideration of site-specific factors is not a proper or reliable basis for developing production and time estimates for the Lower Passaic River.

Response:

EPA agrees that site-specific information needs to be considered when estimating production rate and other design parameters, but disagrees that this level of care was not included in the RI/FFS.

Both during preparation of the RI/FFS, and in response to comments, EPA has developed production rate estimates based on information from a number of sources including the results of the Environmental Dredging Pilot Study, other work on the Passaic River (e.g., RM 10.9 Removal, Tierra Phase 1 Removal), other recent contaminated sediment projects such as the Hudson River PCBs and Fox River Superfund Sites, and communications with experienced dredging contractors and equipment suppliers. Production rates and duration will be refined, as necessary, during the design phase.

H.4.5 Comment: Unclear if Mechanical or Hydraulic Dredging would be Used

Commenters stated that EPA did not clarify if a mechanical or hydraulic dredge would be used for implementation of the preferred alternative, and that the sizes and number of dredges to perform the work were not clearly indicated in the FFS. Commenters stated that without this information, EPA's production and project duration estimates had a high level of uncertainty.

Response:

As discussed in the RI/FFS, both mechanical and hydraulic dredging are potential process options for sediment removal. In the FFS Report, Section 3.7, the process options retained for sediment removal included excavation, mechanical dredging, and/or hydraulic dredging. Mechanical dredging was selected as the representative process option for detailed analysis and cost estimation purposes. The number and sizing of the dredges are discussed in Section 4.2.3 of the RI/FFS. For evaluation purposes in the RI/FFS, it was assumed that two primary dredges each operating at 2,000 cy per day would perform the bulk of the removal with a small secondary dredge that would operate at a lower production rate around bulkheads and obstructions. Similar discussions on the number and sizing of dredges appear in Appendices F and H of the RI/FFS.

In response to comments, EPA has calculated revised dredging rates, which are presented in Section III.C.3. Revised cost estimates for mechanical dredging are presented in Section III.D.1. Revised cost estimates for hydraulic dredging are presented in Table II.H.1.12 - 3. None of the revised dredging rates and cost estimates result in a significant change from those estimated in the RI/FFS. Since there are no significant differences between mechanical and hydraulic dredging cost estimates, either could be used, as concluded in the RI/FFS and Proposed Plan. The selection of mechanical or hydraulic dredging technologies will be done during the remedial design phase.

H.4.6 Comment: Time Efficiency from Environmental Dredging Pilot Overestimated

Commenters stated that upon review of the LBG 2012 Environmental Dredging Pilot Study Report, it was difficult to associate the time efficiency of 60 percent with the actual data presented in either the report or the contractor dredging logs. Commenters stated that a time efficiency of approximately 45 percent appears to more closely reflect the time efficiency experienced in the 2005 Environmental Dredging Pilot Study. Commenters stated that additional data should be collected in order to make a site-specific estimate of potential dredging efficiency.

Response:

EPA disagrees with the commenter's interpretation of data from the Environmental Dredging Pilot Study (LBG, 2012) and the associated time efficiency estimate. Adequate data were collected during the Environmental Dredging Pilot Study to meet the study objectives and the report's estimate of time efficiency were in compliance with the USACE technical guidelines.

According to the USACE Technical Guidelines for Environmental Dredging of Contaminated Sediments, (USACE, 2008), effective working time efficiency (EWTE) is the ratio of the effective working time to the dredging time.

- Dredging time is comprised of non-effective working time and effective working time.
- Non-effective working time is when the dredge is operational (fueled and staffed), but no production is taking place.
- Effective working time is the time during the dredging operations when actual production is taking place, such as material being placed into a sediment barge or moving through the pipeline. This is also referred to as "operating time."

In calculating the EWTE, the commenters included lost time, standby time and survey time in their total dredging time and therefore calculated a lower time efficiency (44 percent including all days and 46 percent excluding December 9th). The USACE guidelines explicitly state that lost time is not included in determining dredging time. Standby time should also not be considered part of non-effective working time since it was an artifact of the Environmental Dredging Pilot Study, and the tasks performed during standby time were not typical activities during dredging projects. During the Environmental Dredging Pilot Study, surveying times were only included for one day, December 7th, and it was not possible to extrapolate the data to the other days. Therefore, survey time was not added to the dredging time; if added it would reduce the time efficiency for that day to 61 percent.

The table below compares the commenters' EWTE estimate with EPA's EWTE estimate (excluding December 9th). While the commenters and EPA agree on the amount of effective working time, the commenters' calculation of total dredging time is higher than EPA, since they erroneously included standby and lost time. This difference in dredging time is reflected in the difference in the EWTEs calculated by the commenters and EPA.

Date	Effective Working Time/ Operating Time (hrs)	Commenters' Dredging Time (hrs)	EPA Dredging Time (hrs)	Commenters EWTE (percent)	EPA EWTE (percent)
12/5/2005	5.45	13.51	12.09	40 percent	45 percent
12/6/2005	5.01	14	11.17	36 percent	45 percent
12/7/2005	5.76	11	7.67	52 percent	75 percent
12/8/2005	4.04	7.16	4.91	56 percent	82 percent
12/10/2005	4.62	8.5	5.75	54 percent	80 percent
Total	**24.88**	**54.17**	**41.59**	**46 percent**	**60 percent**

EPA's overall time efficiency of 60 percent calculated for the Environmental Dredging Pilot Study falls within the normal range for environmental dredging projects (USACE, 2008). Thus, additional data collection is not necessary at this time. Dredging production rates will be refined as necessary during the remedial design phase.

H.4.7 Comment: Estimated Production Rate Unrealistic

Commenters stated that although the data presented in the FFS are not sufficiently detailed with respect to the 3,300 cubic yards per day production rate, a reasonable assumption is that EPA's production rate assumption was based in part on production rates experienced on navigation maintenance dredging projects performed in New York Harbor or Newark Bay. Commenters stated that the assumed dredging productivity of 2,000 cubic yards per 24-hour day per dredge and a dredging season of 40 weeks [24-hour days, 6 work days per week, 240 days per year] are not realistic or achievable and that these assumptions should be revised; which, in turn, calls into question the implementability of FFS Alternative 3 and greatly impacts costs.

Response:

As discussed in the RI/FFS, Section 4.2.3 and Section 2.4.3 of Appendix F, the estimated average production rate was based on the results of the Environmental Dredging Pilot Study and communications with dredging contractors performing environmental dredging in the area, not on navigational dredging production rates as assumed by the commenters.

As described in the response to comment II.H.4.3, EPA reviewed and revised the estimated dredging schedule and duration based on, among other things, further consideration of fish windows and weather-related delays. In this re-evaluation, EPA divided the lower 8.3 miles of the Lower Passaic River into five reaches with varying dredging production rates estimated by reach depending on its specific constraints (see evaluation in Section III.C.3). On the basis of this analysis, EPA has revised the estimated average combined production rate, reducing it from 4,000 to 3,850 cy per day. The former estimate from the RI/FFS was based on 2,000 cy per day per dredge with two dredges working simultaneously, while the revised combined production rate is based on one to three dredges of varying sizes operating simultaneously. The estimated production rates by reach are summarized below.

Dredging Rates and Constraints by Reach

Reach	Daily Dredging Rate (cy)	Dredging Rate Constraint
RM 0 to RM 2.6	1,100 to 3,850	Dredging rate varies to maintain an overall combined production rate of 3,850 cy per day, depending on sequencing of dredging in other reaches
RM 2.6 to RM 5.7	1,100	Limited by maximum barge size. Tug/barge size limited by minimum vertical clearance (20ft) under bridges
RM 5.7 to RM 6.1	500	Limited by minimum air draft (10ft) under bridges. Alternative transport options evaluated; bypass pumping assumed.
RM 6.1 to RM 8.1	1,100	Limited production rate to accommodate barge sizes receiving pumped material below RM 5.7.
RM 8.1 to RM 8.3	500	Horizontal clearance on bridge at RM 8.1

The re-evaluations resulted in an extension in the estimated duration of implementation for EPA's selected remedy, from 5 to 6 years, and a small reduction in the estimated cost, from $1.73 billion to $1.64 billion (as discussed in the response to comment II.H.3.3, an adjustment to the navigation channel depths included in the selected remedy further reduced the estimated cost to $1.38 billion). The re-evaluations did not change EPA's comparative analysis of remedial alternatives conducted in the RI/FFS and Proposed Plan.

H.4.8 Comment: Information on Sizes and Movements of Dredges and Barges should have been Presented

Commenters stated that information regarding sizes of dredges and barges as well as mapping of barge transport to the processing site is not available in the FFS. Commenters stated that the FFS makes no mention of the installation of 3-dimensional positioning and recording devices for all in-place measurements, surveys, obstruction locations, sampling, dredge drops, etc., that complete a continuous and permanent record of all events throughout the project. Commenters stated that the locations of access points and problems of ingress and egress for all steps impacting various distances among active locations are also not presented. Commenters stated that all of this is necessary to establish dredging production rates and project duration.

Response:

EPA disagrees with the commenters on the level of detail necessary to estimate dredging production rates and construction duration with sufficient accuracy for the RI/FFS. The use of 3-dimensional positioning and recording devices for all in-place measurements, surveys, obstruction locations, etc., as suggested by the commenter, was not needed to estimate production rates and construction duration for the FFS. The need for and use of this equipment will be addressed during remedial design or pre-design investigations. For the RI/FFS, EPA used information from previous work on the river (e.g., the Tierra Phase 1 Removal, RM 10.9 Removal and Environmental Dredging Pilot Study), as well as input from experienced dredging contractors and equipment suppliers to estimate the dredging production schedules.

EPA does not expect ingress and egress to be a problem or to affect dredging production rates and/or construction duration, based on experience from previous work on the river and transport options discussed in Section III.C.1. Ingress and egress locations will be resolved during the predesign and design phase.

Production rates were based on the assumption that a sediment processing facility would be sited in the lower three miles of the Lower Passaic River or Upper Newark Bay. EPA identified four sites meeting the criteria and on the market as of March 2015 between RM 3 and the upper portion of Newark Bay; in addition, several other sites meeting the criteria were identified somewhat beyond the preferred project location as discussed in Section III.C.2.

H.4.9 Comment: Quantity and Distribution of Debris not Presented

Commenters indicated that the FFS lacks a reasonable assessment of the quantity and distribution of debris, and lacks an assessment of the associated impacts on dredge production rates and the overall project schedule.

Response:

EPA agrees that debris needs to be factored into the assessment of the construction duration. In the FFS Report, debris management was discussed in Section 4.2.8 and mentioned in the implementability and cost discussion of the active remedial alternatives and in Appendix G, Sections 3.4.2, 3.4.5, 5.22 and 5.3. The estimated quantify of debris, as presented in Appendix H of the RI/FFS and updated in response to comments is discussed in response to comment II.H.1.15. For the RI/FFS, debris was divided into three categories:

- Large debris included shipwrecks, cars, shopping carts, large tree trunks, and miscellaneous large items observed during scans of the river.
- Medium debris included pieces of metal, reinforced concrete, rocks and stones, tires, glass and wood, typically two inches or larger in size.
- Small debris was a combination of gravel and partially decomposed organic material such as branches, leaves, garbage, and other items. This small material must be removed prior to processing to minimize clogging of the injectors on the dewatering system.

According to EPA's conceptual design, during the pre-design investigation, a debris survey would be conducted using sonar and other scans to identify large items and areas where significant quantities of debris are located, for example near bridges and along banks. This material would be removed under a separate debris removal program conducted prior to the start of dredging as described in Section 3.4.5 of Appendix G, and would not impact the duration of dredging. Other large debris may be encountered during the dredging process. This material would be removed and placed on barges for transport to the sediment processing facility. If any item is too large to remove using equipment operated from the dredge platform, its location would be marked and it would be removed later. Large debris would be transported to the processing facility, decontaminated and recycled or hauled offsite for disposal. A water quality control work plan would be developed to address potential water quality issues associated with the handling of debris.

To allow for bypass pumping around bridges upstream of RM 5.7 as contemplated in EPA's evaluation (see analysis in Section III.C.1), medium-sized debris would be removed at the dredging site using grizzly screens or similar equipment and hauled separately to the processing facility for disposal. Because the estimated production rate for dredging in this portion of the river in EPA's conceptual design is not based on maximizing the rate of dredging but rather on equalizing the processing facility annual throughput, (see analysis in Section III.C.3), debris handling would not impact the estimated dredging duration. Below RM 5.7, medium sized debris would be removed by screens at the processing facility and would not impact the dredge production rate.

Small debris would be removed by screens at the processing facility, sized as necessary based on dewatering equipment requirements, and would not impact the dredge production rate.

H.4.10 Comment: Geotechnical and Physical Conditions (Including Slope Stability, Shoreline Protection and Buried Utilities) not Adequately Analyzed or Addressed

Commenters stated that the Proposed Plan's geotechnical assessment of implementability issues relating to bridge, bulkhead and slope stability, was incomplete and unreliable. Commenters stated that issues with the slope stability assessment included use of textbook soil data (based on the unified soil classification system) in the absence of site-specific geotechnical data; assessment of post-construction conditions only, even though limiting geophysical conditions will almost certainly occur during dredging construction, rather than at its completion; and analysis which did not address the stability of bridge abutments, shoreline buildings and bulkheads. Commenters stated that shoreline protection during dredging/capping operations was not adequately addressed in the FFS, in that insufficient data on site conditions was available to conclude that bulkheads would not be impacted by dredging operations under Alternative 3; the extent of the area requiring protection is underestimated; and work in New Jersey tidelands requires permission of riparian owners, who may be able to refuse permission or demand compensation.

Commenters stated that water depths, elevations, side slopes and sediment characteristics (geotechnical, water content, density, particle size distribution and degree of consolidation) are variables that must be quantified to establish any degree of certainty in production and project duration estimates. Commenters also noted that EPA's dredge prism calculations included no provisions for dredging offsets from hardened shorelines. Commenters stated that acreage of underwater slopes to be dredged and the angle of repose are also critical to production and project duration estimates. Commenters stated that the dredging site physical conditions/situations including shoreline structures, water obstructions, such as pilings, bridges, and other non-removable supporting devices may require small dredges, tugs, and barges for access resulting in low production and delay. Commenters stated that the precise location and depth of utilities, such as electrical, gas, sewage, and drinking water pipes, that are buried in the sediment need to be identified and the regulations regarding required distances the dredge must maintain from these pipes and plans for the hazardous sediment that may remain over and near these pipes must be determined. Commenters also noted that no provisions for any utility protection are provided in the EPA cost estimate for Alternative 3 and that EPA's dredge prism calculations included no provisions for utility protection corridors.

Response:

Geotechnical issues pertaining to bridge abutments, shoreline structures, bulkheads and slope stability were considered in EPA's engineering analysis of pre-dredging and post-dredging conditions for all of the active remedial alternatives in the FFS Report and Proposed Plan. EPA's conceptual design for each of the alternatives incorporated reliable information from some of the largest environmental dredging and capping sediment remediation projects that are currently being implemented in the United States, such as the Hudson River and Fox River.

EPA evaluated the type and condition of structures present along the shoreline throughout the lower 8.3 miles of the Passaic River during the RI/FFS. Of the approximately 88,000 linear feet of shoreline, there are approximately 30,000 linear feet of piers/bulkheads and bridge abutments, approximately 27,000 linear feet of shoreline known to be stabilized with rip-rap and an additional 26,000 linear feet of shoreline that appears to be stabilized with engineered structures of an unknown type. Most of this latter category is likely to be hardened with riprap which may have deteriorated over the years or may be partially buried by sediment. In addition, there are approximately 5,600 linear feet of natural and unprotected shoreline areas, all located upriver of RM 1.7.

In the RI/FFS, EPA assumed that shoreline structure protection (sheet piling, setbacks) would primarily have been required under Alternative 2, in portions of the river where deep dredging was proposed, particularly around bulkheads, bridges and abutments, to prevent these structures from being physically damaged due to undercutting during dredging. Given the variable depth of dredging required in different reaches of the river, not all sections would require protection, even under Alternative 2. For cost estimating purposes, EPA assumed that approximately 20 percent of the shoreline comprised of piers/bulkheads and bridge abutments (or approximately 6,100 linear feet) would require protection and reinforcement. For the selected remedy, Alternative 3, dredging is generally limited to depths of approximately 2.5 feet with the material removed being replaced by an engineered cap. EPA considered that additional shoreline protection for bulkheads and other structures generally would not be necessary. It is possible that, based on conditions that may be identified during the pre-design investigation, some form of protection (reinforcement, increased setback distance) may be necessary in select locations; if so, those areas will be addressed during the remedial design phase. Specific measures to be taken will vary based on location. For areas where rip-rap is placed along the shoreline and around bridge piers and abutments, the rip-rap would not be disturbed during dredging. To avoid damaging the surface or undermining the toe of slope of the stone fill, dredge cut line could be designed in a manner similar to that shown as shown in Figures II.H.4.10 – 1 and II.H.4.10 – 2.

Some disturbance of existing rip-rapped slopes is likely to occur and the existing riprap slope protection may have failed already in some locations. Therefore, an allowance has been included in the RI/FFS cost estimate for repair or replacement of riprap slope protection. For Alternative 2 it was assumed up to 10,000 square yards of riprap would require repair at an estimated cost of $75 per square yard. For Alternative 3, where dredging depths are limited to 2.5 feet along most areas of shoreline protected by riprap, an allowance of 5,000 square yards was included; for Alternative 4, an allowance of 2,500 square yards was included.

In addition, as discussed in Appendix F of the RI/FFS, Section 3.5.3.1, any portions of the shoreline damaged or disturbed by the remedial action will be restored upon completion of dredging operations. For unprotected, natural shorelines it was assumed that the dredge cut lines perpendicular to the shore will either be designed to produce a stable slope or backfill will be installed to achieve a stable slope as soon as practicable after dredging has been completed. Under Alternative 2, EPA assumed that natural shoreline areas out to about 20 feet from shore would be restored to their original bathymetry in areas where the top of slope of the navigation channel is far enough offshore to permit this. For estimating purposes, EPA assumed that such areas would be backfilled to the pre-existing river bottom elevations for a distance of 20 feet from shore and that the backfill layer would then be placed at a slope of 3 horizontal to 1 vertical until the final design surface is reached. Under Alternative 3 and Alternative 4, EPA assumed that the engineered cap would replace the volume of material removed in most areas (that is, except between RM 0 to RM 1.7 within the federal navigation channel for Alternative 3). In those areas, stable slope conditions would be established during the final design. The costs for shoreline protection are presented in Tables 1-2 through 1-10 and in the text in Appendix H of the RI/FFS.

EPA agrees that New Jersey law anticipates that property owners will receive notice of work in the river adjacent to their upland property. EPA does not expect that obtaining consent to access will impede the remedial action. CERCLA includes provisions allowing EPA (or its designee) to enter property to undertake a response action, and EPA has policies and procedures to effectuate entry, which is typically achieved with consent of the property owner. EPA has successfully implemented many responses actions on private property. Finally, EPA has experience implementing or overseeing response actions in the Passaic River, is familiar with the Tidelands Act and does not anticipate that it will be a barrier to constructing the remedy including elements that involve shoreline protection.

Preliminary utility locations were included in FFS Figures 4-5 through 4-7, based on public sources for a feasibility-level evaluation. The RI/FFS cost estimates included the costs of side-scan sonar to locate utilities during the pre-design investigation. For Alternative 2, construction safeguards such as coffer dams to protect utilities during dredging were incorporated into the cost estimate. In the RI/FFS and Proposed Plan, based on EPA's experience locating utilities for the RM 10.9 Removal, EPA assumed that the relatively shallow dredging called for in Alternatives 3 and 4 (top 2.5 feet) could be conducted without disturbing utilities. As to the deeper dredging called for in the navigation channel in the lower 2.2 miles of the river in Alternative 3, EPA assumed that no utilities would have been sited in that section of the river, because the USACE had maintained a navigation channel there from the late 1800s to early 1980s. (As discussed in response to comment II.H.3.3, in the selected remedy, the deeper dredging extends only to RM 1.7.) Underwater utilities could not be installed in the reach of the river with an active navigation channel without authorization/permitting by the USACE, and such authorization would not be forthcoming for locations that would hinder the dredging of the channel. These assumptions will be verified during the design phase. The remedy design will include procedures to locate utilities more precisely in the lower 8.3 miles and determine appropriate dredging setbacks, if necessary. This work will need to be performed in coordination with utility owners and operators along the river.

For estimation purposes, EPA assumed that for work in and around shorelines and buried utilities, the smaller dredge platform (see Section III.C.3) would be used. This is conservative both in terms of project cost and construction duration. Overall, the volume estimates prepared for the FFS were intended to be conservative.

Finally, while the other details contained within the comments (e.g., water content, particle size distribution, degree of consolidation) were incorporated into the various tools that EPA used to evaluate the alternatives in the RI/FFS (e.g., the mechanistic model and CSM), they may not have been explicitly discussed under the implementability criterion. The NCP does not require nor anticipate that all the details of a proposed alternative will be developed at the Proposed Plan phase. As noted by EPA guidance (EPA, 2000d), cost estimates are prepared during the feasibility study for purposes of comparing alternatives during the remedy selection process, not for budgeting or negotiations. Sufficient information and detail to reasonably compare remedial alternatives does not require that each one should be developed with the level of detail typically found in remedial design documents. In fact, EPA guidance for preparing cost estimates provides that the expected accuracy of the cost estimates for the feasibility study, and for remedy selection purposes, is +50/-30 percent. This range for the expected accuracy shows EPA's expectation that not every detail necessary for implementation of an action can be established at the time of remedy selection.

H.4.11 Comment: Construction Duration for Preferred Alternative Seems Short Compared to RM 10.9 Implementation Time

Commenters questioned the Proposed Plan's estimate of the length of time it would take to implement EPA's preferred cleanup plan (5 years), particularly considering the duration of the River Mile 10.9 removal. Other commenters asked whether the dredging rate of one million cubic yards a year (as an assumption underlying the five-year implementation time estimate for the selected remedy) is achievable on the heavily urbanized and tidal Passaic River. Commenters asked how EPA had estimated the project duration estimates for each of the active alternatives evaluated in the FFS and whether EPA had retained a third party engineering firm to confirm those estimates.

Response:

The implementation time for the selected remedy is not expected to be proportional to the RM 10.9 Removal, because the large scale of the selected remedy allows for economies of scale to increase implementation efficiency. For example, larger dredging buckets will be used in portions of the lower 8.3 miles, allowing for higher dredging rates than were achieved on the relatively small RM 10.9 mudflat. Lessons learned from the implementation of the RM 10.9 Removal include either to avoid use of the type of active cap membrane used in the RM 10.9 Removal, which proved difficult to install, or to obtain more expertise in cap installation during design to address potential implementation issues earlier in the process. EPA's estimate for construction duration of Alternative 3, the selected remedy, was based on site-specific engineering evaluations of every significant aspect of the implementation, as documented in the RI/FFS. The RI/FS process does not incorporate a third party review of the engineering studies conducted to support the feasibility study, nor is this necessary. During remedial design, a detailed project schedule will be developed.

As described in the response to comment II.H.4.1, EPA reviewed and revised the estimated dredging schedule and duration. The re-evaluations resulted in an extension in the estimated duration of implementation for EPA's selected remedy, from 5 to 6 years.

H.4.12 Comment: Construction Sequencing

With reference to the sequencing of construction activities for the preferred alternative, commenters recommended that dredging in the navigation channel in RM 0 to RM 1.2 occur at the beginning of the construction phase, that the dredged channel be used to capture the sediments stirred up during dredging of the rest of the lower 8.3 miles, and that it be re-dredged and backfilled at the end of the construction phase. Commenters stated that this would allow for the capture of contaminated sediments generated during construction and enhance the life expectancy of the navigation channel in RM 0 to RM 1.2. Commenters recommended that, to the extent feasible while avoiding inefficiencies and recontamination, the areas in the lower 8.3 miles at highest risk of affecting human health and ecosystem integrity (i.e., the most contaminated and highly mobile sediments) should be addressed first, to more quickly eliminate the worst problems.

Response:

EPA developed a construction sequence for the purpose of evaluating remedial alternatives in the remedy selection process, but the actual sequencing of construction activities will be determined during the remedial design phase. EPA expects to conduct extensive public outreach so that stakeholders will have the opportunity to provide input during the design. As discussed in Section III.C.3, in response to comments, EPA has further refined the sequence, demonstrating the validity of the estimate in the RI/FFS as a factor for the remedial evaluation. However, the sequence remains conceptual, with the actual sequence to be developed during the design phase.

H.4.13 Comment: Difference in Construction Duration between Alternatives 2 and 3 is not very Long

Commenters stated that the six-year difference in implementation time between cleanup options 2 and 3 is not very long compared to the 50 to 60 years that the river has been contaminated.

Response:

Implementation time is evaluated within the short-term effectiveness criterion, which is one of the nine criteria that EPA uses to compare among alternatives and select a final remedy. The longer implementation time for Alternative 2 (Deep Dredging with Backfill) compared to Alternative 3 (Capping with Dredging for Flooding and Navigation, or EPA's selected remedy) means that Alternative 2 would have more potential adverse impacts during construction, such as noise, light, odors, blocked views, air quality impacts, disruptions to commercial and recreational users in the river, occupational risks to construction workers, resuspension of contaminated sediments during dredging and loss of habitat for organisms in dredged areas. One of the reasons that EPA selected Alternative 3 was that, while both Alternatives 2 and 3 meet the threshold criterion of protectiveness, Alternative 3 does so with significantly less short-term impact on the community, workers and the environment.

H.4.14 Comment: Monitoring Program During Dredging And Capping

Commenters indicated that development and acceptance of a monitoring program that isolates potential water quality exceedances due to dredging/capping activities will be a challenge. Commenters stated that misinterpretation of the monitoring data could lead to unwarranted project shutdowns, resulting in schedule delays and/or unnecessary best management practices.

Response:

There will ample time during the predesign investigation and design phase of the project for the development and acceptance of a suitable water quality monitoring program. EPA has experience with developing monitoring programs in the context of implementing and overseeing other Superfund remedial actions, such as the Hudson River PCBs Superfund Site. EPA will work with the design and construction teams to address unforeseen conditions encountered on the project to ensure that work is not needlessly delayed.

H.4.15 Comment: Permitting Process for a Large Scale Dredging Project such as the Preferred Alternative

Commenters indicated that the permitting process for a large-scale removal has the potential to delay the initiation of dredging activities, as issuance of permit equivalents requires notice of all landowners adjacent to the river followed by a public statement period to grant access.

Response:

The lower 8.3 miles of the Lower Passaic River is being remediated as part of a Superfund site. According to CERCLA Section 121(e)(1), no Federal, local or state permits are necessary for remedial action conducted on site, when the response action is selected and carried out in compliance with CERCLA's requirements. For those aspects of the remedial actions that occur off-site, e.g., off-site treatment and disposal, permits would be required.

Notwithstanding the permit exemption under Section 121(e)(1), a party performing work under CERCLA may elect to obtain permits or participate in a "permit equivalency" process to ensure that it is complying with substantive legal obligations, although this is not required. In the RI/FFS, Appendix G, regulatory requirements were considered under pre-construction activities and are assumed to occur during that timeframe. In addition, EPA agrees that notice to landowners may be appropriate. In the conceptual schedule prepared by EPA for RI/FFS purposes, approximately 3.5 years are allotted to pre-construction activities, which include pre-design investigation, remedial design, and processing facility siting, design and construction.

H.4.16 Comment: Sources of Delay for Implementation of Preferred Alternative

Commenters stated that potential sources of significant delay include: waiting for test results and/or direction from the owner/engineer/agency, delay time caused by waiting on the return of light barges from processing, and delay time associated with navigating the bridges leading to the LPR worksites.

Response:

Based on EPA's recent project experience, the items identified in the comment are no more likely to cause time delays on this project than on other similar projects; and EPA considered such factors in the project duration estimates provided in the FFS Report. While bridge openings may cause some delays, as discussed in Section III.C.1, the need for bridge openings can be minimized through targeted equipment sizing or the use of alternative transport mechanisms.

During the pre-design and design phases, the design team will manage the project to minimize work delays and to ensure that the work is performed in accordance with the project schedule. During the construction phase, the contractor and design team will control the flow of work and develop contingency plans as needed to ensure that work proceeds in an expeditious manner. EPA will oversee the design and construction teams to address unforeseen conditions encountered on the project to ensure that work is not needlessly delayed.

H.5. Achievement of Goals

H.5.1 Comment: What Outcomes will the Alternatives Achieve?

Commenters stated that the outcomes for all of the alternatives would be the same, and that none of the alternatives would improve the health of Newark residents. Commenters expressed the view that the river will never be fishable and swimmable. Some commenters thought that the outcome of the cleanup would be that one fish could be eaten in ten years, while others thought that people would not be able to eat the fish and crab even after implementation of EPA's preferred alternative. Commenters expressed hope that after implementation of the cleanup, fish and crab consumption advisories would be lifted and anglers would be able to freely eat fish and crab. Other commenters stated that the preferred alternative would not achieve an effective reduction in risk and any risk reduction obtained would not be sustained. Commenters thought that the amount of ecological risk reduction due to the remediation was undefined and unclear.

Response:

EPA explained in the Proposed Plan that the outcomes for Alternatives 1 (No Action) and 4 (Focused Capping with Dredging for Flooding) are different from the outcomes for Alternatives 2 (Deep Dredging with Backfill) and 3 (Capping with Dredging for Flooding and Navigation, or EPA's selected remedy). As discussed in various responses to comments above (e.g., II.E.2.8, II.H.3.3 and II.H.4.1), EPA's updates to the evaluation tools used in the RI/FFS, re-evaluations of the implementation processes assessed in the RI/FFS and adjustments to the navigation channel included in the selected remedy did not change EPA's comparative analysis results from the RI/FFS and Proposed Plan. The updated modeling and risk assessment results developed during the response to comments are discussed in the ROD in Sections 10.1 and 10.3 (see ROD Figures 19, 20, 21 and 22 in Appendix I). ROD Section 12.13 explains the factors on which the preference for Alternative 3 is based, as opposed to Alternatives 2 and 4, and Section 12.15 summarizes the expected outcomes of the selected remedy. In those sections and throughout, the ROD shows how the Alternatives differ, and why EPA has selected Alternative 3 as the remedy. These outcomes and differences are summarized below.

Alternative 1 (No Action) means that nothing would be done, including dredging, capping or institutional controls. COC levels would remain many times higher than risk-based remediation goals, and the unacceptable risks identified in the baseline risk assessments would also remain. New Jersey's prohibitions on fish and crab consumption presumably would remain in place, although not as part of EPA's remedy.

Under Alternative 2, approximately 9.7 million cy of contaminated sediment covering approximately 650 acres of river bottom between RM 0 and RM 8.3 would be permanently removed from the ecosystem of the LPR after construction is completed, with dredging residuals covered by a layer of backfill. Under Alternative 3, the selected remedy, approximately 3.5 million cy of contaminated sediment covering approximately 650 acres of river bottom between RM 0 and RM 8.3 would be permanently removed, followed by construction of a two-foot engineered cap (or placement of backfill where appropriate) over the entire 8.3 miles. EPA's modeling predicts a significant decline in surface sediment COC concentrations in the lower 8.3 miles after Alternatives 2 and 3 are implemented. In particular, by the early 2060s, surface sediment concentrations of dioxin would be approximately at EPA's remediation goal. Surface sediment concentrations of PCBs, mercury and Total DDx would remain higher than EPA's remediation goals. Therefore, Alternatives 2 and 3 would incorporate the existing New Jersey fish and crab consumption prohibitions and advisories, and EPA would also conduct enhanced outreach to increase awareness.

One important distinction between Alternatives 1 and 4, and Alternatives 2 and 3, is that EPA's model predicts that shortly after construction of either Alternative 2 or 3, surface sediment concentrations of dioxin and PCBs in the lower 8.3 miles would reach the interim remediation milestones that correspond to interim protective fish and crab tissue concentrations, sufficiently protective to potentially allow NJDEP to consider lifting or relaxing the stringency of prohibitions on fish and crab consumption (e.g., allowing one fish meal per month, as opposed to the current prohibitions on consumption of fish or crab from the Lower Passaic River). This would not be the case for either Alternative 1, which would allow contamination to remain unaddressed, or Alternative 4.

Under Alternative 4, approximately 1.0 million cy of contaminated sediments in discrete areas totaling approximately 220 acres of river bottom between RM 0 and RM 8.3 would be permanently removed, followed by placement of a two-foot engineered cap over the dredged areas. Because the contaminated surface sediments in the two-thirds of the lower 8.3 miles of the Lower Passaic River that remain unaddressed would contribute to risk by remaining in place and would recontaminate adjacent capped areas, Alternative 4 would not achieve as much risk reduction as Alternatives 2 and 3. By the early 2060s, surface sediment concentrations of dioxin would remain over six times higher than EPA's remediation goal. Surface sediment concentrations of PCBs, mercury and Total DDx would also remain higher than EPA's remediation goals, but more so than Alternatives 2 and 3. Further, while Alternative 4 would also incorporate fish and crab consumption prohibitions and advisories with enhanced outreach, the surface sediment concentrations of dioxin and PCBs that EPA's model predicts would be reached shortly after construction do not correspond to interim protective fish and crab concentrations, so NJDEP would be unlikely to relax the stringency of prohibitions on fish and crab consumption.

Another distinction between Alternatives 2 and 3, and Alternative 4, concerns the potential for recontamination. EPA's modeling results show that after bank-to-bank remediation of the lower 8.3 miles under Alternatives 2 and 3, incoming COCs from above Dundee Dam, from Newark Bay and from the Lower Passaic River above RM 8.3 will gradually recontaminate the new riverbed surface. However, EPA's model underestimates the effectiveness of the bank-to-bank remedies because, while the model assumes that the incoming COCs will remain constant until the end of the simulation period (until the early 2060s), EPA expects that those COCs will decline over time as the Lower Passaic River above RM 8.3 and Newark Bay are remediated through actions selected after the completion of the 17-mile RI/FS and Newark Bay RI/FS, respectively, and Clean Water Act programs will address COCs from above Dundee Dam. Such actions, taken while the remedy for the lower 8.3 miles is being designed and implemented, will reduce the incoming COCs and minimize the degree of recontamination, allowing the bank-to-bank remedies (Alternatives 2 and 3) to achieve protectiveness. Whether and when the Lower Passaic River will be "fishable and swimmable" would be evaluated after all of those actions are implemented. As conditions in the river improve, EPA expects that all those who live or work near the river, or recreate on the river, will benefit.

In contrast, while EPA's model also underestimates the effectiveness of Alternative 4 by not accounting for any reduction in incoming COCs over time, the effect of recontamination on Alternative 4 would include and be greatly exacerbated by the resuspension of highly contaminated sediments from the unremediated two-thirds of the lower 8.3-mile riverbed redepositing on adjacent capped areas. While EPA actions under the Superfund and Clean Water Act programs would reduce the incoming COCs in the future, the resuspension of highly contaminated sediments from the unremediated two-thirds of the lower 8.3 miles would continue unabated.

The ROD details other distinctions in the outcomes of the selected remedy and Alternatives 2 and 4, such as differences in construction time, implementability and cost.

The amount of ecological risk reduction that will result from implementing the selected remedy is discussed in the ROD, under the overall protection of human health and the environment criterion in Section 10.1. For dioxin, Alternatives 2 and 3 would lower ecological risks by approximately one to two orders of magnitude (or 10-100 times) compared to taking no action (as under Alternative 1). For the other COCs, Alternatives 2 and 3 would lower ecological risks when compared to Alternative 1, but by less than an order of magnitude.

H.5.2 Comment: Uncertainties Associated with Effectiveness of Fish and Shellfish Consumption Advisories

Commenters noted that, for the 30 years following construction of the remedy, 1) residual cancer risks to human health from consumption of fish and crab would remain higher than EPA's target range of 1 x 10^{-6} to 1 x 10^{-4}; 2) noncancer HIs due to fish and crab consumption would remain higher than EPA's goal of 1; and 3) ecological hazards would also remain higher than acceptable levels. Commenters stated that, to the extent that the preferred alternative would rely on institutional controls in the form of fish consumption advisories and enhanced public outreach to achieve protectiveness, the uncertainty associated with these measures is not recognized or clearly articulated. Commenters concluded that the FFS and Proposed Plan are deficient and inconsistent with the NCP, because they fail to acknowledge these uncertainties and limitations in the ability of the preferred alternative to meet the CERCLA threshold criterion of overall protection of human health and the environment.

Response:

The results predicted by the updated computer model developed in response to comments confirm that in the 26-year period after construction of the selected remedy, total cancer risks for the adult and child for all COCs will exceed the acceptable risk range (10^{-4} to 10^{-6}) and the noncancer health hazard for the adult and for the child will exceed EPA's goal of an HI of 1. The selected remedy will incorporate institutional controls such as fish and crab consumption prohibitions and advisories enhanced by additional outreach to ensure protectiveness. As discussed in the response to comment II.H.5.1, EPA's model predicts that shortly after construction, surface sediment concentrations of dioxins and PCBs in the lower 8.3 miles would reach the interim remediation milestones that correspond to interim protective fish and crab tissue concentrations, potentially allowing NJDEP to consider lifting, or relaxing the stringency of prohibitions on fish and crab consumption (e.g., allowing one fish meal per month, as opposed to the current prohibitions on consumption of fish or shellfish from the Lower Passaic River). In contrast, Alternative 4 would not achieve as much risk reduction as the selected remedy. The surface sediment concentrations of dioxin and PCBs that EPA's model predicts would be reached shortly after construction do not correspond to interim protective fish and crab concentrations, so NJDEP would be unlikely to relax the stringency of prohibitions on fish and crab consumption.

The FFS, Proposed Plan and ROD all show figures illustrating and include text discussing the uncertainties and limitations of the remedial action. The fact that the fish and crab consumption prohibitions and advisories must remain in place is clearly stated under the threshold criterion of overall protection of human health and the environment. Under the threshold criterion of long-term effectiveness and permanence, EPA describes how the selected remedy will incorporate institutional controls such as fish and crab consumption prohibitions and advisories to ensure protectiveness of human health, and explains that as part of the remedy, the fish and crab consumption prohibitions and advisories will be enhanced by additional outreach to ensure protectiveness.

In addition, the uncertainty in the ability of the selected remedy to meet the CERCLA threshold criterion of protection of human health and the environment is indicated by the uncertainty bands around the model predictions of surface sediment contaminant concentrations (Figures II.H.5.2 – 1 through II.H.5.2 - 4) which show that surface sediment concentrations may approach remediation goals either earlier (lower uncertainty band) or later (upper uncertainty band) than the model's average prediction. Uncertainty is also shown by the inclusion of fluctuations in surface sediment concentrations due to storms whose magnitude and frequency, while programmed into the model based on historical trends, in reality cannot be predicted with any degree of certainty.

H.6. Short-Term Effectiveness

H.6.1 Comment: Dredging Resuspension Underestimated, Failure to Evaluate Extreme Events During Construction

Commenters stated that there were several issues with the dredging and construction analyses that strongly affect the comparison of short-term effectiveness among the four alternatives, including: underestimated losses of contaminants due to dredging; failure to assess the adverse effects of possible extreme events during construction; unrealistic estimates of construction time; miscellaneous threats to dredging productivity; and possibly extensive prop-wash resuspension of contaminated material during construction of the more intrusive alternatives.

Response:

EPA agrees that the issues raised in the comment are important, which is why they are already addressed in the RI/FFS and Proposed Plan under the comparative analysis of the four alternatives (refer to Pages 26 through 40 of the Proposed Plan and to Section 5.3.1 and Table 5-4 of the FFS Report). EPA's assumptions regarding losses of contaminants due to dredging were based on careful consideration of existing literature and the Agency's experience from dredging projects such as the Hudson River PCBs and Fox River Superfund Sites. The mechanistic model included loss of contaminants due to dredging at 3 percent of the mass dredged, which is conservative, given that dredging losses at the Hudson River PCBs Superfund Site have been measured at approximately 1 percent over the past 4 years (GE, 2015). Section 4.3.1 of RI/FFS Appendix F describes some of the engineering and operational controls that could be implemented to minimize adverse environmental impacts due to dredging, including, but not limited to, the following:

- Use of a closed, watertight clamshell dredge or hydraulic dredge with appropriate controls;
- Appropriate operation and maintenance of equipment or machinery, including adequate training, staffing and working procedures (including appropriate contract/operator incentives);
- Minimizing the number of passes needed to dredge a particular volume of sediment;
- Slowly withdrawing the clamshell through the water column;
- Avoiding barge overflow during filling;
- Minimizing vessel movement within the dredging area.

During remedial design, these and other controls will be specified in more detail to minimize resuspension of contaminated sediments due to dredging.

As described in the RI Report, the FFS Report, Appendix B.I, Appendix B.II and Appendix G, adverse effects of extreme events were evaluated and considered in EPA's modeling and construction analyses.

To respond to this and other comments received by EPA, the various factors affecting dredging productivity and duration for all three active remedial alternatives were re-evaluated as described in response to comment II.H.4.1, and Sections III.C.3.1, III.C.3.2 and III.C.3.3. EPA also revised and updated the Reach-by Reach analysis described in the FFS Report and Appendix F. The re-evaluation has resulted in an increase in the estimated duration of implementation for EPA's selected remedy and confirmed that even when all of the additional factors raised by commenters are taken into account in the construction schedule, the selected remedy can be implemented in an amount of time roughly comparable to the duration estimated in the Proposed Plan (6 years compared to the five-year duration in the Proposed Plan).

Miscellaneous threats to dredging productivity were mentioned in the comment but were not specifically identified. EPA's revised estimate includes an additional three weeks of downtime beyond the 17 weeks fish window to allow for additional schedule delays during the construction season.

Resuspension due to propeller wash was not included in EPA's model because data concerning the number and types of vessels traveling up and down the Lower Passaic River and details concerning the propellers are not readily available at present. EPA anticipates that during the design phase, data specific to the vessels in use will be developed. Please refer to the response to comment II.E.1.1 for more information about agitation and remobilization of bottom sediments due to vessel operation (i.e., propeller, or "prop" wash).

H.6.2 Comment: Off-Site Disposal has Large Social and Environmental Effects

Commenters indicated that the Proposed Plan discussed the off-site sediment disposal option as if it had minor social and environmental effects, when it actually may have very substantial social and environmental effects that must be fully analyzed, documented, and considered before a final sediment remedial alternative is selected. In particular, commenters stated that social costs from quality of life impacts will be higher under the off-site disposal scenario than the confined aquatic disposal scenario, including social costs such as reduction of property values near the upland processing facility that would handle hazardous substances and higher energy use, among others. Commenters also indicated that major actions generating social costs included constructing and operating the sediment handling and wastewater treatment facility as well as getting sediment to, and removing it from, the facility.

Response:

EPA agrees that the off-site disposal option included in the selected remedy will have social, environmental and energy costs commensurate with the nature and magnitude of the cleanup operation. However, there are also costs associated with choosing not to remediate actively, or with selecting a different disposal option, which is why the quality of life and environmental impacts of all of the disposal options were evaluated in the RI/FFS and Proposed Plan, and considered during remedy selection in the context of short-term and long-term effectiveness.

EPA anticipates that the sediment processing and transfer facility needed for the off-site sediment disposal option will have operational characteristics similar to a small concrete-manufacturing plant. Properties large enough to accommodate such a sediment processing facility in proximity to both to the dredging operations and freight rail services are highly likely to be located in a heavily industrialized area. The commenters have provided no information to show that siting a processing facility in such an area would have any discernable effect on property value. With respect to the Hudson River PCBs Superfund site, EPA has documented (2015) the creation of hundreds of local jobs annually associated with the remedial work generally (including the construction and operation of the sediment processing facility) – a social benefit, although not measured in the NCP analysis and not a goal of the Superfund program.

H.6.3 Comment: Monitoring for Environmental Conditions and Quality of Life Effects should be done during Construction

Commenters stated that monitoring should be provided during construction for both environmental conditions and quality of life impacts. Commenters suggested that adding TSS/ ABS monitoring at Dundee Dam could significantly improve sediment transport and contaminant transport and fate modeling in the future, by reducing errors in the specification of upstream (freshwater) boundary conditions.

Response:

As described in the FFS Report (Section 4.2.8, p. 4-19, and Appendix F, Sections 3 and 4), EPA anticipates that environmental monitoring will be conducted during construction, including water, sediment and air media; appropriate DQOs for the construction monitoring program will be developed during the design phase. Conducting upstream monitoring at or near the Dundee Dam rather than or in addition to data collection at the historical monitoring location at Little Falls is an option to be considered at that time, whether for additional modeling during the design phase (if appropriate) or during and following construction, such as for five-year reviews. As discussed in the response to comment II.E.1.5, monitoring data at Dundee Dam (including TSS, carbon and contaminant data collected between 2000 and 2013) has already been used to improve the specification of the upstream boundary conditions in the mechanistic model developed by EPA to support its analyses in the ROD.

H.6.4 Comment: Bridge Openings will Affect Rail and Car Commuters

Commenters noted that the proposed remedy for the lower 8.3 miles would require opening of several bridges including three roadway bridges and three passenger railroad bridges several times a day including during low tide to allow for the movement of barges to and from the dredging operation to the sediment processing facility. Commenters stated that this could involve 5 to 10 openings per day for each bridge. Commenters calculated that total losses would range from $363,000 per month (one opening per day) to $3.6 million per month (10 openings per day) for delays at the roadway and passenger rail crossings. Commenters estimated that 20,000 to 25,000 individual bridge openings would be required under EPA's proposed Alternative 3, depending on equipment sizing assumptions. Commenters stated that all possible efforts should be made to improve and coordinate the operations and traffic on the affected bridges well before the remedial design is complete. Commenters noted that this would require a great deal of time and energy to achieve and much of this is outside the purview of EPA and the Superfund program.

Response:

To respond to comments concerning the potential impact that numerous bridge openings would have on the operators and local community, EPA evaluated options for minimizing the number of openings needed during the dredging process. Based on this analysis, presented in Section III.C.1, EPA concludes that bridge openings will not be needed on a daily basis for transporting dredged or capping material. EPA then re-calculated estimates of dredging durations to account for the revised equipment sizing, as presented in Section III.C.3. The re-evaluations resulted in an extension in the estimated duration of implementation for the selected remedy, from 5 to 6 years, while demonstrating that the need for most bridge openings can be eliminated with planning and engineering solutions, although periodic openings would still be required to move over-sized equipment or to handle large debris. Additional details are discussed in the response to comment II.H.4.2.

H.6.5 Comment: Traffic Management Programs

Commenters stated that EPA did not appear to have evaluated the need for or implementation of traffic management programs.

Response:

EPA understands that project-related traffic is a potential concern to local residents and workers, depending on the location of the sediment processing facility, as well as other work staging areas or crew mustering points. EPA anticipates that the sediment processing facility will be located in an industrial area with access to main transportation routes, avoiding commercial and residential areas. EPA also anticipates that processed sediment will be shipped to off-site disposal facilities by rail rather than trucks, avoiding associated congestion on local roads. Siting analyses reviewed for the RI/FFS (see Appendix G of the RI/FFS) and an updated siting study conducted in response to comment II.H.2.10 and others (see Section III.C.2) identified potentially suitable sites meeting these criteria on the shores of the Lower Passaic River and connected waterways. Vehicles entering and leaving the sediment processing facility will be restricted to established routes.

Most traffic generated by the project will be due to work crews entering and leaving the parking facilities associated with various work areas. Wherever possible, EPA anticipates that on-site parking will be provided at work sites to minimize traffic and parking congestion. The operating schedule for work crews would vary, depending on the type of operation; for example, dredging crews typically work 12-hour shifts and, if necessary, work shifts could be staggered to avoid peak traffic periods. The majority of the workers would be located at the sediment processing facility. Staffing at the facility can be expected to involve 10 to 20 workers per shift with the facility staffed 24 hours per day, similar to many industrial facilities in the area. Assuming, at most, several dozen crew members per shift entering and leaving various facilities in urban industrial areas, it is anticipated that management of traffic impacts can adequately be addressed during design.

H.7. Cost Estimate

H.7.1 Comment: Cost Estimate and Dredging Volume Unchanged from 2007 Draft FFS to 2014 Final FFS

Commenters stated that the cost estimate in the 2014 FFS is largely unchanged from the cost estimate in the 2007 draft FFS with the exception of a brief introductory narrative. Commenters stated that it was conducted using a very similar format and level of detail, and did not reflect significantly revised information or assumptions. Commenters stated that although the estimate of removal volumes acknowledged the availability of more current bathymetric data, rather than incorporating the new data into the supporting figures and conceptual design of alternatives, the 2014 FFS used the 2004 bathymetry and a rough adjustment factor (for purposes of volume/cost estimate only) to account for the current sediment bed elevations.

Response:

EPA agrees that the format and structure of the cost estimates did not change substantially between the 2007 draft FFS and the final FFS documents released in 2014. Such a change would only be expected when the original format was found to be flawed or unhelpful. However, comments on the draft estimate received from stakeholders, and as a result of EPA's CSTAG and NRRB processes among others, as well as information gathered after the publication of the 2007 draft prompted a significant amount of additional evaluation on the design concepts for each of the alternatives, which is reflected in the final analysis and cost estimate.

Significant changes in the 2014 Final FFS Report from the 2007 draft FFS that were reflected in the updated cost estimate include the following:

- Adjustments were made to the volume of material handled under each of the alternatives reflecting new information from additional core data, reanalysis of contaminant concentrations and locations in shoals, updated modeling results, revisions to the navigational channel, and updated bathymetric data.
- Adjustments were made to the volume of hazardous material requiring thermal treatment prior to disposal.
- Changes were made in the dredged materials management approaches for both upland processing and in-water disposal options to reflect experience at other major Superfund sediment sites as well as comments from stakeholders.
- Adjustments were made to predesign investigation activities to reflect changes in design concepts.
- Changes were made to long-term site operation and management activities included, such as the type of maintenance and monitoring activities to be performed and the timing of these activities.
- Additional costs were included for restoration of the processing facility location.
- New/updated unit prices were used, based on information including vendor quotes and discussions with contractors and suppliers.

Finally, additional information was provided in the write-up on quantities, unit prices, and source of information used in the estimate (RI/FFS Appendix H).

As noted by the commenters, additional bathymetric surveys were conducted during the FFS process in 2010 and in 2012. EPA's analysis of this new data indicated that the change in sediment volume between 2004 and 2012 represented an increase of approximately 2 percent for the selected remedy, spread across more than 8.3 miles of the river. This small increase in the overall volume and location of material would have no significant impact on specific estimated project costs, within the accuracy of the overall cost estimate. In response to comments, EPA did update dredging volume estimates to incorporate the 2012 bathymetric survey, as shown in Section III.C.4, and confirmed that differences were minor.

H.7.2 Comment: Cost Sensitivity Analysis

Commenters stated that the cost sensitivity analysis of changes in dredging productivity should be revised to consider the impact of time in addition to the impact of dredging volume, because a dredging contractor willing to work under a unit quantity pay item arrangement will still need to be paid if time-related constraints outside of the contractor's control cause dredging productivity changes. In addition, commenters stated that the evaluation of the cost impact of increasing the extent of the engineered cap that is armored failed to account for the associated increase in cap thickness that would require additional dredging. Commenters concluded that the FFS should be revised to properly consider all impacts of increasing the extent of armoring the engineered cap.

Response:

When performing the cost sensitivity analysis, EPA considered a number of critical factors that would have significant impacts on the overall project costs. Factors evaluated generally represented those with costs that were a significant portion of the overall capital costs, such as dredging volumes and cap construction, or other components of the financial analysis process such as the discount rate. The terms of dredging contracts are highly uncertain and do not lend themselves to sensitivity analyses.

In the RI/FFS, EPA evaluated the sensitivity of the cost to additional armoring of the engineered cap and concluded that the cost of purchasing and installing the armor represented less than 0.5 percent of the capital costs for the project. EPA's analysis indicated that the amount of armor incorporated into the RI/FFS cost estimate was conservative, and if any additional armoring is needed, it is likely to be required only in limited areas and is unlikely to be necessary for the entire length of the river. The cost of additional dredging in limited areas to install the armor will not substantially increase the overall project costs. In addition, while EPA did not evaluate the additional costs associated with dredging to accommodate a thicker cap, in "Cost Sensitivity to Factor 2: Changes in the Volume of Sediment Removed," EPA did evaluate the cost sensitivity associated with changing the volume of sediment dredged. That analysis accounts for cost items affected by an increase in dredging volume, including, but not limited to, dredging, barge transport, hydraulic off-loading, mechanical dewatering, transport and disposal.

H.7.3 Comment: 7 Percent Discount Rate used was too High

Commenters stated that the alternatives in the Proposed Plan, including EPA's preferred alternative, were not cost-effective, and used a discount rate that is unrealistic and out-of-date and does not reflect current interest rates or realistic rates of return for private funds reserved for future remediation costs. Commenters proposed use of a lower discount rate (the 20-year United States Treasury bond rate from 2013), which would result in a higher cost estimate, based on a number of theories including the following: 1) the Securities & Exchange Commission (SEC) and accounting guidelines for disclosing environmental liabilities in financial statements call for a risk-free discount rate when reporting in financial statements; 2) the 20-year United States Treasury bond rate has decreased over time, from 1993 to 2013; 3) when PRPs fund remedies by collecting money up front and investing it, they typically seek low-risk investments; and 4) at other Superfund sites, EPA has sometimes evaluated costs using discount rates lower than 7 percent. Commenters also noted that EPA's sensitivity analysis evaluated the costs of the remedial alternatives using 3 percent and 10 percent discount rates, but asserted that EPA did not provide a basis for these alternate rates.

Response:

According to the NCP's nine criteria that EPA is required to use to select a remedy, cost effectiveness is evaluated by balancing "cost" with the other criteria. Overall effectiveness of a remedial alternative is determined by evaluating long-term effectiveness and permanence; reduction in toxicity, mobility and volume through treatment; and short-term effectiveness. Overall effectiveness is then compared to cost to determine whether the remedy is cost-effective. As discussed in the ROD, the selected remedy is cost-effective.

In the RI/FFS, to evaluate the remedial alternatives pursuant to the NCP criteria, including cost-effectiveness, EPA developed cost estimates for each alternative. The cost criterion, as described in the NCP, includes capital costs, O&M costs, and net present value of capital and O&M costs. According to the EPA Guide to Developing and Documenting Cost Estimates during the Feasibility Study or Cost Estimate (EPA, 2000d), EPA uses present value analysis to evaluate expenditures, either capital or O&M, which occur over different time periods. The use of present value analysis allows for cost comparisons of different remedial alternatives on the basis of a single cost figure for each alternative. This single number, referred to as the present value, is the amount needed to be set aside at the initial point in time (base year) to assure that funds will be available in the future as they are needed, assuming certain economic conditions.

In the RI/FFS, EPA used a 7 percent discount rate to develop the present value cost estimate for remedial alternatives, consistent with the Cost Estimate Guide. As the commenters noted, the Cost Estimate Guide states that there may be circumstances in which it would be appropriate to consider the use of a lower or higher discount rate than 7 percent for the present value analysis. For example, for Federal facility sites being cleaned up using Superfund authority, it is generally appropriate to apply a discount rate based on interest rates from Treasury notes and bonds. Because the Federal government has a different "cost of capital" than the private sector, these lower rates are appropriate to use for adjusting future year expenditures in a present value calculation for Federal facility remediation projects. Similarly, if there were no possibility that financially viable PRPs might exist to perform or fund the remedial action, it might be appropriate to use a lower discount rate to reflect the lower returns on government investments. However, the Cost Estimate Guide clearly states that the 7 percent discount rate should generally be used in calculating net present value for all non-Federal sites. For the lower 8.3 miles RI/FFS and Proposed Plan, circumstances did not dictate deviating from the preferred discount rate.

The commenters' theories for using an alternate, lower rate do not provide a clear basis for departing from the 7 percent discount rate. The Cost Estimate Guide explains that the estimates developed during the FS stage, typically carried over to the Proposed Plan for public comment, are primarily for the purpose of comparing remedial alternatives, not for establishing project budgets or negotiating enforcement settlements. In fact, the FS cost estimate used for the detailed analysis of alternatives/conceptual design has an expected accuracy of -30 percent/+50 percent. This is not at all comparable to the example of SEC guidelines for disclosure of environmental liabilities by public companies, where the focus is on the actual and potential costs to the disclosing company and its shareholders. Nor does the fact that EPA has, on occasion, developed cost estimates using a lower discount rate than the 7 percent specified by the Cost Estimate Guide, which allows for such a departure based on site-specific circumstances, establish that use of a lower rate would have been appropriate for the cost estimates for the lower 8.3 miles of the Lower Passaic River.

The commenters' arguments against a 7 percent discount rate turn largely on the observations that United States Treasury bond rates have decreased since the Cost Estimate Guide was issued, and also, that conservative investments, which the commenters state are often used by PRPs funding a remedy, typically yield less than 7 percent. Recognizing the variability of interest rates and that cost of capital may vary among the parties that might fund the remedy, EPA evaluated the impact of changes in the discount rate on the present value of the remedial alternatives. In the sensitivity analysis (Section 5.3.2 of the FFS Report), the present value was calculated using a 3 percent discount rate and a 10 percent discount rate, for comparison to the base discount rate of 7 percent established by the Cost Estimate Guide. These rates represent a realistic estimate of the potential cost of capital covering a range and mix of potential rates varying from a low of 3 percent for 30-year Treasury notes to a high of 10 percent representing corporate bonds for smaller or less secure business entities.

Because the structure of each of the alternatives is relatively similar (large capital costs spent early in the performance period and comparatively low long-term O&M costs), the present value of the alternatives varied in a similar manner with changes in the discount rate. Decreasing the discount value to 3 percent increased the present value of the various alternatives by 21 percent to 33 percent but did not change the relative cost among the alternatives. Using a 3 percent discount rate (roughly equivalent to a current 30-year Treasury bond interest rate), the present value of the selected remedy would increase by approximately 25 percent. Likewise, decreases in present value were relatively consistent across alternatives with an increase in the discount rate to 10 percent, ranging from 12 percent to 18 percent, with their relative rankings unaffected. Using a 10 percent discount rate, the decrease in present value for the selected remedy would be approximately 14 percent.

While the cap proposed under Alternative 3 will need to be maintained in perpetuity, the discounted cost of future cap monitoring and maintenance (even when extending the project schedule beyond the typical 30-year performance period) did not change the relative position of each of the remedial alternatives on a scale from least to most cost. Increasing or decreasing the discount rate thus does not make a substantial change in the NCP analysis of overall effectiveness in relation to cost.

H.7.4 Comment: More Dredging would Result in Less Costly, more Permanent Remediation

Commenters stated that a more permanent cleanup involving more dredging (testing the sediment and dredging until clean) and in-situ treatment of sediment through bioremediation would cut long-term costs - both financially and in terms of impacts to human health and the environment. The commenter stated that even the sediment that is dredged for the purposes of flooding prevention could be treated by in-situ methods rather than be transported off-site to incinerators and landfills.

Response:

The commenter appears to propose that Alternative 2 with onsite ex-situ treatment of dredged sediment through bioremediation is a more permanent and less costly remedy than Alternative 3. In the RI/FFS, Proposed Plan and ROD, EPA evaluated Alternative 2 and Alternative 3 (the selected remedy) against the threshold criterion of overall protectiveness of human health and the environment and concluded that both alternatives would protect human health and the environment to approximately the same degree in the long-term, contrary to the commenter's assertion. As shown in the response to comment II.C.4.5, Alternative 3 (whose cost estimate already includes long-term monitoring) is less costly than Alternative 2, whether or not discounting is used in the cost estimate and, in the present value calculation, whether 30 years or 100 years of O&M are assumed in Alternative 3.

EPA did consider in-situ bioremediation in the RI/FFS, but screened it out in the FFS Report, because there is such a large mixture of contaminants in Lower Passaic River sediments, with most either not biodegradable (particularly heavy metals) or very persistent in the environment, that based on available information at the time, bioremediation was not considered feasible or effective. Bioremediation is further discussed in the response to comment II.H.1.1.

H.7.5 Comment: There were no Data Use Objectives for pre-Design Investigation

Commenters noted that cost of the predesign investigation in EPA's RI/FFS cost estimate included an extensive sediment coring program but that there were no data use objectives for the pre-design investigation data. Commenters stated that the Alternative 3 pre-design investigation task of sediment coring for chemical analyses served no data use objective and should be eliminated from the FFS.

Response:

Commenters are correct that explicit data use objectives were not identified for the various elements of the predesign investigation developed in the RI/FFS for cost estimation purposes. However these objectives can be inferred from the title of each cost element in Tables 1-2 through 1-11 and the text in Appendix H of the RI/FFS. The primary purpose of the chemical sampling under Alternative 3 is for the design of the cap, the thickness of which is dependent on the contaminant concentrations in the underlying sediment.

Sample collection (coring) for the predesign investigation developed for RI/FFS cost estimation purposes was divided into two programs: cores collected for chemical, waste characterization, and geologic sampling and analysis; and cores collected for geotechnical sampling and analysis. A reduction in the number of samples to be analyzed for chemical parameters would not necessarily impact the number of cores collected since the majority of cores collected serve dual purposes. During development of the predesign investigation, the final number of sampling locations or parameters will be defined based on site conditions and DQOs.

In response to this comment, EPA reviewed the number of cores and chemical samples included in the predesign investigation developed for RI/FFS cost estimation purposes. During this review, it was noted that that the number of deep cores (greater than 12 feet) was overestimated. In the RI/FFS cost estimate for Alternative 3, the cores were divided roughly in half based on area, with areas downstream of RM 2.2 (which includes the navigation channel) having deeper cores. However, while the area downstream of RM 2.2 covers approximately 50 percent of the open water, a significant portion of that area was in shoal areas (e.g., the Kearny mudflats) for which only shallow cores (less than 12 feet) would be required. This reallocation resulted in a reduction in the program coring costs, because the deeper cores are more expensive and fewer samples are collected from the shallower cores. In addition, as discussed in response to comment II.H.3.3, in the selected remedy, the dredging to accommodate use of the navigation channel extends only to RM 1.7. Overall these changes resulted in a reduction in the estimated direct costs of approximately $17 million for Alternative 3 (the selected remedy). This reduced cost of the predesign investigation was reflected in the overall updating of costs for the alternatives performed in response to comments described in Section III.D.1 and used in the ROD. The revised cost estimates did not result in either a significant change from costs estimated in the RI/FFS or a change in the relative costs among alternatives.

H.7.6 Comment: Cost Estimate was based on Outdated Unit Costs

Commenters stated that EPA used outdated unit costs. Commenters stated that the mechanical dredging and mechanical dewatering unit rates were underestimated; realistic rates should have been identified and the FFS cost estimates revised accordingly. Commenters stated that the unit rates used to develop the processing and disposal cost component were outdated, and as such, the FFS should have been revised to incorporate current unit rates.

Response:

EPA disagrees that the unit prices do not reflect current prices as of the date of the RI//FFS. As noted in Appendix H of the RI/FFS, unit prices were taken from a variety of published and unpublished sources such as RS Means© (cost estimating software), internal cost databases, standard industrial multipliers, and communications with contractors, suppliers, vendors and other professional engaged in similar activities. Where appropriate, costs were based on the delivery of goods and services in Newark, New Jersey. Sources referenced in Appendix H include the following:

- Vendor or contractor communications – these unit prices/lump sum are based on verbal or written communications or published data from contractors, manufacturers, laboratories and other material or equipment suppliers.
- Recent project experience –these unit prices/lump sum are based on recent related experience on investigation and construction projects performed by EPA's RI/FFS contractor and others.
- Standard multiplier – standard industry multipliers were used to estimate costs for mobilization/demobilization, mechanical/electrical costs, and other facility construction costs for which detailed information was not available at the conceptual design level.
- Cost estimating software – these unit prices/lump sum costs are based on unit prices taken from cost estimating software such RS Means©, FOB Newark, New Jersey.

Dredging costs were based on discussions with dredging contractors and reflect the average cost for dredging over the entire river using a range of equipment sizes. In unobstructed areas of the river unit where it is possible to use larger equipment, lower unit prices are likely; in areas where equipment sizing or obstructions would slow down dredging and transport operation unit prices are likely to be higher. The unit prices used in the estimate reflect a compilation of prices from various sized pieces of equipment as necessary to achieve project objectives.

A written quote for the dewatering costs based on the estimated volume of material and other parameters for the different alternatives was provided by the firm that conducted mechanical dewatering for the Fox River project. Prior to completion of the RI/FFS, the firm was contacted and the quoted price was confirmed for the current timeframe.

EPA reevaluated and revised unit prices and unit quantities from previous estimates prior to submittal of the RI/FFS, as necessary to reflect January 2014 prices. Where obtaining new information directly from vendors was not feasible, costs were updated using the Engineering News Record Construction Cost Index (ENR CCI). The ENR CCI at the time the estimates were finalized was 9664.45 (ENR, 2014). In some instances, based on recent discussions with vendors and contractors, it was found that unit prices had not increased. In the case of laboratory costs, unit prices actually decreased from previous estimates, based on the compilation of written quotes from five certified laboratories.

H.7.7 Comment: The Cost of Alternative 2 with CAD was Approximately the same as the Cost of Alternative 3 with Off-Site Disposal

Commenters noted that Alternative 2 with CAD disposal costs approximately the same as Alternative 3 with Off-Site disposal.

Response:

In the RI/FFS, the cost of Alternative 2 with CAD was estimated at $1.34 billion and the cost of Alternative 3 with Off-Site disposal was estimated at $1.73 billion. While the commenters' statements about relative costs are correct, EPA makes remedial decisions based on the NCP's nine criteria, one of which is cost. See response to comment II.C.4.2 for a review of the overall comparison of Alternative 2 to Alternative 3 performed in the RI/FFS and Proposed Plan. See response to comment II.H.2.1 for a review of the administrative infeasibility of CAD cells in Newark Bay.

H.8. ARARs

H.8.1 Comment: ARAR Waiver for NJ Surface Water Quality Standards

Commenters stated that the FFS and Proposed Plan failed to acknowledge that an ARAR waiver for New Jersey's promulgated surface water quality standards will be required for any remedial action in the LPRSA due to regional/urban background sources of contamination.

Response:

The Proposed Plan and ROD specify that the remedy for the lower 8.3 miles of the Passaic River is a final action for the sediments of the lower 8.3 miles of the Passaic River and an interim action for the water column. It is an interim action for the water column, because, although remediation of contaminated sediment will contribute to improved water quality, implementation of any one of the alternatives evaluated in the RI/FFS by itself will be unlikely to achieve compliance with ARARs in the water column. The lower 8.3 mile action is only part of the remedial activities under consideration for the 17-mile Lower Passaic River and Newark Bay, so that compliance with surface water ARARs, or the need for ARAR waivers, will be more appropriately evaluated after additional response actions have been implemented.

I. Other Comments

I.1. Cooperating Parties Group's "Sustainable Remedy"

I.1.1 Comment: Support for CPG's "Sustainable Remedy"

Commenters stated that even if legacy sediments were found to be the most significant ongoing source of contaminants to the lower 8.3 miles of the Passaic River, an alternate approach focusing on "hot spot" remediation would be at least as effective as the proposed alternative, with far less impact on the river and surrounding communities. Commenters expressed support for the CPG's "Sustainable Remedy", because it would: 1) be just as effective as, or more effective than a bank-to-bank remedy; 2) minimize impacts on the business community and local residents; 3) remediate the most highly contaminated sediments in the least amount of time; 4) remediate all 17-miles in the same amount of time as the preferred alternative would remediate the lower 8.3 miles; 5) reduce the potential for recontamination by addressing on-going sources from the entire river; 6) bring new green infrastructure projects and employment to New Jersey; and 6) address uncertainty by incorporating adaptive management.

Response:

During the development of the RI/FFS and Proposed Plan, and in their comments on the Proposed Plan, the CPG did not submit enough information for EPA to reproduce the calculations on which the CPG and other commenters based their claims that the "Sustainable Remedy" is just as or more effective than a bank-to-bank remedy (e.g., see responses to comments II.D.1.5, II.F.1.1, II.F.2.2). EPA did develop and include a less than bank-to-bank, or focused, remedial alternative (Alternative 4) in the RI/FFS, Proposed Plan and ROD. As discussed in the ROD (using risk calculations updated in response to comments, see Section III.A.1) and in response to comment II.H.5.1, under Alternative 4 (Focused Capping with Dredging for Flooding), in the 26-year period after construction, human health total cancer risk (for adult and child for all COCs) would be 1 x 10^{-3} and 7 x 10^{-4} for fish and crab consumption, respectively, and noncancer health hazards for the child would be 68 and 34 for fish and crab consumption, respectively. Alternative 3 (Capping with Dredging for Flooding and Navigation), the selected remedy, in the 26-year period after construction would reach human health total cancer risks for adult and child of 5 x 10^{-4} and 4 x 10^{-4} for fish and crab consumption, respectively, and noncancer health hazards for the child of 29 and 20 for fish and crab consumption, respectively. Alternative 4, which includes dredging and capping of more of the lower 8.3 miles than the CPG's "Sustainable Remedy," is not as effective as the selected remedy, Alternative 3.

Although implementation of the CPG's "Sustainable Remedy" might have less of a short-term impact on the local community and businesses during construction than Alternative 3, it would have a greater long-term impact, leaving higher concentrations of contaminants in river sediments and causing unacceptable risks farther into the future.

As discussed in response to comment II.B.1.2, in the Lower Passaic River, the majority of the contaminated sediment is found in the lower 8.3 miles. Starting the remediation of the Lower Passaic River in the lower 8.3 miles addresses the area where the majority of the contamination is located, achieving substantial risk reduction and minimizing the potential for recontamination. Responses to comments II.C.3.1 and II.E.2.8 further discuss EPA's analysis of potential sources of recontamination, and the limitations of targeted remediation.

The CPG has not submitted enough information for EPA to evaluate the claim that the "Sustainable Remedy" would bring new green infrastructure projects and employment to New Jersey, or whether implementation of such projects could be carried out under the authority of CERCLA.

As explained in the ROD, EPA expects to employ an adaptive management approach during the remedial design and implementation of the remedy. This will allow for appropriate adjustments to ensure efficient and effective remediation.

I.1.2 Comment: Opposition to CPG's "Sustainable Remedy"

Commenters provided their own understanding of the CPG's "Sustainable Remedy," characterizing it as follows: there will still be contamination left in place that will continue to cycle through the environment and its organisms for years to come; areas of contamination other than the sediments will not be addressed (such as wooden bulkheading and shorelines); while source control is important, the CPG should be focused on the best cleanup for the sediments currently contaminated; adaptive management will not prove useful when the outcomes of the "Sustainable Remedy" are already apparent before the process has even begun; and no amount of "fisheries restoration" will make fish from the Lower Passaic safe for human consumption without removing the contaminants.

Response:

The purpose of the Responsiveness Summary is to respond to public comments on the alternatives evaluated in the RI/FFS and Proposed Plan. As described in the response to comment II.I.1.1, during the development of the RI/FFS and in their comments on the Proposed Plan, the CPG did not submit enough information on the "Sustainable Remedy" for EPA to evaluate and include it in the RI/FFS. However, EPA did develop and include a focused, less than bank-to-bank, remedial alternative (Alternative 4) in the RI/FFS, Proposed Plan and ROD. Alternative 4, which includes dredging and capping of more of the lower 8.3 miles than the CPG's "Sustainable Remedy", is not as effective as the selected remedy, Alternative 3.

I.1.3 Comment: CPG's "Sustainable Remedy" meets the nine criteria

Commenters stated that the CPG's "Sustainable Remedy" is near completion within the 17-mile LPRSA RI/FS process and had been developed through extensive technical evaluation of all the sediment, surface water and ecological data collected by the CPG during the 17-mile RI (under EPA oversight) and by EPA and others in previous investigations. Commenters concluded that CPG's "Sustainable Remedy" better meets the nine CERCLA remedy selection criteria and is more consistent with EPA's sediment management principles and guidance than any of the bank-to-bank dredging alternatives in the FFS and Proposed Plan. Commenters asserted that the mechanistic model developed by the CPG and used to predict future concentrations of contaminants in sediment and fish provides assurance that the "Sustainable Remedy" would be protective of human health and the environment. Commenters stated that the "Sustainable Remedy" would include the use of phased actions that would quickly reduce risk and would be followed by monitoring to determine if any additional actions need to be implemented.

Response:

The purpose of the Responsiveness Summary is to respond to public comments on the alternatives evaluated in the RI/FFS and Proposed Plan. The CPG did not submit enough information during the development of the RI/FFS and in their comments on the Proposed Plan for EPA to reproduce the calculations on which the CPG and others based their claims that the "Sustainable Remedy" meets the nine CERCLA remedy selection criteria. As discussed in the response to comment II.I.1.1, EPA concluded that alternatives that are less than bank to bank in scope would not be protective of human health and the environment, based on an evaluation in the FFS of a less than bank to bank alternative that would have remediated more area in the lower 8.3 miles than the "Sustainable Remedy". In addition, EPA notes that it is not clear that the CPG's 17-mile RI/FS is close to completion, as discussed in the response to comment II.A.1.1.

I.1.4 Comment: Opposition to and lack of information about fish exchange program

Commenters expressed opposition to proposals for "a fish farm in order to trade fish to the people of Newark." Commenters noted that very limited information is available on fish exchange programs ever being used at a contaminated site and that it would be extremely difficult to assess its potential for success in reducing human exposures. Commenters listed a number of unknowns about the CPG's proposed fish exchange program. Other commenters described the implementation of a one-year fish exchange and veterans' training pilot study to determine the feasibility of a program to provide healthy fish, or vouchers which can be used to obtain healthy fish, to individuals who would otherwise catch and consume fish from the Lower Passaic River. The objective of the fish exchange program would be to curtail short-term risk from consumption of resident fish, while creating jobs for neighboring residents.

Response:

The purpose of the Responsiveness Summary is to respond to public comments on the alternatives evaluated in the RI/FFS and Proposed Plan. A fish farm and fish exchange program were not evaluated in the RI/FFS or the Proposed Plan, nor has the CPG submitted details of the proposed fish exchange program to EPA for review as part of the 17-mile RI/FS.

I.2. Paying for the Remediation

I.2.1 Comment: How will implementation of the selected remedy be funded

Commenters urged EPA to require that companies potentially responsible for discharging contaminants to the river pay for the cleanup. Some commenters asserted that EPA's preferred cleanup plan or that Superfund law included the requirement that PRPs pay for the cleanup. Other commenters urged the U.S. government to pay for the cleanup along with the PRPs, because Agent Orange was used by the government in the Vietnam War and because the government owns or is responsible for land beneath many waters where disposing of dioxins was allowed prior to 1979.

Response:

The purpose of the Responsiveness Summary is to respond to public comments on the alternatives evaluated in the RI/FFS and Proposed Plan, not to address questions of funding or liability in any detail. EPA agrees that the parties responsible under CERCLA should pay for the cleanup. Under CERCLA, EPA searches for parties legally responsible for the contamination and seeks to hold those parties accountable for the costs of investigations and cleanups, by requiring them to perform or fund the necessary investigatory and remediation. EPA will follow this approach for the Passaic River.

I.2.2 Comment: Bridge maintenance is not a CERCLA response cost

Commenters indicated that language in the 2014 FFS suggested that EPA may consider technical assistance to bridge authorities to be a legitimate CERCLA response cost. Commenters stated that maintenance of bridges so as not to impede river navigation is a legal responsibility of the bridge operators alone.

Response:

The RI/FFS did not suggest that technical assistance to bridge authorities is a CERCLA response cost and notably, the cost estimate developed for the RI/FFS and Proposed Plan did not include any costs for technical assistance or bridge maintenance. The RI/FFS included the following two sentences: “The FFS Study Area is also crossed by 14 bridges of various heights. The necessary coordination, which may include assisting bridge authorities with engineering evaluations and maintenance of the bridges, would occur during the remedial design.” The RI/FFS used the term “necessary coordination” to highlight that it is critical that EPA and the parties performing work coordinate with bridge owners and operators during remedial design and remedial action to inform them of any potential effects that remedial construction might have on the bridges in the lower 8.3 miles of the Lower Passaic River and work with them to minimize those effects (see response to comment II.C.6.3 and analysis in Section III.C.1 for how this might be done). The nature of the coordination required will be determined by the questions that come up during design of the selected remedy.

I.3. Potentially Responsible Parties

I.3.1 Comment: Objection to being identified as a PRP that discharged into Passaic River

Commenters objected to statements in the FFS and Proposed Plan that characterized all companies identified as PRPs as having discharged contaminants into the Passaic River, and requested that their clients' companies be removed from the list of PRPs and not be required to participate in any further studies or remediation of the LPRSA.

Response:

The purpose of the Responsiveness Summary is to respond to public comments on the alternatives evaluated in the RI/FFS and Proposed Plan, not to address questions of funding or liability with respect to individual entities. Whether or not particular entities identified as PRPs will participate in future work with respect to the river, and the degree of participation, is a matter beyond the scope of this document.

I.3.2 Comment: PRPs associated with the former Diamond Alkali facility

Commenters stated that the 2,3,7,8-TCDD from the 80 Lister Avenue facility was the predominant chemical of concern in the Lower Passaic River. On three key issues – the Phase II Removal Action for contaminated river sediment in front of Lister Avenue based on EPA's 2008 AOC, the 17-mile LPRSA RI/FS, and the River Mile 10.9 Removal based on EPA's 2012 Unilateral Administrative Order (UAO) – commenters asserted that the Lister Parties (the parties associated with ownership of and operations at 80-120 Lister Avenue) have not fulfilled their responsibilities and EPA has taken no action to compel the Lister Parties to meet their obligations or enforce the AOC and UAO. Commenters concluded that the Lister Parties should be held accountable for any remediation required for the Lower 17 Miles of the Passaic River.

Response:

The purpose of the Responsiveness Summary is to respond to public comments on the alternatives evaluated in the RI/FFS and Proposed Plan, not to address liability-related issues with respect to individual entities. However, EPA notes that, aside from 2,3,7,8-TCDD, the RI/FFS and Proposed Plan identified seven other COCs that contribute substantially to the cancer risks, noncancer health hazards and ecological risks in the lower 8.3 miles of the Passaic River: PCBs, mercury, DDT, PAHs, dieldrin, copper and lead. Under CERCLA, EPA searches for parties legally responsible for the contamination and seeks to hold those parties accountable for the costs of investigations and cleanups, by requiring them to perform or fund the necessary investigatory and remediation. EPA will follow this approach for the Lower Passaic River.

I.3.3 Comment: History of contamination in the Lower Passaic River

Commenters provided histories of the Passaic River, focusing on how the former Diamond Alkali facility at 80-120 Lister Avenue, Newark, New Jersey contributed to contamination in the river.

Response:

These comments are noted. A description of the former Diamond Alkali facility can be found in EPA's history of the site included in the RI/FFS, Proposed Plan and ROD.

I.4. Comparisons to Other Superfund Sites

I.4.1 Comment: How might the remediation of other sediment sites inform remedy selection for the Lower Passaic River

Commenters asked whether there are any comparable water bodies that have been cleaned up and whether those cleanups might inform the choice of a remedy for the Lower Passaic River.

Response:

Every water body has site-specific characteristics that must be considered when making a remedial decision. However, EPA is constantly learning from remedies implemented at other sites. For example, as discussed in the response to comment II.C.6.3, the Hudson River PCBs Superfund site remediation has taught EPA that there are low-profile barges and tugs that can navigate under the bridges on the lower 8.3 miles of the Passaic River, minimizing the need to open those bridges. As discussed in response to comments II.C.4.3 and II.C.4.5 capping has been used successfully at numerous sites to isolate contaminated sediments from the rest of the water body, provided adequate monitoring and maintenance are performed.

I.5. Public Participation

I.5.1 Comment: Adequacy of Public Outreach up to and including Proposed Plan comment period

Some commenters expressed appreciation for the availability of concise public information and raw data on the web that enabled information provided in reports to be verified. Other commenters asserted that the public comment period was too short to evaluate documents of such a complex technical and scientific nature, and that none of the public meetings provided the opportunity for interaction with the authors of the technical reports. Some commenters expressed disappointment that residents near treatment or disposal facilities had not been engaged during the public comment period, and asked for EPA to meet with those residents in advance of final decision-making. Other commenters urged residents of Staten Island to comment on the Passaic River lower 8.3 mile Proposed Plan, because they live near connected waterways.

Response:

EPA is committed to making information about its studies and remedial decisions available to the public. As discussed in Section I.A, EPA has used a number of community involvement tools throughout the development of the RI/FFS and Proposed Plan to keep the public informed about project issues and maintain a meaningful public dialogue.

The Proposed Plan, released on April 11, 2014, provided for a public comment period starting on April 21 and ending on June 20, 2014, which was longer than the initial 30-day comment period specified in the NCP. On two subsequent occasions, in response to requests and in accordance with the NCP, 40 C.F.R. § 430(f)(3)(C), EPA agreed to extend the public comment period, with the second extension leading to the final end date of August 20, 2014. This represented a 61-day extension from the original end date of the comment period, for a total duration of over 120 days. The final duration was consistent with public comment periods for other complex Superfund sites, such as the Housatonic River (four months), Lower Duwamish River (3.5 months), Grasse River (two months) and Gowanus Canal (four months), to mention only a few.

During the public comment period, EPA went beyond its usual public outreach process by organizing three public meetings to present information and receive public comments about the RI/FFS and Proposed Plan. Although not part of the formal public comment process, EPA also participated in three public forums sponsored by other organizations, two Passaic River Community Advisory Group meetings and a New York-New Jersey Harbor and Estuary Program Citizens Advisory Committee meeting, all open to the public, to present information and answer questions about the RI/FFS and Proposed Plan. During all of these meetings, EPA staff were available to answer questions relating to the reports for the RI/FFS, and received and answered many technical questions that came up in those meetings, while at the same time clarifying that anyone wishing to submit comments on the Proposed Plan would have to do so in writing, or at an EPA public meeting. All of these meetings were advertised and provided ample opportunity for stakeholders to be engaged during the public comment period.

I.5.2 Comment: NCP's public participation expectations not met because Proposed Plan deferred too much to remedial design

Commenters stated that the FFS and Proposed Plan did not satisfy the NCP's public participation expectations (40 C.F.R. § 300.430(f)(1)(ii)) because they presented incomplete and misleading information. Commenters stated that the FFS and Proposed Plan did not provide an adequate analysis of the feasibility of the preferred alternative and significantly underestimated the duration, cost, difficulty and impacts of the project, so that the preferred alternative could only be considered highly conceptual and not properly evaluated. Commenters stated that EPA intentionally failed to adequately consider critical implementation issues that would substantially increase the time, difficulty, cost, and short-term effectiveness associated with completing the cleanup and deferred so many critical issues to the remedial design phase that the FFS did not meet the standard for a feasibility study under CERCLA and the NCP.

Response:

EPA's Proposed Plan fully evaluated each remedial alternative, including the preferred alternative, using the criteria established in the NCP. While some decisions related to implementation are necessarily deferred to the remedial design, EPA's analysis is based on a careful, detailed study supported by analyses of cost, conceptual design of dredging and capping, mitigation, and dredged material management considerations including waste characterization, upland processing options, off-site disposal, sediment treatment and CAD cell design.

Among the issues that commenters suggest should have been addressed in greater detail in the Proposed Plan, because they concern implementability and short-term effectiveness, are difficulties associated with siting a sediment processing facility, delays associated with bridges and underwater utilities, and impacts to local communities from both dredging and truck traffic. Potential sites for an upland sediment processing facility were addressed in the FFS, and that analysis is further supported in the technical evaluation presented in Section III.C.2. As discussed in the technical evaluation presented in Sections III.C.1 and III.C.3, and in the responses to comments II.C.6.3 and II.H.4.10, EPA evaluated challenges associated with bridges and utilities in the FFS comparative analysis of alternatives, and has further evaluated engineering solutions to minimize bridge openings in response to comments. Poorly maintained bridges will require some special considerations during design, as will underwater utilities, but they have not been simply deferred or overlooked as suggested by commenters.

The concern that EPA has not informed the public about the impacts to the local communities from dredging and truck traffic is not valid. Few NPL sites have included as robust and comprehensive a community participation and outreach process as EPA has undertaken here. Further, EPA has consistently stated that enhanced outreach to members of the public will be appropriate during remedial design, including in particular those who reside in areas that may be affected by a processing facility, truck traffic or by the work itself.

Finally, the NCP does not require nor anticipate that all the details of a proposed alternative will be developed at the Proposed Plan phase. As noted by EPA guidance (EPA, 2000d), cost estimates are prepared during the feasibility study for purposes of comparing alternatives during the remedy selection process, not for budgeting or negotiations. Sufficient information and detail to reasonably compare remedial alternatives does not require that each one should be developed with the level of detail typically found in remedial design documents. In fact, EPA guidance for preparing cost estimates provides that the expected accuracy of the cost estimates for the feasibility study, and for remedy selection purposes, is +50/-30 percent. This range for the expected accuracy shows EPA's expectation that not every detail necessary for implementation of an action can be established at the time of remedy selection.

I.5.3 Comment: Public outreach necessary after remedy selection

Commenters urged EPA to consult with the rowing community so that the cleanup efforts would take their needs into account. Commenters also urged EPA to engage communities and local governments on a regular basis during design and construction to ensure that concerns and problems are addressed. Commenters specifically requested that community input be required when selecting final dredging technology and in the design of the cap (materials used in cap layers). Commenters requested a community-centered approach to the cleanup that will involve all of Newark. Commenters offered to assist EPA with outreach to and communication with the local community. Commenters urged EPA to meet with New Jersey Transit to discuss bridge openings and potential impacts of implementation on New Jersey Transit's infrastructure.

Response:

EPA agrees that it is important and necessary for the Agency to reach out to the community, including residents, recreational users, local businesses and locally-employed workers and all others potentially affected by the planned remedial action, during the remedial design and throughout the remedial action.

EPA is committed to the same high level of public outreach and community involvement extended to stakeholders during the course of the Lower Passaic River investigation and response actions (see Section I.A). During the remedial design, EPA will continue its active outreach to communities affected by implementation of the lower 8.3 mile action. Details of the outreach will be documented in a revised Community Involvement Plan (CIP) that will be an update of the Lower Passaic River Restoration Project and Newark Bay Study CIP published in June 2006. EPA anticipates that the outreach will include regular meetings with rowing clubs, the CAG, local and state government representatives, and residents of municipalities on both sides of the Passaic River, so that stakeholders understand the impacts of remedial implementation and have an opportunity to provide input into plans to minimize, to the degree reasonably possible, those impacts.

I.5.4 Comment: Deficiencies in TASC report prepared for CAG

Commenters criticized various aspects of the 2014 report "Potential Economic Impacts of the Proposed Cleanup for the Lower Passaic River's Lower Eight Miles" prepared by Skeo Solutions (TASC contractor) for the CAG.

Response:

While Skeo Solutions was engaged by EPA under its national TASC contract, it provided technical assistance directly to the CAG. The 2014 report referenced in the comments was provided by Skeo Solutions to the CAG at the CAG's request to assist in its review of and comment on the Proposed Plan. The 2014 report was not approved by EPA and EPA did not rely on it for any conclusions reached in the RI/FFS or Proposed Plan.

I.6. Working with Other Government Agencies

I.6.1 Comment: Working with other government agencies

Commenters pointed out that a Federal Interagency Working Group had been formed in July 1996 as a forum for federal agencies to coordinate on Brownfield activities and that EPA should include other federal agencies in the Passaic River cleanup so that Newark's economic, political and social challenges could all be addressed in a coordinated effort.

Response:

EPA coordinates extensively with other federal and state agencies on the remediation and restoration of the Lower Passaic River. EPA worked most closely with the Partner Agencies, including the USACE, NJDEP, NOAA and USFWS, to develop the RI/FFS and Proposed Plan. Outside of the Superfund process, EPA is also participating in the Urban Waters Federal Partnership, which works to reconnect urban communities with their waterways by improving coordination among federal agencies and collaborating with community-led revitalization efforts to improve the nation's water systems and promote their economic, environmental and social benefits. The Urban Waters Federal Partnership includes agencies such as EPA, USACE, NOAA, U.S. Department of the Interior (DOI), Centers for Disease Control and Prevention, U.S. Department of Agriculture, U.S. DOT, U.S. Department of Housing and Urban Development (HUD), U.S. Department of Education, National Institute of Environmental Health Sciences, and U.S. Department of Energy. The Lower Passaic River is one of the locations selected by the Urban Waters Federal Partnership for special focus. EPA is also participating in the New York/New Jersey Federal Leadership Resiliency Collaborative that includes HUD, Federal Emergency Management Agency, DOT, DOI and USACE to coordinate Hurricane Sandy recovery efforts and programs to build future hurricane and flooding resiliency. This collaborative groups is also focusing on the Lower Passaic River, among other geographic areas.

I.7. Climate Change and Green Remediation

I.7.1 Comment: Proposed Plan did not consider the carbon footprint of the alternatives

Commenters stated that Carbon Footprint/Collateral effects were not considered and no consideration had been given to the very different carbon footprints of the four alternatives. Commenters stated that Alternatives 2 and 3 would fill a large fraction (or perhaps all) of the presently available disposal site volume in the Eastern United States, requiring truck or rail shipment of waste across much of the continent. Commenters stated that the very large carbon footprint of such an operation had not been considered and that such long distance shipment was also undesirable because of potential rail accidents that could distribute contaminants far from the Passaic River, as the recent accidents associated with increased rail shipment of oil had demonstrated. Commenters stated that CAD represents the “Green” option, in that it is not only a proven and effective method for managing contaminated sediment, it is also a more “sustainable” option than any of the other alternatives proposed in the FFS. Commenters concluded that overall, CAD will generate a much smaller carbon footprint than the selected DMM option.

Response:

Carbon footprint, in and of itself, is not one of the NCP’s nine criteria used to evaluate alternatives and select a remedy, and neither is “sustainability.” As discussed in response to comment II.I.7.3, energy use, greenhouse gas emissions and resource consumption associated with remedial alternatives would be considered as part of the NCP’s nine criteria used to evaluate alternatives and select a remedy to the extent they give rise to site-specific impacts, such as would be evaluated under the short-term effectiveness or implementability criteria. For the lower 8.3 miles of the Lower Passaic River, resource use and greenhouse gas emissions did not have any site-specific impacts relevant to EPA’s analysis. However, EPA uses green remediation strategies during remedial implementation to help minimize the environmental footprint of cleaning up Superfund sites and to ensure a protective remedy within the Superfund statutory and regulatory framework. The EPA Region 2 “Clean & Green” Policy and other tools developed under EPA’s *Superfund Green Remediation Strategy* will be used to the degree applicable to decrease the environmental footprint of EPA’s selected remedy. The availability of landfill space is addressed in the response to comment II.C.5.3. The potential for rail accidents is not evaluated in the NCP’s nine criteria, but EPA’s experience on the Hudson River PCBs Superfund Site shows that the rate of rail accidents is not substantially increased by transport of dredged materials to off-site landfills.

I.7.2 Comment: Proposed Plan did not evaluate effects of large-scale future changes

Commenters stated that the ramifications of possible future changes to the system had not been considered in the evaluation of alternatives, including: (a) a possible Passaic River flood diversion tunnel; (b) climate change and sea-level rise; (c) a storm surge barrier in New York Harbor; and (d) abandonment of the shipping channel above RM 0.

Response:

The USACE has not made a decision to implement a Passaic River flood diversion tunnel. Under a 2000 law, the USACE currently is prohibited from designing or constructing the flood diversion tunnel alternative. The USACE is using it only for comparison to the other alternatives being considered (non-structural and level or floodwall) [Shea, 2015]. EPA and USACE are meeting to coordinate both the Superfund remediation and flood risk management projects.

Climate change and sea-level rise are long-term changes that have relatively small and unpredictable year-to-year effects in the short-term, such that those changes are included in the uncertainty bounds around the model projections of surface sediment concentrations post-remedy. Potential effects of climate change and sea-level rise will be considered in remedy design.

There are no design plans or funding for implementation of a storm surge barrier in New York Harbor. Should plans be made or funding obtained, a storm surge barrier will be accounted for in the remedial design.

The statement that the shipping channel has been abandoned is not consistent with EPA's understanding and is not supported by the record. As discussed in the ROD and response to comment II.H.3.3, USACE's 2010 Lower Passaic River Commercial Navigation Analysis Report (USACE, 2010) documented current commercial navigation in the lower 1.7 miles of the river closest to Newark Bay. The USACE has advised that it will support a recommendation for Congressional action to deauthorize the authorized navigation channel in RM 1.7 to RM 8.3, and to modify the authorized depth between RM 0.6 and RM 1.7 to the depths included in the selected remedy. There is no basis in the record to support deauthorization below RM 1.7.

I.7.3 Comment: Proposed Plan did not evaluate the alternatives against EPA's green remediation principles

Commenters stated that EPA's analysis of environmental impacts of the FFS alternatives ignored key metrics, including energy use, greenhouse gas emissions and resource consumption that are recognized under EPA's green remediation principles and EPA Region 2's Clean and Green policy. Commenters also stated that EPA failed to implement its own recommended footprint evaluation methodology that is used to support green remediation and reduce negative environmental effects during assessment and cleanup of contaminated sites.

Response:

EPA's analysis of environmental impacts in Chapter 5 of the FFS Report was performed in accordance with the requirements of CERCLA and the NCP and in accordance with EPA's RI/FS guidance documents. As a general matter, energy use, greenhouse gas emissions and resource consumption associated with remedial alternatives would be considered as part of the NCP's nine criteria used to evaluate alternatives and select a remedy to the extent they give rise to site-specific impacts, such as would be evaluated under the short-term effectiveness or implementability criteria. For the lower 8.3 miles of the Lower Passaic River, resource use and greenhouse gas emissions did not have any site-specific impacts relevant to EPA's analysis. The EPA Region 2 "Clean & Green" Policy and other tools developed under EPA's 2010 *Superfund Green Remediation Strategy* will be used to the degree applicable during preparation of the work plans for the design phase and throughout implementation of the selected remedy. To the extent practicable, green remediation strategies will be used to help minimize the environmental footprint of cleaning up the lower 8.3 miles and to ensure a protective remedy within the Superfund statutory and regulatory framework.

I.8. Environmental Justice

I.8.1 Comment: Environmental Justice

Some commenters supported and others opposed EPA's preferred alternative for environmental justice reasons. Commenters urged EPA to implement the cleanup according to the environmental justice principles of fair treatment and meaningful involvement of all people regardless of race, color, national origin or income. Commenters urged EPA to consider environmental justice in siting decisions, such as for a sediment processing facility.

Response:

EPA is committed to taking environmental justice into account in all aspects of environmental protection. When siting an uplands processing facility, EPA's goal is always to minimize the impact on communities as much as possible. As demonstrated during Phase 1 of the Tierra Removal, EPA has a commitment to reaching out to affected communities to inform people on the potential adverse impacts of remedial actions and to work with communities to mitigate or minimize those impacts.

I.9. Natural Resource Damages

I.9.1 Comment: Natural Resource Damages

Commenters stated that PRPs should be assessed Natural Resources Damages, which could be used to pay for the cleanup of the lower 8.3 miles.

Response:

CERCLA provides for a group of legal authorities to address releases or threatened releases of hazardous substances, pollutants or contaminants that could endanger human health and/or the environment. EPA has comprehensive authority as the lead agency under CERCLA, in cooperation with individual States and Tribal governments, to investigate and respond to releases of hazardous substances. EPA's goal is to prevent further contamination and remediate sites to levels protective of human health and the environment [CERCLA Section 104; Executive Order 12580 §2(g) (January 23, 1987)]. In contrast, the Natural Resource Trustees have been delegated authority to perform Natural Resource Damage Assessments (NRDAs) and to restore natural resources injured or services lost due to a release or discharge. This can include recovering costs beyond cleanup costs to restore or replace natural resources to the conditions that would have existed without the hazardous substance release [CERCLA Section 107(f)(1); 40 C.F.R. § 300.615(c)(3), (4)].

The Federal and State Natural Resource Trustee agencies (NOAA, USFWS and NJDEP) are the entities with legal authority for assessing past, present and future injuries to the natural resources of the Lower Passaic River from exposure to hazardous substances; determining the restoration needed to compensate the public for injuries to natural resources; and negotiating legal settlements or taking other legal action against the parties responsible for the release of those hazardous substances. Natural resource damages are a separate category of legal claims from the costs of cleanup of hazardous substances under CERCLA. Funds recovered in relation to Natural Resource Damages cannot be directed to CERCLA actions.

I.10. Remedial Design Comments

I.10.1 Comment: Bid process for construction of the selected remedy

Commenters sent information about the products and services that their companies could provide to implement a remedy and asked for information about the bid process for implementation of the cleanup.

Response:

Since this is the remedy selection phase of the project, a bid process for implementation of the remediation has not yet been established. During the remedy design phase, detailed implementation plans will be developed for the selected remedy. At that time, a contracting process will be established and information about products and services will be considered by the parties implementing the cleanup.

III. Technical Evaluations

A. Human Health Risk Assessment

A.1. Revised Future HHRA Estimates for the Record of Decision

Objective: To assess the risk posed by the sediments of the lower 8.3 miles of the Passaic River after remediation based on mechanistic model and EMBM results that were updated in response to comments (see Attachment E).

Evaluation: As part of the RI/FFS, EPA developed a mechanistic contaminant fate and transport model and an EMBM to predict the concentrations of COPCs in surface sediments of the lower 8.3 miles under the following four alternatives:

- Alternative 1: No Action
- Alternative 2: Deep Dredging with Backfill
- Alternative 3: Capping with Dredging for Flooding and Navigation
- Alternative 4: Focused Capping with Dredging for Flooding

Based on comments received on the Proposed Plan, EPA updated the mechanistic model and EMBM (see Attachment E) and new future sediment concentrations were simulated for each of the COPCs for each alternative. The updated mechanistic model was used to estimate future sediment concentrations for mercury, Total PCBs based on congeners, 4,4'-DDT, 4,4'-DDE, 4,4'-DDD and TEQs for both PCB and dioxin/furan congeners. The updated EMBM was used to estimate future sediment concentrations for chlordane. These revised future modeled surface sediment concentrations were converted to associated biota concentrations through the use of statistical regression-based relationships between sediment and tissue using site-specific data as was performed in the RI/FFS. The estimated biota concentrations were then used to estimate future residual risks remaining in the lower 8.3 miles post-remediation (termed "future modeled risk").

The revised future modeled HHRA evaluated the same COPCs and exposure pathway (ingestion of fish and crab) as were evaluated in the RI/FFS risk assessment. Consumption of fish and crab is the primary exposure pathway for the lower 8.3 miles and is the only one evaluated in this future modeled risk assessment. The only difference in methodology between the future modeled risk assessment presented here and the one provided in the RI/FFS HHRA is the use of updated EPA default exposure parameters. Two exposure parameters used in the revised future modeled human health risk evaluation were updated based on new default values published by EPA after the Proposed Plan was issued: (1) ED, which decreased from 24 years to 20 years for the adult for a total ED of 26 years; and (2) adult body weight, which increased from 70 kg to 80 kg. See response to comment II.F.1.5 for more discussion.

The tissue EPCs for future exposures were derived using the revised modeled annual average projections of future concentrations in sediment in conjunction with site-specific and chemical-specific sediment-tissue relationships (e.g., sediment-tissue regressions). Contaminant transport models were used to predict surface sediment concentrations for each of the remedial alternatives as average annual concentrations for the COPCs over a 26-year time period to coincide with the revised EPA default ED of 26 years (i.e., 6 years as a child plus 20 years as an adult). For each of the remedial alternatives, EPA assumed that remedy implementation would begin in July 2020. Because the remedy construction duration is different for each of the active remedial alternatives, the end of the 26-year ED time period, which begins at the end of remedy construction, is different each active alternative. Table III.A.1 - 1 summarizes the remedy construction duration for each of the alternatives and the beginning and end year for the 26-year ED time period.

For protection of human health, future EPCs were developed for the COPCs to account for the variable nature of the surface sediment concentrations over a 26-year time period and the ED component of the risk/hazard equation. Therefore, EPA developed a sliding scale of annual averages based on the ED for each receptor (e.g., 6 years for the child and 20 years for the adult) over the total 26-year ED time period. The maximum annual rolling average for the receptor-specific ED was selected for EPC derivation to ensure the EPC was not biased low because of a downward trend. As such, EPA used the maximum annual averages over 6-year time periods for the child and 20-year time periods for the adult to evaluate exposure for each receptor. In addition, the annual average concentration predicted 26 years after remediation was completed was used to evaluate exposure to both the adult and child receptors.

For this updated risk evaluation, as was done in the RI/FFS, cancer risks and noncancer health hazards were estimated for the RME individual (consistent with the NCP's requirement that risk decisions be based on the RME). For cancer risk, EPA evaluated a 26-year exposure period, assuming 20 years as an adult and 6 years as a child, to depict a scenario resulting in the most health protective calculations of cancer risks. For noncancer health hazards, EPA evaluated both a child receptor and an adult receptor to depict scenarios resulting in the most health protective noncancer health hazards. Tables III.A.1 - 2 through III.A.1 - 5 summarize the estimated cancer risks and noncancer hazard results for each of the alternatives.

In order to illustrate how changes made to the updated contaminant transport models impacted estimates of cancer risks and noncancer hazards, comparisons of future modeled risks from the RI/FFS and Proposed Plan are shown next to EPA's revised future modeled risk results in Figures III.A.1 - 1 and III.A.1 - 2 for ingestion of fish and ingestion of crab, respectively. Note that the use of the updated EPA defaults for ED (20 years) and BW (80 kg) in the revised future modeled cancer risk calculations for the adult + child combined receptor results in cancer estimates that are about 20 percent (or a factor of 1.2) lower than what the results would have been EPA had used ED and BW set to the old default values of 24 years and 70 kg, respectively. Similarly, for the health hazards for the adult receptor, hazard estimates incorporating the new EPA default value for BW results in noncancer hazard estimates about 13 percent (or a factor of 1.1) lower than estimates using the old BW value. Risk and hazard estimates for the adult only were affected by these default updates; exposure factors for the child receptor did not change as a result of EPA's 2014 publication of new default values. Notwithstanding EPA's updates to the contaminant transport models, the future estimated cancer risks and hazards for the adult receptor (and thus the adult + child combined receptor) calculated in this updated assessment are slightly lower than those estimates provided in the RI/FFS due to the use of updated EPA default values.

Also shown on Figures III.A.1 - 1 and III.A.1 - 2 are revised RI/FFS baseline risks and hazards. Baseline risks and hazards were determined in the RI/FFS using site-specific tissue sampling data. These baseline risk/hazard numbers were re-calculated using the updated default parameters as part of the response to comment II.F.1.5 and are denoted on Figures III.A.1 - 1 and III.A.1 - 2 as "Revised FFS Baseline".

In the ROD, EPA evaluates each alternative against the threshold criterion of overall protection of human health and the environment by comparing the upper-bound excess lifetime cancer risks derived in this assessment to the risk range of 10^{-4} to 10^{-6} established in the NCP. EPA's evaluation of noncancer health effects is based on a comparison to EPA's goal of protection of an HI equal to 1.

B. Ecological Risk Assessment

B.1. Revised Future BERA Estimates for the Record of Decision

Objective: To assess the risk posed by the sediments of the lower 8.3 miles of the Passaic River after remediation based on mechanistic model and EMBM results that were updated in response to comments (see Attachment E).

Evaluation: As part of the RI/FFS, EPA developed a mechanistic contaminant fate and transport model and an EMBM to predict the concentrations of COPCs in surface sediments of the lower 8.3 miles under the following four alternatives:

- Alternative 1: No Action
- Alternative 2: Deep Dredging with Backfill
- Alternative 3: Capping with Dredging for Flooding and Navigation
- Alternative 4: Focused Capping with Dredging for Flooding

Based on comments received on the Proposed Plan, EPA updated the mechanistic model and EMBM (see Attachment E) and new future sediment concentrations were simulated for each of the COPECs for each alternative. The updated mechanistic model was used to estimate future sediment concentrations for mercury, Total PCBs based on congeners, Total DDx (sum of 4,4'-DDT, 4,4'-DDE and 4,4'-DDD), TEQs for both PCB and dioxin/furan congeners[50] and 2,3,7,8-TCDD. The updated EMBM was used to estimate future sediment concentrations for copper, lead and HMW-PAHs.[51] Similar to the HHRA, future biota tissue concentrations associated with the different alternatives were estimated using regression-based relationships between sediment and tissue developed using site-specific data sets (see response to comment II.D.4.4). Future modeled ecological risks were estimated based on exposure to the estimated modeled annual average sediment and biota tissue concentrations.

Table III.B.1 - 1 summarizes the remedy construction duration for each of the alternatives and the beginning and end year for the 30-year time period considered in the RI/FFS ERA. Tables III.B.1 - 2 through III.B.1 - 8 summarize the estimated hazard results[52] for each of the alternatives. In the ROD, EPA evaluates each alternative against the threshold criterion of overall protection of human health and the environment by comparing the estimated hazard results to EPA's goal of an HQ of 1.

B.2. Evaluation of Sediment Exposure Depth

Objective: To summarize the basis for EPA's assumption of a 15 cm sediment BAZ assumed in the RI/FFS mechanistic model and risk assessments.

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[50] TEQs were calculated using mammal, bird and fish TEFs because all three receptor categories were evaluated in the BERA.

[51] Future concentrations of the two remaining COPECs (i.e., LMW-PAHs and dieldrin) were not estimated using either model.

[52] Values are the geometric means of upper and lower risk bounding estimates (e.g., NOAELs and LOAELs).

Evaluation: This analysis is based on site-specific studies such as the Sediment Profile Imaging (SPI) Survey conducted by Germano & Associates, Inc. in 2005 and benthic macroinvertebrate community studies conducted for the 17-mile RI/FS in 2005 and 2010. A majority of the benthic organisms in the estuarine portion of the LPR are small deposit feeders found primarily on or immediately below the sediment-water interface. Use of a 15-cm sediment BAZ for such organisms is based on the following concepts:

- Significance of environmental variability and data uncertainties;
- Functional importance of numerically less dominant (larger) organisms that burrow deeper into the sediment;
- Assumptions regarding the significance of potential stressors that could account for the observed community type and spatial distribution of organisms in the LPR; and
- Practical issues related to the available sediment analytical and bathymetric data sets.

The sediment exposure depth incorporated in the RI/FFS risk assessments has both empirical and theoretical support. Jumars & Wheatcroft (1989) proposed that the bioturbation depth represents a balance between resource acquisition, niche specialization and the increasing energy costs associated with deeper burrowing. Boudreau (1998) developed a simple resource-feedback model for bioturbation based on food availability and carbon reactivity (lability) and derived a mixing zone depth estimate of 9.7 cm. That mixing zone depth is remarkably close to the global mean of bioturbation effects attributable to deposit-feeding organisms in marine sediments, previously derived based on a compilation of over 200 data points (Boudreau, 1994; 9.8 cm with 4.5 cm standard deviation). Based on the empirical data compiled by Boudreau (1994), the mean mixing zone depth in marine sediments appears to be a constant over a wide range of water column depths (although the data suggest that the mixing zone depth is most variable at shallow depths, with a range of 2.5 – 30 cm; see Figure 1 in Boudreau, 1998). The fundamental relationship between the biological mixing zone coefficient and sediment burial rate across a wide range of marine environments is due to strong inverse relationship between both organic (food) and mineral (burial) inputs with water column depth. Some commenters on the Proposed Plan claimed that benthic communities in the lower 8.3 miles reside only above the redox boundary, which is approximately the top 1 to 2 cm of sediment. However, literature shows that the presence of deeper organic material represents a resource to organisms that are capable of exploiting it (Boudreau, 1994; 1998; Herman et al., 1999).

Table III.B.2 - 1 summarizes the results of the SPI study conducted by Germano Associates in 2005. The sediments in the estuarine portion of the lower 8.3 miles of the LPR consist primarily of silty clays with a narrow apparent RPD (mean – 1.6 cm). The high Organism-Sediment Index (OSI) and high proportion of benthic community samples characterized as “early successional” (i.e., 61%) suggest that the mouth of the LPR is a relatively unstable environment subject to frequent periods of sediment deposition and resuspension.

Examination of the SPI data shows that, in the lower 8.3 miles of the LPR (transects T1 through T17), feeding voids ranged from a minimum of 0.5 cm to a maximum of 14.8 cm. 80% of the feeding void lengths were approximately 10 cm or less. At the Housatonic River Superfund Site (Weston, 2006), the bioturbation depth was conceptualized as two sublayers, including the biologically mixed layer (i.e., a shallower zone of more thorough mixing) and the biologically influenced layer (i.e., a deeper zone of less intense mixing). The depth of the biologically mixed layer is significantly influenced by the maximum depth to which benthic organisms feed, because feeding activities generally play the greatest role in sediment reworking. In the lower 8.3 miles of the LPR, the biologically mixed layer may be interpreted as the top 10 cm, since that is where 80% of the feeding void lengths were found. The depth from 10 cm to 15 cm, where the other 20% of feeding void lengths were found, may be interpreted as the biologically influenced layer, where less intense mixing occurs, but where benthic organisms still feed and are exposed to COCs (Joseffson et al., 2011; Timmermann & Anderson, 2003).The mixing zone depth of 10 cm incorporated into the mechanistic model developed by EPA for the RI/FFS and updated in response to comments appropriately simulates the biologically mixed layer, whereas use of the entire 15 cm stratum in the RI/FFS risk assessments considers the importance of both sublayers in estimating ecological exposures and contaminant bioavailability to the aquatic food web in the lower 8.3 miles.

The benthic community data collected for the 17-mile LPRSA RI/FS (presence/absence) and literature information on feeding biology and microscale habitat requirements of indigenous organisms also provide a basis for use of a 15-cm sediment BAZ. The dominant organisms identified in sampling locations located within the brackish portion of the LPR are primarily polychaetes and oligochaetes, whereas oligochaetes, amphipods and insects predominate in freshwater benthic samples (Windward, 2014); dominant taxa are summarized in Table III.B.2 - 2.

Species such as *Maranzelleria viridis* and *Limnodrilus hoffmeisteri*, which dominate the polychaete and oligochaete fauna in benthic samples, are considered opportunistic species that can quickly colonize exposed habitat (i.e., Stage I). These species, along with *Hobsonia florida*, are primarily considered "surface" feeders; although the oligochaete feeds in a head down "conveyor-belt" position. *H. florida* has the potential to move substantial sediment mass to the surface. The maximum feeding depth of tubificid worms, such as *Limnodrilus* spp., typically ranges from 2 to 10 cm (Karichhoff & Morris, 1985). *Heteromastus filiformis*, a capitellid polychaete, is considered a "deep" subsurface feeder and is likely a major component of the Stage III (or Stage I/Stage II on Stage III) location communities identified in the Germano (2005) SPI study. These organisms feed (also in a head down position) to depths reaching 30 cm (Fauchald & Jumars, 1979). The selective ingestion of organically-enriched sediment particles at depth by species such as *H. filiformis* and subsequent defecation at the sediment-water interface can mobilize buried contamination (Neira and Hopner, 1994)[53].

The dominant freshwater organisms include oligochaetes (*L. hoffmeisteri* and *Quistadrilus multisetosus*), amphipods (i.e., *Gammarus* sp.) and dipterans (*Chironomus* spp; *Procladius* sp.). Charbonneau and Hare (1998) discuss burrowing behavior in aquatic insects; chironomid larvae burrows are typically found at sediment depths ranging from 2 to 10 cm whereas the omnivorous midge *Procladius* sp. is found at shallower depths.

The presence of Stage III seres in the LPR along with presence of the deep burrowing *H. filiformis* (brackish sediment) and the numerically abundant *L. hoffmeisteri* (throughout) and *Chironomus* spp. (freshwater sediment) support the use of 15 cm as a conservative but reasonable vertical stratum for exposure assessment. Factors such as the numerical abundance of burrowing organisms, the balance between organic and mineral inputs to the river, and the spatial heterogeneity in physical disturbance patterns will determine the relative importance of bioturbation in intervals between the shallow depths (e.g., 2 cm) and that assumed in the risk assessments (15 cm). The SPI study suggests that the relatively stable conditions necessary for benthic macroinvertebrate succession is limited in both brackish and tidal freshwater sections of the river; e.g., Type III communities were seen in only 21 of 75 (i.e.,

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[53] Neira, C., and T. Hopner, 1994. The role of *Heteromastus filiformis* (Capitellidae, Polychaeta) in organic carbon cycling; Ophelia 39:55-73.

approximately 28 percent) of brackish sampling locations and overall sampling densities were low as well. However, as indicated in Table III.B.2 - 3, the relatively rare, later-successional taxa likely represent a majority of biomass in the benthic community. *Macoma balthica* was collected at relatively low densities[54] compared to the surface deposit feeding tubificid worms but accounted for two-thirds of the available biomass for RM 0 to RM 4 in the benthic community data collected for the 17-mile RI/FS in 2010. In the 17-mile RI/FS benthic community survey, food web interactions at the sediment-water interface are not characterized to the level of detail necessary to determine the relative significance of deeper fauna in the function of this estuarine ecosystem.

The foraging behavior and feeding guilds associated with the dominant benthos are consistent with the SPI observations that reported generally minimal biological activity at depth in the LPR estuarine sediments (Table III.B.2 - 3). In general, the SPI and benthic community study findings for the lower 8.3 miles exhibit the lower taxonomic diversity characteristics of other estuarine areas. Physical stressors, including the variable salinity regime, reducing conditions and episodic high energy events limit the number of organisms that can survive in this zone. Nonetheless, a number of uncertainties remain unresolved by the 17-mile RI/FS data, further supporting the use of a 15-cm BAZ, even if it is conservative: the data do not show which benthic prey are most important with respect to the transfer of sediment-borne contaminants to benthivorous fish (and benthic probing birds); even if surficial organisms were to constitute the majority of prey items, the data do not provide information on the role that deeper-burrowing organisms play as prey to specific components of the food web or as mobilizers of deeper contamination for uptake by surficial feeders by their foraging activities; and the data cannot determine to what extent deeper sediments would be exploited by benthic organisms were the highly concentrated and toxic COCs not present.

Other information providing the basis for a 15 cm BAZ includes the site-specific data describing the functional relationship between sediment and LPR biota tissue concentrations as well as practical issues related to the available sediment analytical and bathymetric data sets, both of which are discussed in the response to comment II.D.4.3.

The recently released EPA (2015[55]) guidance provides conservative[56] estimates of the depth of the biological exposure zone which are consistent with EPA's assumptions in the RI/FFS risk assessments. As indicated in the following table, the most appropriate values for the majority of the lower 8.3 miles are 10 and 25 cm based on abundance and biomass, respectively.

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[54] As pointed out by the CPG, these low densities were collaborated by the limited abundance and shallow depth of feeding voids in the SPI data collected in 2005.

[55] EPA, 2015. Determination of the Biologically Relevant Sampling Depth for Terrestrial and Aquatic Risk Assessments; National Center for Environmental Assessment, Ecological Risk Assessment Support Center, Cincinnati, OH; EPA/600/R-15/176.

[56] Practical default values were selected to minimize the risk that the actual relevant sampling depth would be under-estimated (i.e., mean 80th percentile values were rounded up to the nearest 5-cm boundary and when the maximum 80th percentile exceeded the mean by more than 5 cm, 5 cm was added to the mean, which was then rounded up).

Habitat Type[1]	# Studies	Biotic Zone (cm) – Abundance-based[2]	Biotic Zone (cm) – Biomass-based[2]
Mesohaline Sand	2	10	20
Mesohaline Mud	8	10	25
Mesohaline Mixed Substrate	4	10	30
Oligohaline Sand	2	5	10
Oligohaline Mud	2	5	5
Oligohaline Mixed Substrate	4	15	15

[1]The "mesohaline mud" habitat type (shaded) is most appropriate for the lower section of the lower 8.3 miles. Consistent with hydrodynamic principles and RI/FFS Conceptual Site Model, sediments in the LPR (particularly RM 0-4) are classified as consisting predominately of "fines" (i.e., mud). Salinity conditions are variable but typically are greater than 3 parts per trillion (ppt) [Oligohaline (0.5 - 3 ppt) and Mesohaline (3 – 18 ppt)].

[2]Values are the 80th percentiles of abundance or biomass depth distributions derived from a meta-analysis of various studies that provide sediment cores detailing depth distribution of benthos by abundance or biomass (sites with obvious point source contamination were excluded).

B.3. Evaluate Oyster Body Dioxin Residue

Objective: To show how USFWS (Kubiak et al., 2007) derived a sediment benchmark for 2,3,7,8-TCDD based on reproductive effects in Eastern oyster using biological response data from Wintermyer and Cooper, 2003 and sediment chemistry from nearby CARP sampling stations.

Evaluation: The United States Fish and Wildlife Services (USFWS) derived a sediment benchmark of 3.2 pg/g for 2,3,7,8-TCDD (Kubiak et al., 2007) based on reproductive effects in Eastern oyster using the following equation:

$$SB = \frac{\left(C_{oyst-lip} \times f_{SOC}\right)}{\left(BSAF\right)}$$

Where:

SB	=	sediment benchmark
$C_{t\text{-}lip}$	=	lipid-normalized threshold effect concentration in oyster tissue
f_{soc}	=	fraction of organic carbon in sediment
BSAF	=	biota sediment accumulation factor (the ratio the lipid normalized concentration in oyster tissue to organic carbon normalized concentration in sediment)

The threshold effect concentration was estimated based on published data from Wintermyer and Cooper (2003). Wintermyer and Cooper conducted a 10-month (September 2000 until June 2001) field study to evaluate the bioaccumulation of dioxins/furans and PCBs in transplanted adult eastern oysters (*Crassostrea virginica*). Adult oysters were deployed to Newark Bay, Arthur Kill, and Sandy Hook, NJ, and accumulated 3.2/2.1, 1.3/1.7, and 0.15/2.3 parts per trillion (ppt or pg/g) of 2,3,7,8-TCDD/2,3,7,8-TCDF, respectively. The number of fertilized eggs (± SD) from strip spawned transplanted oysters from Newark Bay, Arthur Kill, and Sandy Hook, NJ, was 107 (± 6.00), 54 (± 36.11), and 113 (± 13.61), respectively, and the number of unfertilized eggs was 164 (± 25.6), 178 (± 15.9), and 97 (± 39.9), respectively (Figure III.B.3 - 1). The number of veliger larvae that resulted from fertilized eggs was 3 (± 1.7), 4 (± 2.31), and 82 (± 12.2) for Newark Bay, Arthur Kill, and Sandy Hook, NJ, respectively. Survival data from a laboratory study using an acute static 48-h *in-vivo* and *ex-vivo* exposure regiment to 2,3,7,8-TCDD demonstrated that exposure to 2 pg/g dioxin caused adverse effects on egg fertilization and development. The authors further reported that the "oysters transplanted to Sandy Hook had the highest level of fitness followed by oysters transplanted to Newark Bay and Arthur Kill, based on lesion grading, inflammatory-like responses, infectious disease states, weight gain/loss, and the degree of gonadal development."

Tables III.B.3 - 1 and III.B.3 - 2 present the derivation of BSAFs and Biota Suspended Sediment Accumulation Factors (BSSAFs) using eastern oyster tissue data from Wintermyer and Cooper (2003) and sediment chemistry data collected as part of CARP. Table III.B.3 - 1 presents 5 BSAF values derived using the oyster data from Arthur Kill (one composite from the 10-month Wintermyer & Cooper study) and five CARP sediment samples; the estimated BSAFs range from 0.43 to 1.6 with an average of 0.91 (SD = 0.47). Table III.B.3 - 2 presents the Kubiak et al. (2007) data set used to calculate BSSAFs for Newark Bay, Arthur Kill (2 stations). The normalized uptake factors based on suspended sediment concentrations range from 0.96 to 2.09 (Newark Bay station) with an arithmetic mean and standard deviation of 1.39 and 0.61, respectively. Due to similarity between the surficial and suspended data sets, the BSAFs and BSSAFs are comparable.

Kubiak et al., 2007 estimated the threshold TCDD sediment concentration using a geometric mean tissue concentration (0.44 pg/g) of the Sandy Hook (background, no effect level) and Arthur Kill (lowest adverse effect level). This was multiplied by the Sandy Hook oyster lipid percentage and divided by either the average of the five BSAF values for Arthur Kill (0.91, Table III.B.3 - 1) or the average of the two BSSAFs for Arthur Kill (1.05) to estimate the sediment benchmarks.

C. Implementation and Schedule

C.1. Review and Evaluation of Options Associated with Bridge Openings

Objective: To assess the feasibility and cost of bypass pumping as an alternative to routine opening of the Clay Street and Bridge Street Bridges.

Issue: As noted elsewhere (see Section III.C.3), two bridges (Clay Street Bridge at approximately RM 6.1 and Bridge Street Bridge at approximately RM 5.7) in the lower 8.3 miles of the LPR are too low to allow passage of a barge and tug that are sized for the proposed dredge production rate without being opened. For these bridges, the vertical clearance even at MLW is less than 15 feet.[57] Equipment sized to pass under the bridges would be so small as to substantially extend the project schedule. Although it is possible to open these bridges, due to the age of the bridges and the impact on traffic, routine opening and closing of the bridges could lead to delays in the project, and create a burden for communities affected by traffic problems..

A number of potential design options were identified that would minimize the need to open the bridges regularly. Table III.C.1 – 1 summarizes the various options that were identified and the relative advantages and disadvantages of each. Of these design options, bypass pumping was selected for additional evaluation since it provides the greatest flexibility for dredging operations and processing facility siting.

[57] Currently Hudson County and Essex County are considering options to replace/rehabilitate the Clay Street Bridge. Options being evaluated include movable bridges and fixed span bridges with 15-foot clearance at MHW (20 ft at MLW).

Evaluation: Pump manufacturers and dredging firms were contacted for input into evaluation of the option for bypass pumping around the two low bridges mentioned above.

Dredging contractor representatives provided the following comments:

- Bypass pumping of high solids materials (i.e., 50 to 70 percent solids content) is used relatively frequently for this type of situation.
- Long distance pumping can be problematic due to the increased potential for clogging of the discharge line through solids dropping out of suspension. This can lead to a blowout of the discharge line and the need to remediate the affected area. Their recommendation was to limit pumping distances for high solids materials to between 500 to 1000 feet.
- Screening of the large-sized debris is important to limit materials handling problems. Screening at the dredge site is recommended over screening at the pump site since it eliminates double handling of the material and the potential for spills at the pump site. This approach would involve use of a grizzly screen on a barge with the screened sediment discharging into the transfer barge and the separate debris being placed in a dumpster or other container for transfer at a later time. Odors during screening activities can be an issue.

EPA's evaluation of bypass pumping was based on pumps from one manufacturer that was recommended by a number of professionals in the dredging industry. Other companies also manufacture high solids pumping equipment that could be used during implementation. The exact pumping equipment will be determined during the design phase. The following provides a summary of information on pump sizing, recommendations on the design concepts and operational parameters, and pricing data that was used in the evaluation:

- In general, while pumping material at 70 percent solids content is feasible, the material has to be relatively homogenous. For instance, it would be feasible to pump the capping material from the RM 5.7 transfer point to RM 6.1 at a relatively high solids content because the sand flows freely and is relatively homogenous. Cohesive soils (clays and silts) that can clump easily or larger materials (i.e., debris, rocks), which are more characteristic of the dredged material, are more likely to drop out of suspension and clog the discharge pipeline. Because of this, it is likely that the effective solids content for pumping dredged material will be in the range of 20 to 30 percent. The shorter the distance to be pumped, the more likely the higher solids content approach is feasible.
- Information was provided by the manufacturer on several sizes of pumps. The primary difference among the pumps is in their weights, which affects the users' ability to safely handle the equipment. As an example, the manufacturer provided information on pumps weighing approximately 1650 pounds and 2450 pounds. The difference in weight can impact the ease of moving the pump in the barge and the potential risk to site workers. Because of the weight, the pump would have to be moved using an excavator or crane.
- Another factor to be considered is the diameter of the discharge line from the pump (the manufacturer provided information on 6- or 8-inch diameter discharge lines). A larger-diameter pipe has a higher pumping capacity, so that it would take a shorter amount of time to empty a barge, while the smaller-diameter pipe would take longer to empty a barge. However, the larger-diameter pipe may not generate enough friction head to maintain a velocity that will keep solids in suspension, risking more frequent clogging of the line and interruption of the process.

- From the example pumps provided by the manufacturer, the 1650-pound model can pump sediment (with 50 percent solids content) at a theoretical rate of approximately 243 gpm,[58] with a friction head of 100 feet over a horizontal distance of 2,500 feet, thus emptying a 1500-cy barge in approximately 21 hours. Adding a jet ring to the pump would reduce the solids content to approximately 20 to 30 percent, but increase the pumping capacity to 384 gpm, with a friction head of 100 feet, thus emptying the same 1500-cy barge in approximately 12 hours. The 2450-pound model can pump at a theoretical rate of approximately 3200 gpm, with a friction head of 72 feet over a horizontal distance of 2,800 feet, thus emptying a 1500-cy barge in approximately 2 hours. Assuming an hour or two for transfer and positioning of the barge at the offload point, the total cycle time is estimated to be well under 24 hours.
- A booster pump would be required to extend the effective range to allow pumping from upstream of RM 6.1 to downstream of RM 5.7.

Overall, bypass pumping is not anticipated to impact the production schedule.

It is anticipated that the solids content of the mechanically dredged solids in the barge will be approximately 30 percent based on the process flow calculations used in the cost estimate (see Appendix H of the RI/FFS). Assuming a minimum 30-percent solids content for bypass pumping, a 1:1 relationship of upstream to downstream barges will be required. However, if the solids content at the downstream end of the pipeline is reduced by the use of the jet ring to 20 percent, it results in a ratio of approximately 1:1.3 of upstream to downstream barges and it may be necessary to provide additional barges at the downstream end.

Conceptual design: As discussed in Section III.C.3, the river has been divided into five reaches for technical evaluation of project schedules and development of productivity estimates. Bypass pumping is only being considered for material dredged in the upper three reaches. This means the following volumes of material may be subject to bypass pumping (durations apply to the amounts to be handled above RM 5.7):

- Alternative 2 - 1.22 million cubic yards over 6.5 years
- Alternative 3 - 0.65 million cubic yards over 3.5 years
- Alternative 4 - 0.34 million cubic yards over 2 years

Implementing a bypass pumping station option would entail the following steps:

1. Mechanical dredging would proceed as normal. In accordance with USACE guidance (USACE, 2001), it was assumed that the additional time spent on equipment movement and screening operations would be offset by the use of different sized equipment or other modifications to site operations and would have minimal impact on productivity. As noted in Section III.C.3, the conceptual design for the areas requiring bypass pumping is not based on maximizing the rate of dredging but rather on equalizing the processing facility annual throughput. Optimizing the equipment selection process would be addressed during the design phase.
2. As material is removed from the water, it would be placed in a hopper to a screening device for gross solids removal (material greater than 2.5 inches in size). Grizzly screens have been used in similar application on other sediment projects (e.g., Tierra Phase I Removal on the Lower Passaic River). The hopper and screen would be positioned such that the screened sediment would discharge to the transfer barge (potentially using a conveyor belt or trough) and the material

[58] In reality, when handling materials such as sediment, which may be hard to pump, the effective pumping rate is likely to be somewhat less.

removed from the sediment stream would discharge to a dumpster or other container on the barge where the screen is located. Provisions for cleaning the screen/hopper/conveying system would be provided, including rakes and power washers.

3. When full, the debris container would be transported to the processing facility to be managed for disposal. Odor control solutions such as BioSolv or other products would be applied as necessary.
4. The barge containing the sediment, once full, would be moved to the upstream pumping station near RM 6.1 (Clay St Bridge). A land-based staging area (estimated to be approximately 1 acre in size) would be established prior to the start of pumping with on-land utilities (power) provided. It is possible to run the pumps off a generator but that would increase the noise generated at the pumping site. A spud barge could be used as a temporary dock for sediment barges.
5. At the pumping station, a submersible pump mounted on a crane or excavator would be lowered into the barge and would pump the sediment into a similarly sized barge at an offloading station located downstream of the bridge. Once in the barge, the pump could be moved around using the excavator/crane or a small skidsteer could be placed in the barge to push the sediment to the pump. The larger sized pump (2450-pound model) was used for cost estimating purposes, but pump selection would be reviewed during the design phase.
6. For the cost estimate, it was assumed that a second pumping station with similar setup would be located near RM 5.7 (Bridge St Bridge). The pump manufacturer indicated that it may be feasible to pump the entire distance using one pumping system and a pump booster station in-route, although dredging contractor representatives cautioned against this approach because of the risk of clogging. This option may be assessed further during the design phase.
7. Downstream of RM 5.7, the sediment would be reloaded onto barges for transfer to the processing facility.
8. For this analysis, it was assumed that a separate screening operation would be set up for the reach above RM 8.1 (Alternatives 2 and 3 only). The same bypass pumping stations would be used as described for dredging the immediately downriver reaches. Based on pumping capacity data supplied by the manufacturer, the bypass system could handle one barge from the upper reach and one barge from the lower two reaches per day with adequate time for equipment maneuvering.

Cost Estimate: To assess the cost of bypass pumping, relatively conservative assumptions were used to represent a worst case situation. It is anticipated that these costs could be reduced through optimization during the design phase. These assumptions include:

- Screening operation for area upriver of RM 8.1. This station could be moved downstream following the completion of dredging in this area and could be used in the reach between RM 6.1 and RM 5.7. For cost estimation purposes, two separate screening operations were assumed.
- Separate pumping stations at both Clay Street (RM 6.1) and Bridge Street (RM 5.7) bridges. It was determined that labor and sediment transport were the highest cost items, representing over 60 percent of the overall costs for the bypass pumping scenarios. Use of a booster pump, if determined to be feasible, would reduce the cost of pumping substantially by eliminating the need for one of the pumping stations.
- The unit price for sediment transport costs included in the estimate was considered incremental since the original cost estimate for dredging included sediment transport from the dredge site to the processing facility.

See Table III.C.1 - 2 for a summary of impacts of the bypass pumping option on costs presented in the FFS.

C.2. Review and Updating of Facility Siting Studies

Objective: To assess the current availability of sites meeting preliminary criteria developed in the RI/FFS for the sediment processing facility.

Evaluation Approach: To respond to comments about the availability of sites for a processing facility, EPA conducted an updated site evaluation to assess the current availability of appropriate parcels of land along the Lower Passaic River and Upper Newark Bay. The evaluation consisted of the following steps:

- The list of desirable site characteristics in Section 3.3 of Appendix G in the FFS was updated to make general preferences more specific, in order to guide the local realtor described below (see Table III.C.2 - 1).
- A local realtor specializing in siting commercial and industrial facilities in the Newark area was engaged to identify parcels on the market potentially meeting the siting guidelines. Information was obtained on sites that met the basic screening characteristics for reference purposes only. No contact was made with the current property owners.
- Once potential sites were identified, EPA evaluated environmental conditions such as the presence of wetlands, floodplains, remediation status and other factors that would impact the proposed development suitability.

Potential Sites Identified: Potential sites identified are presented in Table III.C.2 - 2. General site locations are shown in Figure III.C.2 - 1. Included in Table III.C.2 - 2 is some general information on site conditions impacting the suitability of the parcel for development as a sediment processing facility. This information is preliminary, highlighting some of the site features and is not intended to be comprehensive.

In reviewing this information, a number of things should be recognized:

1. The final timing for siting the facility is unknown but may not occur for several years over which time the market will change. These sites may not be available at the time the facility is actually sited but new sites are expected to become available in the interim.
2. Some information is general and reflects the preliminary data available to the brokers. Items that could change include specific portions of the parcel that may not be currently available due to active leases, additional land (adjacent to or in the area) that may be available but not identified as part of the current sale, or conditions the owner may have added on the sale of the parcel.
3. The cost for purchase of property was included in the FFS cost estimates at an average cost of $510,000 per acre extended to the estimated parcel size required for the sediment processing facility. The actual size of the parcel procured will depend on the options available at the time of purchase.
4. Processing facility construction considered in the FFS is temporary in nature.
5. All of the sites identified are in heavily industrial areas and have a long history of industrial operations. A number of the sites either currently require remediation, are being remediated, or have been subject to an enforcement action requiring remediation in the past. The current status of the site with regard to upland remediation activities and the need for site remediation has not been verified.

C.3. Assessment of Project Schedule and Productivity Estimates

Objective: To evaluate whether longer fish windows, more weather-related delays and engineering solutions to minimize the need to open bridges would significantly lengthen construction durations beyond those estimated in the RI/FFS.

Evaluation Approach: The time to implement EPA's selected remedy (Alternative 3) or any of the active remedial alternatives is primarily dependent on the following factors:

- allowances for environmental (fish) windows, equipment breakdown, weather- and other miscellaneous delays;
- the total volume of contaminated sediment to be removed and the annual production rate;
- the number and sizes (and bucket capacity for mechanical dredging or size of the cutter-head for hydraulic dredging) of the dredge platforms;
- the production rate for each dredge;
- the depths of removal within the channel and the shoals;
- the depths of the water column in various reaches of the river;
- the number and sizes of barges and tug boats;
- constraints due to vehicle or railroad bridge crossings (vertical and/or horizontal clearances), the presence of shoreline and in-river structures and obstructions (dredging offsets); and,
- the location of the upland sediment processing facility.

One of the most important factors considered in the FFS from the list above is the estimated production rate for each dredge. In the FFS, the average productivity per dredge was estimated to be 2,000 cy for a 24-hour work day. This production rate was based on the results of the Environmental Dredging Pilot Study (LBG, 2012), comparisons to large Superfund sites such as Hudson River and Fox River, a reach-by-reach analysis, and discussions with dredging contractors. A productivity rate of 2,000 cy per day per dredge is a conservative estimate taking into account both periods of lower production (for example, to ensure safety and geotechnical stability while working closer to shoreline structures like docks and bulkheads and in-river structures such as abandoned piles, bridge piers and abutments), as well as higher productivity rates in the lower two to three miles of the river where the majority of targeted sediment is located. Details can be found in Appendix F of the RI/FFS.

An annual production rate of 960,000 cy per year was calculated for the FFS using the daily production rate and assuming the use of two dredges, 40 weeks per year, six days per week. The 40-weeks-per-year work schedule was based on 12 weeks of downtime for a fish window, but allowed time for equipment maintenance. The active operational period of six days per week was based on conversations with dredging contractors and equipment vendors, who recommended one day per week of shutdown for regular equipment maintenance.

The annual production rate calculated for the FFS was supported by a reach-by-reach analysis (refer to Appendix F of the RI/FFS), which assumed that bridges could be opened on an "as-needed" basis. However, commenters voiced concerns about the impacts of regular bridges openings on local traffic, as well as concerns about aged bridges being able to handle regular openings over the multi-year implementation period. Moreover, the impact of time restrictions on bridge openings (see 33 C.F.R. 117.739 - Passaic River - U.S. Coast Guard drawbridge operation regulations for moveable bridges across the Passaic River) and size of the equipment could limit the dredging production rates and affect the duration of construction of the selected remedy.

The location of the sediment processing facility may also be a factor in the construction duration. In the RI/FFS, EPA assumed that the sediment processing facility would be located along the lower 8.3 miles of the river, the upper portion of Newark Bay (not far from RM 0), or other areas nearby. In response to comments, this assumption was reassessed and was confirmed to be reasonable based on currently available properties (see Section III.C.2).

In response to comments, the reach-by-reach analysis was also revised to evaluate the impact of two primary drivers to the production schedule:

- Downtime, which is composed of a combination of fish windows, periodic equipment maintenance, weather related delays and other unscheduled idle time.
- Bridge and river constraints, which includes an evaluation of equipment size limits and options to transport dredged material around bridges.

Evaluation of downtime: During the Tierra Phase 1 Removal, NMFS recommended a fish window of approximately 17 weeks running from March 1 to June 30. A similar fish window was implemented during the RM 10.9 Removal. Therefore, instead of the 12 weeks assumed in the RI/FFS, a fish window of 17 consecutive weeks was used for this analysis, which corresponds to an annual dredging season of 35 weeks (vs. the 40 weeks used in the RI/FFS).

Since maintenance or weather-related downtime cannot be predicted and is likely to occur randomly throughout the year, an additional three non-consecutive weeks of downtime for maintenance and other weather-related closures were assumed to occur throughout the 35-week dredging season. Therefore, the new annual production rate was calculated assuming operations 24 hours a day, 6 days a week and 32 weeks a year.

Evaluation of bridge and river constraints*:* The size of the equipment that can be used for dredging operations is limited by the physical constraints of the bridges – primarily the maximum clearance under low tide conditions when the bridge is closed. EPA considered various approaches for addressing the constraints imposed by the bridges. One of the possible approaches involves bypass pumping of dredged material under bridges with low clearance conditions (see Section III.C.1 for more details). In response to comments, this analysis combines bypass pumping and the use of equipment sized to minimize the required number of bridge openings.

Based on its experience at the Hudson River PCBs Superfund Site, EPA expects that bridges with a vertical clearance of greater than 18 feet would be navigable without being opened, using low profile tugs and barges. See Attachment F for a list of bridges with photos and their specifications. Of the 13 bridges in the lower 8.3 miles, one has the swing span removed and one is being maintained in the open position. Of the remaining 11 bridges generally maintained in the closed position in the lower 8.3 miles, six have vertical clearances greater than 20 feet at high tide, another three have vertical clearances greater than 20 feet at low tide and two have lower vertical clearances. The bridges with vertical clearances greater than 20 feet at high tide do not restrict dredging operations, as discussed in response to comment II.H.4.2. The three bridges with vertical clearances greater than 20 feet at low tide (the Conrail Point-No-Point Bridge, Jackson Street Bridge and the NJTRO Morristown Line Bridge) may need additional logistical planning to stage and schedule barge movement with the tides. The two bridges that present the greatest vertical clearance challenges to navigation handle vehicular traffic and are located in the upper portion of the lower 8.3 miles: the Bridge Street Bridge (RM 5.7) and Clay Street Bridge (RM 6.1).

In addition, the NJTRO West Arlington Bridge at RM 8.1 has horizontal clearance limitations, that is, the distance between the piers (vertical supports of the bridge) is not wide enough to allow safe passage for larger vessels as per USACE guidelines. In conjunction with other constraints in the physical setting, these limitations may restrict access for larger equipment. However, it should be noted that during the RM 10.9 Removal in 2013 and 2014, dredged material was transported by barge through this bridge without reported problems.

Updated Reach-by-Reach Analysis*:* To assess the impact of equipment sizing on dredging productivity rates and hence the project schedule, the lower 8.3 miles of the Passaic River was divided into 5 reaches based on access restrictions. The dredging rates were then adjusted depending on the characteristics of the bridges within each reach. In the portions of the river from RM 5.7 to RM 6.1 and from RM 8.1 to RM 8.3, the reaches can only accommodate small barges due to physical restrictions in the river. To account for the smaller equipment, the estimated dredging rate was decreased to 500 cubic yards per day (based on in-situ volumes) in these reaches. In the portions of the river from RM 2.6 to RM 5.7 and from RM 6.1 to RM 8.1, there are fewer physical restrictions in the river; in these reaches, the dredging rate was adjusted to 1,100 cubic yards per day (based on in-situ volumes) to accommodate bridge clearance restrictions on equipment sizes. There are no production rate restrictions in the reach between RM 0 and RM 2.6 and a variable production rate was used for reasons explained below.

Table III.C.3.1 – 1 shows the estimated dredging rates and constraints by reach. As shown in the duration bar charts for Alternatives 2, 3, and 4 (Figure III.C.3 – 1A through 1C), two or more reaches are assumed to be dredged simultaneously. EPA selected a combined maximum production rate of 3,850 cubic yards per day (based on in-situ volumes) for the lower 8.3 miles based on an evaluation of unrestricted environmental dredging operations, a review of available production rate data for remediation projects on the Fox River and Hudson River, and discussions with industry professionals. This results in an annual dredging production rate of 739,200 cubic yards per year (based on in-situ volumes) under a 32-week per year production schedule.

It is necessary to maintain a constant removal rate to facilitate sizing and consistent operation of the sediment processing facility. Thus, the estimated production rate between RM 0 and RM 2.6 (where there are no constraints) was varied as necessary to maintain the maximum combined dredging rate of 3,850 cubic yards per day (i.e., sum of production rates for all reaches dredged simultaneously at any given time). This means that the daily dredging rate in that reach must be adjusted depending on the dredging production rate that is occurring simultaneously in the other reaches as depicted in Figure III.C.3 – 1A through 1C. For example, if the first two reaches were being dredged simultaneously, and the dredging production rate in the second reach between RM 2.6 and RM 5.7 were 1,100 cy/day, then the rate in the first reach between RM 0 and RM 2.6 would be maintained at 2,750 cy/day (i.e., 3,850 minus 1,100). This can be achieved by operating two dredges in the first reach, but adjusting production schedules of one of them to achieve a lower daily rate, for example by operating fewer or shorter shifts, or by deploying dredges with different capacities at different times.

For each of the four reaches above RM 2.6, the estimated achievable dredging production rate is less than 2,000 cy/day due to limitations imposed by bridge constraints. This production rate is supported by site-specific data collected during the December 2005 Environmental Dredging Pilot Study (LBG, 2012). Below RM 2.6, the dredging rate is mostly at or below 2,750 cy/day. This equates to a maximum operating production rate of 190 cy/hour. By comparison, the highest production rate achieved during the Environmental Dredging Pilot Study using an 8-cy bucket was 240 cy/hr. Dredging production rates could also be increased by use of a larger bucket. For example, a 10-cy bucket has an estimated operational production rate of over 245 cy/hr (USACE, 2008), which equates to a production rate of

3,500 cy/day, assuming a 60 percent dredging efficiency. For a short period of time (less than six months) in Alternatives 2 and 3, dredging below RM 2.6 was assumed to have a production rate of 3,850 cy because operations in the four reaches above RM 2.6 would have been completed. This maximum production rate could be achieved by the use of two dredges operating simultaneously within this reach.

Under the revised dredging plan, bridges would not be opened on a daily basis for transporting dredged or capping material.[59] Periodically, however, some of the bridges may have to be opened to bring in new equipment or dredging plant; bridges may also be opened to allow passage of vessels transporting large debris. Bypass pumping stations would be established between RM 6.1 and RM 5.7 to transport material dredged upriver of RM 5.7. Pumping equipment would be sized such that it would not impact the overall productivity rate (see Section III.C.1).

Dredging would occur simultaneously at several reaches while maintaining the maximum daily dredging rate. Table III.C.3.1 – 2 and Figure III.C.3.1A through 3.1C illustrate the dredging sequencing for each of the alternatives evaluated in the RI/FFS.

Conclusions*:* Use of a consecutive 17-week fish window and 3 weeks of downtime, as well as additional evaluation of bridge constraints, result in small increases in construction durations for each alternative as compared to those presented in the FFS Report and the Proposed Plan: from 11 years to 14 years for Alternative 2, from 5 years to 6 years for Alternative 3 (the selected remedy), and from 2 to 2.5 years for Alternative 4. Table III.C.3.1 – 3 summarizes the revised in-river durations[60] by alternative compared to those estimated in the FFS. Note that for Alternative 2, an additional year was assumed for placement of the final backfill layer. These small increases did not change the relative durations among alternatives, and so did not change EPA's comparative analysis results from the RI/FFS and Proposed Plan.

C.4. Update of Volume Estimates based on Latest 2012 CPG Bathymetric Survey and Revisions to Navigation Channel Depths for Alternative 3

Objective: To provide updated volume estimates based on 1) differences in depths between the 2004 bathymetry survey used in the RI/FFS and the subsequent 2012 bathymetric survey conducted for the 17-mile LPRSA RI/FS; and 2) differences in depths between Alternative 3 evaluated in the Proposed Plan and the selected remedy due to the adjusted navigation channel configuration.

Issue: The volume estimates presented in Appendix G of the RI/FFS were calculated using an average-end area method. The calculations were originally based on cross-sections from the 2004 bathymetric survey, which was the latest survey at the time the estimate was prepared. The volume estimates were later adjusted using the 2010 bathymetric survey conducted for the 17-mile RI/FS. For that analysis, the 2004 and 2010 bathymetric surfaces for the lower 8.3 miles of the Passaic River were compared and the difference between the surfaces was applied to the previously estimated volume. Commenters noted that a subsequent 2012 bathymetric survey conducted for the 17-mile RI/FS was not used to calculate the volumes. Also, in response to comments (see II.H.3.3), EPA adjusted the depths of the navigation channel from those included in Alternative 3 in the Proposed Plan (30 ft from RM 0 to RM 1.2, 25 ft from RM 1.2 to 1.7, 20 ft from RM 1.7 to RM 2.2) to those included in the selected remedy (30 ft from RM 0 to RM 0.6 and 20 ft from RM 0.6 to RM 1.7).

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[59] Alternate methods are available to move the capping material upstream without opening the bridges and will not impact this analysis.

Evaluation: Sediment volume estimates were updated to incorporate the results of the 2012 bathymetric survey and the revised sediment removal depths for the selected remedy. For this analysis, the 2012 bathymetry data was compared to the 2004 survey results to assess the overall change in sediment volume.

EPA compared the 2004-2012 bathymetric surveys using methods similar to those described in Appendix G of the RI/FFS, to determine the locations and associated depths of erosion or deposition in the sediment bed. If erosion occurred between 2004 and 2012, less sediment would need to be removed, whereas if deposition occurred, more sediment would need to be removed. This analysis showed that, in general, net deposition occurred below RM 2.6 and net erosion occurred above RM 2.6. The bathymetric comparison was applied to the alternatives to update the volume estimates as follows:

- For Alternative 2, the sediment removal volume is dependent on the targeted elevation to be dredged for contaminant removal. Erosion or deposition will impact the total volume of sediment in those areas and, therefore, new volume estimates were prepared.
- For Alternative 3, the sediment removal volume is dependent on the targeted elevation only for the portion of the river between RM 0 and RM 2.2 (for comparison to the Alternative 3 evaluated in the Proposed Plan). Because erosion or deposition will impact the total volume of sediment in this area, new volume estimates were prepared. From RM 2.2 to RM 8.3, where a cap will be placed, only the top 2.5 feet of sediment will be removed during pre-dredging. Because the removal volume is not based on targeted elevations, erosion or deposition would not affect the volume and no new volume estimates were prepared.
- Under Alternative 4, the top 2.5 feet of sediment would be removed during pre-dredging. Because the removal volume is not based on targeted elevations, erosion or deposition would not affect the volume and no new volume estimates were calculated.

New volume estimates were calculated based on the 2004-2012 bathymetric comparison. As can be seen from the table below, revised volumes are not significantly higher than the 2014 RI/FFS estimate.

Updated Volumes Estimates for Alternatives 2 and 3 Based on Bathymetric Comparisons

Item	Volumes (cy)	
	Alternative 2	**Alternative 3**
Volume difference between 2004-2010 bathymetric surveys	151,000	263,000
Volume difference between 2004-2012 bathymetric surveys	182,000	353,000
Deposition occurring between 2010-2012 surveys	31,000	90,000
2014 FFS Volume Estimate	9,681,347	4,303,708
2015 Volume Estimate	*9,712,347*	*4,393,708*
Percent Change in Volume Estimate	+0.3	+2.1

New cross-sections based on the 2012 bathymetric survey were not developed because the bathymetric comparison data indicated that the change in the sediment volume estimates between 2004 and 2012 was not substantive. The volume estimates in the FFS are primarily used for cost estimating purposes and the changes did not affect the implementability or the effectiveness of the alternatives. Overall the small change in volume was not significant enough to impact remedy selection as it did not alter the relative costs among alternatives, and so did not change EPA's comparative analysis results from the

RI/FFS and Proposed Plan. Updated bathymetry will be collected during the design process and cross-sections will be revised accordingly.

To evaluate the effect of adjusting the navigation channel depths from Alternative 3 in the Proposed Plan to the selected remedy in the ROD, average-end area volume calculations were updated using the same methodology described in Appendix G of the RI/FFS. The depths of cross-sections B, C and D in the selected remedy concept designs were updated and are presented in Figure III.C.4-1. The selected remedy is approximately 762,000 cy (or 17 percent) less than Alternative 3 as presented in the Proposed Plan.

Updated volume estimates were used in the revised cost estimates presented in Section III.D.1.

C.5. Short-Term Effectiveness: Barge Traffic To and From Newark Bay CAD Site

Objective: To determine the number of barges that would be needed to transport dredged material from the lower 8.3 miles of the LPR to a CAD site in Newark Bay under DMM Scenario A.

Assumptions:

- EPA based the number of barges that would be used on the reach by reach analysis for the dredging production rates discussed in Section III.C.3. Figures III.C.3 – 1A through C show examples of how dredging operations could be sequenced (final sequencing will be optimized in the design phase) and were used to determine the number of barges on a daily basis.
- Three sizes of barges would be used: small (~500 cy capacity), medium (~1500 cy capacity) and large (~3000 cy capacity). The material in the small-sized barges would be transferred to medium-sized barges, so that only medium- and large-sized barges would transport material to a CAD site in Newark Bay. Large barges would only be used downstream of RM 2.6.
- Material upstream of RM 5.7 would be transported under low bridges without opening them using high solids pumping. To maintain flow in the pipes, it may be necessary to reduce the solids content by adding water, which would increase the volume by 50 percent, as compared to the *in situ* volume (see Section III.C.1). Below RM 5.7, the in-situ volumes increase due to water entrainment during dredging would be approximately 30 percent.

Evaluation:

EPA estimated that approximately 2 to 4 barges a day would be needed to transport dredged materials from the lower 8.3 miles of the LPR to and from a CAD site in Newark Bay:

- For Alternative 2, based on Figure III.C.3 – 1A, 4 barges per day would be used in the first half year of construction and 3 barges per day would be used from construction year 0.5 to the end of construction.
- For Alternative 3, based on Figure III.C.3 – 1B, 3 barges per day would be used from the beginning of construction to year 4.5 and 2 barges per day would be used from year 4.5 to the end of construction.
- For Alternative 4, based on Figure III.C.3 – 1C, 3 barges per day would be used from the beginning of construction to year 1.5 and 2 barges per day would be used from year 1.5 to the end of construction.

To evaluate the short-term impact of barge transport to and from a CAD site in Newark Bay on existing vessel traffic into and out of the LPR, the estimated number of barges calculated above was compared to USACE's Waterborne Commerce Data. For the comparison, the daily number of barges was converted to an annual number, based on a construction schedule of 6 days per week and 32 weeks per year of dredging (see Section III.C.3). The number was doubled to include both filled barges going to the CAD site and empty barges returning from the CAD site.

Summary of Waterborne Commerce Data – Foreign and Domestic Traffic in All directions

Vessel Draft	Number of Vessel Trips per Year					
	CY2013	CY2012	CY2011	CY2010	CY2009	AVERAGE
All Drafts	2158	1886	2260	1976	2594	2175

Summary of Number of Barges from Dredging Operations – All directions

# Barges Filled per Day	Barges per year (In and Out Bound)	Percent Increase in # Vessel Trips
4	1536	70
3	***1152***	***50***
2	768	35

D. Cost Estimates

D.1. Revised Cost Estimates

Objective: To evaluate and document changes to the FFS cost estimates based on comments received on the Proposed Plan.

Issue: During the public comment period, EPA received comments on several areas of the project that had the potential to impact the cost estimates included in Appendix H of the RI/FFS. These comments addressed the following areas:

- The FFS productivity estimates were based on 40 weeks of dredging which is inconsistent with other recent dredging projects on the Lower Passaic River. Changes in the dredging schedule will impact the construction duration and schedule impacting the project costs. See Section III.C.3.
- The space for rail car storage at the sediment processing facility was inadequate as compared to the space provided at the Hudson River facility. See response to comment II.H.2.10.
- The routine opening of bridges along the Lower Passaic River (to allow barge traffic to the sediment processing facility and transport of backfill or capping material) would disrupt traffic. In addition, given the age and current condition of the bridges, it was suggested that bridges could not handle regular openings and closings. See Section III.C.1.
- The need for the chemical analysis of core samples under the selected remedy was questioned. See response to comment II.H.7.5.
- The need to incorporate the most recent bathymetry data for the Lower Passaic River into the sediment volume estimates was asserted. See Section III.C.4.
- The depth of the navigation channel for Alternative 3 was questioned. See Section II.H.3.3.

Responses to these comments are addressed elsewhere; this evaluation focuses on how these issues impact to the estimated project costs.

Evaluation: The following is a summary of the changes to the cost estimate presented in Appendix H of the RI/FFS due to EPA's responses to the comments identified above.

- **Revisions to the construction duration due to changes in the dredging schedule**. The impact of changes to the construction duration was discussed in Section III.C.3. From this analysis, it was determined that the following changes would impact the calculations in the cost estimate:
  - The annual construction season was reduced to 32 weeks per year from the 40 weeks estimated in the RI/FFS.
  - Equipment sizing and project sequencing was changed to reflect site-specific conditions that constrain site access. Based on the analysis, the combined daily production rate was dropped to 3,850 cubic yards per day from 4,000 cubic yards per day.

  New construction durations were estimated by incorporating the revised construction season length and daily production rate numbers which resulted in small increases to the project schedule and affected the estimated costs in the following ways:
  - Changes in the project schedule extended the discount period used to calculate the present values by three years for Alternative 2, one year for Alternative 3 and half a year for Alternative 2 (see response to comment II.H.4.1). Overall, extending the project schedule reduced the projected annual costs and extended the costs over a longer period of time. Because of the impact of discounting, this reduced the present values for Alternatives 2 and 3. For Alternative 4, which was the least impacted by changes to the project schedule, the reductions in the present value due to discounting were offset by increases in the project costs (as discussed below) resulting in a net increase in the present value over the final FFS estimates.
  - A number of items are sized based on the annual throughput for the sediment processing facility in the DMM cost estimate. Reducing the throughput rate and increasing the construction duration resulted in some minor changes in the facility sizing and the DMM costs.
- **Estimate of space for railcar storage.** In the FFS, under Scenario B (off-site disposal, for all alternatives) approximately 3 acres of land were included in the size of the sediment processing facility to account for rail car storage. To be conservative, the rail car storage requirements were recalculated assuming only one pull (i.e., train) per month. This change increased the amount of rail car storage space required while allowing for more efficient staging of rail cars when multiple pulls are provided. The additional storage was added to the sediment processing facility area estimates which affected the site development costs for items that are area-based (e.g., stormwater management, fencing, lighting, roads). Overall, the cost increase was not significant. It should be noted that the Hudson River PCBs Superfund Site has been getting 60 to 80 pulls per construction season which equates to 2 or more pulls per week, reducing the amount of railcar storage required at the site.
- **Incorporating bypass pumping between RM 5.7 and 6.1 to minimize bridge openings.** Routine bridge openings would have a significant impact on traffic in the area, and it is not clear that the aging bridges can withstand the stress of regular activity. In addition, some of the bridges are so low when closed that equipment small enough to pass under them would not be economical to use. To address this issue, alternatives to minimize the number of bridge openings over the life of the project were identified and evaluated as presented in Section III.C.1.

  In this assessment, it was determined that low vertical clearance was only an issue between RM 2.6 and RM 6.1, although from RM 2.6 to RM 5.7 the issue could be resolved by scheduling barge movement with the tides. EPA determined that using equipment similar in size and design to that used on the Hudson River PCBs Superfund Site would allow dredged material transport without opening bridges on the majority of the river with only two areas of concern: above RM 8.1 where horizontal clearance is limited and between RM 5.7 and RM 6.1 where vertical clearance is the most severely constrained. Given the limited volume of material to be removed above RM 8.1, EPA determined that small equipment could be used without impacting the project schedule. For dredged material coming from above RM 5.7, EPA assumed that high solids pumping techniques would be used to transport the material between RM 5.7 and RM 6.1, eliminating the need to open bridges for dredged material transport. The cost for bypass pumping was added to the cost estimates.

- **Changes in the estimated number of deep and shallow cores for chemical analysis of sediment.** In response to the comment on the use of the chemical data (II.H.7.5), EPA reviewed the number of cores and chemical samples and noted that that the number of deep cores (i.e., greater than 12 feet) had been overestimated in the RI/FFS. In the RI/FFS cost estimate for Alternative 3, deeper cores are specified for areas downstream of RM 2.2 (which, for the Alternative 3 evaluated in the Proposed Plan included the navigation channel), and shallower cores are specified for areas upstream of RM 2.2. However, while the area downstream of RM 2.2 covers approximately 50 percent of the open water, a significant portion of that area represents shoals (e.g., the Kearny mudflats) for which only shallow cores would actually be required. Because the deeper cores are more expensive, this reallocation resulted in a reduction in the coring program costs. In addition, because fewer samples are collected from the shallower cores, the number of samples was reduced, thus reducing the chemical analysis costs. Costs were further reduced by the adjustment to the navigation channel included in the selected remedy (see response to comment II.H.3.3), which includes shallower cores upstream of RM 1.7. Overall, these changes resulted in a reduction of the estimated direct costs of approximately $17 million for the selected remedy.
- **Modifications to the estimated sediment volume based on the incorporation of the 2012 bathymetry and revised navigation channel depths for the selected remedy.** The need to incorporate the latest bathymetry data from 2012 into the sediment volume estimates was addressed in Section III.C.4. From this analysis EPA concluded that the changes in the estimated sediment volume between 2004 (original RI/FFS estimate) and 2012 based on site bathymetry was small (less than 5 percent of the total volume) and the impact on project costs would be minor. The sediment volume estimates for Alternative 3 were also revised with the adjusted navigation channel depths for the selected remedy. The updated sediment volumes were used in preparing the latest version of the cost estimates.

Table III.D.1 – 1 presents a summary of the updated present value cost estimates; Table III.D.1 – 2 compares changes in the overall present value costs between the FFS and the revised estimate for the ROD.

IV. Acronyms

ABS	acoustic backscatter
ADCP	acoustic Doppler current profiler
AF	Accumulation Factor
AhR	aryl hydrocarbon receptor
ANCOVA	Analysis of covariance
AOC	Administrative Order on Consent
ARARs	Applicable or Relevant and Appropriate Requirements
BAF	Biota Accumulation Factor
BAZ	Biologically Active Zone
BERA	Baseline Ecological Risk Assessment
Be-7	Beryllium-7
B-IBI	Benthic Index Biotic Integrity
BN	Bayesian networks
BSAF	Biota-Sediment Accumulation Factor
BSSAF	Biota Suspended Sediment Accumulation Factor
BTV	Background Threshold Value
BW	Body weight
CAD	Confined aquatic disposal
CAG	Community Advisory Group
CalEPA	California Environmental Protection Agency
CARP	Contamination Assessment and Reduction Project
CBR	Critical body residue
CDF	Confined Disposal Facility

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFD	computational fluid dynamics
C.F.R.	Code of Federal Regulations
cfs	cubic feet per second
Chl-a	chlorophyll-a
CIP	Community Involvement Plan
cm	centimeter
COC	Contaminants of concern
COPCs	Contaminants of potential concern
COPECs	Contaminants of potential ecological concern
CPG	Cooperating Parties Group
CSF	cancer slope factor
CSM	conceptual site model
CSO	combined sewer overflow
CSTAG	Contaminated Sediments Technical Advisory Group
CTE	Central tendency exposure
CWCM	Chemical Water Column Monitoring
cy	cubic yard
D/F	Dioxins/furans
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DER	Data Evaluation Report
DLC	dioxin-like compounds
DL-PCB	dioxin-like PCB

DMM	Dredged Material Management
DoC	Depth of Contamination
DOC	dissolved organic carbon
DOI	Department of the Interior
DOT	Department of Transportation
DQO	Data Quality Objective
EASB	Engineering and Analytical Branch
ECOM	Estuarine and Coastal Ocean Model
EMBM	Empirical Mass Balance Model
ED	Exposure duration
ENR CCI	Engineering News Record Construction Cost Index
EPCs	Exposure Point Concentrations
ER-L	Effect Range - Low
ER-M	Effect Range - Median
ERAGS	Ecological Risk Assessment Guidance for Superfund
ESD	Explanation of Significant Differences
ETM	Estuarine Turbidity Maximum
EWTE	Effective working time efficiency
FFS	Focused Feasibility Study
FI	fraction ingested
f_{OC}	organic carbon fraction
FOIA	Freedom of Information Act
ft	feet
GOF	goodness of fit
HDP	Harbor Deepening Project

HHRA	Human health risk assessment
HI	Hazard Index
HMC	high molecular weight
HQ	Hazard Quotient
HUD	Housing and Urban Development
IRIS	integrated risk information system
JECFA	Joint Food and Agriculture Organization of the United Nations and World Health Organization Expert Committee on Food Additives
kg	kilograms
KM	Kaplan-Meier
LMW	low molecular weight
LOAEL	Lowest observed adverse effect level
LOE	Lines of Evidence
LPR	Lower Passaic River
LPRSA	Lower Passaic River Study Area
m	meter
mg/l	milligrams per liter
MLW	Mean Low Water
MNR	monitored natural recovery
MSL	mean sea level
NAS	National Academy of Sciences
NMFS	National Marine Fisheries Service
NBSA	Newark Bay Study Area
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEBA	Net Environmental Benefits Analysis

ng	nanogram
NGVD	National Geodetic Vertical Datum
NJDEP	New Jersey Department of Environmental Protection
NJDOT	New Jersey Department of Transportation
NJTRO	New Jersey Transit Rail Operations
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No observed adverse effect level
NPL	National Priorities List
NRRB	National Remedy Review Board
O&M	operation and maintenance
OBS	optical backscatter
OC	organic carbon
OCDD	octachlorodibenzodioxin
OEHHA	Office of Environmental Health Hazard Assessment
OSWER	Office of Solid Waste and Emergency Response
PAHs	polycyclic aromatic hydrocarbons
PATH	Port Authority Trans-Hudson
PCBs	polychlorinated biphenyls
PCDD	polychlorinated dibenzo-dioxins
PCDFs	polychlorinated dibenzo-furans
PDT	Project Delivery Team
PeCDD	pentachlorodibenzo-p-dioxin
PeCDF	pentachlorodibenzofuran
pg/g	picogram/gram or parts per trillion

POC	particulate organic carbon
POM	Princeton Ocean Model
pmol/g	picomole per gram
ppb	parts per billion
ppt	parts per trillion
PRA	Probabilistic risk assessment
PRG	Preliminary Remediation Goal
PRPs	Potentially Responsible Parties
PTMI	Provisional tolerable monthly intake
PVSC	Passaic Valley Sewage Commission
PWCM	Physical Water Column Monitoring
QAPPs	Quality Assurance Project Plans
QA/QC	Quality assurance/quality control
RAGS	Risk Assessment Guidance for Superfund
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
REMAP	Regional Environmental Monitoring and Assessment Program
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study
RM	River Mile
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SA	Sensitivity analysis
SLERA	Screening Level Ecological Risk Assessments

SPI	Sediment Profile Imaging
SQT	Sediment Quality Triad
SSP	Supplemental Sediment Sampling Program
SUST	System Understanding of Sediment Transport
SWAC	Surface weighted average concentration
SWEM	System Wide Eutrophication Model
SWO	stormwater outfalls
TAG	Technical Assistance Grant
TASC	Technical Assistance Services for Communities
TCDD	Tetrachlorodibenzo-p-dioxin
TCLP	Toxicity Characteristic Leaching Procedure
TDI	Tolerable Daily Intake
TEF	Toxic Equivalency Factor
TEQ	Toxic Equivalency
TMO	Tierra/Maxus/Occidental
TRV	Toxic Reference Value
TSS	Total suspended solids
UAO	Unilateral Administrative Order
UBS	Upland Borrow Sand
UCL	Upper Confidence Limit
µg/kg	microgram/kilogram
um	micrometer
UQ	Uncertainty Qualification
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service

USGS	United States Geologic Survey
WRDA	Water Resources Development Act

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ATTACHMENT A

PROPOSED PLAN

U.S. Environmental Protection Agency
Region II

Lower Eight Miles of the Lower Passaic River
Part of the Diamond Alkali Superfund Site

Essex and Hudson Counties, New Jersey

April 2014

EPA ANNOUNCES PROPOSED PLAN

This Proposed Plan describes the remedial alternatives considered for the sediments of the lower eight miles of the Lower Passaic River, part of the Diamond Alkali Superfund Site, and identifies the preferred remedial alternative with the rationale for this preference.

This Proposed Plan was developed by the U.S. Environmental Protection Agency (EPA), the lead agency for the Site, in consultation with the New Jersey Department of Environmental Protection (NJDEP), the support agency. In addition, EPA and NJDEP have consulted with the U.S. Army Corps of Engineers (USACE), National Oceanic and Atmospheric Administration (NOAA) and U.S. Fish and Wildlife Service (USFWS), key federal stakeholders in the Lower Passaic River, Newark Bay and New York-New Jersey Harbor Estuary. EPA is issuing the Proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA) and Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The nature and extent of the contamination in the lower eight miles of the Lower Passaic River and the remedial alternatives summarized in this Proposed Plan are described in greater detail in two documents: the *Remedial Investigation Report for the Focused Feasibility Study of the Lower Eight Miles of the Lower Passaic River* (RI Report) and the *Focused Feasibility Study Report for the Lower Eight Miles of the Lower Passaic River* (FFS Report). These and other documents are part of the

MARK YOUR CALENDAR

Public Comment Period:

April 21 to June 20, 2014

EPA will accept written comments on the Proposed Plan during the public comment period. Written comments should be addressed to:

Alice Yeh, Remedial Project Manager
Environmental Protection Agency
290 Broadway, 19th Floor
New York, New York 10007-1866

Fax: (212) 637-4439
e-mail:
PassaicLower8MileComments.Region2@epa.gov

Public Meetings
EPA will hold a series of public meetings to explain the Proposed Plan and all of the alternatives presented in the Focused Feasibility Study. Oral and written comments will also be accepted at the meetings. The meetings will be held at the following locations:

Portuguese Sports Club
55 Prospect Street, Newark, NJ 07105
May 7, 2014 at 7:00 P.M.

Kearny, NJ
May 2014
Specific date and location to be determined

Belleville, NJ
June 2014
Specific date and location to be determined

EPA will announce the dates and locations of the Kearny and Belleville meetings by posting them on ourPassaic.org, issuing news advisories and/or placing ads in local newspapers.

publicly available administrative record file. EPA encourages the public to review these documents to gain a more comprehensive understanding of the Site and the Superfund activities that have been conducted at the Site.

EPA's preferred alternative consists of constructing an engineered cap over the lower 8.3 miles of the Lower Passaic River bank to bank. The engineered cap would consist of approximately two feet of sand and, where needed to prevent erosion of the sand, a layer of armoring stone. Before the engineered cap is installed, the river would be dredged bank to bank (approximately 4.3 million cubic yards) so that the cap can be placed without causing additional flooding and to allow for the continued use of the federally-authorized navigation channel in the 2.2 miles of the river closest to Newark Bay. The final amount to be dredged, thickness of the cap and material to be used for the cap would be determined during remedy design. Mudflats dredged during implementation of the remedy would be replaced with similar material to provide a suitable habitat. Dredged materials removed would be dewatered and transported by rail to off-site permitted incinerators and landfills depending on their characteristics. Institutional controls, such as NJDEP's fish and crab consumption advisories, would remain in place and would be enhanced with additional outreach until the concentrations of contaminants of concern in fish and crab tissue reach protective concentrations that correspond to interim remediation milestones, at which time EPA expects to be able to recommend to NJDEP that advisories gradually be relaxed. Measures to reconstruct habitat impacted by the dredging and capping would also be implemented, including habitat assessment and surveys during remedy design. The design would address placement of habitat recovery material and aquatic vegetation. The preferred alternative includes long-term monitoring and maintenance of the engineered cap to ensure its stability and integrity. Long-term monitoring of fish and sediment would be performed to determine when interim remediation milestones and remediation goals are reached. Other monitoring, such as water column sampling, would also be performed.

While all of the alternatives discussed in this Proposed Plan are subject to public comment, EPA will provide focused public outreach on two aspects of the preferred alternative: dredged material management options (choice of off-site disposal versus a contained aquatic disposal [CAD] site in Newark Bay) and navigational depths (whether shallower depths might accommodate reasonably-anticipated future uses in the lower 2.2 miles of the river). These aspects of the preferred alternative are discussed further below. The focused outreach will occur through facilitated public meetings and information sessions during the public comment period. This will help to ensure that all opinion, views and comments, and new relevant information, are addressed and available in the administrative record to support the selection of the remedy.

Community Role in the Selection Process

This Proposed Plan is being issued to inform the public of EPA's preferred alternative and to solicit public comments pertaining to all of the remedial alternatives evaluated, including the preferred alternative. Changes to the preferred alternative, or a change from the preferred alternative to another alternative, may be made if public comments or additional data indicate that such a change would result in a more appropriate remedial action. The final decision regarding the selected remedy will be made after EPA has taken into consideration all public comments. EPA is soliciting public comment on all of the alternatives considered in the Proposed Plan, because EPA may select a remedy other than the preferred alternative. This Proposed Plan has been made available to the public for a public comment period that concludes on June 20, 2014.

Public meetings will be held during the comment period to provide information regarding the investigations of the lower eight miles of the Lower Passaic River, the alternatives considered and the preferred alternative, as well as to receive public comments. The public meetings will include formal presentations by EPA of the preferred alternative and other cleanup options for the river.

Information on the public meetings and submitting written comments can be found on Page 1.

Comments received at the public meetings, as well as written comments, will be documented in the Responsiveness Summary Section of the Record of Decision (ROD). The ROD is the document that explains which alternative has been selected and the basis for the selection of the remedy.

SITE DESCRIPTION

The Focused Feasibility Study Area (FFS Study Area) is the lower eight miles of the Lower Passaic River in northeastern New Jersey, from the river's confluence with Newark Bay at River Mile (RM) 0 to RM8.3 near the border between the City of Newark and Belleville Township. The FFS Study Area is part of the Lower Passaic River Study Area, which is the 17-mile, tidal portion of the Passaic River, from the river's confluence with Newark Bay (RM0) to Dundee Dam (RM17.4), and its watershed, including the Saddle River (RM15.6), Third River (RM11.3) and Second River (RM8.1) [see Figure 1]. The FFS Study Area, Lower Passaic River and Newark Bay are all part of the Diamond Alkali Superfund Site.

During a comprehensive study of the 17-mile Lower Passaic River, the sediments of the FFS Study Area were found to be a major source of contamination to the rest of the river and Newark Bay. Therefore, EPA completed this FFS to evaluate taking action to address these sediments, while the comprehensive study of the 17-mile Lower Passaic River is on-going.

The sediments of the FFS Study Area pose an unacceptable risk to human health and the environment due to the presence of a variety of contaminants that stay in the environment for a long time and can build up in fish and shellfish. These contaminants include polychlorinated dibenzo-p-dioxins and furans (dioxins and furans), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), DDT[1] and other pesticides, mercury, lead and other metals.

The FFS Study Area is located in a highly developed urban area, with approximately 1.4 million people living in Essex County (west bank) and Hudson County (east bank). Intensive commercial and industrial uses occur near the mouth of the river (RM0) and around portions of Newark Bay, in part to take advantage of the transportation infrastructure (rail, air and marine). Farther upriver, near RM4, commercial uses continue, but more residential and recreational uses are also included. There are narrow bands of park and open space along the river, surrounded by commercial and dense urban residential development. Near RM7, there are marinas and boat launches along with park lands surrounded by more suburban residential neighborhoods. Hard shorelines, such as bulkhead and riprap (some with overhanging vegetation) make up approximately 95 percent of the banks of the FFS Study Area, while aquatic vegetation predominates along about 5 percent of the banks. Mudflats total approximately 100 acres of the 650-acre FFS Study Area.

The New Jersey Surface Water Quality Standards classify the Lower Passaic River from its mouth to the Second River (RM0 to RM8.1) as saline-estuarine 3 (SE3), with designated uses including secondary contact recreation (activities where the probability of water ingestion is minimal and which include, but are not limited to, boating and fishing). The Lower Passaic River from Second River to Dundee Dam (RM8.1 to RM17.4) is classified as freshwater 2 non-trout (FW2-NT) and saline-estuarine 2 (SE2). Designated uses for FW2-

[1] DDT is a common name that refers to an industrially produced, chlorinated pesticide, dichlorodiphenyl-trichloroethane. DDT breaks down in the environment to form two compounds commonly called DDD and DDE. The term Total DDT used in this Proposed Plan refers to the sum of DDT, DDD and DDE concentrations in a sample.

NT and SE2 include secondary contact recreation. Designated uses for FW2-NT also include primary contact recreation (activities that involve significant ingestion risks and include, but are not limited to, wading, swimming, diving, surfing and water skiing). NJDEP's fish and crab consumption advisories indicate that no species of fish or shellfish from the Lower Passaic River (RM0 to RM17.4) should be eaten due to contamination by PCBs, dioxin and mercury.

The Lower Passaic River has a federally authorized navigation channel which was first constructed, to RM8.1, in the 1880s. It was expanded to its maximum length, to RM 15.4, in 1915, with depths ranging from 30 feet (from RM0 to RM2.6) down to 10 feet at the farthest upstream reaches. After construction, USACE dredged the channel regularly to maintain navigation and prevent infilling with sediments suspended in the water column from storm events and with each tide cycle. The channel below RM2.5 was regularly maintained until 1983. The channel above RM2.5 was dredged periodically through the 1930s (in RM2.5 to RM4.6 and in RM7.1 to RM8.3), through 1950 (in RM4.6 to RM7.1), and through 1976 (in RM8.3 to RM15.4).

As maintenance dredging declined and eventually stopped, this artificially-maintained channel filled with sediments. At the same time, industrial activities along the river grew, and industries and municipalities disposed of wastewaters in the river. The coincidence of chemical disposal in the river and the filling-in of the navigation channel created an ideal situation for the accumulation of contaminated sediments in the Lower Passaic River.

The Lower Passaic River's cross-sectional area declines steadily from RM0 to RM17.4, with a pronounced constriction at RM8.3 (see FFS Report Figure 1-6). At that location, there is also a change in sediment texture. The river bed below RM8.3, from bank to bank, is dominated by fine-grained material (silts) with pockets of coarser materials (sand and gravel). Above RM8.3, the bed is dominated by coarser sediments with smaller areas of silt, often located outside the channel. About 85 percent of the fine-grained surface area in the Lower Passaic River is located below RM8.3 and, by volume, about 90 percent of silts in the Lower Passaic River are located below RM8.3. Due to a combination of a wider cross-section and a deeper navigation channel below RM8.3 (16 to 30 feet) than above RM8.3 (10 feet), thicker and wider beds of contaminated sediments accumulated below RM8.3 than above it.

The contaminants of concern (COCs) shown in Table 1 tend to bind tightly to fine sediment particles (i.e., silts). Therefore, the majority of the contamination tends to be found in areas that are predominantly comprised of silts which, for the Lower Passaic River, are the lower 8.3 miles, the FFS Study Area.

SITE BACKGROUND

The Passaic River was one of the major centers of the American industrial revolution, starting two centuries ago. By the end of the 19th century, a multitude of industrial operations, such as manufactured gas plants, paper manufacturing and recycling facilities, petroleum refineries, pharmaceutical and chemical manufacturers, and others had located along the river's banks as the New Jersey cities of Newark and Paterson grew. Industries and municipalities often discharged wastewater directly to the river. To date, over 100 industrial facilities have been identified as potentially responsible for discharging contaminants to the river, including, but not limited to, dioxins and furans, PCBs, PAHs, DDT and other pesticides, mercury, lead and other metals.

The Lower Passaic River is a part of the Diamond Alkali Superfund Site, a former manufacturing facility located at 80-120 Lister Avenue in Newark, New Jersey, at RM3. Manufacturing of DDT and other products began at this facility in the 1940s. In the 1950s and 1960s, the facility was operated by Diamond Alkali Company (later purchased by and merged into Occidental

Chemical Corporation or OCC), which used the facility for the manufacture of the defoliant chemical known as “Agent Orange,” among other products. A byproduct of this manufacturing process was 2,3,7,8-TCDD (2,3,7,8-tetrachlorodibenzo-p-dioxin, the most toxic form of dioxin), which was released into the river.

Superfund History

After investigations by NJDEP and EPA, the Site was placed on the National Priorities List in 1984. After further investigations and several emergency response actions that addressed dioxin found on nearby properties, EPA issued a ROD in 1987 to select an interim containment remedy for the Lister Avenue facility. The remedy consisted of capping, subsurface slurry walls, and a groundwater collection and treatment system that would prevent exposure to contaminated soil (that originated at the facility and that was brought to the facility from neighboring lots), and prevent further releases to the river.

Construction of the remedy at the 80-120 Lister Avenue facility was carried out by OCC and the owner of the facility, Chemical Land Holdings, Inc., now Tierra Solutions, Inc. (Tierra), under EPA oversight. Construction was completed in 2001 and maintenance of the facility is performed by Tierra on OCC’s behalf, under EPA oversight. EPA performs periodic reviews of the protectiveness of the remedy.

In 1994, OCC agreed to investigate a six-mile stretch (RM1 to RM7) of the Lower Passaic River, with the work being performed by Tierra on OCC’s behalf, under EPA oversight. Results from this investigation indicated that contaminated sediment moved into and out of the six-mile stretch, suggesting that a more comprehensive study was required. In 2002, EPA expanded the

Table 1
Contaminants of Concern in Surface Sediments (top 6 inches)

Surface Sediments, 0-6 inches [a]	Unit [b]	Frequency of Detection	Minimum	Maximum	Mean	Median
2,3,7,8-TCDD [c]	pg/g	363/365	0.09	34,100	951	280
Total TCDD	pg/g	311/312	2.20	37,900	1,193	399
Total PCBs	ug/kg	357/358	0.10	28,600	1,668	1,004
Total DDT	ug/kg	361/361	0.32	10,229	235	102
Dieldrin	ug/kg	269/355	0.01	152	11	5.3
Total PAHs	mg/kg	361/361	0.21	2,806	48	31
Mercury	mg/kg	373/381	0.05	16	2.72	2.20
Copper	mg/kg	382/384	0.21	2,470	183	169
Lead	mg/kg	378/378	4.40	906	259	235

Based on 1995 – 2012 data.

[a] The top six inches of sediment is where most organisms in contact with the sediment are exposed to COCs, because it is where they are most active (e.g., burrowing or feeding).

[b] pg/g = picograms per gram or parts per trillion (ppt); ug/kg = micrograms per kilogram or parts per billion (ppb); mg/kg = milligrams per kilogram or parts per million (ppm).

[c] 2,3,7,8-TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin is the most toxic form of dioxin.

investigation to include the entire 17-mile Lower Passaic River.

While working with OCC and Tierra on the Lister Avenue facility and the first studies of the river, EPA also identified other potentially responsible parties (PRPs) for the Lower Passaic River. A number of companies that owned or operated facilities on the river formed the Cooperating Parties Group (CPG). In 2004, EPA signed a settlement agreement with the CPG in which the group agreed to pay for EPA to perform the 17-mile Lower Passaic River RI/FS. The settlement agreement was amended in 2005 and 2007, adding more parties to reach a total of over 70 members. In 2007, the CPG entered into a separate administrative order on consent (AOC) in which the group agreed to take over the performance of the 17-mile Lower Passaic River RI/FS from EPA. This RI/FS is ongoing.

In 2002, at the start of the 17-mile Lower Passaic River RI/FS, EPA also formed a partnership with USACE, the State of New Jersey, NOAA and USFWS to conduct a joint study that would bring each agency's legal authorities to bear on the complex environmental problems of the Lower Passaic River.

In 2004, EPA and OCC signed an AOC in which OCC agreed to conduct a separate RI/FS of Newark Bay, under EPA oversight. As with the 1994 agreement, Tierra is performing the work on OCC's behalf. This study of Newark Bay is ongoing.

In June 2008, EPA, OCC and Tierra signed an AOC for a non-time-critical removal action to remove 200,000 cubic yards (cy) of contaminated sediment from the river (from RM3.0 to RM3.8) adjacent to the 80-120 Lister Avenue facility. This action is referred to as the "Tierra Removal." Sediment adjacent to the facility has been found to have the highest levels of 2,3,7,8-TCDD measured in the river. Dredging, dewatering and transport off-site of the first 40,000 cy of sediment (known as Phase 1 of the Tierra Removal) was completed in 2012. The AOC contemplates that Phase 2 (160,000 cy) will undergo a separate engineering study and proposal that will be submitted to the public for review and comment at a later date. Both phases of this removal action are considered source removal projects.

In June 2012, EPA and the CPG signed an AOC for a time-critical removal action to address the risks posed by high concentrations of dioxins, PCBs and other contaminants found at the surface of a mudflat on the east bank of the river at RM10.9 in Lyndhurst, New Jersey. This action is referred to as the "RM10.9 Removal." The action involved placing an engineered cap over contaminated sediments, thereby reducing exposure and preventing migration of the contamination to other parts of the river. In order to ensure that the action did not make flooding worse, a sufficient volume of surface sediments was first dredged from the area to make space for the cap. The work began in 2013 and is on-going in 2014. This time-critical removal action is not a final remedy; a final decision for the RM10.9 Removal area will be made by EPA as part of the 17-mile Lower Passaic River RI/FS ROD.

Concurrent with these river studies and removal actions, EPA concluded that expediting the Superfund process for the lower 8.3 miles of the river, which was known to contain the bulk of the contaminated sediment, would best support the overall protection of human health and the environment. Because the majority of fine-grained (and, therefore, more heavily contaminated) sediment was found below RM8.3, EPA undertook a targeted RI and FFS of the lower eight miles, which has led to this Proposed Plan.

WHAT ARE THE "CONTAMINANTS OF CONCERN"?

EPA has identified many hazardous substances in the FFS Study Area sediments. The following eight are Contaminants of Concern or COCs, which pose the greatest potential risks to human health and the environment in the FFS Study Area.

Dioxins and furans are human health and ecological COCs. They are by-products of chemical manufacturing, combustion (either in natural or industrial settings), metal processing and paper manufacturing. The dioxin compound (or congener) known as 2,3,7,8-TCDD (2,3,7,8-tetrachlorodibenzo-p-dioxin is the most toxic form of dioxin) and others were byproducts in the manufacture of "Agent Orange," a defoliant used in the Vietnam War, and other herbicides. Dioxins stay in the environment for a long time and can build up in fish and shellfish. Toxic effects in humans include reproductive problems, problems in fetal development or early childhood, immune system damage and cancer. In animals, effects include developmental and reproductive problems, hemorrhaging and immune system problems.

PCBs are human health and ecological COCs. They are manmade chemicals that were banned in the late 1970s. PCBs are mixtures of up to 209 compounds (or congeners). Some commercial PCB mixtures are known in the United States by an industrial trade name, Aroclor. Because they do not burn easily and are good insulating materials, PCBs were used widely as coolants and oils, and in the manufacture of paints, caulking and building material. PCBs stay in the environment for a long time and can build up in fish and shellfish. PCBs are classified as probable human carcinogens. Children exposed to PCBs may develop learning and behavioral problems later in life. PCBs are known to impact the immune system and may cause cancer in people who have been exposed to them over a long time. In birds and mammals, PCBs can cause adverse effects such as anemia and injuries to the liver, stomach and thyroid gland. PCBs also can cause problems with the immune system, behavioral problems and impaired reproduction.

Mercury is a human health and ecological COC. It is a metal that comes from a variety of sources, including metals processing, burning of coal, medical and other wastes, industrial effluent and atmospheric deposition. Mercury stays in the environment for a long time and can build up in fish and shellfish. Toxic effects in humans include developmental and reproductive problems, and effects on the brain, nervous system and kidney. In birds and mammals, mercury can cause adverse effects in the central nervous system.

DDT and its primary breakdown products, dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE), are ecological COCs. DDT is a pesticide that was banned for use in the United States in 1972. It was used widely to control insects on crops and to control mosquitoes that spread malaria. These compounds can build up in fish and shellfish and can cause adverse reproductive effects such as eggshell thinning in birds.

Copper is an ecological COC. It is a metal that enters the environment through releases from factories that make or use copper metal or compounds, leachate from landfills, combustion of fossil fuels, wood processing, fertilizer production and natural sources such as dust from soils, volcanoes and forest fires. Although copper is an essential element at low levels for all organisms, at higher levels it is highly toxic in aquatic environments and can build up in fish and shellfish. Copper can cause adverse effects in fish, invertebrates and amphibians. Copper also impacts growth, development and causes organ problems in birds and mammals.

Dieldrin is an ecological COC. It is a pesticide that is no longer produced or used, but was once used extensively as an insecticide on crops or to control termites. It can build up in fish and shellfish. Dieldrin is highly toxic to aquatic crustaceans and fish. Dieldrin also causes liver damage, central nervous system effects and suppression of the immune system in mammals and egg shell thinning in birds.

PAHs are ecological COCs. These chemicals are a major component of petroleum products, or are formed during incomplete burning of coal, oil, gas, wood or other substances. PAH molecules are composed of two or more carbon and hydrogen rings. Low molecular weight (LMW) PAHs have two to three rings, while high molecular weight (HMW) PAHs have more than three rings. There are more than 100 different PAHs, which generally occur as complex mixtures. PAHs are toxic to invertebrates and cause inhibited reproduction, delayed emergence, sediment avoidance and mortality. In fish, PAHs cause liver abnormalities and impairment of the immune system. PAHs can cause adverse effects on reproduction, development and immunity in birds and mammals.

Lead is an ecological COC. Lead occurs naturally in the environment, but most of the higher levels found in the environment come from mining or factories that use lead compounds. Lead is also released into the air during burning of coal, oil or waste. Lead can cause muscular and neurological effects in fish. It is also toxic to invertebrates and can cause damage to the nervous system in birds and mammals.

SITE CHARACTERISTICS

Summary of Sampling Results and Other Investigations

The RI and FFS Reports evaluated contamination in the Lower Passaic River and Newark Bay using data from field investigations that have been conducted from the 1990s through 2013 by federal and state agencies, potentially responsible parties under EPA oversight, such as the CPG and OCC, and academic institutions. The investigations that support this Proposed Plan include: bathymetric, geophysical and geotechnical surveys; river flow and sediment transport studies; sediment erosion studies; sediment sampling for contaminants; water quality studies; fish and crab tissue sampling; habitat surveys; a dredging pilot study; and sampling at combined sewer overflows (CSOs) and stormwater outfalls (SWOs). Additional investigations and modeling were conducted to study the fate and transport of the COCs in the FFS Study Area. The FFS has incorporated the following data from the 17-mile Lower Passaic River RI/FS: 2008 low resolution sediment coring program; 2009-2010 benthic and surface sediment program; 2012 low resolution supplemental sediment sampling program; 2009-2010 physical water column monitoring program; 2010 high-flow water column suspended solids sampling; 2011-2012 chemical water column monitoring program; 2009-2010 fish community and tissue collection surveys; 2010 habitat identification survey; 2010 summer/fall avian community survey; 2007 through 2011 single and multi-beam bathymetric surveys; 2011-2012 River Mile 10.9 sampling; and 2012 background benthic sediment sampling. More detail can be found in the RI Report for the FFS Study Area and other documents in the administrative record file.

Sediment Conceptual Site Model

The Lower Passaic River is a two-layer estuary. The tides drive a wedge of denser salt water from Newark Bay north into the river along the bottom part of the water column, under a top layer of fresher water flowing in from the Upper Passaic River over Dundee Dam. Near the upstream limit of the salt wedge, where it meets the freshwater flow, turbulence creates a cloud of suspended sediments resulting in elevated suspended sediment concentrations in part or all of the water column, depending on flow conditions. During low flow conditions, the salt wedge and suspended sediment cloud can reach as far upstream as approximately RM12, while during storm events they may be pushed out to Newark Bay. Under typical flow conditions, the salt wedge and suspended sediment cloud are located between RM2 and RM10 and move back and forth along about 4 miles of the river each tidal cycle (twice a day). The movement of the salt wedge and suspended sediment cloud causes surface sediments in the river to resuspend and redeposit on each tidal cycle, resulting in longitudinal mixing of the surface sediments. This means that, while there is a broad range of concentration values present at the surface (high values more than 100 times low values), there is little or no trend in COC median surface sediment concentrations with river mile from RM2 to RM12 (see RI Report Figures 4-2, 4-11, 4-17a, 4-32a, 4-47a). In addition, data show that, between RM0 and RM8.3, surface sediments in the navigation channel are as highly contaminated as those in the shoals (see RI Report Figures 4-7, 4-14, 4-23, 4-38, 4-57). In other words, data show that elevated concentrations of COCs are ubiquitous in surface sediments of the FFS Study Area, bank-to-bank.

Maintenance of the navigation channel stopped in some reaches in the 1930s and in much of the rest of the river after 1950 (except in the first two miles and in portions dredged in 1976 as described above), at which time the formerly dredged channel began to fill in. Since many industrial discharges were most active in the decades when the navigation channel was first filling in, the highest contaminant concentrations tend to be found deeper in the sediment bed (see Table 2 or RI Report Figure 4-75). The total estimated inventory of contaminated fine-grained sediments in the FFS Study Area is approximately 9.7 million cy.

Sediment erosion studies show that the shear stress (the force exerted by water flowing along the river bed that causes sediment particles to erode) at which erosion is first observed increases with depth, so that shallow sediments are easily erodible, and sediments are less erodible deeper in the river bed. This is due to the consolidation of deeper sediments over time caused by the weight of overlying sediments.

When maintenance dredging was significantly curtailed after 1950, sediment infilling rates in the navigation channel were relatively high (approximately 4 inches per year) and coincided with a period when industrial discharges were most active, so the deepest sediments are the most highly contaminated. Then, in the 1970s and 1980s, industrial discharges declined as a result of Clean Water Act regulations, and the channel began to fill with less contaminated sediment, leading to a slow decline in concentrations over several feet of sediment. Recently (since the 2000s), much of the channel has filled in and the river has begun to reach a quasi-steady state.

As discussed in more detail below, the surface sediments have the most direct consequences on human health and the environment, so understanding current conditions in the surface sediments and predicting future conditions was a central focus of the FFS. As overall patterns of

Table 2
Contaminants of Concern below 6 Inches

Contaminant Concentrations in Sediment with Depth	0.5 - 1.5 feet		1.5 - 2.5 feet		2.5 - 3.5 feet		3.5 feet – end*	
	Min-Max	Mean (Median)	Min-Max	Mean (Median)	Min-Max	Mean (Median)	Min-Max	Mean (Median)
2,3,7,8-TCDD (pg/g or ppt)	0.29 - 50,400	1,900 (400)	0.26 - 77,900	3,620 (520)	0.46 - 932,000	9,900 (470)	0.07 - 5,300,000	19,300 (280)
Total TCDD (pg/g or ppt)	0.032 - 27,700	1,920 (500)	0.11 - 60,200	3,390 (620)	0.021 - 67,900	3,670 (790)	0.021 - 2,760,000	12,400 (380)
Total PCBs (ug/kg or ppb)	0.15 - 33,000	2,940 (1,640)	0.33 - 1,800	3,570 (1,880)	0.0062 - 29,960	4,050 (1,650)	0.00059 - 133,000	3,360 (940)
Total DDT (ug/kg or ppb)	0.024 - 1,800	230 (120)	0.04 - 30,800	580 (130)	0.02 - 7,800	460 (180)	0.0038 - 14,000,000	29,300 (120)
Dieldrin (ug/kg or ppb)	0.019 - 250	15 (3.6)	0.024 - 250	17 (3.9)	0.0014 - 580	25 (3.9)	0.0016 -1,000	27 (3.0)
Total PAHs (mg/kg or ppm)	0.006 - 6,500	73 (30)	0.0013 - 7,750	140 (32)	0.0011 - 720	45 (29)	0.00032 - 1,270	64 (33)
Mercury (mg/kg or ppm)	0.0034 - 28	4.6 (3.7)	0.017 - 29	5.9 (4.4)	0.01 - 28	5.9 (4.8)	0.0016 - 30	6.6 (5.5)
Copper (mg/kg or ppm)	1.5 - 3,020	270 (220)	3.4 - 1,210	290 (270)	2.3 - 1,040	280 (280)	2.1 - 4,700	330 (310)
Lead (mg/kg or ppm)	1.9 - 17,900	460 (340)	1.7 - 1,100	430 (410)	1.7 - 980	410 (420)	1.0 - 7,860	430 (460)

Based on 1990-2012 data
* Depth of cores is highly variable, but averages about 12 to 20 feet.

infilling have slowed considerably and alternated with some scouring during high flow events, this quasi-steady state condition means that the river is no longer steadily filling with "cleaner" sediments from elsewhere. Daily tidal action resuspends and redeposits the contaminated surface sediments, while occasional scouring during high flow events uncovers and resuspends deeper, more highly-contaminated sediments.

The RI and FFS assessed the degree to which filling with newer, "cleaner" sediments from elsewhere, a process called natural recovery, might allow the river to improve on its own. Contaminant concentrations in approximately the top two feet of sediments have declined extremely slowly in recent years. Sampling from 1995 through 2012 confirms that FFS Study Area surface sediment median contaminant concentrations have remained almost unchanged over that 17-year period (see RI Report Figures 4-8, 4-15, 4-26, 4-41, 4-62) even though industrial sources along the river have declined and generally ceased discharging.

Based on analyses discussed in the RI Report for the FFS Study Area, direct atmospheric deposition, groundwater discharge and industrial point sources currently are not significant contributors to the FFS Study Area of sediments and the contaminants bound to them. The Upper Passaic River, Newark Bay, the three main tributaries, and CSOs and SWOs were sampled between 2005 and 2011. A mass balance of suspended sediment and contaminant loads was performed with the data (a mass balance assumes that the sum of contaminants coming into the water column from various sources must equal the sum of contaminants going out of the water column). Results show that the tributaries, CSOs and SWOs are minor contributors of COCs, since they are minor contributors of sediments compared to the Upper Passaic River and Newark Bay, and the concentrations of contaminants bound to those sediments are low compared to the surface sediments of the Lower Passaic River main stem. Contributions from the various sources are summarized in Table 3.

The daily movement of contaminated surface sediment combined with the occasional uncovering and resuspension of deeper, more highly-contaminated sediments in the FFS Study Area are the primary ongoing source of COCs to the water column and surface sediments of the Lower Passaic River.

Fish and Crab Tissue

In the FFS Study Area, contaminant concentrations in fish and crab tissue have similar patterns and

Table 3
Percent Contributions from Various Sources to Recently-Deposited Surface Sediments of Lower Passaic River

	Upper Passaic River	Newark Bay	Tributaries	CSOs-SWOs	Lower Passaic River Resuspension
Solids	32	14	6	1	48
2,3,7,8-TCDD	0	3	0	0	97
Total TCDD	3	5	0	0	92
Total PCBs	11	6	1	0	81
DDE	10	8	3	1	78
Copper	14	12	1	1	72
Mercury	11	14	0	0	75
Lead	19	7	2	2	71
Benzo(a)pyrene	53	7	5	1	33
Fluoranthene	47	5	6	2	40

Notes: All numbers represent percent of total mass for each contaminant.
Benzo(a)pyrene and Fluoranthene are PAHs.

trends to those observed in the surface sediments. Spatially, there is a broad range of contaminant concentrations in fish and crab tissue (high values more than 10 times low values), but there is little or no trend in COC median concentrations with river mile (see Appendix A of the RI and FFS Reports, Data Evaluation Report No. 6, Figures 2-1 through 2-4).

Lipid-normalized contaminant concentrations[2] in fish and crab tissue have not consistently increased or decreased with time from 1999 to 2010, consistent with surface sediment COC concentrations, which also have remained almost unchanged over approximately the same time period. Concentrations of one contaminant may increase over time in one species, while decreasing in another species, or even tissue type (see Appendix A of the RI and FFS Reports, Data Evaluation Report No. 6, Figure 2-12). The lack of consistent trends over time across species and tissue type, as well as the lack of trend with river mile indicate that variations in contaminant concentrations in fish and crab tissue do not represent variations in the sediment COC concentrations to which the fish or crab are exposed, but are probably attributable to factors such as analytical differences among studies, variations in sample types (e.g., variations in number, size, age or tissue type of specimens in a typical sample), seasonal variations in the time of collection or other environmental factors not related to long-term trends in sediment contamination.

SCOPE AND ROLE OF THE ACTION

The Diamond Alkali Site, of which the Lower Passaic River is a part, is being addressed by EPA with phased response activities, including removal actions and operable units. EPA typically addresses sources first, which at this Site includes the interim remedy at the 80-120 Lister Avenue facility, the Tierra Removal and the RM10.9 Removal.

The Operable Units of the Diamond Alkali Superfund Site are the 80-120 Lister Avenue facility, the FFS Study Area, the Lower Passaic River Study Area and the Newark Bay Study Area (Figure 1). This Proposed Plan addresses the risks associated with the contaminated sediments of the lower 8.3 miles of the river (FFS Study Area). EPA expects to select a remedy for the FFS Study Area after considering comments on this Proposed Plan, which will be the final action for the sediments of the FFS Study Area and an interim action for the water column. After completion of the on-going RI/FS for the 17-mile Lower Passaic River Study Area, EPA expects to select a remedy that addresses the entire Lower Passaic River, including the water column. The on-going Newark Bay Study Area RI/FS is expected to be completed subsequently.

EPA has determined that the remedy for the FFS Study Area will be consistent with the expected remedies for the Lower Passaic River and Newark Bay Study Areas for reasons discussed below.

EPA investigated potential COC sources to the Lower Passaic River, including atmospheric deposition, groundwater, industrial point sources, Upper Passaic River, Newark Bay, major tributaries, CSOs and SWOs. Data and screening level analyses show that those sources are minor contributors of most of the COCs when compared to the resuspension of sediments in the FFS Study Area.

The primary objective of this action is to address the contaminated sediments in the FFS Study Area. Addressing these sediments would reduce COC concentrations in biota including fish and crab tissue, thereby significantly reducing potential human health and ecological risks. In addition, remediation of FFS Study Area sediment would reduce this major on-going source of contaminants

[2] Tissue contaminant concentrations were normalized by lipid concentrations (i.e., each tissue contaminant concentration was divided by the lipid concentration of the fish analyzed) in order to focus on changes in tissue contaminant concentrations over time that are not related solely to changes in lipid concentrations over time. Lipid content is a measure of the amount of fats and oils in the fish and crab tissue.

to the rest of the Lower Passaic River, Newark Bay and the New York-New Jersey Harbor Estuary.

The COCs tend to bind tightly to fine sediment particles (*e.g.*, silts). Therefore, the highest concentrations of COCs tend to be found in areas that are predominantly comprised of silts, which, for the Lower Passaic River, are the lower 8.3 miles, i.e., the FFS Study Area. As described in the "Site Characteristics" section above, sediment sampling data show that elevated concentrations of COCs are found throughout the surface sediments of the FFS Study Area, bank-to-bank. Data further show that median concentrations of COCs in surface sediments have remained almost unchanged in the last 17 years (1995-2012). Any remedy for the lower 8.3 miles selected by EPA at the conclusion of the comprehensive study of the 17-mile Lower Passaic River would need to take into account the toxic and persistent nature of the COCs that exist bank-to-bank in the lower 8.3 miles. Given that the proposed FFS Study Area remedy: (1) addresses the part of the 17-mile Lower Passaic River that contains a majority of the sediments to which COCs tend to bind; and (2) is based on the physical characteristics of sediment texture, supported by chemical data on the spatial and temporal extent of contamination, EPA has concluded that a FFS Study Area remedy would be consistent with the remedy likely to be selected for the 17-mile Lower Passaic River.

Given the complexity and uncertainty involved with remediating sediment sites, especially at such a large scale, EPA expects to employ an adaptive management approach during the remedial design and implementation of the remedy. This will allow for appropriate adjustments to ensure efficient and effective remediation. This will ensure that uncertainties are promptly and effectively addressed, inform specific design decisions, and address concerns about how this action will be integrated with the ongoing RI/FS for the 17 miles Lower Passaic River Study Area.

The identification of principal and low level threats is made on a site-specific basis to help streamline and focus waste management options by categorizing the suitability of the waste for treatment or containment. Principal threat wastes include source materials that are considered highly toxic. The NCP states that EPA expects to use treatment to address principal threats posed by a site whenever practicable.

The dioxin, PCB and other COC concentrations in sediments throughout the FFS Study Area are present at levels contributing to 10^{-3} risks for humans consuming fish and crab caught in the FFS Study Area. Although the engineering and sediment transport modeling work done as part of the FFS has determined that the sediment, despite its toxicity, under current conditions, can be reliably contained, EPA nevertheless considers the most highly contaminated sediments as principal threat wastes at the site.

EPA has considered treatment as a component of dredged material management. However, EPA does not believe that additional treatment of all the sediment in the FFS Study Area is practicable or cost effective given the high volume of sediment and the number of COCs that would need to be addressed and lack of applicable in-situ treatment technologies.

SUMMARY OF SITE RISKS

A baseline risk assessment was conducted for the FFS Study Area to estimate the risks associated with current and future site conditions. The baseline risk assessment is detailed in Appendix D of the RI and FFS Reports.

Human Health Risk Assessment

A Human Health Risk Assessment (HHRA) was conducted to assess the cancer risks and non-cancer health hazards associated with exposure to COCs in the FFS Study Area (see "What Is Risk and How Is It Calculated," below). Based on the results of Superfund HHRAs conducted for other river sites with bioaccumulative COCs, such as dioxins and PCBs, consumption of fish and shellfish (e.g., crabs) is anticipated to be associated with the highest cancer risks and non-cancer health hazards compared to ingestion, dermal contact or inhalation of chemicals in surface water or sediment during recreational exposures. Despite NJDEP's fish and crab consumption advisories, and prohibitions on taking blue crabs in the Newark Bay Complex, numerous published studies show that people are catching and eating fish and crab along the banks of the Lower Passaic River and Newark Bay. Therefore, the FFS evaluated the potential risks to the adult angler/sportsman and other family members (i.e., an adolescent aged 7 to 18 years and a child aged 1 to 6 years) who eat self-caught fish and crab from the FFS Study Area.

Exposure pathways other than fish or crab consumption (such as recreational use of the river) are being evaluated in the 17-mile Lower Passaic River RI/FS.

The HHRA evaluated risks to human health under current and future land use scenarios. Consistent with EPA guidance, the HHRA evaluated risks without taking into consideration the current NJDEP fish and crab consumption advisories. Both a reasonable maximum exposure (RME) and a central tendency exposure (CTE) were evaluated to describe the magnitude and range of exposure that might be experienced by the angler and family members. Risk decisions are based on the RME, consistent with the NCP. The HHRA assumed that the angler and family members would eat self-caught fish and crab at the rates shown in the table below. Using the "meals per year" terminology in NJDEP fish and crab consumption advisories, the adult fish consumption rate of 34.6 grams/day is equivalent to 56 eight-ounce fish meals per year, and the adult crab consumption rate of 20.9 grams/day is equivalent to 34 eight-ounce crab meals per year. These rates were based on studies of anglers conducted in the Lower Passaic River, Newark Bay and New York-New Jersey Harbor Estuary. The adult ingestion rates were adjusted to reflect the lower bodyweights of the adolescent and young child. The rates are consistent with

WHAT IS HUMAN HEALTH RISK AND HOW IS IT CALCULATED?

A Superfund baseline human health risk assessment is an analysis of the potential adverse health effects caused by hazardous substance releases from a Site in the absence of any actions to control or mitigate these under current and future land uses. A four-step process is used for assessing site-related human health risks for reasonable maximum exposure scenarios.

Hazard Identification: In this step, the contaminants of potential concern (COPCs) at the Site in various media (*i.e.*, soil, groundwater, surface water, and air) are identified based on such factors as toxicity, frequency of occurrence, and fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence, and bioaccumulation.

Exposure Assessment: In this step, the different exposure pathways through which people might be exposed to the contaminants identified in the previous step are evaluated. Examples of exposure pathways include ingestion of contaminated fish or crab, incidental ingestion of and dermal contact with contaminated sediment and ingestion of and dermal contact with contaminated surface or groundwater. Factors relating to the exposure assessment include, but are not limited to, the concentrations in specific media that people might be exposed to and the frequency and duration of that exposure. Using these factors, a "reasonable maximum exposure" (RME) scenario, which portrays the highest level of human exposure that could reasonably be expected to occur, is calculated. A "central tendency exposure" (CTE) scenario is also calculated, which shows an average level of human exposure.

Toxicity Assessment: In this step, the types of adverse health effects associated with chemical exposures and the relationship between magnitude of exposure (dose) and severity of adverse effects (response) are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other non-cancer health hazards, such as changes in the normal functions of organs within the body (e.g., changes in the effectiveness of the immune system). Some chemicals are capable of causing both cancer and non-cancer health hazards.

Risk Characterization: This step summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks for all COPCs. Exposures are evaluated based on the potential risk of developing cancer and the potential for non-cancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a 10^{-4} cancer risk means a "one in ten thousand excess cancer risk"; or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions identified in the Exposure Assessment. Current Superfund regulations for exposures identify the range for determining whether remedial action is necessary as an individual excess lifetime cancer risk of 10^{-4} to 10^{-6}, corresponding to a one-in-ten-thousand to a one-in-a-million excess cancer risk. For non-cancer health effects, a "hazard index" (HI) is calculated. The key concept for a non-cancer HI is that a threshold (measured as an HI of less than or equal to 1) exists below which non-cancer health hazards are not expected to occur. The goal of protection is 10^{-6} for cancer risk and an HI of 1 for a non-cancer health hazard. Chemicals that exceed a 10^{-4} cancer risk or an HI of 1 are typically those that will require remedial action at a site and are referred to as contaminants of concern (COCs) in the ROD.

those to be used in the 17-mile Lower Passaic River RI/FS.

	Adult [grams/day]		Adolescent [grams/day]		Child [grams/day]	
	Fish	Crab	Fish	Crab	Fish	Crab
RME	34.6	20.9	23.1	13.9	11.5	7.0
CTE	3.9	3.0	2.6	2.0	1.3	1.0

The results for cancer risks from the HHRA are summarized in the table below. For the RME adult and child, a cancer risk of $5x10^{-3}$ for fish or $2x10^{-3}$ for crab means that eating fish or crab from the FFS Study Area may cause five additional cancers in a population of 1,000 people or two additional cancers in 1,000 people, respectively. All of the RME risks are greater than the goal of protection established in the NCP of $1x10^{-6}$ (i.e., one additional cancer in 1,000,000 people). All of the RMEs are also greater than the $1x10^{-4}$ cancer risk that typically would require remedial action at a site.

	Cancer Risk to Adult and Child		Cancer Risk to Adolescent	
	Fish	Crab	Fish	Crab
RME	5×10^{-3}	2×10^{-3}	2×10^{-3}	6×10^{-4}
CTE	1×10^{-4}	1×10^{-4}	5×10^{-5}	4×10^{-5}

The results for non-cancer health hazards from the HHRA are summarized in the table below. For the RME child who eats fish or crab from the FFS Study Area, the health hazard results indicate exposure to contaminant concentrations that are 195 or 67 times higher, respectively, than chemical specific reference doses. All of the RME hazards are much higher than EPA's goal of protection of a HI of less than or equal to 1.

	Non-Cancer Hazard to Adult		Non-Cancer Hazard to Adolescent		Non-Cancer Hazard to Child	
	Fish	Crab	Fish	Crab	Fish	Crab
RME	126	43	113	38	195	67
CTE	8	6	8	5	13	9

Dioxins and furans and PCBs are the primary contributors to the human health cancer risk and non-cancer health hazard for ingestion of fish and crab, with mercury another contributor.

Ecological Risk Assessment (ERA)

Although the FFS Study Area is in a densely-populated urban area, a wide range of ecological receptors may be exposed to COCs, including the following:

- Benthic invertebrates (represented by worms that live in/on the sediment and blue crab);
- Forage fish (represented by mummichog);
- Predatory fish (represented by white perch and American eel);
- Water-dependent birds (represented by great blue heron); and
- Water-dependent mammals (represented by mink).

The receptors listed above were evaluated for exposure to COCs through direct contact with and incidental ingestion of sediments, as well as ingestion of contaminated prey. To assess exposures to early life stages (the most sensitive to dioxin-like effects), fish and herring gull embryo viability was also evaluated. The ERA evaluated potential risks to receptors under current and future use scenarios. An ERA quantifies risk to different potentially exposed ecological receptors as a Hazard Quotient (HQ). If an HQ is calculated to be equal to or less than 1, then no adverse health effects are expected as a result of exposure. If the HQ is greater than 1, then adverse health effects are possible.

Risks to benthic invertebrates were evaluated two ways: first, for worms, by comparing sediment contaminant concentrations to literature values (called sediment benchmarks) that represent health-protective concentrations (one conservative and one less conservative). In the FFS Study Area, sediment concentrations for all COCs exceeded the sediment benchmarks. Based on the magnitude of exceedance of sediment benchmarks, dioxins (HQs of 300), DDT (HQs of 6 to 200), PCBs (HQs of 6 to 60), PAHs (HQs of 5 to 40), dieldrin (HQs of 5 to 20) and mercury (HQs of 5 to 20) contribute most substantially to risks to worms. Second, for crabs, a comparison was made between crab tissue concentrations and literature values called critical body residues, again representing health-protective concentrations. FFS Study Area crab tissue concentrations were higher than critical body residues for copper, mercury, PCBs and dioxins. Based on the magnitude of exceedance of critical body residues, dioxins (HQs of 40 to 400) and PCBs (HQs of 10 to 40) contribute most substantially to risks to crabs.

For fish, FFS Study Area tissue concentrations were higher than critical body residues for copper, PCBs and dioxins. Estimates of fish egg concentrations were greater than egg critical body residues for dioxins.

Risks to water-dependent birds and mammals were evaluated by modeling the potential daily doses of COCs that these receptors might be exposed to from eating food (prey) and from incidental ingestion of sediment. The modeled daily doses were compared to literature values called toxicological reference values that represent health-protective concentrations. For the heron consuming fish, only dioxin-modeled daily doses exceeded the toxicological reference values. The contaminant concentrations in eggs from fish-eating birds substantially exceeded literature values (critical body residues) for PCBs, dioxins and DDT. For the mink, modeled daily doses were higher than toxicological reference values for dioxins (HQs of 30 to 900), PCBs (HQs of 4 to 100) and mercury (HQs of 2 to 4).

WHAT IS *ECOLOGICAL* RISK AND HOW IS IT CALCULATED?

A Superfund baseline ecological risk assessment is an analysis of the potential adverse health effects to biota caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these under current and future land and resource uses. The process used for assessing site-related ecological risks includes:

Problem Formulation: In this step, the contaminants of potential ecological concern (COPECs) at the site are identified. Assessment endpoints are defined to determine what ecological entities are important to protect. Then, the specific attributes of the entities that are potentially at risk and important to protect are determined. This provides a basis for measurement in the risk assessment. Once assessment endpoints are chosen, a conceptual model is developed to provide a visual representation of hypothesized relationships between ecological entities (receptors) and the stressors to which they may be exposed.

Exposure Assessment: In this step, a quantitative evaluation is made of what plants and animals are exposed to and to what degree they are exposed. This estimation of exposure point concentrations includes various parameters to determine the levels of exposure to a chemical contaminant by a selected plant or animal (receptor), such as area use (how much of the site an animal typically uses during normal activities); food ingestion rate (how much food is consumed by an animal over a period of time); bioaccumulation rates (the process by which chemicals are taken up by a plant or animal either directly from exposure to contaminated soil, sediment or water, or by eating contaminated food); bioavailability (how easily a plant or animal can take up a contaminant from the environment); and life stage (e.g., juvenile, adult).

Ecological Effects Assessment: In this step, literature reviews, field studies or toxicity tests are conducted to describe the relationship between chemical contaminant concentrations and their effects on ecological receptors, on a media-, receptor- and chemical-specific basis. In order to provide upper and lower bound estimates of risk, toxicological benchmarks are identified to describe the level of contamination below which adverse effects are unlikely to occur and the level of contamination at which adverse effects are more likely to occur.

Risk Characterization: In this step, the results of the previous steps are used to estimate the risk posed to ecological receptors. Individual risk estimates for a given receptor for each chemical are calculated as a hazard quotient (HQ), which is the ratio of contaminant concentration to a given toxicological benchmark. In general, an HQ above 1 indicates the potential for unacceptable risk. The risk is described, including the overall degree of confidence in the risk estimates, summarizing uncertainties, citing evidence supporting the risk estimates and interpreting the adversity of ecological effects.

Conclusion

Based on the results of the remedial investigation and the risk assessments, EPA has determined that the preferred alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare and the environment from actual or threatened releases of hazardous substances into the environment.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) describe what the proposed site cleanup is expected to accomplish. The following RAOs have been established for the FFS Study Area:

- Reduce cancer risks and non-cancer health hazards for people eating fish and shellfish by reducing the concentrations of COCs in the sediments of the FFS Study Area.

- Reduce the risks to ecological receptors by reducing the concentrations of COCs in the sediments of the FFS Study Area.

- Reduce the migration of COC-contaminated sediments from the FFS Study Area to upstream portions of the Lower Passaic River and to Newark Bay and the New York-New Jersey Harbor Estuary.

According to Superfund guidance, reasonably anticipated future land and waterway uses in the FFS Study Area should be considered during the development of remedial alternatives and remedy selection. Except for the two miles closest to Newark Bay, the federally-authorized navigation channel in the FFS Study Area has not been regularly maintained since 1950. The lowest two miles were last dredged in 1983. Various physical constraints, such as shallow depths and low vertical clearance bridges, limit commercial use of most of the navigation channel. However, the lower two miles of the river are used for commercial navigation by a number of companies. A berth-by-berth analysis for 1997-2006 done by USACE establishes current waterway use, and a 2010 USACE survey of commercial users showed future waterway use objectives in the lower 2.2 miles of the river. In a February 6, 2014 letter, USACE confirmed that "USEPA's remedial action is critical to restoring the navigation channel for the viability and economic sustainability of the area and its users."

In addition, the communities along the banks of the FFS Study Area have clearly planned for future increases in recreational access to the river, particularly above RM2.2, through master plans. Increasing recreational access to the FFS Study Area will result in recreational reasonably anticipated future uses above RM2.2.

Preliminary Remediation Goals

There are no federal or State of New Jersey cleanup standards for the COCs in sediment. Therefore, site-specific preliminary remediation goals (PRGs) for FFS Study Area sediments were developed. PRGs are used to define the extent of cleanup needed to achieve RAOs.

Human Health PRGs. Risk-based human health concentrations were developed first as tissue concentrations of COCs (dioxins, PCBs and mercury) that would allow adult anglers to eat self-caught fish or crab from the FFS Study Area without incurring a cancer risk above 10^{-6} and a non-cancer health hazard above 1, which is EPA's goal of protection (see Table 4). Protective concentrations in tissue were also developed for a cancer risk of 10^{-4}, which is typically the level that requires remedial action at a site. Protective concentrations in fish and crab tissue were calculated based on the site-specific adult consumption rates of 34.6 g/day for fish and 20.9 g/day for crab used in the HHRA. These consumption rates are equivalent to 56 eight-ounce fish meals per year and 34 eight-ounce crab meals per year. Additional risk-based tissue concentrations were developed for 12 eight-ounce fish or crab meals per year, for use as interim remediation milestones (Table 4, columns 8-10). Interim remediation milestones are contaminant levels that will be used during monitoring after remedy implementation to evaluate if contaminant concentrations in sediment, fish and crab tissue are decreasing as expected. It is expected that as fish and crab tissue levels decrease, EPA will be able to recommend to NJDEP that institutional controls be adjusted to increase consumption rates.

Then, sediment concentrations needed to meet protective fish and crab tissue concentrations were estimated using site-specific non-linear regressions that showed the relationship between COC concentrations in sediments and co-located fish or crab tissue concentrations. That relationship between sediment and tissue concentrations takes into account the possibility that some of the fish or crab may have been exposed to contamination outside of the FFS Study Area, and is consistent with research showing that tissue concentrations may not be reduced at the same rate as sediment concentrations after sediments are remediated. These are the risk-based sediment PRGs for human health (Table 5, columns 3-8 and 12-13).

Ecological PRGs. While all of the COCs discussed in the "Ecological Risk Assessment" section cause unacceptable risks (HQ greater than 1) to some or all of the receptors evaluated, risk-based PRGs were developed for dioxins, PCBs, mercury and DDT, because they are representative COCs (based on the magnitude of HQs and number of receptors affected) and because there were multiple lines of evidence developed to evaluate how the alternatives would achieve PRGs for these four COCs after remediation. In addition, most active alternatives (i.e., alternatives other than No Action) designed to address these COCs would also address the other COCs.

Table 4
Fish and Crab Tissue Concentrations Protective of the Adult Angler

Contaminant [All Units in ng/g or ppb]	Cancer Risk-Based Tissue Concentrations									Noncancer Hazard-Based Tissue Concentrations		
	56 fish meals per year			34 crab meals per year			12 fish or crab meals per year					
	10^{-6}	10^{-5}	10^{-4}	10^{-6}	10^{-5}	10^{-4}	10^{-6}	10^{-5}	10^{-4}	56 fish meals per year	34 crab meals per year	12 fish or crab meals per year
Mercury	Classification — C; possible human carcinogen; There is no quantitative estimate of carcinogenic risk from oral exposure									200	330	940
Total PCBs	2.9	29	290	4.8	48	480	14	140	1400	40	66	190
2,3,7,8-TCDD	0.000039	0.00039	0.0039	0.000064	0.00064	0.0064	0.00018	0.0018	0.018	0.0014	0.0023	0.0066

All units in ng/g or ppb.

Sediment PRGs that would be protective of benthic invertebrates were developed based on the sediment benchmarks used to evaluate risks in the ERA. The benchmarks are published literature values shown through independent research to be good predictors of toxicity. The overall ecological risk-based PRG for dioxin, one of the risk drivers, is site-specific, in that it is based on reproductive effects data collected in the Newark Bay complex.

Tissue concentrations that would be protective of crab and fish were developed based on the critical body residues used to evaluate risks in the ERA. Tissue concentrations that would be protective of birds and mammals were developed based on the toxicological reference values used to evaluate risks in the ERA. The corresponding sediment concentrations needed for each species to meet the protective tissue concentrations were then estimated using the site-specific non-linear regressions described above (under "Human Health PRGs").

Table 5 (column 2) presents the overall ecological risk-based sediment PRG for the representative COCs. The overall ecological risk-based PRG for each COC is the lowest of the PRGs developed for each category of receptor, so that all of the organisms, including the most sensitive species, would be protected.

Background Concentrations. The Dundee Dam (RM17.4) physically isolates Dundee Lake and other Upper Passaic River sediments from Lower Passaic River influences. Conditions above Dundee Dam meet EPA's definition of "background" as constituents or locations that are not influenced by releases from the Site, including both anthropogenic and naturally derived substances. The concentrations of the COCs detected in recently-deposited sediments collected from the Upper Passaic River immediately above Dundee Dam that are representative of current background conditions for the FFS Study Area are as follows (all in ng/g or ppb): mercury 720, PCBs 460, DDT 30, dioxin 0.002, copper 63,000, lead 130,000, LMW PAHs 7,900, HMW PAHs 53,000 and dieldrin 5. While the Superfund program generally does not clean up to concentrations below natural or anthropogenic background levels, in the Lower Passaic River the flow of water and suspended sediment over Dundee Dam is just one of many sources of surface water and sediment into the FFS Study Area. Sediment particles coming from above Dundee Dam make up about one third of particles in the FFS Study Area water column. When those particles flow down to the FFS Study Area, they mix with the other particles in the system (including cleaner particles in the water column that would result from a remediated FFS

Table 5
Human Health and Ecological Risk-Based Sediment PRGs and Remediation Goals

Contaminant [All Units in ng/g]	Overall Eco Sediment PRG	Cancer Threshold Sediment PRG for an Adult									Noncancer Threshold Sediment PRG		
		56 fish meals per year			34 crab meals per year			12 fish or crab meals per year					
		10^{-6}	10^{-5}	10^{-4}	10^{-6}	10^{-5}	10^{-4}	10^{-6}	10^{-5}	10^{-4}	56 fish meals per year	34 crab meals per year	12 fish or crab meals per year
Mercury	**74**	Classification — C; possible human carcinogen; There is no quantitative estimate of carcinogenic risk from oral exposure									550	45,000	67,000
Total PCBs	7.8	3.2	32	320	1.6	51	1600	13	170	2000	**44**	82	230
Total DDT	**0.30**	-	-	-	-	-	-	-	-	-	-	-	-
2,3,7,8-TCDD	0.0011	0.000095	0.0016	0.022	0.00043	0.005	0.058	0.0008	0.012	0.19	**0.0071**	0.019	0.059

All units in ng/g or ppb.
Bolded numbers are remediation goals.

Study Area); after they are deposited, they also mix with the clean material placed on the river bed as part of remediation. So contamination in the top six inches (the bioactive zone) should end up being much less than background concentrations coming over Dundee Dam. Furthermore, future background conditions are expected to continue to improve as a result of source controls and restoration activities under the other operable units and under other local, state and federal authorities.

Selected Remediation Goals

PRGs become final remediation goals when EPA makes a final decision to select a remedy for the FFS Study Area, after taking into consideration all public comments. According to EPA guidance, the starting point for setting remediation goals is a risk level of 10^{-6} and a non-cancer HI equal to one for protection of human health and the lowest ecological PRG set to protect the various ecological receptors evaluated at an HQ equal to one. However, remedial action at a site may achieve remediation goals set anywhere within the range of 10^{-4} to 10^{-6} and HI at or below 1. The remediation goals for the FFS Study Area are summarized in Table 5 (bolded numbers). For the COCs with human health PRGs, the remediation goals are within the risk range and at or below an HI equal to 1, so they are protective of human health. For mercury and DDT, the remediation goals are at an HQ equal to 1, so they are indicators of environmental improvement. EPA's analysis indicates that surface sediment concentrations would fluctuate around or very near the remediation goals under at least two of the active alternatives described below in the "Description of Alternatives" section, in conjunction with natural recovery processes. For dioxins and PCBs, it is unlikely that the ecological PRGs could be met under any of the alternatives within a reasonable time frame, even with natural recovery processes. However, given that bank-to-bank remediation of the FFS Study Area would be necessary to achieve protection of human health (see "Long Term Effectiveness and Permanence" section below), the ecological PRGs would not result in any additional remediation in the FFS Study Area, and those ecological PRGs were not selected as remediation goals.

SUMMARY OF REMEDIAL ALTERNATIVES

CERCLA § 121(b)(1), 42 U.S.C. § 9621(b)(1), mandates that remedial actions must be protective of human health and the environment, be cost-effective, and use permanent solutions and alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which employ, as a principal element, treatment to permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants and contaminants at a site. CERCLA § 121(d), 42 U.S.C. § 9621(d), further specifies that a remedial action must require a level or standard of control of the hazardous substances, pollutants, and contaminants, which at least attains applicable or relevant and appropriate requirements (ARARs) under federal and state laws, unless a waiver can be justified pursuant to CERCLA § 121(d)(4), 42 U.S.C. § 9621(d)(4). Detailed information about the remedial alternatives is provided in the FFS Report.

Common Elements of the Active Alternatives

Four remedial alternatives were evaluated in detail (described in the next section). All of the active alternatives (i.e., alternatives other than "No Action") contain some common elements, as described below. In addition, the cost of each of the active alternatives has been estimated for each of the three dredged material management (DMM) scenarios described below on page 21. Because Alternatives 3 and 4, and Alternative 2 when paired with DMM Scenario A, would result in some contaminants remaining on site above levels that would allow for unrestricted use, five-year reviews would be conducted.

Institutional Controls: NJDEP fish and crab consumption advisories currently in place would continue under all of the alternatives. Each active alternative would include enhanced outreach efforts conducted in every municipality on both shores of the FFS Study Area to educate community members about the NJDEP consumption advisories and to emphasize that advisories will remain in place during and after remediation until remediation goals are reached. For the active alternatives that rely on an engineered cap for protectiveness, additional institutional controls would be necessary to maintain cap integrity in perpetuity. Such controls might include: prohibitions on anchoring vessels within the FFS Study Area to prevent damage to the cap; restrictions on construction and dredging in the FFS Study Area except in the federally-authorized navigation channel; restrictions on construction and dredging below the depths of the federally-authorized navigation channel; and/or bulkhead maintenance agreements or deed restrictions in the FFS Study Area that specify or limit what can be done with regard to bulkhead construction or repair. Additional institutional controls could be developed during remedial design.

Dredging: Dredging is an element of all of the active alternatives. Large debris would be removed first. The FFS assumed that dredging would occur using a mechanical dredge fitted with an environmental clamshell bucket, although costs for a hydraulic dredge were also estimated. Once a remedy has been selected, the most appropriate and effective equipment will be determined during the design phase and used during construction. The FFS assumed use of two primary mechanical dredges equipped with 8-cy environmental clamshell buckets. The production rate for each of the two dredges was conservatively estimated to be 2,000 cy per 24-hour day, based on a test of environmental dredging conducted in the FFS Study Area by USACE and NJDOT in 2005. A secondary dredge would operate at a lower production rate around obstructions such as bridge abutments and bulkheads. Dredging was assumed to occur for 40 weeks per year to account for equipment maintenance, weather and a period during which work may halt to allow for fish migration (known as a fish window). During the remedy design, a fish migration study would be conducted to better define the fish window.

Capping or Backfilling: Capping and/or backfilling are elements of all of the active alternatives. Both capping and backfill material would consist of coarse-grained sand from nearby borrow sources. The term backfill is used for sand placed on the river bed after all contaminated fine-grained sediments have been removed (e.g., in Alternative 2 and in RM0.0 to RM1.2 in Alternative 3, as described below). The sand layer's purpose is to mitigate the impact of any residual[3] fine-grained sediment remaining after dredging. For cost-estimation purposes, the FFS assumed an average 2-foot backfill layer. Backfill would not be maintained after placement, since the intent is not to leave behind any inventory of contaminated sediments that could become mobile.

[3] Dredging residuals are the small amounts of contaminated sediments that are inevitably left behind after dredging.

DREDGED MATERIAL MANAGEMENT (DMM): THREE SCENARIOS

DMM Scenario A: Contained Aquatic Disposal (CAD). CAD cells have been proven to be a viable disposal option at other Superfund sediment sites. They can be a technically viable and cost effective means to dispose of contaminated sediments. The bottom of Newark Bay consists of approximately 60 feet of clay beneath a few feet of silts. In the context of the FFS, CAD cells would be containment pits excavated into the clay bottom that could serve as disposal sites for contaminated sediments dredged out of the FFS Study Area. In this DMM Scenario, multiple CAD cells approximately 50 feet deep would be excavated into the Newark Bay bottom (see FFS Report Figure 4-1). For cost estimation purposes, it was assumed that the clay excavated to create the CAD cells would be disposed of in an ocean disposal area, such as the Historic Area Remediation Site (HARS) in the New York Bight east of Sandy Hook. Final disposal locations would be determined during remedy design. The CAD site would be surrounded by a sheet pile containment system to minimize impacts to Newark Bay during construction and dredged material placement.

The dredged materials would be barged directly to the CAD site in a split hull or bottom dump barge and disposed of in the CAD cells under water. Because Resource Conservation and Recovery Act (RCRA) regulations exclude dredged material that is subject to the requirements of Clean Water Act Section 404 (as this material would be) from the definition of hazardous waste, there is no requirement that FFS Study Area sediments be treated prior to disposal in the CAD cells. After each CAD cell is filled, an engineered cap would be placed over the dredged material as final cover, restoring the Bay bottom.

DMM Scenario B: Off-Site Disposal. Off-Site Disposal includes two components: incinerators and landfills. This is because FFS Study Area sediments have the potential to be characterized as hazardous under RCRA standards. At this time, incineration is the only technology known to be able to treat sediments to the applicable RCRA standards if those sediments are characterized as hazardous under RCRA and contain dioxin as an underlying hazardous constituent at concentrations requiring treatment. Dredged materials characterized as non-hazardous may be disposed of directly in a landfill (for cost assumption purposes, placement in a RCRA Subtitle C landfill was conservatively assumed, since that was the method of disposal for both the Phase 1 Tierra Removal and RM10.9 Removal). The ash generated by incineration can also be disposed of in a RCRA Subtitle C landfill.

The dredged materials would be barged to an upland sediment processing facility in the vicinity of the Lower Passaic River/ Newark Bay shorelines. Debris and sand would be separated for disposal or potential beneficial use. The remaining fine-grained material would be actively dewatered using filter presses or other technology to be determined during remedy design. The contaminated water generated from dewatering would be treated at a water treatment plant at the processing facility to meet NJDEP water quality standards and discharged to the Lower Passaic River or Newark Bay. For cost estimation purposes, it was assumed that the dewatered dredged material would be transported by rail and disposed of as follows: EPA estimates that less than 10 percent (about 30,000 to 790,000 cy depending on the alternative) would require incineration at facilities in the United States or Canada, with the other approximately 90 percent going directly to regulated landfills in the United States or Canada. The ash generated by incineration would be disposed of in a RCRA Subtitle C landfill.

DMM Scenario C: Local Decontamination and Beneficial Use. Local Decontamination and Beneficial Use includes three components: thermal treatment, sediment washing and solidification/stabilization. FFS Study Area sediments have the potential to be characterized as hazardous under RCRA standards. According to pilot tests of the decontamination technologies, only thermal treatment technologies were able to treat sediments to the applicable RCRA standards if those sediments are characterized as hazardous and contain dioxin as an underlying hazardous constituent. Fine-grained dredged materials characterized as non-hazardous could be treated with the sediment washing technology. A small percentage of FFS Study Area sediments may meet New Jersey standards for beneficial use without treatment. It was assumed that this small percentage would be solidified and stabilized with a binding material such as Portland cement, and beneficially used in an industrial setting.

The dredged materials would be barged to an upland sediment processing facility in the vicinity of the Lower Passaic River/ Newark Bay shorelines. Debris and sand would be separated for disposal or potential beneficial use. The portion of the fine-grained material to be decontaminated using thermal treatment and solidification/stabilization would be actively dewatered using filter presses or other technology to be determined during remedy design. The portion of the fine-grained material to be decontaminated using sediment washing would be dewatered after treatment. The contaminated water generated from dewatering would be treated at a water treatment plant at the processing facility to meet NJDEP water quality standards and discharged to the Lower Passaic River or Newark Bay. For cost estimation purposes, it was assumed that 10 percent or less of the dredged materials would require thermal treatment, with beneficial use end-products; approximately 90 percent would undergo sediment washing (and potential solidification/stabilization if necessary) for use as RCRA Subtitle D landfill capping in or out of New Jersey; and the remaining few percent would be expected to pass for industrial beneficial use with only stabilization.

By contrast, the term "capping" is used when an engineered cap is placed over contaminated fine-grained sediments (that have not been dredged) to sequester them (i.e., isolate them from the environment). The engineered cap would consist of sand with varying grain sizes and amounts of organic carbon, whose thickness is designed to provide chemical isolation and to protect against disturbance from bioturbation (mixing of sediment by burrowing organisms), erosion, and consolidation and settling of underlying sediments. Based on modeling results, certain areas of the river may need armoring with stone to reduce the erosion of the sand material particularly after high flow events (exact areas to be determined during remedy design). The engineered cap would need to be monitored and maintained in perpetuity. For cost estimation purposes, the FFS assumed a 2-foot thick engineered cap with 0.5-feet of armor stone in some areas. In the mudflats, the FFS assumed a one-foot thick sand layer with one foot of mudflat reconstruction (habitat) substrate. During remedy design, appropriate enhanced capping technologies, such as additives (e.g., activated carbon or organoclay) to create an active cap or thin-layer capping technologies would be considered in areas where necessary or where conditions are conducive to such approaches. USACE habitat restoration plans for the New York-New Jersey Harbor Estuary could provide additional information on appropriate habitat reconstruction techniques. Re-deposition of fine-grained material in capped and armored areas is anticipated to occur over time, making these areas similar in grain size to non-capped areas. It is anticipated that over time, the re-colonized benthic community would likely be similar to the benthic community currently in the Lower Passaic River.

Removal Actions: All alternatives assume that the Tierra Removal (Phase 1 and 2) and RM10.9 Removal have been implemented, since they are governed by existing agreements. The agreement for Phase 2 of the Tierra Removal contemplates the siting of a confined disposal facility[4] (CDF) as a receptacle for the dredged materials, which has not been done to date. If Phase 2 has not been implemented by the start of the FFS Study Area remediation, then EPA expects that Phase 2 would be implemented in conjunction with the FFS Study Area remedy in a coordinated and consistent manner.

Remedial Alternatives

Alternative 1: No Action

Present Value (PV):	$0
Construction Time:	0 years

The Superfund program requires that the No Action alternative be considered as a baseline for comparison with the other alternatives. The No Action alternative would not include any remedial measures, although the Tierra and RM10.9 Removals are assumed to have been implemented.

Alternative 2: Deep Dredging with Backfill

PV:	
With DMM Scenario A	$1.34 Billion
With DMM Scenario B	$3.25 Billion
With DMM Scenario C	$2.62 Billion
Construction Time:	11 years

Deep Dredging with Backfill evaluates a bank-to-bank remedy that would involve dredging of all contaminated fine-grained sediments throughout the FFS Study Area (9.7 million cy) and placing two feet of backfill over the dredged area to address dredging residuals. This alternative is intended to remove the contaminated sediment inventory causing the current and potential future risks in the FFS Study Area. This alternative would also result in the restoration of the authorized navigation channel, since the contaminated

[4] A confined disposal facility (CDF) is an engineered structure, built on land or in the water (on the sediment bed) to store contaminated dredged material, isolating it from the surrounding environment. An in-water CDF may be constructed with sheet pile walls or other containment structures, either against the shore or as an island. Once an in-water CDF is filled, it would be capped, converting open water to dry land.

sediment inventory is coincident with the authorized navigation channel.

Within the horizontal limits of the authorized navigation channel, the depth of contaminated fine-grained sediment corresponds well with the depth of historical dredging. Therefore, the depth of dredging is assumed to be the authorized channel depth plus an additional three feet to account for historical dredging accuracy and over-dredging. The resulting sediment removal depths (all in mean low water [MLW]) would be:

Channel Dredging Under Alternative 2		
River Mile Section	Dredging Depth (Resulting Channel Depth)	Width
RM0 to RM2.6	33 feet (30-foot deep channel)	300 feet
RM2.6 to RM4.6	23 feet (20-foot deep channel)	300 feet
RM4.6 to RM7.1	19 feet (16-foot deep channel)	300 feet
RM7.1 to RM8.1	19 feet (16-foot deep channel)	200 feet
RM8.1 to RM8.3	13 feet (10-foot deep channel)	150 feet

Outside the horizontal limits of the navigation channel (in the shoals), the depth of contaminated fine-grained sediment to be dredged varies from 3 feet to 20 feet below the sediment surface. Final dredging depths would be refined in the remedy design. Mudflats dredged during implementation of Alternative 2 would be reconstructed to their original grade and would include one foot of mudflat reconstruction (habitat) substrate.

Dredging and backfilling would be approximately concurrent tasks. As soon as practicable after dredging, two feet of backfill material would be placed to mitigate residuals, inside and outside of the channel.

Institutional controls (such as NJDEP's fish and crab consumption advisories with enhanced outreach) would be implemented until all remediation goals are met. Monitoring and reporting in five-year reviews would also be required until all remediation goals are met. In addition, because Alternative 2 with DMM Scenario A would result in some contaminants remaining on-site above levels that would allow for unrestricted use (in Newark Bay CAD cells), CERCLA would require that five-year reviews be conducted.

Dredged materials removed would be managed in accordance with one of three DMM scenarios described on page 21.

The construction duration for the alternative is not dependent on the DMM scenario, because DMM facilities were assumed to be sized according to the dredged material throughput for the alternative. Construction duration for DMM Scenario C is more uncertain than for the other two scenarios, because the decontamination technologies evaluated in DMM Scenario C have not been constructed and operated in the United States on a scale approaching the capacity needed for this alternative. The construction time estimate includes time for dredging, backfilling and dredged material disposal.

Alternative 3: Capping with Dredging for Flooding and Navigation

PV:	
With DMM Scenario A	$0.95 Billion
With DMM Scenario B	$1.73 Billion
With DMM Scenario C	$1.59 Billion
Construction Time:	5 years

Capping with Dredging for Flooding and Navigation evaluates a bank-to-bank remedy that would place an engineered cap (or backfill where appropriate, as described below) bank-to-bank over the FFS Study Area. Before placement of the cap, enough contaminated fine-grained sediment (4.3 million cy, based on a potential cap thickness of two feet) would be dredged so that the cap could be placed without causing additional flooding and to allow for the continued use of the federal navigation channel between RM0 and RM2.2. This alternative includes dredging the 300-foot wide federally-authorized navigation channel at the reasonably-anticipated future use depths from RM0 to RM2.2, as supported by a 2010 USACE survey of commercial users. To ensure that the public is fully informed about the depths of the navigation channel that will result from this alternative and the associated costs, EPA will provide for further facilitated discussions focused on this issue during the public comment period. If information developed during this process shows and supports that shallower post-remedy navigation depths could accommodate the reasonably-anticipated future use, this may be considered in the Agency's remedy decision.

Where dredging depths coincide with the federally-authorized navigation channel (RM0 to RM1.2), an additional three feet would be dredged to account for historical dredging accuracy and over-dredging. Because this is expected to dredge all contaminated fine-grained sediments within this channel, a cap would not be required; this area would be backfilled with a 2-foot sand layer to address dredging residuals. Where dredging depths are shallower than the federally authorized channel (RM1.2 to RM2.2), an additional 5.5 feet of sediment would be dredged to accommodate an engineered cap (to provide a cap protection buffer and allowance for future maintenance dredging). Resulting dredging depths would be as follows (all in MLW):

Channel Dredging Under Alternative 3		
River Mile Section	Dredging Depth (Resulting Channel Depth)	Width
RM0 to RM1.2	33 feet (30-foot deep channel)	300 feet
RM1.2 to RM1.7	30.5 feet (25-foot deep channel)	300 feet
RM1.7 to RM2.2	25.5 feet (20-foot deep channel)	300 feet

Between RM2.2 and RM8.3, dredging would be performed to prevent the engineered cap from causing additional flooding and to provide a depth of at least 10 feet below MLW over a 200-foot width (except between RM8.1 and RM8.3, where dredging would be over a 150-foot width) to accommodate reasonably anticipated recreational future uses above RM2.2, discussed under the "Remedial Action Objectives" section above. This means dredging approximately 2.5 feet below the sediment surface (most of the dredging would be to accommodate the engineered cap). Final dredging depths may be refined in the remedy design, and would include enough dredging to ensure cap stability and integrity.

Mudflats dredged during implementation of Alternative 3 would be reconstructed to their original grade. The engineered cap over the mudflats would consist of one foot of sand and one foot of mudflat reconstruction (habitat) substrate. USACE habitat restoration plans for the New York-New Jersey Harbor Estuary could provide additional information on appropriate habitat reconstruction techniques.

Institutional controls and monitoring would be implemented after construction until remediation goals are met. Institutional controls might include NJDEP's fish and crab consumption advisories with enhanced outreach and restrictions on activities that might disturb the engineered cap, such as limitations on dredging in the FFS Study Area except in the navigation channel in RM0 to RM2.2, restrictions on anchoring vessels within the FFS Study Area or bulkhead maintenance restrictions (as discussed in the "Common Elements of the Active Alternatives" section above). Since the depths after remediation in RM1.2 to RM8.3 would be shallower than the federally authorized channel depths, modification of the authorized federal navigation channel in RM1.2 to RM2.2 and deauthorization of the navigation channel in RM2.2 to RM8.3 under the federal Rivers and Harbors Act, through USACE administrative procedures and Congressional action would be pursued. Because Alternative 3 (under all DMM scenarios) would result in some contaminants remaining on-site above levels that would allow for unrestricted use, CERCLA would require that five-year reviews be conducted.

Dredged materials removed would be managed in accordance with one of three DMM scenarios described on page 21.

The construction duration for the alternative is not dependent on the DMM scenario, because DMM facilities were sized according to the dredged material throughput for the alternative. Construction duration for DMM Scenario C is more uncertain than for the other two scenarios, because the decontamination technologies evaluated in DMM Scenario C have not been constructed and operated in the United States on a scale approaching the capacity needed for this alternative. The construction time estimate includes time for dredging, capping and backfilling, and dredged material disposal.

Alternative 4: Focused Capping with Dredging for Flooding

PV:	
With DMM Scenario A	$0.37 Billion
With DMM Scenario B	$0.61 Billion
With DMM Scenario C	$0.61 Billion
Construction Time:	2 years

This alternative evaluates a remedy that is less than bank to bank in scope. It focuses on discrete areas of the FFS Study Area sediments that release the most contaminants into the water column. Focused Capping with Dredging for Flooding includes dredging of contaminated fine-grained sediments (1 million cy) in selected portions of the FFS Study Area (adding up to 220 acres or about one third of the FFS Study Area surface) with the highest gross and net fluxes of COCs. Dredging would occur to a depth of 2.5 feet to allow an engineered cap to be placed over those portions dredged without causing additional flooding (see Figure 2). Alternative 4 would not include any dredging to accommodate the continued use of the channel for navigation. Mudflats dredged during implementation of Alternative 4 would be reconstructed to their original grade. The engineered cap over the mudflats would consist of one foot of sand and one foot of mudflat reconstruction (habitat) substrate.

Institutional controls and monitoring would be implemented after construction until remediation goals are met. Institutional controls might include NJDEP's fish and crab consumption advisories with enhanced outreach and restrictions on activities that might disturb the engineered caps, as discussed in the "Common Elements of the Active Alternatives" section above. Since the depths after remediation would be shallower than the federally-authorized channel depth from RM0 to RM8.3, de-authorization of the federal navigation channel under the federal River and Harbors Act through USACE procedures and Congressional action would be pursued. Because Alternative 4 (under all DMM scenarios) would result in some contaminants remaining on-site above levels that would allow for unrestricted use, CERCLA would require that five-year reviews be conducted.

Dredged materials removed would be managed in accordance with one of three DMM scenarios described on page 21.

The construction duration for the alternative is not dependent on the DMM scenario, because DMM facilities were sized according to the dredged material throughput for the alternative. Construction duration for DMM Scenario C is more uncertain than for the other two scenarios, because the decontamination technologies evaluated in DMM Scenario C have not been constructed and operated in the United States on a scale approaching the capacity needed for this alternative. The construction time estimate includes time for dredging, capping and dredged material disposal.

THE NINE SUPERFUND EVALUATION CRITERIA

1. Overall Protection of Human Health and the Environment evaluates whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.

2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.

3. Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.

4. Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

5. Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, the community, and the environment during implementation.

6. Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.

7. Cost includes estimated capital and annual operations and maintenance costs, as well as present value cost. Present value cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

8. State/Support Agency Acceptance considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.

9. Community Acceptance considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

COMPARATIVE ANALYSIS OF ALTERNATIVES

In this section, the alternatives are evaluated in detail to determine which would be the most effective in achieving the goals of CERCLA and the RAOs for the FFS Study Area. The alternatives are compared to each other based on the nine criteria set forth in the NCP at 40 CFR 300.430(e)(9)(iii) (see box above).

Overall Protection of Human Health and the Environment

A primary requirement of CERCLA is that the selected remedial action be protective of human health and the environment. An alternative is protective if it reduces current and potential future risks associated with each exposure pathway at a site to acceptable levels.

Alternative 1 (No Action) would not be protective of human health and the environment. Under Alternative 1, the resuspension of contaminated sediments in the FFS Study Area would continue to contaminate surface sediments and biota, so that the unacceptable risks to humans and the environment calculated in the baseline risk assessments would continue for the foreseeable future. Sediment data show some decline in surface sediment concentrations over time due to natural recovery processes, although these processes have slowed considerably over approximately the past 15 years as the navigation channel has filled in and the river has begun to reach a quasi-steady state. Computer modeling results for Alternative 1 show that the decline in concentrations is extremely slow, so that in the period of 2019 to 2048 (30-year period chosen to allow comparison to the 30-year period after construction for the active alternatives), human health total cancer risk (sum for the adult and child for all COCs) would be $4x10^{-3}$ and $2x10^{-3}$ for fish and crab consumption, respectively. The total non-cancer health hazards for the adult would be 90 and 40 for fish and crab consumption, respectively, and for the child would be 163 and 71 for fish and crab consumption, respectively. By the end of that 30-year period, total ecological hazards for benthic invertebrates would range from 40 to 300, for fish would range from 10 to 200 and for wildlife would range from 2 to 700. Since, under Alternative 1, risk levels would remain 10 to several hundred times above protective goals 30 years into the future, it would not be reasonable to expect natural recovery processes to achieve these levels in the foreseeable future beyond the modeling simulation period.

Alternative 2 (Deep Dredging with Backfill) and Alternative 3 (Capping with Dredging) would both protect human health and the environment to approximately the same degree.

Alternative 2 would address the unacceptable risks due to COCs in FFS Study Area sediments by removing the extensive inventory of contaminated fine-grained sediments from RM0 to RM8.3 (approximately 9.7 million cy). Dredging residuals that remain in the FFS Study Area after construction would be covered by a two-foot layer of backfill. The extent to which the surface sediments in the FFS Study Area would be re-contaminated would be determined by the influx, mixing and deposition of sediment that enters from above Dundee Dam, from between the dam and RM8.3, and from Newark Bay. The FFS Study Area is the major source of COCs to the river above RM8.3 and to Newark Bay; so removing those sediments would reduce that source of contamination to those areas, thereby reducing the contamination brought back into the FFS Study Area from those areas over time. Overall contamination levels in the Lower Passaic River and Newark Bay watersheds would be reduced even further by any additional remedial actions EPA might take following completion of the 17-mile Lower Passaic River RI/FS and Newark Bay RI/FS.

Computer models predict that Alternative 2 would reduce risks by ten times after remedial construction, so that in the 30-year period after construction, the human health total cancer risk (for the adult and child for all COCs) would be $5x10^{-4}$ and $4x10^{-4}$ for fish and crab consumption, respectively. The upper boundary of EPA's acceptable risk range is not a discrete line at $1x10^{-4}$. This specific risk estimate for Alternative 2, which is around 10^{-4}, is within the acceptable range. The non-cancer health hazard for the adult would be 10 and 7 for fish and crab consumption, respectively, and for the child would be 22 and 15 for fish and crab consumption, respectively. The non-cancer health hazards would be above EPA's goal of an HI of one, so Alternative 2 would incorporate institutional controls such as fish and crab consumption advisories enhanced by additional outreach to ensure protectiveness. However, Alternative 2 is expected to reduce risks low enough that the stringency of the consumption advisories might be reduced over time, as discussed in the "Long Term Effectiveness and Permanence" section below. Thirty years after construction, total ecological hazards for benthic invertebrates would range from 4 to 30, for fish would range from 2 to 20 and for wildlife would range from 0.8 to 40.

Alternative 3 (Capping with Dredging) would address the unacceptable risks due to COCs in FFS Study Area sediments by sequestering the extensive inventory of contaminated sediments in the FFS Study Area under a bank-to-bank engineered cap. The extent to which the surface sediment in the FFS Study Area would be re-contaminated would be determined by the influx, mixing and deposition of sediment that enters from above Dundee Dam, from between the dam and RM8.3, and from Newark Bay. The FFS Study Area is the major source of COCs to the river above RM8.3 and to Newark Bay; so capping those sediments would reduce that source of contamination to those areas, thereby reducing the contamination brought back into the FFS Study Area from those areas over time. Overall contamination levels in the Lower Passaic River and Newark Bay watersheds would be reduced even further by any additional remedial actions EPA might take following completion of the 17-mile Lower Passaic River RI/FS and Newark Bay RI/FS.

Computer models predict that Alternative 3 would reduce risks by more than ten times after remedial construction, so that in the 30-year period after construction, human health total cancer risk (for the adult and child for all COCs) would be $4x10^{-4}$ and $3x10^{-4}$ for fish and crab consumption, respectively. The upper boundary of EPA's acceptable risk range is not a discrete line at $1x10^{-4}$. This specific risk estimate for Alternative 3, which is around 10^{-4}, is within the acceptable range. The non-cancer health hazard for the adult would be 8 and 6 for fish and crab consumption, respectively, and for the child would be 18 and 13 for fish and crab consumption, respectively. The non-cancer health hazards would be above EPA's goal of an HI of one, so Alternative 3 would incorporate institutional controls such as fish and crab consumption advisories enhanced by additional outreach to ensure protectiveness. However, Alternative 3 is expected to reduce risks low enough that the stringency of the consumption advisories might be reduced over time, as discussed in the "Long Term Effectiveness and Permanence" section below. Thirty years after construction, total ecological hazards for benthic invertebrates would range from 3 to 30, for fish would range from 2 to 20 and for wildlife would range from 0.8 to 30.

Alternative 4 (Focused Capping with Dredging) would address the unacceptable risks due to COCs in FFS Study Area sediments to some extent by capping the sediment areas that contribute the most contaminant flux to the water column; the discrete areas of sediments to be capped would add up to about one-third of the FFS Study Area surface. However, computer models predict that Alternative 4 would not come close to achieving protectiveness of human health and the environment in the 30 years after construction (duration of model simulation). Alternative 4 would reduce risks by about half after remedial construction, so that in the 30-year period after construction, human health total cancer risk (for adult and child for all COCs) would still be $2x10^{-3}$ and $1x10^{-3}$ for fish and crab consumption, respectively. The non-cancer health hazard for the adult would be 55 and 27 for fish and crab consumption, respectively, and for the child would be 97 and 47 for fish and crab consumption, respectively. Thirty years after construction, total ecological hazards for benthic invertebrates would range from 30 to 200, for fish would range from 10 to 100 and for wildlife would range from 2 to 400. Since, under Alternative 4, risk levels would remain up to 100 times above protective goals 30 years after construction, it would not be reasonable to expect natural recovery processes to result in achieving protective goals in the foreseeable future beyond the model simulation period. Since cancer risks remain outside EPA's risk range and non-cancer health hazards are above EPA's goal of an HI of 1, Alternative 4 would incorporate institutional controls such as fish and crab consumption advisories enhanced by additional outreach to ensure protectiveness. Unlike Alternatives 2 and 3, Alternative 4 would primarily rely on fish and crab consumption advisories for protectiveness in perpetuity, since they would remain in place in the foreseeable future without any change in stringency. These computer model predictions are consistent with the body of data collected over the past 17 years and the conceptual understanding of the river system presented under the "Site Characteristics" section, above. The data show that FFS Study Area surface sediments have average COC concentrations that are almost 100 times higher than the remediation goals. Given the ubiquitous nature of highly contaminated sediments in the FFS Study Area, capping discrete areas that only add up to about one-third of the FFS Study Area is unlikely to lead to substantial decreases in COC concentrations. The contaminated sediments in the two-thirds of the FFS Study Area not addressed by Alternative 4 would move with the tide or in storm events to re-contaminate the adjacent capped areas.

Under Alternatives 2, 3 and 4, for DMM Scenario A (CAD), an engineered cap would be placed over the CAD cells in Newark Bay and the cap would be monitored and maintained in perpetuity.

In recent correspondence, the State of New Jersey, NOAA and USFWS have expressed serious concerns about the disposal of highly contaminated sediment from the Lower Passaic River into a CAD cell in Newark Bay, which they note is unprecedented in terms of its scale and footprint, and the coincident potential impacts to the aquatic environment.

These concerns are discussed further in the "Short-Term Effectiveness" section below, because EPA has analyzed the impacts as short-term, temporary impacts during remedy construction. However, NOAA estimates that CAD cells that would be open in Newark Bay for two to eleven years under the three active alternatives could have long-term impacts on some species that are dependent on limited bay bottom habitat for critical life stages. In contrast, DMM Scenarios B (Off-Site) and C (Local Decontamination) have no environmental impact on the aquatic environment of Newark Bay.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Any alternative considered by EPA must comply with all federal and state environmental standards, requirements, criteria or limitations, unless they are waived under certain specific conditions.

Alternative 1 (No Action) would not contribute significantly toward eventual achievement of federal and state surface water ARARs. Since there is no active remediation associated with this alternative, action-specific and location-specific ARARs do not apply.

Compliance with surface water quality ARARs is both a short-term requirement during remediation and a long-term requirement after the remediation is completed. In the short term, actions would be taken during the implementation of Alternatives 2 (Deep Dredging with Backfill), 3 (Capping with Dredging) and 4 (Focused Capping with Dredging) to reduce construction-related surface water quality impacts. Alternatives 2, 3 and 4 are designed to address sediment contamination in the FFS Study Area. Although remediation of contaminated sediment would contribute to improved water quality, implementation of one of these alternatives, by itself, would be unlikely to achieve compliance with ARARs in the water column. However, because this FFS only addresses the sediments portion of the lower 8.3 miles and is an interim action for the water column, and is only part of the remedial activities under consideration for the 17-mile Lower Passaic River and Newark Bay, compliance with surface water ARARs would more likely be achieved after additional response actions have been implemented. Alternatives 2, 3 and 4 would satisfy the location-specific and action-specific ARARs, such as the requirements of the Clean Water Act that would apply to dredging and the RCRA requirements that would apply to management of dredged materials.

Long-Term Effectiveness and Permanence

This evaluation takes into account the residual risk remaining at the conclusion of remedial activities, and the adequacy and reliability of containment systems and institutional controls.

Alternative 1 (No Action) would not be effective in addressing the contaminated sediments that are causing the unacceptable risks identified in the baseline risk assessments. Natural recovery processes would cause some decline in surface sediment concentrations over time, but computer modeling results (see FFS Report Figure 4-3) for Alternative 1 show that, by the late 2050s (end of the model simulation period), FFS Study Area surface sediment concentrations would remain far above any of the remediation goals or background levels for any COC.

- For dioxin, by the late 2050s, FFS Study Area surface sediment concentrations would remain well over ten times higher than the remediation goal.
- For PCBs, DDT and mercury, by the late 2050s, surface sediment concentrations would remain almost twice as high as background concentrations and over ten times (for PCBs and mercury) or 100 times (for DDT) higher than the remediation goals.

Alternative 1 (No Action) would not include any containment systems or institutional controls to address COC contamination in FFS Study Area sediments.

Modeling has predicted that in order for any alternatives to achieve protectiveness of human health (i.e., not only be within the risk range of $1x10^{-4}$ to $1x10^{-6}$, but also be at or below an HI equal to 1), bank-to-bank remediation in the FFS Study Area would be necessary. Modeling results also predicted that bank-to-bank alternatives would reduce surface sediment concentrations for some of the COCs to below background levels in the future. This is because particles coming over Dundee Dam (background for the FFS Study Area) make up about one third of particles in the FFS Study Area water column. When those particles flow down to the FFS Study Area, they mix with the other particles in the system (including cleaner particles in the water column that would result from a remediated FFS Study Area) and also the clean material placed on the river bed as part of remediation. So contamination in the top six inches (the bioactive zone) should end up being much less than background concentrations coming over Dundee Dam.

Under Alternative 2 (Deep Dredging with Backfill), approximately 9.7 million cy of contaminated sediments covering approximately 650 acres of river bottom between RM0 and RM8.3 would be permanently removed from the ecosystem of the Lower Passaic River after construction is completed. Dredging residuals remaining in the FFS Study Area would be covered by a two-foot layer of backfill. Under Alternative 3 (Capping with Dredging), approximately 4.3 million cy of contaminated sediments covering approximately 650 acres of river bottom between RM0 and RM8.3 would be permanently removed from the ecosystem of the Lower Passaic River, followed by construction of a two-foot engineered cap (or backfill where appropriate) over the entire FFS Study Area. After construction is completed, the resuspension of contaminated sediments within the FFS Study Area would no longer continue to contaminate surface sediments and biota or pose unacceptable risks to humans and the environment. A significant decline in surface sediment concentrations in the FFS Study Area is predicted for COCs under both alternatives (see FFS Report Figure 4-3).

- For dioxin, in the 30-year period after construction, surface sediment concentrations are predicted to decline tenfold and end up fluctuating around the remediation goal. The fluctuations depend on the magnitude and frequency of storm events, which are programmed into the model at 15 year intervals, although in reality the sequence of storm events cannot be predicted with any degree of certainty.
- For PCBs, in the 30-year period after construction, surface sediment concentrations are predicted to decline over tenfold and end up fluctuating around the remediation goal depending on the magnitude and frequency of storm events.
- For mercury, during the 30-year period after construction, surface sediment concentrations are predicted to decline over tenfold and end up fluctuating around the remediation goal, depending on the magnitude and frequency of storm events.
- For DDT, during the 30-year period after construction, surface sediment concentrations are predicted to decline over tenfold, to fluctuate at a level about ten times higher the remediation goal.

Alternatives 2 and 3 would incorporate fish and crab consumption advisories to ensure protectiveness of human health. For dioxin and PCBs, approximately 10 years after construction, surface sediment concentrations are expected to reach the interim remediation milestones that correspond to interim protective fish and crab tissue concentrations, potentially allowing NJDEP to consider relaxing the stringency of fish and crab consumption advisories (e.g., allowing one fish meal per month, as opposed to the current advisory that recommends no consumption of fish or shellfish from the Lower Passaic River).

Alternative 2 would not rely on a containment system to maintain protectiveness in the FFS Study Area over the long term, since the contaminated fine-grained sediments would be removed. Note that a containment system might be incorporated as part of the dredged material management option selected for this alternative (see below).

Alternative 3 would be effective in the long term in limiting exposure to risks posed by COCs in the FFS Study Area sediments provided the integrity of the engineered cap is maintained. Therefore, the cap would need to be monitored and maintained in perpetuity. Engineered caps have been demonstrated to be effective in the long term in sequestering contaminated sediments at other Superfund sites, when they are properly designed and maintained. For FFS cost-estimation purposes, the engineered cap for the FFS Study Area was assumed to consist of sand with a grain size large enough to withstand a 100-year storm with less than 3 inches of erosion (a fraction of the cap's thickness), thus minimizing the likelihood that cap integrity would be compromised during a storm event or season. Based on modeling results, certain areas of the river were assumed to need armor stone for further protection against erosion. The FFS cost estimate also assumed cap inspection and any necessary maintenance at regular intervals and after storm events.

For Alternative 4, approximately 1.0 million cy of contaminated sediments in discrete areas totaling approximately 220 acres of river bottom between RM0 to RM8.3, would be permanently removed, followed by placement of a two-foot engineered cap over those areas dredged. As discussed above, Alternative 4 would not achieve much risk reduction, because the contaminated surface sediments in the two-thirds of the FFS Study Area that remain unaddressed would re-contaminate the adjacent capped areas. Computer modeling results (see FFS Report Figure 4-3) show that, by the late 2050s (end of the model simulation period), FFS Study Area surface sediment concentrations would remain far above any of the remediation goals, although some background levels might be reached.

- For dioxin, in the 30-year period after construction, surface sediment concentrations are predicted to remain well over ten times higher than the remediation goal.
- For PCBs and DDT, in the 30-year period after construction, surface sediment concentrations are predicted to be 25 percent higher than background concentrations and ten times (for PCBs) or 100 times (for DDT) higher than the remediation goals.
- For mercury, in the 30-year period after construction, surface sediment concentrations are predicted to just meet background concentrations and to be ten times higher than the remediation goal.

For dioxin and PCBs, under Alternative 4, surface sediment concentrations are not expected to be reduced enough to reach interim remediation milestones. Therefore, unlike Alternatives 2 and 3, Alternative 4 would primarily rely on fish and crab consumption advisories for protectiveness in perpetuity, since they would remain in place in the foreseeable future without any change in stringency.

For Alternatives 2, 3 and 4, under DMM Scenario A (CAD), the engineered caps over the CAD cells would have to be monitored and maintained in perpetuity in order to ensure that the alternatives are protective of human health and the environment over time. In contrast, there is no such requirement for DMM Scenario B (Off-Site Disposal) and DMM Scenario C (Local Decontamination), because existing landfills already have provisions for long-term monitoring and maintenance by landfill owners and operators.

DMM Scenario B relies on off-site incinerators and landfills which are in operation and have proven to be reliable technologies. The reliability of local decontamination technologies (DMM Scenario C), such as thermal treatment and sediment washing, is more uncertain, since they have not been built and operated in the United States on a scale approaching the capacity needed for this project. In addition, sediment washing may be less effective when the matrix contains multiple contaminants and consists of a large proportion of finer particles like silts and clays. Multiple treatment passes, which would increase cost, may be needed under such conditions.

Reduction in Toxicity, Mobility, or Volume Through Treatment

This criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and/or significantly reduce the toxicity, mobility or volume of hazardous substances as their principal element.

For Alternative 1 (No Action), only natural recovery processes would potentially reduce COC concentrations in sediments and surface water. Under Alternative 1, there would be no reduction of toxicity, mobility or volume through treatment.

For the active alternatives, reduction of mobility and volume of contaminated sediments in the FFS Study Area would be achieved by dredging and capping, not through treatment. The ultimate reduction of toxicity, mobility and volume of the sediments removed from the FFS Study Area would depend on the DMM Scenario selected.

Under Alternative 2 (Deep Dredging with Backfill), reduction of mobility and volume in the FFS Study Area would be achieved by the removal of 9.7 million cy of contaminated sediments by dredging, including elimination of approximately 24 kilograms (kg) of 2,3,7,8-TCDD, 41,000 kg of mercury, 23,000 kg of PCBs and 4,200 kg of DDT. For Alternative 3 (Capping with Dredging), reduction of mobility and volume in the FFS Study Area would be achieved by the removal of 4.3 million cy of contaminated sediments by dredging, including elimination of approximately 8 kg of 2,3,7,8-TCDD, 16,000 kg of mercury, 7,000 kg of PCBs and 800 kg of DDT. The remaining 5.4 million cy of contaminated sediments would be sequestered in the river under an engineered cap, so that mobility would be effectively eliminated, but there would be no reduction of toxicity for the contaminants that remain under the cap. Under Alternative 4 (Focused Capping with Dredging), reduction of mobility and volume in the FFS Study Area would be achieved by the removal of 1.0 million cy of contaminated sediments by dredging, including elimination of approximately 1 kg of 2,3,7,8-TCDD, 2300 kg of mercury, 1300 kg of PCBs and 100 kg of DDT. The remaining 8.7 million cy of contaminated sediments would not be addressed, so there would be no additional reduction in toxicity, mobility or volume through treatment.

For Alternatives 2, 3 and 4, under DMM Scenario A (CAD), the mobility of the COCs removed from the FFS Study Area would be effectively eliminated, not through treatment, but by sequestering the dredged sediments in the CAD cells under an engineered cap that would need to be monitored and maintained in perpetuity. There would be no reduction in the toxicity or volume of the COCs.

Under DMM Scenario B (Off-Site Disposal), the toxicity, mobility, and volume of the COCs removed from the FFS Study Area are estimated to be reduced as follows:

Alternative	Dredged Material Incinerated[a] (CY)	Dredged Material Landfilled[b] (CY)
2	790,000	7,130,000
3	250,000	3,310,000
4	30,000	800,000

Notes: Numbers are in-situ cubic yards and exclude volume of reclaimed materials (sand) and some debris separated in the mechanical dewatering process.
[a] Incineration would reduce toxicity, mobility and volume through treatment. Actual amount incinerated would depend on results of characterization for disposal.
[b] Landfilling would reduce mobility without any reduction in toxicity or volume, through sequestration not treatment.

Under DMM Scenario C (Local Decontamination), the toxicity, mobility, and volume of the COCs removed from the FFS Study Area are estimated to be reduced as follows:

Alternative	Dredged Material Undergoing:		
	Thermal Treatment[a] (CY)	Sediment Washing[b] (CY)	Stabilization[c] (CY)
2	790,000	6,970,000	160,000
3	250,000	3,270,000	40,000
4	30,000	780,000	17,000

[a] Thermal treatment would reduce toxicity, mobility and volume (achieving 99% reduction in toxicity) through treatment.
[b] Sediment washing would reduce toxicity, mobility and volume (achieving 10-80% reduction in toxicity, depending on the contaminant) through treatment.
[c] Stabilization would reduce mobility through treatment, without any reduction in toxicity or volume.

Short-Term Effectiveness

This criterion addresses the effects of each alternative during construction and implementation until RAOs are met. It considers risks to the community, on-site workers and the environment, available mitigation measures and time frame for achieving the response objectives.

Short-Term Effectiveness: Potential Adverse Impacts on Communities and Workers During In-River Construction. The impacts due to construction in the river are mainly driven by the volume dredged and duration of construction for each alternative. Alternative 1 would not involve any construction that could present a risk to the community or workers. Implementation of Alternative 2 would have larger impacts on the community and workers than Alternative 3, because construction would last longer (11 years) and would involve handling of a higher volume of contaminated sediments (9.7 million cy). Implementation of Alternative 3 would have less of an impact on the community, workers and the environment than Alternative 2, although those impacts would still be important to mitigate, since the construction period would last five years and would involve handling of 4.3 million cy of contaminated sediments. Alternative 4 would also cause adverse impacts on the community, workers and the environment during construction, but those impacts would be smaller than those caused by Alternatives 2 and 3, because of the relatively short construction period (2 years) and smaller volume of contaminated sediments handled (1.0 million cy) relative to Alternatives 2 and 3.

Impacts to communities from construction of Alternatives 2, 3 and 4 would include temporary noise, light, odors, blocked views, potential air quality impacts and disruptions to commercial and recreational river users in the FFS Study Area (operating for a few months at a given location). These impacts could be lessened through use of best management practices documented in community health and safety plans, but disruptions would still be significant, since dredging and backfilling or capping is expected to proceed 24 hours a day, six days per week and 40 weeks per year. Potential occupational risks to site workers from construction of Alternatives 2, 3 and 4 could include direct contact, ingestion and inhalation of COCs from the surface water and sediments and routine physical hazards associated with construction work and working on water. Measures to minimize and mitigate such risks would be addressed in worker health and safety plans, by the use of best management practices and by following properly approved health and safety procedures.

Short-Term Effectiveness: Potential Adverse Impacts on the Environment During In-River Construction. Under Alternatives 2, 3 and 4, dredging would result in resuspension of contaminated sediments, which would cause fish and other organisms in the water to be exposed to higher concentrations of contaminants than usually present in the water column. Studies have shown that dredging can result in resuspension loss of 1 to 3 percent of the material removed. The volume dredged under each alternative and the concentrations of contaminants on the resuspended sediments drive this adverse impact. Alternative 2 would have the most impact on the environment when compared to Alternatives 3 and 4, because Alternative 2 would have the largest volume dredged and the deepest dredging into the sediment bed, where contaminant concentrations are highest. Alternative 3 would have less impact on the environment than Alternative 2, but more than Alternative 4. Risks due to resuspension could be minimized through the control of sediment removal rates (through careful operation of the dredging equipment). Environmental impacts from construction would include temporary loss of benthos and habitat for the ecological community in dredged areas and in areas affected by resuspension of contaminated sediments during dredging. Habitat replacement measures would be implemented to mitigate these impacts. Since the remedial action would improve and replace existing open water, mudflat and intertidal habitat, no additional compensatory mitigation measures would be necessary for this aspect of the remediation. Natural benthic re-colonization following a disturbance is usually fairly rapid, and can begin within days after perturbation. In some cases, full recovery to pre-disturbance species composition and abundance can occur within one to five years.

Short-Term Effectiveness: Impacts on Communities, Workers and the Environment from Disposal Options. The impacts associated with the disposal options are mainly driven by the mode of transportation for the dredged materials and amount of local processing of dredged materials.

For Alternatives 2, 3 and 4, under DMM Scenario A (CAD), it was assumed that the CAD cells would be sited in the part of Newark Bay where the thickest layer of clay (approximately 60 feet) is likely to be found. Dredged materials from the FFS Study Area would be barged to the Newark Bay CAD site so that an upland sediment processing facility on the banks of the Lower Passaic River or Newark Bay would not be necessary. This would minimize on-land impacts to the community, but increase traffic in the bay. Since major container terminals are located in Newark Bay near the CAD sites that EPA considered in the FFS, increased barge traffic to and from the CAD site may interfere with existing port commercial traffic and increase the potential for waterborne commerce accidents. While dredged materials would also have to be barged to an upland processing facility under DMM Scenarios B (Off-Site) or C (Local Decontamination), an FFS-level survey of land along the FFS Study Area shoreline showed a number of locations suitable for an upland processing facility, so that the impact of increased in-water traffic associated with DMM Scenarios B and C could be minimized and interference with the major container terminals in Newark Bay could be avoided as much as possible.

DMM Scenarios B (Off-Site) and C (Local Decontamination) would cause more on-land impacts to the local community and workers. These disposal options would require the siting of a 26- to 40-acre (depending on the alternative and scenario) upland sediment processing facility on the banks of the Lower Passaic River or Newark Bay. For FFS cost and scheduling estimation purposes, the facility was assumed to operate for 24 hours a day, 6 days a week, 40 weeks each year for 2 to 11 years (depending on the alternative). Best efforts to minimize impacts on the local community and workers would be implemented; however, operation of the facility would still result in more odors, noise, light pollution, potential air quality impacts, greater risk of accidents from equipment operation and increased traffic on local roads than DMM Scenario A, which does not need an upland sediment processing facility. DMM Scenario B would have less impact on the local community and workers than DMM Scenario C, because DMM Scenario B involves less processing of dredged materials at the upland processing facility than DMM Scenario C. For DMM Scenario B, only coarse material separation and dewatering would be performed at the upland processing facility before materials are loaded onto rail cars and shipped off site. For DMM Scenario C, material separation, dewatering, thermal treatment, sediment washing and solidification/stabilization would occur at the upland processing facility before the beneficial use end-products are loaded into trucks or railcars to be sent to their final destination. Less processing of dredged materials at the upland processing facility means less equipment operating for the duration of the project and a smaller footprint for the upland processing facility. Measures to minimize and mitigate impacts on the community would be addressed in community health and safety plans, and by the use of best management practices.

Under DMM Scenario A, construction and operation of the CAD site could have substantial impacts on the aquatic environment, some of which could be lessened through engineering controls. Computer simulations of CAD cells placed in Newark Bay and operated without any dissolved- and particulate-phase controls were modeled over short time periods. Modeling results indicated contaminant losses from the CAD cells of approximately one percent of the mass placed, even after the short time period modeled (seven days), and assuming placement of small amounts of dredged materials in the CAD site (approximately 38,400 cy). Based on these modeled results, the CAD site conceptual design used for developing DMM Scenario A in the FFS includes sheet pile walls on all sides and a silt curtain across the entrance channel, intended to lessen the migration of dissolved and particulate-phase contaminants out of the CAD cells during construction and operation. Even with the use of sheet pile walls and a silt curtain, some of the dissolved-phase contamination could still escape during dredged material disposal.

Intertidal and subtidal shallows, such as those where CAD cells would be located, provide valuable habitat for various aquatic species, including areas designated by NOAA as Essential Fish Habitat.

In a recent letter, the Federal Trustees urged EPA not to consider alternatives that include disposal of contaminated sediment into the waters of Newark Bay. They explained that a CAD cell in this situation would be unprecedented in terms of the potential for adverse implications to aquatic habitat, the high concentrations of contaminants, the volume of sediment and the footprint (acres) of the CAD cell, and observed that some species (particularly winter flounder) use the Bay bottom to lay their eggs and will not spawn if those areas are disturbed or not accessible. The Trustees distinguished Newark Bay in this regard from the species and locations involved in Superfund CAD cells at Puget Sound and New Bedford Harbor. The Trustees also concluded that other species that use the Bay (such as juvenile *Alosines*, bay anchovy and silverside) are prey species for federally managed species such as bluefish, summer flounder and windowpane. Therefore, adverse impacts on the prey species would result in reduction in prey and would be considered an adverse impact to Essential Fish Habitat. In addition, the trustees observed that several species in Newark Bay have special status, including Atlantic sturgeon, which is federally listed as an endangered species.

The State of New Jersey has expressed similar concerns, most recently in a letter dated March 12, 2014 from NJDEP Commissioner Bob Martin to EPA Administrator Gina McCarthy. The Commissioner noted that use of a CAD cell for disposal of the required volume and concentration of dioxin-contaminated dredged material is unprecedented. He noted that dioxins are highly persistent, bio-accumulative and toxic chemicals that are highly resistant to degradation from biotic or abiotic processes. Consequently, NJDEP is not willing to support disposal of contaminated sediment in Newark Bay as it is unlikely to degrade to any appreciable extent in a reasonable timeframe.

Based on their November 30, 2012 letter, the USACE believes that CAD cells can be constructed and utilized with only localized short-term impacts and with the least impacts to the surrounding communities. CAD cells have been implemented all over the country including the construction, utilization and recent capping of the Newark Bay Confined Disposal Facility. They note that conditions in Newark Bay are favorable based on natural presence of a thick impermeable red-clay shelf over bedrock in a Bay with a well-established, already impacted, depositional environment (i.e., very low potential for erosion due to storm events) ensuring the secured and consolidated disposal of contaminated sediment in the long-term.

Operation of the CAD site would involve discharging dredged materials into waters of the United States for 11 years under Alternative 2, 5 years under Alternative 3 and 2 years under Alternative 4. The area of the open waters subject to temporary impacts from construction and operation of the CAD site would be approximately 171 acres for Alternative 2, 80 acres for Alternative 3 and 19 acres for Alternative 4. In addition to restoring the bay bottom at the completion of the project, compensatory mitigation for the CAD site would be required; that is, provision of a separate mitigation site to offset the temporal ecological losses to habitat and their functional value. For FFS cost estimation purposes, local mitigation banks have been tentatively identified to provide the mitigation necessary to offset the temporal losses associated with the Alternatives 3 and 4 CAD site. Existing mitigation banks could only provide about 55 percent of the total mitigation acreage necessary to offset the temporal losses associated with the Alternative 2 CAD site. Additional acres could be provided through restoration of sites identified in USACE's Hudson-Raritan Estuary Comprehensive Restoration Plan and Lower Passaic River Ecosystem Restoration Plan. The cost of mitigation is included in the cost of the alternatives that include DMM Scenario A. Furthermore, in addition to habitat loss, there is the potential for fish and semi-aquatic birds moving into the open CAD cells during their 2- to 11-year operation and being exposed to highly concentrated contamination by direct contact or ingestion of prey.

DMM Scenarios B and C would have much less impact on the aquatic environment than DMM Scenario A, because they would not involve discharge of contaminated sediments through the water column and into CAD cells. While DMM Scenarios B and C have greater on-land impacts (discussed above) due to the need for an upland processing facility, those impacts can be mitigated through proven technologies such as air pollution control technology and buffer zones around construction sites.

Short-Term Effectiveness: Time Until Remedial Response Objectives are Achieved. See FFS Report Figure 4-3 for modeling results for Alternatives 1 through 4. Under Alternative 1 (No Action), surface sediment concentrations would still be ten to 100 times higher than any of the remediation goals by the late 2050s (end of the model simulation period). Under Alternative 4 (Focused Capping with Dredging), surface sediment concentrations would still be ten to 100 times higher than any of the remediation goals by the late 2050s. Under Alternative 4, fish and crab consumption advisories would remain in place in the foreseeable future, without any change in stringency.

For Alternatives 2 (Deep Dredging with Backfill) and 3 (Capping with Dredging), during the 30-year period after construction, dioxin, PCB and mercury surface sediment concentrations are predicted to fluctuate around the remediation goals, depending on magnitude and frequency of storm events. DDT surface sediment concentrations are predicted to fluctuate at a level about ten times higher than the remediation goal, depending on magnitude and frequency of storm events. For dioxin and PCBs, approximately 10 years after construction, surface sediment concentrations are expected to reach the interim remediation milestones that correspond to interim protective fish and crab tissue concentrations, potentially allowing NJDEP to consider relaxing the stringency of fish and crab consumption advisories. Alternative 3 would achieve significant reductions in surface sediment concentrations sooner than Alternative 2 because of the shorter construction period (5 versus 11 years).

Implementability

This criterion considers the technical and administrative feasibility of implementing each alternative, including availability of services and materials needed during construction.

There are no implementability issues for Alternative 1 (No Action), which does not involve any active remediation.

For Alternatives 2 (Deep Dredging with Backfill) and 3 (Capping with Dredging), every step of the in-river construction (debris removal, dredging, backfilling, engineered capping and dredged material transport) would be technically implementable, although careful planning would be needed to overcome the substantial challenges involved in the handling of such large volumes of dredged materials. Equipment and technical expertise for dredging and backfill/cap placement are available through several commercial firms. While a large amount of backfill and cap material would be needed, adequate resources have been preliminarily identified at several local borrow sources.

The FFS Study Area river bed is crossed by utilities of various sizes and depths, in a number of locations. During the RM10.9 Removal, concerns were raised by the Jersey City Municipal Utilities Authority about any dredging within 30 feet on either side of the two water lines that cross below the river near Lyndhurst. Dredging for Alternative 2 would affect more utilities than dredging for Alternative 3, because Alternative 2 would involve much deeper dredging than Alternative 3. It is expected that remedy design would include procedures to more precisely locate utilities in the FFS Study Area and determine appropriate dredging off-sets, if necessary. The FFS cost estimates include costs of side-scan sonar to locate utilities and construction safeguards such as coffer dams to protect utilities during dredging.

The FFS Study Area is crossed by 14 bridges of various heights. During the RM10.9 Removal, the opening of bridges to allow construction equipment and dredged materials through was a challenge that involved coordination with the various owners and operators of the bridges. All of the active alternatives would be equally affected by the need to open the bridges. The FFS incorporates the assumption that the necessary coordination, which may include assisting bridge authorities with engineering evaluations and maintenance of the bridges, would occur during the remedial design phase of the project.

In-river construction of Alternative 4 (Focused Capping with Dredging) could be seen as more easily implementable than Alternatives 2 and 3, because smaller volumes of dredged materials would need to be handled and less capping material would be involved. However, under Alternative 4, the process of reliably identifying discrete areas that release the most contaminants into the water column would involve a great degree of uncertainty given the complex estuarine environment of the FFS Study Area. The river bottom changes constantly as the tides move back and forth twice a day and unpredictably as storm events scour different areas depending on intensity, location and direction of travel.

For the in-river work of Alternatives 2, 3 and 4, no insurmountable administrative difficulties are anticipated in getting the necessary regulatory approvals for sediment removal or engineered cap and backfill placement. Since a large number of the activities are expected to occur on site (as defined under CERCLA Section 121(e)(1) and 40 CFR 300.5), federal, state and local permits would not be required. Permits are expected to be obtained from the appropriate local, state and federal agencies for actions that occur off site.

Alternative 4 may face an administrative implementability hurdle with respect to obtaining deauthorization of the federally-authorized navigation channel in the lower 2.2 miles of the river. To obtain deauthorization, a request would need to be submitted to the USACE. After a public comment period, the USACE regional office would make a recommendation to USACE headquarters, which would forward its report to Congress for action. However, the USACE berth-by-berth analysis and survey of commercial users showed clear future waterway use objectives in the lower 2.2 miles of the river. Thus, USACE and Congressional support for deauthorization of the lower 2.2 miles of the federal navigation channel is highly uncertain.

The technical and administrative implementability of the DMM Scenarios vary from one to the next. Every step involved in DMM Scenarios A (dredged material placement in CAD cells) and B (dewatering, dredged material transport and off-site disposal) is technically implementable with proper planning. The technologies have been successfully implemented at other Superfund Sites. Depending on the processing sites that are eventually selected, dewatering, water treatment, and transfer facilities with good rail access and suitable wharf facilities are expected to be available or could be developed. The large volume of sediments to be handled would need significant logistical coordination. For DMM Scenario B, several incinerators and landfills have been identified as potentially having capacity to receive FFS Study Area dredged material by rail.

The decontamination technologies involved in DMM Scenario C (thermal treatment and sediment washing) have not been constructed and operated in the United States on a scale approaching the capacity needed for this project, so their technical ability to handle large volumes of highly contaminated sediments is more uncertain.

- At least four thermal treatment technologies were identified as potentially able to treat FFS Study Area dredged sediments. Pilot demonstrations were conducted by USACE for three of these technologies with Passaic River-Newark Bay sediments and for one technology with Lower Fox River (Wisconsin) sediments. All achieved over 99 percent removal efficiencies for a variety of COCs, including dioxins, PCBs, PAHs and metals, although the demonstrations involved relatively small volumes and short durations.

- At least four vendors have developed sediment washing technologies. In 2005-2006, one conducted a pilot demonstration with Passaic River-Newark Bay sediments that involved high enough processing rates to be considered equivalent to commercial scale operation. The technology achieved variable removal efficiencies (ranging from less than 10 to 80 percent depending on the contaminant) for dioxins and furans, PCBs, PAHs and metals. While data from the demonstration did not conclusively establish that the system would be effective in treating all contaminants to New Jersey standards so as to allow the end product to be used beneficially without restrictions, it is possible that sediment washing, combined with solidification and stabilization technology, would enable the end product to be used as RCRA Subtitle D landfill cover. However, most recently, in mid-2012, bench-scale studies by two sediment washing technology vendors showed that their technologies were unable to reduce Lower Passaic River sediment contamination to levels low enough for beneficial use.

DMM Scenario A (CAD) is a technically viable, cost effective solution that has been constructed and maintained in a protective manner in other locations, including Newark Bay, and Superfund sites such as New Bedford Harbor and Puget Sound Naval Shipyard. In 1997-2012, a CAD cell with a capacity of 1.5 million cubic yards was operated in Newark Bay by the Port Authority of New York and New Jersey and USACE for the disposal of navigational dredged material from the Newark Bay watershed (not for disposal of sediment dredged for environmental cleanup).

However, in this case, DMM Scenario A (CAD) will face significant administrative and legal impediments, because the State of New Jersey has asserted ownership of the bay bottom and strongly opposes construction of a CAD site in Newark Bay, citing the high toxicity and unprecedented volume of contaminated sediment as a primary reason it should not be handled in the aquatic environment. The State's position is clearly articulated in letters dated November 28, 2012 from Governor Chris Christie to former EPA Administrator Lisa Jackson and March 10, 2014 from NJDEP Commissioner Martin to EPA Administrator Gina McCarthy.

Unless the State were to change its position, its opposition is likely to make DMM Scenario A administratively infeasible. Given the State's current position, DMM Scenario A (CAD) is unlikely to satisfy the NCP balancing criterion of implementability and the modifying criterion of state acceptance.

For DMM Scenario B (Off Site Disposal), administrative feasibility is less of a concern, although siting a 26- to 28-acre (depending on the alternative) upland processing facility may be challenging in the dense urban areas around the Lower Passaic River and Newark Bay. For DMM Scenario C, administrative feasibility is less of a concern than for DMM Scenario A but more of a concern than for DMM Scenario B, because Scenario C involves more upland area for dredged material processing (36 to 40 acres depending on the alternative). It also involves the construction of a thermal treatment plant, which may be subject to more stringent limitations on air emissions. In Governor Christie's November 28, 2012 letter, the State of New Jersey also expressed opposition to siting a thermal treatment facility near densely populated urban areas that are already burdened with environmental impacts, particularly from air pollutants. However, the letter acknowledged that decontamination technologies such as those described in DMM Scenario C should be considered in conjunction with off-site disposal.

Cost

Cost estimates are summarized in Table 6. A discount rate of 7 percent was used in the present value calculations, consistent with EPA guidance.

All Alternative 2 capital costs are greater than Alternative 3 capital costs, which in turn are greater than Alternative 4 capital costs, because Alternative 2 involves dredging and managing the largest volume of contaminated sediments, while Alternative 4 involves dredging and managing the least. All Alternative 3 and 4 operation and maintenance (O&M) costs are greater than Alternative 2 O&M costs, because Alternatives 3 and 4 would involve long-term monitoring and maintenance of an engineered cap, while Alternative 2 does not involve any maintenance of the backfill (because there is no contaminated inventory left behind). Annual O&M costs for Alternative 3 and 4 are comparable, estimated at present values of approximately $1.7 to $1.8 million for Alternative 3 and $1.6 to $1.7 million for Alternative 4.

State Acceptance

NJDEP concurs with the preferred alternative. New Jersey has indicated its preference for DMM

Scenario B, and its strong opposition to DMM Scenario A (CAD).

Community Acceptance

Community acceptance of the preferred alternative will be addressed in the ROD following review of the public comments received on the Proposed Plan. However, EPA is aware of opposition to the CAD cells in Newark Bay by many of the community and environmental groups that are actively engaged with the Lower Passaic River.

PREFERRED ALTERNATIVE

EPA's preferred alternative is Alternative 3 (Capping with Dredging for Flooding and Navigation) with DMM Scenario B (Off-Site Disposal). This bank-to-bank alternative includes the following components:

- Installing an engineered cap bank-to-bank from RM1.2 to RM8.3, and in areas outside of the navigation channel from RM0 to RM1.2.
- Dredging the 300-foot wide federal navigation channel from RM0 to RM2.2 to the following depths (all in MLW) to accommodate continued and reasonably anticipated future use:
    - RM0 to RM1.2 = 33 feet (resulting in a 30-foot deep navigation channel);
    - RM1.2 to RM1.7 = 30.5 feet (resulting in a 25-foot deep navigation channel); and
    - RM1.7 to RM2.2 = 25.5 feet (resulting in a 20-foot deep navigation channel).
- Backfilling the dredged channel in RM0 to RM1.2 with 2 feet of sand.
- Prior to installing the cap in RM2.2 to RM8.3, dredging approximately 2.5 feet below the sediment surface to prevent the engineered cap from causing additional flooding and to provide for at least 10 feet below MLW over a 200-foot width in RM2.2 to RM8.1, and over a 150-foot width in RM8.1 to RM8.3, to accommodate reasonably anticipated future recreational uses.

Table 6
Present Value[1] Cost Estimates

Alternative	Disposal Scenario	Capital Costs	Average Annual Long-Term Operation and Maintenance Costs[2]	Total
1) No Action	--	$0	$0	$0
2) Deep Dredging with Backfill	with CAD	$1,318,000,000	$750,000	$1,341,000,000
	with Off-Site	$3,229,000,000	$520,000	$3,245,000,000
	with Decontamination	$2,605,000,000	$520,000	$2,621,000,000
3) Capping with Dredging for Flooding and Navigation	with CAD	$898,000,000	$1,830,000	$953,000,000
	with Off-Site	$1,681,000,000	$1,680,000	$1,731,000,000
	with Decontamination	$1,534,000,000	$1,680,000	$1,585,000,000
4) Focused Capping with Dredging for Flooding	with CAD	$315,000,000	$1,660,000	$365,000,000
	with Off-Site	$566,000,000	$1,600,000	$614,000,000
	with Decontamination	$557,000,000	$1,600,000	$606,000,000

Notes:
1. Present value costs calculated using a seven percent discount rate. Values are rounded to the nearest million (capital costs) and nearest ten-thousand (annual average O&M costs).
2. Total annual and periodic O&M costs averaged over the 30-years post-construction monitoring period to estimate the average annual long-term O&M costs.
3. Total costs may not add due to rounding.

- Reconstructing dredged mudflats to their original grade, with an engineered cap that would consist of one foot of sand and one foot of mudflat reconstruction (habitat) substrate.

This alternative would involve dredging of approximately 4.3 million cy of contaminated sediments, which would be disposed of in the following way:

- Dredged materials would be barged to an upland sediment processing facility in the vicinity of the Lower Passaic River/Newark Bay shorelines for debris screening, sand separation and active dewatering using filter presses.
- Non-hazardous coarse-grained materials (sand) separated during processing would be disposed of at a local landfill, or be beneficially used.
- Dewatered dredged materials would be transported by rail to permitted incinerators and landfills in the United States or Canada for treatment and disposal.
- Water generated by the dewatering would be processed through a water treatment plant to meet NJDEP water quality standards and discharged to the Lower Passaic River or Newark Bay.

During construction, water, air and biota monitoring would be conducted to evaluate whether the project is being managed efficiently to mitigate releases of contaminants to the environment. In instances where water or air quality standards are exceeded, the construction activity that caused the exceedance would be evaluated and additional mitigation measures would be implemented. After construction, frequent monitoring of fish and sediment would be conducted to determine when interim remediation milestones and remediation goals are reached. During and after construction, NJDEP's fish and crab consumption advisories with enhanced community outreach to improve awareness and compliance, would be implemented until remediation goals are met. After construction, monitoring and maintenance of the engineered cap would be required both on a regular basis and after significant storm events. Institutional controls prohibiting disturbance of the engineered cap would be necessary to maintain cap integrity. A review of site conditions would be conducted at least once every five years, as required by CERCLA.

Given the stakeholder interest with respect to the dredged material management options, EPA will provide focused public outreach on this topic through facilitated public meetings and information sessions during the public comment period. These meetings and information sessions will include a discussion of the navigational depths that will result from the remedy, since this issue is also of great interest to stakeholders. If, as a result of comments received or new relevant information, EPA concludes that the record supports making changes to the preferred alternative, the Record of Decision will include a discussion of the significant changes and the reason for such changes.

RATIONALE FOR SELECTION OF PREFERRED ALTERNATIVE

The selection of the preferred alternative is accomplished through the evaluation of the nine criteria as specified in the NCP.

Alternative 3 with DMM Scenario B meets the threshold criteria of Overall Protection of Human Health and the Environment and Compliance with ARARs. This alternative, which relies on an engineered cap bank-to-bank over the entire FFS Study Area and remediates all of the contaminated sediment in the FFS Study Area, achieves substantial risk reduction and controls the major source of contamination to the rest of the river and Newark Bay. Within a reasonable time frame after construction completion, EPA expects to be able to recommend to NJDEP that fish and crab consumption advisories, incorporated to ensure protection of human health, be relaxed as interim remediation milestones are achieved. The preferred alternative fulfills all of the RAOs for the FFS Study Area and would accommodate the reasonably-anticipated future waterway use in the federally-authorized navigation channel identified by USACE's survey of commercial users. Following are the key factors that led EPA to propose this alternative-DMM scenario combination over the others:

- Alternative 3 achieves substantial risk reduction and controls the major source of contamination to the rest of the river and Newark Bay by sequestering all of the contaminated sediments remaining in the FFS Study Area at the completion of the remedy under a bank-to-bank engineered cap. While engineered caps must be monitored and maintained in perpetuity, they have been demonstrated to be effective in the long-term at multiple Superfund sites around the country.
- DMM Scenario B relies on permitted incinerators and landfills that are proven to be reliable technologies and already have provisions for long-term monitoring and maintenance by their owners and operators. In contrast, the local decontamination technologies in DMM Scenario C have never been built and operated in the United States to handle as much as 4.3 million cy of dredged materials.
- Alternative 3 reduces volume in the FFS Study Area by removing 4.3 million cy of contaminated sediments, including 8 kg of 2,3,7,8-TCDD, 16,000 kg of mercury, 7,000 kg of PCBs and 800 kg of DDT among others. Alternative 3 reduces mobility in the FFS Study Area by sequestering the remaining 5.4 million cy of contaminated sediments under an engineered cap that would be maintained in perpetuity. Overall toxicity and volume are reduced by incinerating the 7 percent of dredged materials estimated to be characterized as hazardous under RCRA, while overall mobility is effectively eliminated by disposing of the remaining volume (and the ash from incineration) into a landfill.
- While both Alternatives 2 and 3 meet the threshold criterion of protectiveness, Alternative 3 does so in half the construction duration of Alternative 2 and a smaller volume dredged than Alternative 2. This means that there would be significantly less short-term impact on the community, workers and the environment.
- DMM Scenario B has less of an on-land impact than DMM Scenario C, since off-site disposal would involve fewer acres for, and less processing at, the upland processing facility than local decontamination. DMM Scenario B has significantly less impact on the aquatic environment than DMM Scenario A, since CAD cells, unlike off-site disposal, would involve managing the placement of dredged materials on 80 acres of Newark Bay bottom over 5 years, potentially impacting species that are dependent on limited bay bottom habitat for critical life stages. In addition, CAD cells could increase the potential that fish and birds could be exposed to highly concentrated contamination in the CAD cells, and increase the potential for waterborne commerce accidents in the busy port.
- The dredging and engineered cap components in Alternative 3 have been demonstrated to be technically and administratively feasible at various other Superfund sites. Alternative 3 is more implementable than Alternative 2, because Alternative 3 involves a significantly smaller dredging volume and shallower dredging depths than Alternative 2, which means less challenging logistics for sediment handling and fewer utilities to be located and evaluated. Alternative 3 is more implementable than Alternative 4, because Alternative 3 does not rely on identifying discrete areas of the river that release high fluxes of contaminants into the

water column, and Alternative 3 does not face the administrative implementability hurdle that Alternative 4 faces with respect to obtaining deauthorization of the federally-authorized navigation channel in the lower 2.2 miles of the river.
- The incinerators and landfills included in DMM Scenario B are existing facilities that have the ability to handle FFS Study Area materials. In contrast, because the State of New Jersey strongly opposes construction of a CAD site in Newark Bay, that scenario is likely to face such severe legal and administrative impediments as to make DMM Scenario A administratively infeasible. In DMM Scenario C, sediment washing technologies failed to demonstrate the ability to reduce Lower Passaic River sediment contamination to levels low enough for beneficial re-use, and thermal treatment technology vendors have not sited or constructed commercial-scale facilities with the demonstrated ability to process the large volumes of sediment that would be dredged under Alternative 3.
- At a present value of $1.73 billion, Alternative 3-DMM Scenario B is less costly than the two most costly alternative-DMM scenario combinations, although more costly than three others (excluding costs for Alternatives 1 and 4, which do not meet the protectiveness threshold criterion).
- The State of New Jersey has expressed support for the combination of Alternative 3 and DMM Scenario B.
- Community Acceptance will be evaluated in the ROD following review of the public comments received on the Proposed Plan.

DMM Scenario C does offer some advantages in terms of permanence, reduction of toxicity, mobility and volume through treatment, as well as future sustainability (although this last point is not one of the nine criteria). However, none of the decontamination technologies tested during the FFS development period proved implementable on a commercial scale, particularly with the large volumes contemplated by any FFS Study Area active alternative. Several sediment decontamination vendors are continuing to develop their technologies and continue to express interest in handling Lower Passaic River sediments. It is possible that one or more vendors might succeed in demonstrating that their technology could decontaminate Lower Passaic River sediments and might be able to site and construct a decontamination technology facility in the New York-New Jersey Harbor Estuary. Should this happen during the remedy design phase, EPA could modify the selected remedy through a ROD amendment or Explanation of Significant Differences in such a way as to allow for local decontamination and beneficial use (DMM Scenario C) of all or a portion of the sediment.

Based on information currently available, EPA believes the preferred alternative meets the threshold criteria and provides the best balance of tradeoffs among the alternatives with respect to the balancing and modifying criteria. The preferred alternative would satisfy the statutory requirements of CERCLA §121(b) by being protective of human health and the environment; complying with ARARs; and being cost-effective. Although CERCLA 121(b) also expresses a preference for selection of remedial actions that use permanent solutions and treatment technologies to the maximum extent practicable, there are situations that may limit the use of treatment, including when treatment technologies are not technically feasible or when the extraordinary size or complexity of a site makes implementation of treatment technologies impracticable. The preferred alternative would generate approximately 4.3 million cy of contaminated sediments, which is clearly an extraordinary volume of materials; and the sediment treatment technologies investigated under DMM Scenario C have not been constructed or operated in the United States on a scale approaching the capacity needed for this project, so their technical ability to handle such an extraordinary volume of highly contaminated sediments is uncertain. The preferred alternative is expected to provide treatment of approximately

250,000 cy of contaminated sediment through incineration off-site to comply with applicable RCRA standards.

In its 2007 report on sediment dredging at Superfund sites, the National Research Council (NRC) noted the "difficulty in predicting dredging effectiveness and the limited number of available alternative technologies" (p. 244). The NRC also noted that environmental responses to remediation are complex and difficult to predict (p. 252). The NRC recommended an "adaptive management approach which it defined as "[t]he use of a structured process of selecting a management action, monitoring the effects of the action, and applying those lessons to optimize a management action…" (p.244). The NRC noted it is "context-specific" and involves an active learning process. The NRC also noted that this adaptive management is not a means to permit or sanction a less rigorous cleanup or avoid public input, and stressed the importance of working in concert with site stakeholders so they can contribute to adapting the remedy if necessary. The NRC also stated it is important not only to evaluate new information as it becomes available, but also to document those circumstances that might require deviations from the plan.

Given the complexity and uncertainty involved with remediating sediment sites, especially at such a large scale, as recommended by the NRC, EPA expects to employ an adaptive management approach during the remedial design and implementation of the remedy. This will allow for appropriate adjustments to ensure efficient and effective remediation. Information critical to the successful implementation of the remedy can be evaluated, models may be reviewed and updated and new projections made which will provide the opportunity for the remedial action to be modified, if appropriate. Any remedy modifications will be made and documented in accordance with the CERCLA process, through an Explanation of Significant Differences or an Amendment to the ROD.

Furthermore, EPA will evaluate remedy performance and modify operations to more efficiently attain RAOs. This ensures that uncertainties are promptly and effectively addressed, informs specific design decisions, and addresses concerns about how this action will be integrated with the ongoing RI/FS for the 17 miles Lower Passaic River Study Area being carried out by the CPG under EPA oversight.

FOR FURTHER INFORMATION

The administrative record file, which contains copies of the Proposed Plan and supporting documentation, is available at the following locations:

Newark Public Library
5 Washington Street, Newark, NJ 07101
(973) 733-7784
Hours: Mon, Fri, Sat, 9:00 AM - 5:15 PM
Tues, Wed, Thurs, 9:00 AM – 8:15 PM

Elizabeth Public Library
11 South Broad Street, Elizabeth, NJ 07202
(908) 354-6060
Hours: Mon – Thurs, 9:00 AM – 9:00 PM
Fri, 10:00 AM – 9:00 PM
Sat, 9:00 AM – 5:00 PM

EPA Region 2, Superfund Records Center
290 Broadway, 18th Floor, New York, NY 10007
(212) 637-4308
Hours: Mon - Fri, 9:00 AM - 5:00 PM

In addition, select documents from the administrative record are available online at:

http://www.OurPassaic.org
http://www.epa.gov/region02/superfund/npl/diamondalkali

Additional information about Newark Bay can be found at:

http://www.OurNewarkBay.org

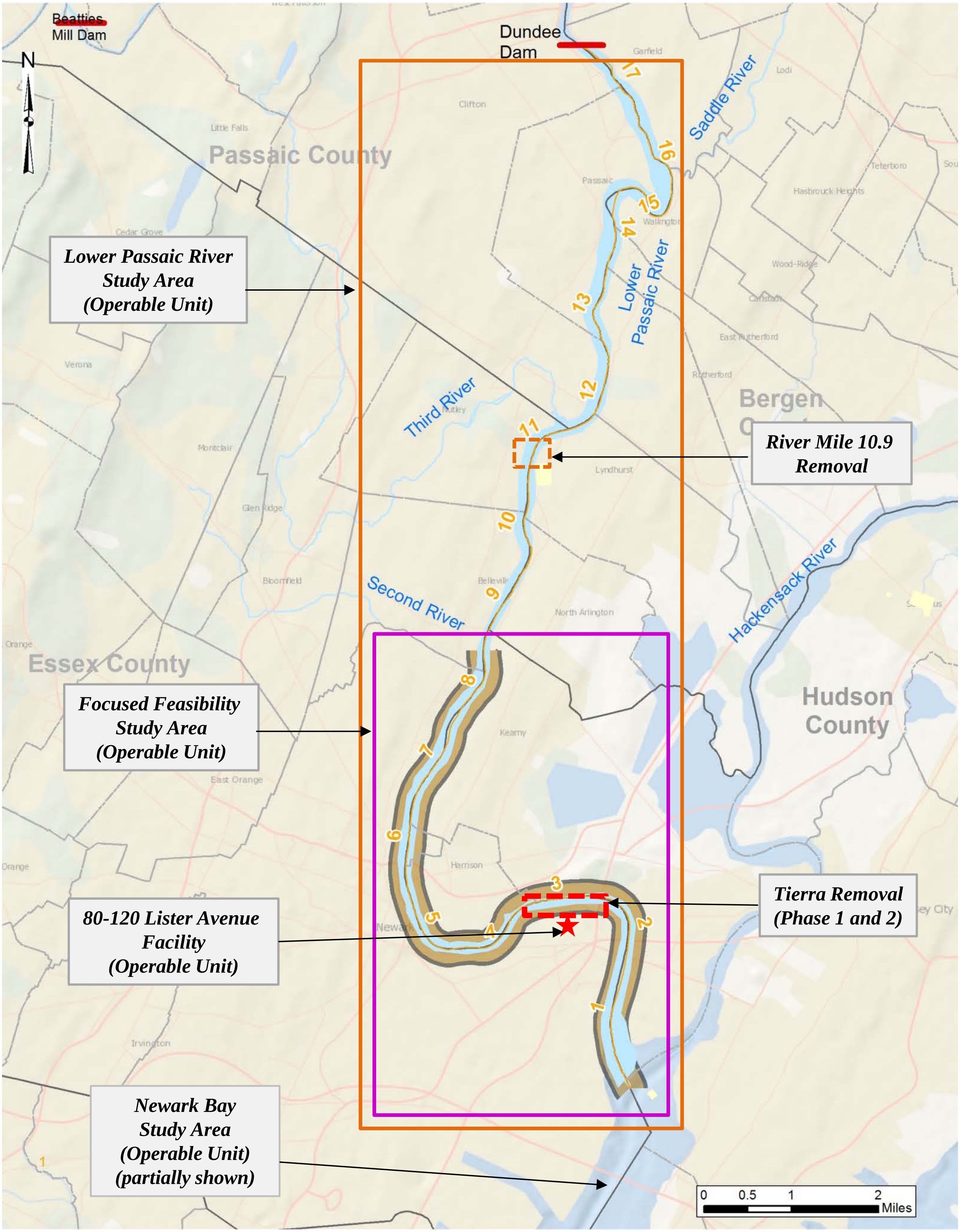
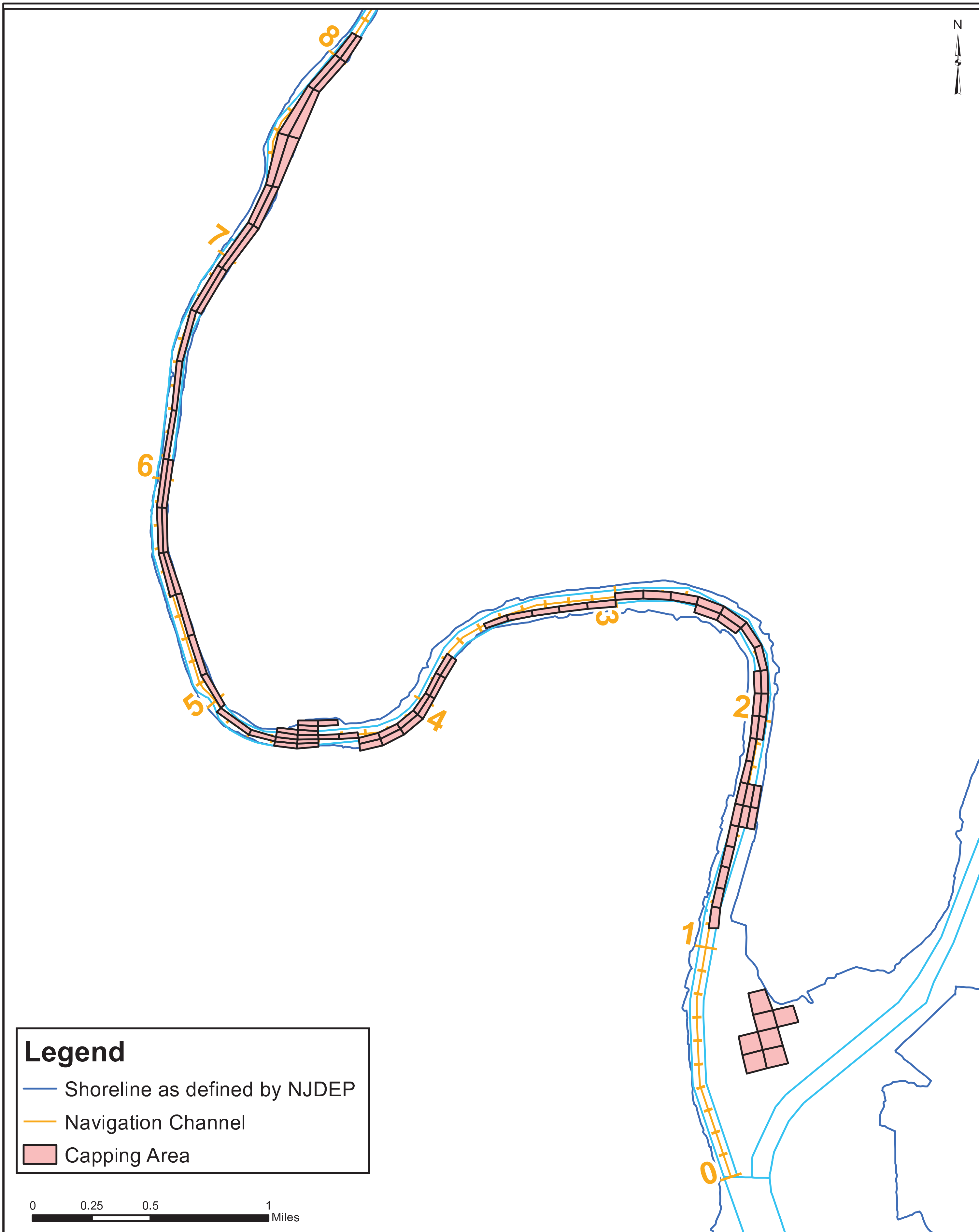


Figure 1 – Map of Diamond Alkali Superfund Site Operable Units and Removal Actions



Capping Area for Alternative 4

Lower Eight Miles of the Lower Passaic River

Figure 2

2014

ATTACHMENT B

PUBLIC NOTICES

Carter

CONTINUED FROM PAGE 1

executive director of a nonprofit, the Association in Defence of the Wrongly Convicted, for 12 years.

Most recently, Carter pursued a new trial for a Brooklyn man named David McCallum, and he penned an op-ed piece in the Feb. 21 Daily News that was typed "quite literally from my death bed."

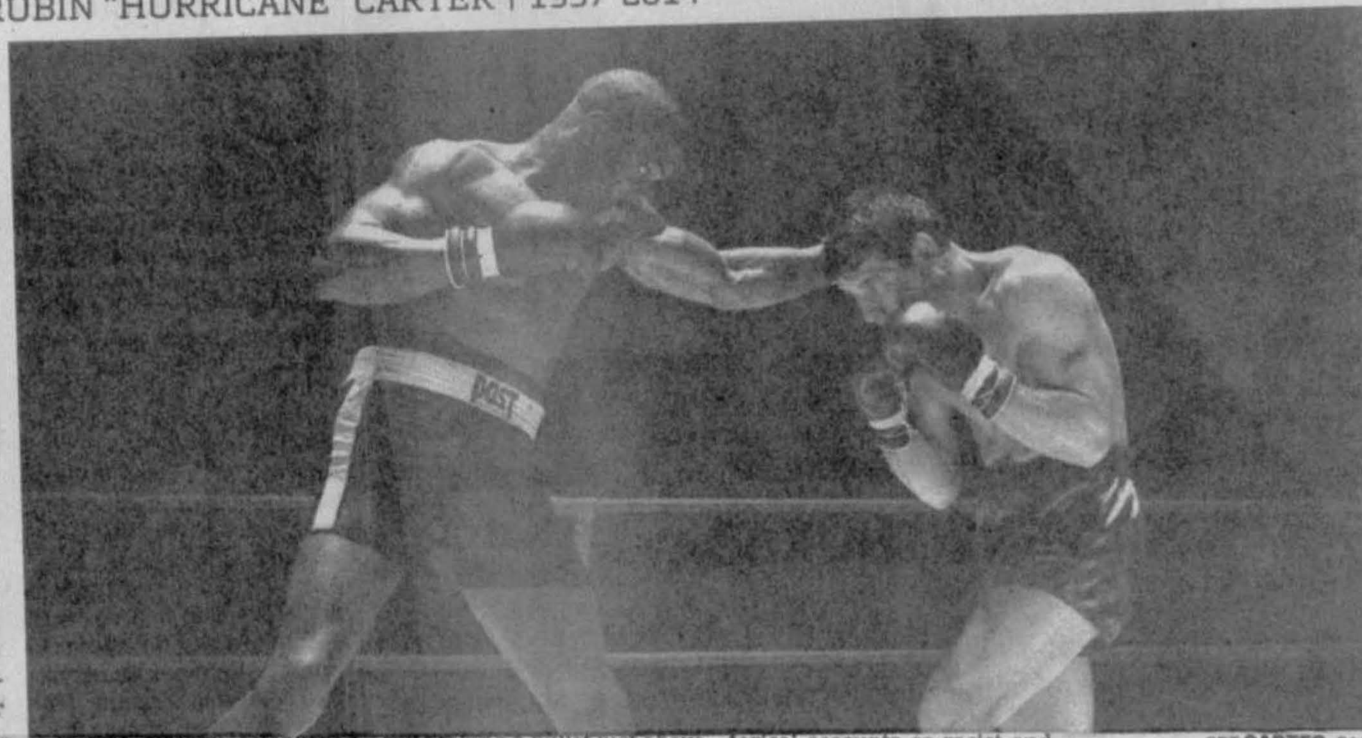
"My aim in helping this fine man is to pay it forward," he wrote, "to give the help that I received as a wrongly convicted man to another who needs such help now."

The pursuit echoed Carter's own battle from 1966 to 1985, when he was finally exonerated for a triple-murder in Paterson

1976 STAR-LEDGER FILE PHOTO

Rubin Carter at a news conference at Clinton Prison in 1976, the year he was freed before being convicted again.

Carter said was the "most despicable thing" he had ever



SEE CARTER, PAGE 6

NASA schedules another attempt to test Mars mission equipment

ASSOCIATED PRESS

LOS ANGELES — NASA hopes to try again to launch a "flying saucer" into Earth's atmosphere to test Mars mission technology after losing the chance because of bad weather, project managers said yesterday.

The space agency is working with the U.S. Navy on the Hawaiian island of Kauai to see if it can get the experimental flight off the ground in late June.

During the current two-week launch window, the team came "tantalizingly close," but winds spoiled every opportunity, said project manager Mark Adler of the NASA Jet Propulsion Laboratory. Winds must be calm for a helium balloon to carry the vehicle over the Pacific so it doesn't stray into no-fly zones.

NASA has invested $150 million in the project so far, and extending the launch window would come with some cost. If the flight doesn't happen this summer, it would be postponed until next year.

The mission is designed to test a new supersonic vehicle and giant parachute in Earth's stratosphere where conditions are similar to the red planet.

For decades, NASA relied on the same parachute design to slow spacecraft streaking through the thin Martian atmosphere. With plans to land heavier payloads, NASA needed to develop new drag devices and a stronger parachute.

Police advised not to disclose surveillance details

Agencies sweeping up cellphone data

By Jack Gillum and Eileen Sullivan
ASSOCIATED PRESS

WASHINGTON — The Obama administration has been quietly advising local police not to disclose details about surveillance technology they are using to sweep up basic cellphone data from entire neighborhoods, the Associated Press has learned.

Citing security reasons, the United States has intervened in routine state public records cases and criminal trials regarding use of the technology. This has resulted in police departments withholding materials or heavily censoring documents in rare instances when they disclose any about the purchase and use of such powerful surveillance equipment.

Federal involvement in local open records proceedings is unusual. It comes at a time when President Obama has said he welcomes a debate on government surveillance and called for more transparency about spying in the wake of disclosures about classified federal surveillance programs.

One well-known type of this surveillance equipment is known as a Stingray, an innovative way for law enforcement to track cellphones used by suspects and gather evidence. The equipment tricks cellphones into identifying some of their owners' account information, like a unique subscriber number, and transmitting data to police as if it were a phone company's tower.

That allows police to obtain cellphone information without having to ask for help from service providers, such as Verizon or AT&T, and can locate a phone without the user even making a call or sending a text message.

CONSTITUTIONAL RIGHTS

But without more details about how the technology works and under what circumstances it's used, it's unclear whether the technology might violate a person's constitutional rights or whether it's a good investment of taxpayer dollars.

Interviews, court records and public-records requests show the Obama administration is asking agencies to withhold common information about the equipment, such as how the technology is used and how to turn it on. That pushback has come in the form of FBI affidavits and consultation in local criminal cases.

"These extreme secrecy efforts are in relation to very controversial, local government surveillance practices using highly invasive technology," said Nathan Freed Wessler, a staff attorney with the American Civil Liberties Union, which has fought for the release of these types of records. "If public participation means anything, people should have the facts about what the government is doing to them."

Harris Corp., a key manufacturer of this equipment, built a secrecy element into its authorization agreement with the Federal Communications Commission in 2011. That authorization has an unusual requirement: that local law enforcement "coordinate with the FBI the acquisition and use of the equipment." Companies like Harris need FCC authorization in order to sell wireless equipment that could interfere with radio frequencies.

USE 'RESTRICTED'

A spokesman from Harris Corp. said the company will not discuss its products for the Defense Department and law enforcement agencies, although public filings showed government sales of communications systems such as the Stingray accounted for nearly one-third of its $5 billion in revenue.

"As a government contractor, our solutions are regulated and their use is restricted," spokesman Jim Burke said.

ACCESS DENIED

Local police agencies have been denying access to records about this surveillance equipment under state public records laws. Agencies in San Diego, Chicago and Oakland County, Mich., for instance, declined to tell the AP what devices they purchased, how much they cost and with whom they shared information. San Diego police released a heavily censored purchasing document.

Oakland officials said police-secrecy exemptions and attorney-client privilege keep their hands tied. It was unclear whether the Obama administration interfered in the AP requests.

"It's troubling to think the FBI can just trump the state's open records law," said Ginger McCall, director of the open government project at the Electronic Privacy Information Center. McCall suspects the surveillance would not pass constitutional muster.

Study: Teens are smoking less and texting while driving more

By Alex Wayne
BLOOMBERG NEWS

WASHINGTON — While smoking among American teens has fallen to a 22-year low, most adolescents admit to engaging in a new type of risky behavior: texting while driving.

About 60 percent of American high school seniors say they have texted behind the wheel, according to the U.S. Centers for Disease Control and Prevention's biennial survey of risky youth behaviors. Texting and driving can lead to car crashes, the No. 1 cause of deaths among adolescents, the Atlanta-based agency said in its report released yesterday.

In addition to risky behavior, the survey describes adolescent Americans threatened by depression and suicidal thoughts as well as rape, bullying and assaults. Less dangerous behavior is commonplace: 88 percent of children who ride bikes said they never or rarely wore a helmet, for example.

"Way too many young people still smoke and other areas such as texting while driving remain a challenge," said Thomas Frieden, the director of the CDC. "Our youth are our future. We need to invest in programs that help them make healthy choices so they live long, healthy lives."

Just 15.7 percent of high school students said they had smoked at least one cigarette in the 30 days before the survey. It's the lowest smoking rate recorded since 1991, when the CDC began surveying dangerous behavior by U.S. children, including drinking, smoking, sex and violence.

While tobacco use has declined, Frieden said health authorities are noticing a "sky-rocketing" popularity of new electronic cigarettes.

"We're very concerned about that," he said in a conference call with reporters. "We're particularly concerned about e-cigarettes reglamorizing traditional cigarettes."

Most e-cigarettes are tubular devices that produce an inhalable vapor to mimic smoking. They deliver nicotine while leaving out the tars, arsenic and other chemicals common in tobacco products. The Food and Drug Administration is considering regulations for the new products and has proposed a ban on the sale to minors.

About 70 percent of deaths among U.S. adolescents ages 10 to 24 result from four causes: car crashes, other accidents, murder or suicide.

25 de Abril foi há 40 anos

História simples de uma Revolução

Talvez seja importante mostrar este artigo aos mais jovens. Nós que passámos o 25 Abril sabemos o que se passou. Eles não.

Na madrugada do dia 25 de Abril de 1974 Lisboa assistiu a um movimento militar inusual.

Homens e veículos avançam, através da noite, pela capital do império e vão ocupando, sem resistência visível, vários alvos estratégicos, com o objectivo de derrubar o regime vigente.

Os militares golpistas, auto denominados Movimento das Forças Armadas – MFA – são comandados, secretamente, a partir do Quartel da Pontinha, em Lisboa, por Otelo Saraiva de Carvalho, um dos principais impulsionadores da acção.

A par das movimentações em Lisboa no 25 de Abril de 1974, também no Porto os militares tomam posições. São ocupados o Quartel-General da Região Militar do Porto, o Aeroporto de Pedras Rubras e as instalações da RTP na cidade invicta.

Aos homens da Escola Prática de Cavalaria de Santarém, comandados por Salgueiro Maia, coube o papel mais importante: a ocupação do Terreiro do Paço e dos ministérios ali instalados. A coluna de blindados vindos da cidade ribatejana chega a Lisboa ainda o dia não tinha despontado, ocupa posições frente ao Tejo e controla, sem problemas aquela importante zona da capital.

Mais tarde Salgueiro Maia desloca parte das suas tropas para o Quartel do Carmo onde está o chefe do governo, Marcelo Caetano, que acaba por se render no final do dia com apenas uma exigência: entregar as responsabilidades de governação ao General António Spínola, oficial que não pertencia ao MFA, para que "o poder não caía nas ruas". O Presidente do Conselho, que anos antes tinha sucedido a Salazar no poder, é transportado para a Madeira e daí enviado para o exílio no Brasil.

Ao longo do dia 25 de Abril de 1974, os revoltosos foram tomando outros objectivos militares e civis e, pese embora tenham existido algumas situações tensas entre as forças fiéis ao regime e as tropas que desencadearam o golpe, a verdade é que não houve notícia de qualquer confronto armado nas ruas de Lisboa.

O único derramamento de sangue teve lugar à porta das instalações da PIDE (Polícia de Investigação e Defesa do Estado) onde um grupo de cidadãos se manifestava contra os abusos daquela organização e alguns dos agentes que se encontravam no interior abriram fogo, atingindo mortalmente 4 populares. Podemos concluir que o 25 de Abril de 1974 foi um golpe relativamente pacifico.

ATTACHMENT C

TRANSCRIPTS FROM PUBLIC MEETINGS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II

- -x

PASSAIC RIVER SUPERFUND SITE

PUBLIC MEETING

- -x

Portuguese Sports Club
55 Prospect Street
Newark, New Jersey

May 7, 2014
7:00 p.m.

A P P E A R A N C E S:

WANDA AYALA

RAY BASSO

SARAH FLANAGAN

PAT HICK

SOPHIA KELLEY

DAVID KLUESNER

JENNIFER LaPOMA

CHUCK NACE

EUGENIA NARANJO

LISA PLEVIN

ELIAS RODRIGUEZ

ALICE YEH

(Prior to the start of the meeting, the audience was welcomed in English, Portuguese, and Spanish.)

MR. KLUESNER: Let's get started. Welcome, folks. We're going to start. If you could please have your seats, we'll get started with our formal presentation. Please have a seat.

Thank you for coming, thank you very much for coming. We are guests in your community. Again, if you missed my introduction, I'm David Kluesner. I'm with the U.S. Environmental Protection Agency. That's EPA.

(Applause)

MR. KLUESNER: Thank you.

Who's ready for the Passaic River to be cleaned up?

(Cheers and applause)

MR. KLUESNER: All right. This is what we're here for.

We are in the formal public comment period. We've been working with the community for years now trying to get to this point. We are finally here.

We're here to take your comments tonight. We are in a formal public comment period through July 21. We've recently extended the public comment period from June 20 to July 21, so you have an extra month to get your comments in.

So, thank you. That's the purpose of tonight's meeting. We're here to talk about the cleanup of the lower eight miles of the Passaic River. And by that we mean the stretch of river from Newark Bay 'til approximately the Belleville-Newark border. So, the lower eight miles of the Passaic River.

There are other cleanup projects that are -- that have occurred and other work underway. And Alice Yeh will explain that to you -- with the EPA -- here shortly.

But I just wanted to acknowledge a few folks in the audience. First, I just want to welcome and make sure everybody's comfortable. I'm nervous.

(Laughter)

MR. KLUESNER: When my mouth dries up, I'm nervous.

I know it's funny because we want you to feel at home making comments, but at the same time we have a stenographer, we have translation services in the booth, we have microphones, and we've asked you to sign in and take an index card if you have questions or comments so we have some order to this process. So, none of the above makes this comfortable for anybody.

But this is a requirement under law, that we have a transcription of tonight's proceedings, because the comments and questions from you, the public, you're the effected community, you're the community that lives here, is interested in or affected by this cleanup, so it's very important that we capture accurately your comments and your questions. So, we are preparing a transcript.

Linda Marino is with Fink & Carney. She's sitting up here on my right taking notes, and this is merely so we have a record of comments and questions.

And what we will do when we make the final cleanup plan selection months down the road, we will provide -- prepare a Responsiveness Summary. We will answer your questions in writing in the document that identifies the selected remedy.

So, right now, EPA has proposed a remedy. We have not selected it. So, we have a proposal and we're going to present that tonight.

So, you are very important to this process. We want to hear from you. If you do not want to make a comment publicly tonight, you can do so at a later date. We're having another meeting in Kearney and one in Belleville.

We also have comment cards in the back. So, feel free to write -- put your comments in writing and leave them here, and they will become a part of the official record just as if they're in the transcript.

Before I turn it over to Alice, I have a couple of housekeeping items, and I want to introduce a few folks.

We have the EPA team here. We have, in my opinion, after having worked for the agency 26 years, the best EPA team in the entire country working on this Passaic River cleanup process.

Elias Rodriguez -- raise your hand -- he's our press officer.

Chuck Nace works on ecological risk assessment.

Our chief of staff, Lisa Plevin for EPA.

Ray Basso, he's the overall project director for all the Passaic River cleanup projects and work.

Alice Yeh, your project manager for the lower eight-mile section.

Jennifer LaPoma, who's working on the seventeen-mile stretch of the river.

Sarah Flanagan, with regional counsel.

Pat Hick, with regional counsel.

Eugenia Naranjo, also with EPA and works on the technical aspects.

Okay. With the State of New Jersey, we have Tom Cozzi and Janine MacGregor.

And we work closely with the State and our other federal agencies to bring this about, and they are a very important part of the project as well.

Here tonight, some of our dignitaries. We have Councilwoman Crump.

(Applause)

MR. KLUESNER: Thank you for coming.

Earlier tonight, we had Councilman Amador here, and I believe he's coming back shortly if he's not here now. But he was here.

Tom Pietrykoski with Congressman Pascrell's office. Raise your hand, Tom. He's there in the back.

Zach McCue from Senator Booker's office is here.

So, I just wanted to acknowledge you and thank you for coming.

And if I missed anybody, we'll catch up shortly and I'll introduce after we break.

So, as far as the agenda for tonight's meeting, we have about a thirty-minute presentation. We will ask that you hold your comments and questions until after the end of the thirty-minute presentation. Alice Yeh, the project manager, will give that presentation.

We will then open it up for questions and answers using the index cards. Just sort of gives us control for the process. If you did not pick up an index card and have a question or comment, you can get one at break or Wanda Ayala or Sophia Kelley in the back can give you a card.

And I failed to mention those two very critical people as well. Sophia and Wanda are my right arm in the public involvement process. And since they're in the back doing sign-up, I forgot to mention them.

So, that's sort of the process. Questions and comments, we'll ask you to come to the mic. We will ask you to identify yourself -- but you don't have to -- that's for the stenographer purpose.

If you can, remember to turn off your cell phones so we have as few interruptions as possible. I would appreciate it.

There are restrooms in the vestibule area. We will be taking a ten-minute break at approximately 9 o'clock.

So, with that, I will turn it over to Alice Yeh, again, project manager with the Federal Environmental Protection Agency, to present our proposal.

Thank you, Alice.

MS. YEH: Thank you, David.

I'm going to try to leave this here, but you will wave at me if I wander too far and you can't hear me.

Okay?

Up?

I see some waves. Maybe I'll hold it up.

MR. KLUESNER: Do you want me to advance?

MS. YEH: No, I can do it.

So, I am here to give you an overview of the proposed cleanup plan for the lower eight miles of the lower Passaic River. So, let's dive right in.

When I say the "lower Passaic River", I mean the seventeen-mile portion of the Passaic River from the mouth at Newark Bay up to Dundee Dam in Garfield, New Jersey.

The lower Passaic River is connected to Newark Bay, which is connected to New York Harbor, and all of those waters are connected to the Atlantic Ocean to the south of this map.

The ocean drives the tides in this area. And, so, for the Passaic River, this means that the water moves back and forth twice a day.

The lower Passaic River project grew out of the Diamond Alkali Superfund site in Newark, New Jersey, marked in the red star on this map. This is a former manufacturer of Agent Orange with a byproduct of dioxin that was disposed of in the river.

But this area is highly industrialized, and, so, aside from dioxin, there are a large number of contaminants in the river. We have found PCBs, metals, pesticides, and so on. This is a long and complex river, so EPA is cleaning it up in stages.

There is a comprehensive study of the whole seventeen-mile lower Passaic River that is ongoing at this moment. As the data come in from that study, EPA is constantly looking for ways to accelerate the cleanup.

And, so, for example, in 2012, EPA oversaw the removal of 40,000 cubic yards of the most highly dioxin-contaminated sediments out of the river in an area near the former Diamond Alkali facility. That is marked in the dotted red box on this map. We call that the Tierra Removal.

Just last year, EPA oversaw another action to dredge and cap a highly contaminated mudflat on the east side of the river near Lyndhurst, New Jersey, and that is marked in the dotted yellow box up there. We call it the River Mile 10.9 Removal because of its location in the river.

And, so, now we turn our attention to the major source of contamination in this system, which is the lower eight miles.

During the seventeen-mile study, we found that the sediments of the lower eight miles are the major ongoing source of contamination in this river system. And, so, we decided to evaluate options for cleaning up that major source while the seventeen-mile study is ongoing. That evaluation produced a Proposed Plan, which is what we're talking about here tonight.

So, a little history of the lower Passaic River.

This river has had industries along its banks for well over a hundred years. And until the 1970s, the discharge of wastewater into the river was common practice. And, so, fast forward to today, EPA has identified over a hundred industrial facilities potentially responsible for sending contamination into the river.

Historically, the lower Passaic River had a navigation channel from Newark Bay upstream to about the Wallington area. A navigation channel is where the river is dredged deeper than its natural depth so that ships, commercial ships, can use the river.

The navigation channel was constructed by the Corps of Engineers in the late 1800s and it was maintained or dredged out until the 1950s for most of the river and until the 1980s in the two miles closest to Newark Bay.

When the Corps of Engineers stopped maintaining the channel in the 1950s, it filled back in with sediments. At that time, the industries in this area were operating at the peak -- were at the peak of their operation and discharging contaminants into the river. And, so, when the river filled in with sediments, it filled in with a large inventory of contaminated sediments.

So, the first question that's usually asked is: Why are you cleaning up the lower eight miles?

The bottom line is that this is a complicated system and you have to start somewhere, and EPA is starting where 85 to 90 percent of the contamination is located.

So, how do we know that?

The contaminants of concern here -- we're talking about the dioxins, the PCBs, the metals, the pesticides, and so on -- they tend to bind to fine-grained sediments. Those are fine particles at the bottom of the river.

So, where in the lower Passaic River are those fine-grained sediments located?

Starting at the mouth of the river near Newark Bay, this river gets shallower and narrower as you go upstream. And at River Mile 8.3, which is the Newark-Belleville border, there was a pronounced narrowing and a change in the sediment texture at the bottom of the river.

Below River Mile 8.3, the bottom of the river is dominated by fine-grained sediments, the fine particles, with pockets of coarser materials. We call those sands. And above River Mile 8.3, the bottom of the river is dominated by sand, the coarse stuff, with pockets of fine materials, usually outside by the channel. And our data show that 85 to 90 percent of the fine-grained sediments are located below River Mile 8.

And, so, for the lower Passaic River the majority of the contaminated -- the contamination is going to be located in the lower eight miles, which is what this Proposed Plan is about.

So, let me tell you a little bit more about the contamination; where it is, and how it's moving around.

The lower Passaic River is tidal. Saltwater comes in from Newark Bay, freshwater comes in from over Dundee Dam, and all of this water mixes together and moves back and forth with the tide twice a day.

This movement stirs up the bottom of the river, the contaminated sediments at the bottom of the river, and, so, the surface of the contaminated sediments gets stirred up by the tides going back and forth. And during a storm deeper, more contaminated sediments also get stirred up.

In the lower eight miles of the river -- that's from Newark Bay to about the Newark-Belleville line -- the river is pretty much equally highly contaminated bank to bank; the middle of the river is just as highly contaminated as the edges of the river in the lower eight miles.

We've taken samples in the river from 1995 to 2012, and the data show that contamination levels in this river have not declined, have not gone down, much in the past fifteen years. This is true for the surface sediments of the river and for the fish and shellfish tissue.

So, this means that the sediments and the fish and the crab in the river are highly contaminated and they're not recovering by themselves over time.

We have also sampled the major sources of contamination into the lower Passaic River; we've sampled in Newark Bay, we've sampled the water that's coming over Dundee Dam; we've sampled the three major tributaries into the river -- that's Saddle River, Third River, and Second River -- and we've sampled the pipes that go into the river called combined sewer overflows and stormwater outfalls.

And the data show that, in general, these sources into the river are not contributing much contamination to the river. It's the resuspension or the churning up of the bottom of the river that's the major source of ongoing contamination to this river system.

So, what does all this contamination mean to human health and the health of the critters that live along the river?

From the contamination levels in the sediments, in the fish, in the crab, EPA has calculated the risks to humans and wildlife that come into contact with the contamination.

For humans, the risk is primarily associated with eating the contaminated fish and shellfish.

The State of New Jersey does have signs posted along the river warning people not to eat the fish and shellfish. But people are still out there fishing and they eat their catch or they bring the fish home for their families to eat.

So, how this works is that contaminants in the top six inches of sediment at the bottom of the river are absorbed by benthic organism. Those are the worms that live in the mud. And the contaminated worms get eaten by the fish, and the fish also accumulate contaminants in their body, and then the contaminated fish are eaten by humans.

EPA has determined that the risks related to eating fish and shellfish from this river are significant, requiring action to reduce those risks.

EPA has also determined that the risks relating to fish and wildlife that come into contact with the contamination is significant, again, requiring action to reduce those risks.

So, what do we do?

How do we clean up all this contamination and reduce that risk?

EPA evaluated four cleanup options

listed here.

No. 1 is no action. EPA is required to evaluate no action as something to compare to the active options, which are listed here as Nos. 2, 3, and 4.

I'll get into more detail about those in the next slide, but for now, I will say that the active options, Nos. 2 through 4, all involve a great deal of dredging, removing sediments from the river. And, so, each of the active options include three possible disposal methods for that dredged sediment. And the disposal methods are also listed here. I'll get into those in a minute too.

So, what are the cleanup options?

Nos. 2 and 3 are bank-to-bank cleanup options.

No. 2 is called deep dredging with backfill. This option would remove all of the contaminated sediments from the lower eight miles of the river and backfill with two feet of sand to address the little bits of contamination that are inevitably left behind after dredging. The intent is to remove all of the contaminated sediments, and, so, there would be no maintenance of the sand backfill in the future.

Option No. 3 is capping with dredging for flooding and navigation. And this option would place an engineered cap over the lower eight miles of the river bank-to-bank.

But our studies show that if you just throw sand on the bottom of this river, you will make the flooding that already happens even worse. And, so, this option would first dredge about two feet of sediments in order for the cap to be able to be placed without making flooding worse.

And, also, in the two miles of the river closest to Newark Bay, there would be more dredging in the navigation channel to allow for commercial navigation to keep going in the future. And more about the navigation channel in a minute.

Cleanup Options 2 and 3 were bank-to-bank options. Cleanup Option No. 4 is more of a partial cleanup option.

No. 4 is called focused capping with dredging for flooding. This option would dredge and cap discrete areas of the river that send the most contamination into the water column. Those areas add up to about a third of the river bottom in the lower eight miles, or about 220 acres.

There would be no navigation channel dredging associated with this option.

So, what about that navigation channel?

As I said earlier in the presentation, the lower Passaic River has a federally-authorized navigation channel. And "federally-authorized" just means that Congress approved the depths of the navigation channel.

And that federally-authorized

channel is shown on the left panel here. The red area is thirty feet deep, the green area is twenty feet deep, and the light blue area is sixteen feet deep.

As I said before, the Corps of Engineers stopped maintaining the channel in the 1950s, so that channel filled in.

But Cleanup Option No. 2 would remove all the contaminated fine-grained sediments out of the lower eight miles, so, as a result, it would restore these depths to the river that are shown on the left.

Cleanup Option 3, there is a navigation channel proposed for the lower 2.2 miles of the river closest to Newark Bay. And River Mile 2.2 goes up to about just north of the Route 1&9 bridge.

The proposed depths included in the Cleanup Option 3 are shown on the right -- on the left here -- I'm sorry, on your right. The red section would be 30 feet, the yellow section 25 feet, and the green section would be 20 feet going up to River Mile 2.2.

These depths are based on a Corps of Engineers survey of companies that use the channel for commercial navigation. They told the Corps these are the depths that we could reasonably use now and into the future.

There would be no navigation channel maintained above River Mile 2.2.

Option 3 does include dredging above River Mile 2.2, if you remember, so that the cap can be installed without causing additional flooding. There is also a little bit of dredging proposed in some places to make sure that the depth is at least ten feet to accommodate future recreational uses that the municipalities identified in a survey the State of New Jersey did.

So, as I said before, the active cleanup options -- Nos. 2, 3, and 4 -- all include quite a bit of dredging. And, so, each of those options include three possible disposal methods.

Disposal Method A is confined or contained aquatic disposal, CAD, in Newark Bay. The bottom of Newark Bay consists of about sixty feet of clay that doesn't allow water to seep through. And, so, if you dig a hole in that clay, it forms a secure pit into which you can put dredged materials.

So, the way they work is we would dredge contaminated sediments out of the Passaic River, put it on a barge, and barge the material down to Newark Bay. The bottom of the barge would open up, and dredged materials would fall through the water column into the CAD cell. Once the CAD cell is full, there would be an engineered cap over the cell to close the CAD cell and restore the bottom of Newark Bay.

Disposal Method B is offsite disposal. Here again, we would dredge contaminated material out of the Passaic River, put it on a barge, but this time the barge would go to an on-land processing facility on the shores of the lower Passaic River or Newark Bay. The dredged materials would be pumped from the barge to the processing facility, where it would be squeezed as dry as possible, the water that's produced would be treated at a water treatment plant on the facility, and the sediments would be put on railcars and sent offsite to EPA-approved landfills and incinerators.

Disposal Method C is decontamination with beneficial use. Here again, contaminated sediments are dredged out of the Passaic River and barged to the on-land processing facility. There, the contaminated sediments would go through these decontamination technologies that basically separate the contamination from the sediment particles. The contamination would be disposed of in a landfill, and the clean -- the cleaner sediment particles could be beneficially reused to make cement or as landfill cover.

Depending on the decontamination technology, you might have to squeeze the sediments dry first before running them through the technology. And, so, that's why there's a dewatering plant shown here, and there would also be a water treatment plant on the upland processing facility.

So, just a quick summary of the cleanup options.

Cleanup option 1 is no action. There's no dredging and no cost associated with doing nothing.

Cleanup option 2 is deep dredging with backfill. That would dredge 9.7 million cubic yards of contaminated sediments out of the river. The dredging would take about eleven years, and depending on the disposal method that EPA chooses, would cost about 1.3 to 3.2 billion dollars.

Cleanup option 3 is capping with dredging for flooding and navigation, and that would dredge 4.3 million cubic yards of contaminated sediments out of the river over about five years, and, depending on the disposal method chosen, would cost 1 to 1.7 billion dollars.

And No. 4, the focused capping, would dredge point nine million cubic yards out of the river and cost point four to point six billion dollars.

I will say that that construction time includes time for dredging, capping, and disposing of the dredged materials. It does not include the time, for example, to design the details of the cleanup plan. The design would come before this time starts.

So, in the Superfund program, we evaluate the cleanup options using nine criteria, shown here. The first two are criteria that the options must meet in order for EPA to pick them.

The next five are tradeoffs, pros and cons that EPA has to balance before we come up with a preferred option. And then during the public comment period, which we are in now, we receive comments from the state and from the community.

So, we take the last two criteria into account after we consider the comments and before we make a final decision. So, in the Proposed Plan, you will see the evaluation laid out this way.

So, the proposed cleanup plan is capping with dredging for flooding and navigation with offsite disposal. For those of you who like numbers and letters, that's Cleanup Option No. 3 and Disposal Method B.

This plan would cap the lower eight miles of the river bank-to-bank. Before installing the cap, we would have to dredge some of the sediments to prevent the cap from causing additional flooding. And this plan would also dredge in the navigation channel, in the 2.2 miles closest to Newark Bay, to the various depths that I showed you before. And after that dredging, that area of the river would also be capped.

The dredged materials would be barged to the on-land processing facility, where it would be squeezed dry, put on railcars, and sent offsite to incinerators and landfills in the U.S. and in Canada.

A fish and crab consumption advisory would remain in place during the construction and for a period afterwards until cleanup goals are met. The contamination levels in this river are going to take some time to come back down after the cleanup action is done.

There would also have to be restrictions on dredging and anchoring in the lower eight miles to protect the cap.

Actually, let's go back and review why EPA is making this proposal.

The lower Passaic River and Newark Bay are large and complex watersheds. We need to clean it up in stages.

You'll recall from the beginning of the presentation, the purple box is the lower eight miles that we're talking about in this Proposed Plan. There is also a seventeen-mile study of the lower Passaic River. There is also a Newark

Bay study to the south of this map. Both of those studies are still ongoing.

Contamination in this lower eight miles is everywhere and the contaminants are highly toxic, requiring EPA to set stringent cleanup goals.

The tidal nature of this river means that water and contaminated sediments move back and forth. It's not always obvious where to start the cleanup, and, so, we are starting the cleanup where the majority of the contamination is located.

This Proposed Plan outlines a comprehensive bank-to-bank approach of cleaning up the sediments of the lower eight miles. This will reduce the risk to human health and the environment significantly. Even so, our studies show that we won't meet all of the human health and ecological cleanup goals for all of the contaminants.

However, this is a big first step. We expect that this action, along with cleanup decisions that we will make at the end of the seventeen-mile study and the Newark Bay study, all together will help us achieve the cleanup goals in the future.

So, just a few key questions that come up when we talk about this plan.

Why does the cleanup have to be bank-to-bank?

Why can't it be dredging and capping of little areas of the river?

As I've said before, many times, contamination is everywhere in the lower eight miles, bank-to-bank, at levels well above the cleanup goals. And, so, bank-to-bank cleanup is the only one that will reduce risks enough that there might be an opportunity in the future to relax those fish consumption advisories step-by-step.

Our study shows that the focused cleanup option, the No. 4, would not reduce risks low enough to allow that to happen.

Why don't you take out all of the contamination from the river?

The taking-it-all-out option is Option 2, deep dredging. Our analyses showed that taking it all out and capping some of it in the river, which is what we're proposing, are equally protective options, but the capping option that we're proposing has much less impact on the community and on the environment.

This is because the proposed cleanup option dredges much less volume and would only take five years to implement, while taking it all out would take eleven years. The dredging, some of you -- many of you probably know, dredging stirs up the bottom -- the contaminants at the bottom of the river, and the contaminants go into the water and then drop out shortly after.

The proposed option dredges just the top two feet of sediment and that's less contaminated than the deeper sediments. And, so, the temporary stirring up of the sediments would have less impact on the environment.

Finally, capping of the sediment in place is more easily implemented than taking it all out. Again, this proposed option dredges less volume, and, so, the logistics of transporting all that dredged sediment and disposing of all that dredged sediment is easier to handle.

The contained or confined aquatic disposal, or CAD, versus offsite disposal, there are pros and cons to each of these disposal methods.

The cap over the CAD cell in Newark Bay has to be maintained forever in the future to make sure that the contaminated sediments in the pit are isolated from Newark Bay.

Offsite -- the offsite disposal would not need additional future maintenance because the landfills that receive Passaic River sediments already have long-term maintenance plans in place for all of the other stuff that they get from elsewhere.

The CAD does not treat any of the

sediments. It's just a container or a pit.

Offsite disposal would incinerate up to ten percent of the dredged materials.

The CAD, though, has the least impact on the community, while offsite disposal would need an on-land processing facility, about thirty acres.

But the CAD does have the most impact on Newark Bay, while offsite disposal would have no impact on Newark Bay.

Both the CAD and the offsite disposal are technically implementable. That means that technically they can be done and have been done at other Superfund sites around the country. But here, the CAD in Newark Bay may not be administratively implementable.

As laid out in the Proposed Plan, the State of New Jersey has asserted ownership of the bottom of Newark Bay, and the State of New Jersey has said that they oppose the citing of a CAD cell in Newark Bay.

And then there's the cost. The cost of the proposed cleanup option with CAD cell disposal would cost a billion dollars. The cleanup plan with offsite disposal would cause $1.7 billion. That's a big difference.

So, EPA is particularly interested in comments during this public comment period about the pros and cons of CAD versus offsite disposal and, also, about which one EPA should include in the final decision.

Final question, I promise: Could the navigation channel be shallower?

The preferred cleanup option includes dredging in the lower 2.2 miles of the river closest to Newark Bay to the various depths that I showed you before. Those future use depths are based on a Corps of Engineers survey of commercial -- of companies that use the river commercially.

In the survey, users said that they often don't bring in fully loaded ships into the Passaic because they don't have enough water depth to bring in the ships. They say that sometimes they have to wait for high tide before they can use the Passaic River, and that's because high tide gives them as much water as possible to bring in their ships. Also, users are restricted from using larger ships in the future if their company should grow.

That's on the one hand.

On the other hand, though, dredging a channel adds a substantial amount of volume and cost to the proposed cleanup plan. And, so, again, EPA is interested in receiving comments during the public comment period on whether the navigation depths proposed in the cleanup plan could be shallower and still accommodate current and future use of the channel, because shallower means less dredging and a less costly cleanup.

Okay?

So, the Proposed Plan and

supporting information are all available on the website ourpassaic.org. And you should send comment to me at that e-mail address or write a letter to the hard copy address that's listed here. All of this information is on the fact sheets that you got when you walked in.

And I'm done.

MR. KLUESNER: Don't go too far.

(Applause)

MR. KLUESNER: So, this presentation will be posted online tomorrow morning, approximately 10 o'clock or so, so you can access it there. If you do not have access to internet, please work with one of my colleagues in the back and we can mail it to you or somehow provide you a copy.

Okay?

So, at this point, I just want to acknowledge Eliana Pintor Marin, who is also here. I don't know where the State Assemblywoman is, but she's here. Thank you for coming.

And before we start the Q&A --

well, actually, we're going to need to start using the index number cards. So, Nos. 1, 2, 3, if you can start getting into position.

In the meantime, Zach McCue would like -- he has requested to give a prepared statement from Senator Booker.

So, Zach?

Then we we'll turn it over and start the Q&A.

MR. McCUE: Thank you, David.

Unfortunately, Senator Booker's responsibilities in Washington prevented him from being here tonight, but I'm happy to read his statement on his behalf.

I write today in support of the Environmental Protection Agency's proposed cleanup plan for the lower eight miles of the Passaic River. Comprehensive removal of contaminants from the most polluted section of the Passaic has long been awaited and is widely accepted by the community as the preferred proposal.

As the largest Superfund cleanup ever proposed, the cleanup will move over 4.3 million cubic yards of toxic sediment. While offsite disposal of contaminants is more costly, I do believe it to be the most viable option when considering public health, environmental impact, and long-term benefits to the community.

Additionally, this cleanup will provide more than five hundred jobs, many of those jobs being filled by local residents.

As the Former Mayor of Newark, I have firsthand knowledge of the potential of the Passaic River. As communities in Newark, Harrison, Belleville, and Kearny continue to grow, it is our responsibility to ensure that the neighborhoods they inhabit are not contained by harmful toxins and chemicals.

The Passaic River is an invaluable resource, and I look forward to the day when fishing and crabbing advisories are lifted and the ecology of the river thrives.

Lastly, I would like to commend EPA Region 2 for their work in developing this plan. Incorporating input from the New Jersey Department of Environmental Protection, the Army Corps of Engineers, the National Oceanic and Atmospheric Administration, U.S. Fish and Wildlife Service, and key community stakeholders, the EPA finds sufficient cooperation to alleviate environmental and public health concerns surrounding the contamination in the lower eight.

I appreciate your time, and look forward to continued cooperation with EPA as we work to ensure the effective remediation of the Passaic River.

Thank you.

(Applause)

MR. KLUESNER: Thank you, Zach.

And before we start with Gentleman No. 1, I want to acknowledge two people that I believe would have been number one and two at the microphone; Sister

Carol Johnston and Ella Filippone, two Passaic River cleanup champions.

(Applause)

MR. KLUESNER: I just want to remember them tonight. I feel their presence. They're here.

So, with that, I want to start it off with the first commenter. If you need translation services, you can come up to the microphone and speak in Spanish or Portuguese, and it will be translated into English.

So, with that...

MR. HARRIS: My name is Donald Harris. I'm a small business owner and operator in the City of Newark, having contributed to the economy by producing over two thousand housing communities over the last thirty years.

I'm concerned about the plan because it appears to be disruptive.

The bridges on the river are quite old. And from what I know about the river and Newark itself, the bridges will not be able to tolerate the stress that's going to be put upon them by opening and closing.

Beyond that, I've seen nothing in your plan that will encourage or enhance the development or utilization of emerging and small businesses, as well as what are you going to do about taking the plan beyond Broad Street?

Often when things happen in Newark, such as this plan, it's always in the Ironbound. There is another segment of the community west of Broad Street, and I don't see anything that EPA is doing that embraces that community.

I'm here tonight representing a number of different churches that I'm working with and other community groups, and I dare say that EPA is derelict as it relates to that community.

(Applause)

MR. KLUESNER: I'll tell you -- either Ray or Alice, is there anything you'd like to address?

Certainly, all of these questions

we are going to take and are going to respond to them in writing. There were a lot of questions and comments in there.

So, we can go to No. 2 or if you want to address -- if you could say something about the community impact and what we typically do.

MR. BASSO: I actually don't remember the question.

MR. KLUESNER: In terms of community impact, there's a lot of questions -- the gentleman had a comment or question about how we're going to ensure not to disrupt the community, how we're going to minimize impact.

There were other questions about other areas, why are aren't we cleaning up other areas.

MR. BASSO: During the remedial design phase, which is before we actually implement the project, we will be working with the community and addressing these impacts that he mentioned he's concerned about.

In fact, we have experience with that in the Phase 1 Removal Action that Alice pointed to before. We had much involvement with the community and developed a community relations plan on all the construction aspects of the project to minimize those impacts.

MR. KLUESNER: Thank you, Ray.

No. 2?

MR. CHARBONE: My name is Tom Charbone.

I stand here tonight as one of the users of the river for whom the proposed cleanup has major impact. I and the other five hundred or so rowers who have been reclaiming the lower Passaic River for recreation/sport use in the past decade or so have something of an existential stake in the EPA's proposed operations.

I completely understand both the eco and moral necessity of removing the top of the contaminants and accumulated sediment. And, in principal I wholly support the EPA's effort to ameliorating the situation. But I have some great practical concerns.

As a member of the community and as a river user, I am apprehensive that the EPA's plans for remediation have given the recreational sport users comparatively scant attention. It goes without saying that we want a clean Passaic.

As a single skull rower, I can pretty much guarantee that over the last ten or twelve years, I have been in the river and in its mudflats more than anyone in the room. I've had all the firsthand experience of river pollution that I care to, thank you, and I don't want future generations to have to burn their socks after they go wading.

But at the same time, I suggest that EPA has an ethical and institutional responsibility to work with the high school, college, and community rowing programs on the river to ensure that the removal of toxins doesn't inadvertently destroy our activities in the process.

I urge the EPA and whoever it awards contracting to, to reach out to the rowing communities and river users in general, and to make every effort to the ensure that its effort to improve what is under and in the water also takes into account those of us on the water.

Thank you.

(Applause)

MR. BASSO: Thank you. We will do that. We have done that before at Mile 10.9, where we've done a removal action and there were rowers up there.

I can't promise you there will be no inconveniences as related to a project of this size, but we will work with you and do our best to minimize it.

MR. CHARBONE: And vice versa.

MR. BASSO: Thank you.

MR. KLUESNER: Thank you.

MR. DELLA FAVE: Joseph Della Fave defers to Assemblywoman Eliana Pintor Marin.

MR. KLUESNER: Absolutely.

ASSEMBLYWOMAN PINTOR MARIN: Hi. Good evening, everyone. I just wanted to say a few words.

I know that I'm here and Nadia from Senator Ruiz's office is here as well, so the 39th District is here represented. And, obviously, our message is to the EPA.

Obviously, we can work hands-on with you guys, just like we have done previously in the past with DEP. So, anything that EPA needs, anything that ICC needs, because we have a strong partnership in the community, and, obviously, our constituents, our offices are open. Any information that you guys need additionally for us to pass on to our constituents, please feel free.

And likewise, if we receive any manner of information from the EPA, we'll be sure to disseminate through our offices.

So, once again, anything that we can do for you on the state level, please feel free to contact us, and we're here to help. Obviously, this is a very important project, it's been long overdue, we've been discussing it for many years now. It's important not only to have a clean environment but, really, a clean, safe place that we can move forward and really extend and have different activities on our riverfront.

So, thank you for coming tonight.

(Applause)

MR. KLUESNER: Thank you, Senator.

MR. DELLA FAVE: Good evening. Joe Della Fave. I'm the Executive Director of Ironbound Community Corporation, and I will speak in support of the EPA's recommendation --

(Cheers and applause)

MR. DELLA FAVE: If I can first welcome you to the Ironbound Community, a multilingual community of 50,000 people enriched by its great cultural diversity if not by its wealth.

I'd like to also welcome you to the great City of Newark, where I was once born on a clean river.

(Applause)

MR. DELLA FAVE: Through the doors of the Ironbound Community Corporation pass a thousand people every day. And I come here to speak today not only on behalf of myself but literally on behalf of thousands of people.

You will hear in a few minutes a petition provided to you has been signed by two thousand people within the last week alone. Many of these people are poor, are not necessarily influential, but that does not mean that they do not deserve a clean river and healthy community.

(Cheers and applause)

MR. DELLA FAVE: We also want to provide for the record a sign-on letter from over thirty organizations from across the City of Newark, including Ironbound Community Corporation, New Community Corporation, La Casa de Don Pedro, and many others, as well as from across the State of New Jersey; American

Friends Service Committee, laborers' unions, SEIU unions, environmental organizations.

This is an unheralded coalition of faith-based, community-based, environmental organizations and labor unions that have come together for one common goal, and that's to see the cleanup of the river with the benefits it will derive as well for many, many thousands of people, including jobs.

(Applause)

MR. DELLA FAVE: Speaking and representing thousands of people, I do want to defy any of the polluting industries to say, in fact, that they speak on behalf of thousands of people and not simply their own treasury.

(Cheers and applause)

MR. DELLA FAVE: I am not here to talk about any of the technical issues or to ask any technical questions. The EPA has engaged in scientific studies for years. The science is in.

For us, this is a simple matter:

Our river was stolen from us years ago. It needs to be returned today. We support the EPA's plan to clean it up now and deliver to us a healthy community and environmental justice.

(Cheers and applause)

MR. DELLA FAVE: We know that nothing is perfect, and EPA's plan may have its questions, it may have things that are not necessarily perfect in it; however, it has the main elements of what we can support.

It's comprehensive bank-to-bank cleanup, not a partial cleanup. When I spill a can of soda, I pick up the whole thing, not just some of it.

(Cheers and applause)

MR. DELLA FAVE: It has offsite disposal, which is important to the people in this community and the City of Newark.

It also will provide thousands of jobs, and we want those jobs, obviously, delivered to Newark residents.

(Applause)

MR. DELLA FAVE: Let me just say as part of our coalition and as part of the many who support this, thank you to the Laborers' Union because we know that they deliver livable wages for jobs.

(Applause)

MR. DELLA FAVE: And, lastly, the fact that this will be paid by polluters and not by the taxpayers cannot be lost on us.

(Cheers and applause)

MR. DELLA FAVE: We lost our river many years ago because it was used as a private dumping ground. And, in effect, companies privatized the river for its own benefit and socialized the costs by dumping those on the rest of us.

It is time we reversed this. It is time to privatize the cost to be paid by polluters --

(Applause)

MR. DELLA FAVE: -- and to socialize the benefits by returning to us a healthy river, a healthy ecosystem, environmental justice that everyone deserves here in Newark.

We support this plan. Thank you. Welcome to our community once again.

(Cheers and applause)

MR. KLUESNER: Number four.

We're doing all right? Everybody good?

REVEREND STONE: I wonder if I can just say: Ditto.

(Laughter)

REVEREND STONE: I want to thank you for this opportunity. My name is Reverend Kathleen Stone, and I work with the Office of Economic and Environmental Justice, with United Methodist Women, and I'm also a resident of Bloomfield, which is home of the Second and Third Rivers, I believe. So, I come here with a multiplicity of hats.

The United Methodist Church in its highest legislative body has resolved to advocate the government's aggressively assessing the extent of possible toxic and hazardous waste disposal problems and require that the entity or entities responsible for the problem pay for hazardous waste cleanup and for the health damages caused by the improper or inadequate disposal of such substances.

That's our official position. So, I'm thankful for EPA's consistent work at getting the study together and proposing as much as they propose.

I think Newark residents have had enough of being in the sacrifice zones of industries who pollute within their bounds, and they've waited for many, many years for this cleanup to begin. They deserve a full and complete cleanup of the Passaic River by those who have polluted it.

I really, really don't like the idea at all of capping the -- we, as United Methodist Women, don't like the idea of capping in Newark Bay at all.

In addition, it's important that the local economy of Newark benefit from the cleanup and the residents that suffered the environmental effects of the industry within their bounds deserve that their workers are hired and receive decent pay. It's not just about a job, it's decent pay and living wages alongside other benefits.

As our group of record sheet states: Corporations are responsible not only to their stockholders but also to other stakeholders; their workers, suppliers, vendors, customers, the communities in which they do business, and for the earth which supports them.

We hope that this will become a reality and we're here to see it happen.

Thank you.

(Cheers and applause)

MR. KLUESNER: No. 5?

UNIDENTIFIED SPEAKER: Good evening, everybody. We have a message -- you're going to have to bear with us. We have a message from the young people of the Ironbound section of Newark, New Jersey.

(Cheers and applause)

UNIDENTIFIED CHILD: We are the Environmental Justice League from

Carroll Street Community Garden.

(Cheers and applause)

UNIDENTIFIED CHILD: We want a full cleanup of our river.

(Cheers and applause)

UNIDENTIFIED CHILD: We want to swim in the Passaic River.

(Cheers and applause)

UNIDENTIFIED CHILD: This petition has over 20,000 signatures that are from people who agree with us.

(Whereupon, the petition was presented to EPA.)

(Cheers and applause)

UNIDENTIFIED SPEAKER: So, on behalf of the Carroll Street community, I just want to re-emphasize we believe in a full cleanup, the river's been stolen, we're taking it back.

Thank you, EPA. And let the polluters pay for that stuff.

(Cheers and applause)

MR. KLUESNER: Thank you.

MR. WALSH: My name is Jim Walsh. I'm Mid-Atlantic Director of Food &

Water Watch.

When I think about Newark and many low income communities across the country, we think about lack of access to healthy foods. And people in Newark in many instances don't have access to good food. And when they turn to their local sources, like the riverways, they find contamination there that continues to make them sick and they're forced back to convenience stores that sell garbage, actually, that's been highly processed.

We need to do more to bring local food options to these Newarkers. By taking steps to clean up the Passaic River, we can help take steps to help people producing their food locally and getting off the industrialized food system that's causing many of the health problems that we're seeing here today in our community.

Also, when I think about the cleanup of the Passaic River, I think about my three year old and the lessons

I'm teaching her right now about cleaning up her room. And she tries to say: Well, maybe if I just clean up part of my room, it will be okay.

Maybe the people who polluted the Passaic River who are pushing for a partial cleanup never had their parents teach them that they need to clean up their entire room.

(Applause)

MR. WALSH: And these proposals that are being put forward to put together a fish farm in order to trade fish to the people of Newark --

(Laughter)

MR. WALSH: -- for a fish they catch out of the river, it's like my daughter telling me: Well, if I eat a good dinner, then can I not clean up my room?

Which is also ridiculous.

We have a dynamic here where the people who caused the damage need to be held responsible for it. So, she doesn't ask her cousins to come up and clean after her mess, she does it herself, and she takes responsibility for that.

I thank the EPA for putting together a strong proposal. I ask you to hold the polluters accountable for what they did to clean up the Passaic River, to make sure this river is brought back to the standards the Clean Water Act brought forward for us; that all the rivers in our country are swimmable and fishable for all to enjoy, not just for polluters to dump and destroy our communities.

Thank you.

(Applause)

MR. KLUESNER: Thank you.

MS. MELLON: My name is Cynthia Mellon. I'm a resident -- thank you.

Anyway, I'm a resident of the Ironbound. I am the environmental justice organizer for the Ironbound Community Corporation.

(Cheers and applause)

MS. MELLON: I can't thank all of

you enough for coming out to support us, people who live here and the people who have come quite a distance to be with us.

I support the EPA's cleanup proposal for a full river cleanup. That's what we need. That will bring jobs to our community, it will bring clarity to our community.

The river is already looking better. I've been looking at that river when it looked sick and it looked tired and you didn't even like to look at it, and already you can see the difference just from the beginning of the cleanup.

So, I'm with the kids: We want to swim there.

Thank you.

(Applause)

MR. KLUESNER: No. 8, 9, and 10, if you could line up, please.

MR. SCALERA: My name is Ciro Scalera. I'm Director of Government Relations for the New Jersey Laborers' Union, and it's a pleasure to be here tonight.

The first thing I'd like to do is to acknowledge many of our members, here in orange, that are with us tonight.

(Applause)

MR. SCALERA: And I really came here tonight to say two things:

First, we have about 20,000 members statewide in New Jersey, but if you look at the Ironbound community in Newark, we have over a thousand of our members that live in the Ironbound community. And if you look along the shores of the river going north, in Kearny, Harrison, and the communities, we probably have thousands of other members who live in those communities as well.

And for them, this is an important health and safety initiative, and it's for that reason we are strongly supporting it.

Specifically, of the four options presented, we are supporting EPA's Alternative 3, capping with dredging for flooding and navigation, with Plan B for the dredged material.

We support this plan, in part, for what it will do for the river in the coming decades, but, also, because long term it will spur economic development, growth, and jobs along the riverbanks and in the communities that border the river, and it is this long-term view that our union takes, looking ahead ten, fifteen, twenty years, to what the power of a clean river will do for our state.

So, for those reasons, we support this proposal and wish you Godspeed in getting it implemented.

Thank you.

(Applause)

MS. CANTY-BARNES: My name is Esther Canty-Barnes. I'm here in a dual role tonight.

I am the director of Education and Health Law Clinic at Rutgers Law School in Newark, where we represent families and children with disabilities and advocate on their behalf.

I am also here in my capacity as president of the Gateway North District of United Methodist Women, where 260 churches are represented, and included in that is the churches -- including churches from the Newark area as well as the Belleville and Bloomfield area as well.

We stand firm with the EPA and its recommendation on April 11, 2014 that compels the environmental polluters to clean up the Passaic River.

We can ill afford the impact of anything less than a full cleanup and getting that stuff out of here. We don't believe in capping anything, we need it out of here. Our children deserve more.

The Newark community has had to withstand the atrocities of these companies for far too many years while facing environmental devastation and dilution in a community in the process.

Anything less than full cleanup would have a continuing and downward spiraling effect upon men, women, and children who cannot afford to move outside of these areas. I speak especially on behalf of women and children and their families who live in poverty and cannot afford to move from these effected areas.

I speak on behalf of all of those disabled children who may have already been adversely effected and whose diagnoses have not been identified.

I speak on behalf of those children whose families have historically lived in these areas and have been effected.

These are the children, past and present, who have seen an overburdened school system.

We are concerned that these contaminants can be especially harmful to women and children -- women of childbearing age and may affect unborn and newborn children who are at risk of developmental and neurological problems if exposed to these chemicals.

The effects of that contamination is already well documented. These are powerful carcinogens affecting the mental, physical, and reproductive health in those who come in contact with it. The impact will not be known until children reach school age.

Many of Newark's poorest already live in poverty and are impacted from almost every direction; lack of lead-free housing and asbestos-free schools, as well as clean air. This is yet another blow to the health, welfare, and quality of life of the families and children who live in these effected areas. We do not know the degree of future impact of these devastations if it is not remedied, but we do know the impact if it is.

We ask that the EPA's proposal be approved. Newark, its women, and especially its children, deserve a better quality of life. The EPA is standing firm in its position and it can make this happen.

Thank you.

(Applause)

MR. KLUESNER: Thank you.

No. 10, I believe.

11, 12, and 13 can get in line and ready.

SISTER HUMPHREYS: My name is Sister Deborah Humphreys. I'm a former Newark resident and a very proud former ICC staff member.

(Cheers and applause)

SISTER HUMPHREYS: I come to you as a member of the leadership team of the Sisters of Charity of Saint Elizabeth, who in 1859 came to serve the children of Newark, the orphans, the families, within the view of the Passaic River.

Clean water was a precious commodity for the brewery where the families worked; for the canals that were built; for the health and welfare and entertainment of all the citizens.

Without clean water, how many more Civil War soldiers who were cared for by our Sisters would have died if they didn't have uncontaminated water?

I never knew the river at such times. When I came in 1972, the Ironbound was already fighting environmental battles on many fronts; from heavy truck traffic and garbage incinerators and the shameless poisoning of the river with dioxin and other chemicals. In addition, Riverbank Park had to be reclaimed, and the community did and it serves as a wonderful monument.

What we have learned from these encounters is that community input, resident participation, and oversight is the key. Community benefit has each of our names on it. The Waterfront Park is testimony to the model of community planning.

I will not speak about science, but I will speak about the process. And with the process, the program will be successful.

Our congregation has long been

involved in support of these efforts to restore the neighborhood. For nearly ten years, Sister Carol Johnston, Director of Special Projects at ICC --

(Cheers and applause)

SISTER HUMPHREYS: She had the goal of cleaning the river with her colleagues at EPA and anywhere she could find them. Even in the last months before she died, she attended meetings, promoted an agenda that would reclaim for us in Newark the river and the waterfront.

The EPA's preferred cleanup method is one which will reduce the toxicity of the river, the detrimental environmental effects, and the risk to our health in the community.

Have the companies that did this pay. Restorative justice rules. Choose this and we choose life.

(Cheers and applause)

MR. KLUESNER: Okay. I have a note from our Police Department there's a white Ford F-150 that is blocking the side. You must move it now.

F-150, that's a truck?

So, a white Ford F-150 is blocking the side. It sounds like it will be towed unless it's moved.

Thank you.

FATHER MORAN: My name is Father Terrence Moran. I'm a Catholic priest and work with the director of the Office of Peace, Justice, and Ecological Integrity of the Sisters of Charity.

So, Sister Deborah is my boss.

(Laughter and applause)

FATHER MORAN: But I'm here of own free will.

(Laughter)

FATHER MORAN: There was a statement -- a vision of Alexander Hamilton in 1778 at the Great Falls of Paterson where he saw the virtual potential commercial value of the Passaic River. And ever since, the Passaic River has been a great source of prosperity for Northern New Jersey.

We, too, are here today because we

have a vision, and perhaps it's a vision that's truer and deeper than Alexander Hamilton's.

He had the limitations of anybody in the 18th Century that saw a river merely as a commodity for human benefit and didn't see that bodies of water have their own value and their own integrity apart from their financial gain for human beings.

Some have called the Passaic River the biggest crime scene in New Jersey. For me, as a person of faith, I'd say the Passaic River is one of the largest sites of sin in the State of New Jersey.

(Applause)

FATHER MORAN: Our bodies of water are miracles. They're sacred. And the Passaic River has been shamelessly profaned by chemical dumping.

We have heard for years the plans for the great potential for renewal of the City of Newark, and it's an illusion to think that there can be a prospering city on the banks of a polluted river;

it's an illusion to think that human beings can flourish without the flourishing of the air, the water, and the land with which we are in a relationship.

So, the proposed cleanup of the EPA is something that I, as a person of faith, strongly support. It's costly, it's ambitious, and it requires significant political will. But it's a vision that is even more inspiring than the one of Alexander Hamilton.

There is a significant cost to doing nothing; it's a tremendous cost to our souls.

So, what will be the cost to our souls and the future of our children if we refuse to act decisively now?

(Applause)

MR. KLUESNER: Thank you, sir.

MR. NARDONE: My name is Joseph Nardone. I've been a member of the EPA's Citizens Advisory Group since 2009. Of course I'm here, and Dave and the other people who know me know that I support this cleanup.

I don't want to repeat what was already said, but I just want to hope that maybe I can make it a little more interesting by giving a history.

One of the things that happened is I walked into the room and Michael Gordon was there. He's a lawyer. When this happened back in 1984, Mike was the lawyer that represented people that worked for Diamond Alkali.

They were given picks, shovels, whatever, to go out to the middle of the Passaic at low tide and break up the mounds of dioxin that were formed in the river from the dumping into the river. This is the pollution we're dealing with.

At that time, the EPA came into that area of Newark in white suits with masks, white protective suits, helmets, and literally vacuumed the sidewalks.

If you go there today, young people see this capped area. But when I went there many years ago, before you, Dave and Alice and Ray, and the other EPA members came around, there was a stack of semi-trucks, 936, stacked four high over 50 feet high. We walked on the top of them, which had all the pollution that was picked up by this -- that was put into the area in the river, the dioxin, the vacuumed-scraped sidewalks and backyards in there.

We could not find a place to take that when this was cleaned up. Those trucks were shredded, cleaned, and buried, entombed on that site which had bulkhead built in, and is going to be a monument there forever in the Ironbound in the State of New Jersey, the City of Newark, because we can't get rid of that stuff because we don't know where to put it.

Now, this is what we're dealing with when we're talking about cleaning up the Passaic. This is the historical history of the pollution that has occurred in our area.

So, I want to thank Mike Gordon

over there who fought pro bono -- a lawyer doing pro bono work -- to protect the residents and to protect the workers who suffered from the pollution in the Passaic River.

Clean up the Passaic. EPA all the way.

(Cheers and applause)

MR. KLUESNER: No. 13.

Let me just ask the Police Department in the back, is there any progress on moving that F-150?

Do we still have an issue? Or not?

We're good?

Thank you.

We are going to take a break at 9 o'clock, then we are going to be here for as long as there are comments or questions. So, we are going to give our translators and stenographer a little bit of a break.

MS. DURCAN: My name is Maria Durcan. I am a resident of the Ironbound and I also work in the

Ironbound.

My family came over from Spain, so we are immigrants, we were immigrants. We were raised on Market Street, if anybody knows the area. Jackson Street Bridge was right across the street from us. I remember when I was younger, remember the bridge opening up and letting the boats, the ships, go by, and it was doing that for a while.

After a while, the ships and the boats stopped. The river was not being utilized. As children, we were told if you went in there, you would come out with two heads.

(Laughter)

MS. DURCAN: Or if you fished, that the fish would have two or three heads. That's how bad it was.

And I understand the problem, but I don't understand why it's taking so long. You know who the polluters are. The polluters should be here listening to the people that have to survive in this area.

I'm proud to be in the Ironbound. I know there's a saying: If you need to get rid of it, dump it in Newark.

And we will not be used as a dumping ground for anyone else. Those companies --

(Cheers and applause)

MS. DURCAN: I had the opportunity to take a ride on a pontoon. Newark was giving rides to the residents to go up the river from the watershed, I believe, all the way up to Belleville. And it was a beautiful sight.

But what you saw on both sides were not pretty homes. You saw factories. You saw nice factories, you saw factories that had been abandoned and structures that are still there.

The ride, we were told at that time that the river was coming back, that there were fish coming back to the river. This was a few years ago.

I don't know what happened. I don't know, the pollution came back, the polluters were not fined or taken to court.

So, I don't understand that after this many years why this EPA is back here again doing another study, which is one study after another. For me, I've heard many studies from the EPA.

Are we -- are you going to be our savior?

I don't have too many years to go. I don't think I'm going to be able to go to the river, but...

(Laughter)

MR. KLUESNER: I understand.

MS. DURCAN: Thank you.

(Cheers and applause)

MS. YEH: There have been a few studies of this river, and it has taken a long time.

I sound like a broken record, but this is a complicated watershed. Water is moving back and forth from Newark Bay, from the Dundee Dam. It's taken a long time to understand how things move and, thus, how the contamination moves, and, therefore, how to clean it up.

And these things, I'm afraid, do take a long time, but this is, hopefully, a good first step towards making a final decision and then designing the cleanup and then actually doing the cleanup.

MR. KLUESNER: Would you be No. 14?

Excellent. And then 15 and 16 can be lining up and getting ready.

Thank you.

MS. MILES: Hi. Good evening. My name is Melissa Miles, and I'm a resident of the Ironbound and I also work with the Ironbound Community Corporation.

Just listening to the last woman speak, I just remembered that recently, I was -- you know, last summer, I had some friends over from New York, and, you know, I was really proud to show them this amazing park we have on the riverfront now and to tell them about all the work that went into getting that park and that I know so many people who were actually instrumental in that.

And we were reading the plaques along the river that talk about the river and even the pollution. You know, they're honest. And then, you know, we saw the ducks. It was so amazing, the kids loved them.

And my friend's like: Yeah, but they're dioxin ducks.

And I couldn't really say anything to that.

(Laughter)

MS. MILES: So, you know, at the same time we have this amazing park, we're still seeing, you know, a lot of pollution just kind of floating by and, you know, we have to feel like: Is it really even safe to be out here?

(Applause)

MS. MILES: So, I'm really in favor of a full bank-to-bank cleanup. I'm really happy that you're all here. I hope that it actually happens now and that residents who have been here for a long time, born here, really get to see a clean river.

So, thank you and good luck. We're with you, we're here, and, you know -- yeah.

Thanks.

(Applause)

MR. KLUESNER: Thank you.

No. 15?

PASTOR MOACIR: I'm Pastor Moacir, St. Stephan's Grace Community --

(Cheers and applause)

PASTOR MOACIR: Before I came here, my hands still smell from gardening because I was just setting up the garden. And I have a story to tell which is this:

A couple years back, some tests were done in our backyard, which is the garden area and playground area. And what was found was lead and arsenic. Both of them, the Church didn't put there. I asked my other folks to see who, if anybody, put it there. No, it's not -- it's everywhere in our community.

But I did not have a choice. We

did not have a choice, the Church. We just spent $50,000 to clean a little tiny bit of land. And I need to say I'm really glad because I think it was the right thing to do, the only one responsible. We didn't have the money, we found a way, we shared it together, and we are resowing our garden.

We didn't put the pollution there. We weren't asked if we put the pollution or not. We needed to clean it and pay for it. There was no -- I tried seven different ways. There was no way around.

My question is: Why are these big companies that put the pollution here, that continue to put it in the air, in the water, on the ground, not taking the same responsibility as any of our other neighbors here?

(Applause)

PASTOR MOACIR: If anyone here has a problem with pollution in your backyard, if it's a tank, if it's whatever, I'm not saying -- that's wrong because you're responsible, but we have taken care of it. I mean, we need to clean up before we know it.

So, our kids have asthma, our land is all contaminated --

(Applause)

PASTOR MOACIR: -- so I really want to encourage all of you that are doing this to make sure that the plan goes forward and to make sure that those responsible pay for it because this community already paid a lot for their pollution.

Thank you.

(Applause)

MR. BASSO: I've had friends of mine who had things go wrong in their backyard with contamination, and the State comes in, and they have to pay for it. So, that was very accurate, what he just said.

But the responsible parties have an opportunity to pay for this cleanup. And we will engage them and talk to them about paying for this cleanup, and they still have a chance to do so. There are representatives here of the responsible parties tonight, and I'm sure they're hearing you loud and clear.

Thank you.

(Applause)

MR. KLUESNER: Thank you.

MR. RICH: Good evening. My name is Damon Rich. I'm the Planning Director of the City of Newark, and I'm happy to be here to support the EPA's plan to clean up the Passaic River.

Everyone here, I hope, heard from Mayor Quintana, who joined us for the press conference right before this, and he expressed it as directly as anyone could, which is: Newarkers have been waiting for thirty years to get the river back and the time to get working on it is right now.

Newarkers have conducted vigils, we've gone on walking tours, we've gone on boat tours. That was mentioned just a second ago. Newarkers have come together and founded an organization called Friends of the Riverfront Park.

And a bit contrary to some of the previous comments, I will say that this is not just an east-of-Broad-Street movement. We have had over two thousand Newark residents --

(Applause)

MR. RICH: -- take time out of their day, pay honest money to come and see this river. The demand is there. People want to be connected to their river.

Also, I will say as the planning director, if you look in the books of our city, of our formal plans, of our master plan adopted in 2012, of our numerous redevelopment and public access plans, you will see written as clear as day the desire of people in this city to get this river cleaned.

We look forward to the day when the river is no longer a barrier towards accessing our neighbors, our neighboring municipalities, our natural environment, but is a spiritual seed that brings us together so that people -- so that Sister Carol will be invoked to the young people of the city who come, and I hope we've all seen them discover this river in our new riverfront parks.

Please proceed with all possible haste to get this done. And I hope that you read the number of people in this room tonight, after a hard day at work, as evidence that the city, our local government, and the residents of Newark are ready to be partners in this process.

Thank you.

(Applause)

UNIDENTIFIED SPEAKER: I'm a resident down here 46 years, and I'm pretty sure there's people here that have been here longer.

I have been to a lot of these proposals throughout these 46 years. I would like an immediate question: When is this going to stop being a proposal, and when is it going to be a reality?

(Applause)

MR. KLUESNER: Let me answer that real quick.

So, we have a process where we're taking formal comments through July 20. We will probably receive a lot of comments and questions. We will have to review those, analyze them.

And, so, we project that in early 2015, we will have a decision on this. But stay tuned, we will inform. Just know that that's our projection.

Then we will go through the process, as Ray said, holding the polluters responsible. We will enter into negotiations with them or use other enforcement for environmental cleanup if they don't cooperate.

Then it will take a few years to actually design the process. So, we're looking at about, you know, several years because it takes -- a project of this magnitude will take several years to design. We have to do the technical work that Alice talked about in terms of: Where is the material going? How is it going to get there? How do we protect the community while we're doing it?

So, that will take a little bit of time.

UNIDENTIFIED SPEAKER: Okay. I understand that.

But it didn't take seven years when they built the stadium over there for them to clean the banks over there.

Did it?

(Applause)

UNIDENTIFIED SPEAKER: It took them as long as they had to build that to clean banks over there.

So, why did it take seven years for that and take seven years to -- because there was big corporate sponsors? What?

MR. KLUESNER: It's a very complex river system, and just the amount of science and engineering that goes into it. And, again, the key component here is doing it safely, to protect the communities, doing it the right way the first time.

UNIDENTIFIED SPEAKER: That was done the right way, I presume.

MR. KLUESNER: I can't speak to that particular project.

UNIDENTIFIED SPEAKER: I mean, didn't they have to go through government standards and everything else to get all that cleaned up?

I mean, if you're part of that, then this should be just as fast.

MR. KLUESNER: I'm just telling you, in trying to answer your question as honestly as I can, which is we have a design process, we have to select the plan, design it, and then the cleanup, and it takes several years.

UNIDENTIFIED SPEAKER: I reiterate, they had a design plan too, but it didn't take them that long.

Okay. Well, I just want to say one more thing.

MR. KLUESNER: Sure.

UNIDENTIFIED SPEAKER: As you can see there's a lot of clergy, community leaders, residents that's here. We're strong. I, personally, at twelve years old, pulled a man out of his car, saving him; I, personally, saved a little boy from two big bullies; I, personally, pulled a little girl out of a burning building. But as you can see, I can't personally do this.

But you can. And we hold you responsible to do this. And as you can see, we are strong. We are very strong. And I want to see --

(Cheers and applause)

UNIDENTIFIED SPEAKER: Don't let these jobs go to people that don't really live in this community. I want these jobs to go to people that, regardless of their educational background or their criminal background, get these jobs.

(Cheers and applause)

MR. KLUESNER: 18, 19, and 20, please come up.

Just to address your last point on the jobs, last time Ray and I were standing in this room, it was a jobs graduation ceremony.

EPA paid for a Superfund job training initiative, where we worked with the ICC to recruit folks in the community and put them to work in the cleanup involved in this. So, we hear you.

18, 19, 20.

MR. KAUFMANN: Good evening. My name is Paul Kauffman. I'm the Director of Advocacy for Green Faith. Green Faith is an interfaith faith-based environmental organization with headquarters in Highland Park, New Jersey.

I'm here to speak in full support of the EPA's proposal and its reveal this evening for bank-to-bank cleanup of the lower eight plus miles of the lower Passaic River. A number of reasons lead us to this position.

Water is a life-sustaining resource which has a significant place in the history, rituals, and symbolism of all the world's great religions. All religions acknowledge water as life-giving and life-preserving and speak for the maintenance of pure water as a sign of respect for the deity.

The history of toxic contamination of the Passaic River goes back many decades, and it's time for us to clean up the mess we have made. The effects of pollution of this river have fallen most severely on environmental justice communities, people of color, and people with little economic power.

Rivers have always been the veins and arteries of society, giving water for drinking and hygiene, facilitating travel and commerce between communities, providing opportunities for food gathering by hunters and fishers, and being location for sport and recreation. The sad demise of the Passaic River has destroyed many of these benefits, which ought to improve for all of our nation's rivers. We have the duty to restore it as best we can.

The plan that's proposed this evening by the EPA is a plan that will most closely accomplish the goal of returning the Passaic River to near normalcy in the long run and within a five-year period.

We urgently recommend the following: That the plan as proposed be adopted and implemented by the EPA; that those who polluted and now own the companies that formerly belonged to the polluters be responsible for paying for this cleanup; that the responsible parties commit to hiring local labor and businesses for the cleanup, thereby bringing economic benefit to the affected communities; that upon completion of the cleanup, the river be restored for fish and wildlife and, if feasible, for recreation.

Thank you for this opportunity.

(Applause)

MS. ESTAIREZ: Hi. My name is Reina Estairez.

And I got to work with a lot of

the Hurricane Sandy victims in the area, and a lot of the streets in the Ironbound got very badly flooded. And a lot of it was with the contaminated water that was in the river. A lot of families had to swim in the contaminated water and expose themselves to God knows what kind of health risk to save their pets, to save their families, to save their children.

I've had clients tell me that they don't know what's going to happen to them because they had to swim in this water when all of the sewage and everything was stirred up during the storm.

And I'm very shy. I had left, but I came back because I feel that as climate change makes things worse, there are more floods, more hurricanes, it's so very important that you clean up that river because it's just going to expose people in Newark -- people that I love very dearly, good people, blue collar people, poor people, people that study, people that want a better life -- to disease and cancer risk and things like that.

And I'm just asking to please clean the river, the entire river. Don't let people live like this anymore. It's been long enough.

(Cheers and applause)

MS. ESTAIREZ: People have been living with contamination just too long.

The house where my parents live -- it's an unrelated issue, but those two streets have TCE contamination. We just found out a study that was done recently, that there's TCE in another area of Newark. I don't know if it's all related or not. Maybe it's a big toxic soup.

But I'm just asking that please, please clean the Passaic River, all of it, so you can help families stay healthy.

Thank you.

(Applause)

UNIDENTIFIED CHILD: We need the

river to be clean because the animals under the water, they will die if the water is dirty.

So, they need to clean it up.

(Cheers and applause)

MR. KLUESNER: Thank you so much.

I think he has a future in public relations.

(Laughter)

MR. KLUESNER: I think we're at No. 21, 22.

MR. THOMAS: Good evening. Ray Thomas, Ironbound Neighborhood Council, resident.

I think we should -- well, the Passaic has been damaged; it's been damaged and our use has been stolen. The people who did the damage did not consider costs when they were taking their profits, they did not consider our future when they were taking our profits, and the cost of cleaning up should not be a consideration now. They should dig out of their pockets and put it back into the river.

In one way, they cannot give back all that they have stolen from us. The health of people who were here, the businesses that are not available now because we've lost things from the river; the boating, the fishing, the crabbing for those people that like to do that.

I know there are people right now who are subsisting on fish that they get from the river. It's not a good idea, it's a bad idea, but they're doing it in spite of the signs that are there. But they don't have the money to do otherwise and the fish are there.

They should be able to do this. They should be able to freely fish or crab, whatever they desire, to help themselves. But right now, it is dangerous. It is actually a threat to their lives.

We should have people that live and work in this area be involved in the cleanup and get paid for that, and, in some way, in a secure fashion, to give back to the community what has been stolen from us already. This is necessary.

But above all that, I want to stress we need a full cleanup, not capping with protective covering so that it's all right for right now. Anything less than full cleanup means that our future has been limited. It has already been damaged and stolen and limited.

Why further limit it by a cap as opposed to a full cleanup?

It doesn't just effect people who are within walking distance to the river, it effects the whole region -- this is away from the river would be effected by this. We need this, and this is what we demand.

Thank you.

(Applause)

MR. KLUESNER: No. 22.

JACOB: My name is Jacob. I work for Essex County 4-H.

I just want to say I work very closely with the youth of Newark, or

what I call the future generation of
Newark.
We're born in a time where -- we
weren't even born when these decisions
were made to start studying source
pollution of the Passaic. We inherited
this issue, but we're the ones that are
going to suffer through it.
And I ask please don't make this a
PR stunt and use the $1.7 billion to
actually benefit us.
Thank you.
(Applause)
MR. KLUESNER: Thank you.
MR. MACULA: My name is Vincent
Macula. I'm a Vietnam veteran.
I think most people understand
that during the course of the Vietnam
War, the Agent Orange site or Diamond
Alkali or Occidental Petroleum helped
create material that were sent to
Vietnam. And the faces of Vietnam
veterans, the faces of the Vietnamese
themselves, just consider what that
material did to their lives in terms of

that.

All of this is documented as far as many court cases, and some of the people probably here are very aware of that. Myself, I was aware of it because I experienced Agent Orange in the United States, in Fort McClellan, Alabama.

I stood guard next to a chemical weapons dump that was situated in an entombment shed in the ground at Fort McClellan. I experienced some extreme results from that.

Okay?

I was asked to go into a hospital, I was asked to get care for my -- what was obviously a very extreme reaction.

I'm asking you -- the only reason that condition went away is when I went home, when I was discharged from the U.S. Army. It probably saved my life.

Doesn't this -- these companies have a responsibility to turn the tide?

Doesn't the U.S. government, since they're partly responsible for proacting President Nixon and whoever approved these projects?

Today, doesn't President Obama, doesn't our governor here, deserve to be on record about what they feel for this site? For this site in Newark? For this thing?

I'm asking you, as well as everybody else, to keep onboard in terms of the complete cleanup. Because I believe it not only has to do with the Hudson, which is already well on its way to be cleaned up, I understand. We have so many other sites that need to be cleaned up. So, let's get this site cleaned up.

And let's use the war in Vietnam as one of the reasons why the U.S. government should underwrite this project itself, not the taxpayers, but underwrite the cleanup of the site along with the responsible parties.

Thanks. That's all I have to say.

(Applause)

MR. KLUESNER: At this point, we're going to take a break, take about a ten-minute break. So, roughly 9:10 we'll resume questions and answers.

Thank you.

(Recess taken)

MS. RAMIREZ: Hi, everyone. My name is Myra Ramirez. I'm a community resident, and I just want to say briefly that I fully support the EPA's plan to clean the Passaic River.

I'd also like to comment on something that was said earlier about giving the polluters an opportunity to clean up the river.

I disagree that we should give them an opportunity. In my opinion, they have to. It should be a requirement.

(Applause)

MS. RAMIREZ: If we double park outside, our cars get towed. So, they come in and they pollute our river, our community, and then they're given an opportunity?

I disagree. We have to hold them accountable and they have to clean the river, period.

So, I support EPA whole heartedly for the full cleanup. It's my birthday, so I'm proud to be here.

Thank you.

(Applause)

MR. KLUESNER: Ray, would you like to address the "opportunity" part?

MR. BASSO: The first step is to give them the opportunity.

MS. RAMIREZ: We've given them multiple opportunities.

MR. BASSO: If they do not take the opportunity to clean the river, we have other options whereby -- a bit more heavy-handed and we sort of force them to do it.

MR. PEREZ: I think it's time for that.

MR. BASSO: But people have due process, and part of the due process is to sit down with them and you ask them if they want to do the cleanup first before we go into the second and third stage.

MS. RAMIREZ: Can I say something in response?

They did not ask us for permission to dump in our backyard. They didn't ask us.

So, why should we ask them if we've already informed them, when we have it documented that they are guilty of polluting?

So, again it should be a requirement. It should not be something that we ask them to do but something that we demand that they do.

MR. BASSO: I've just described the process.

(Applause)

MR. PEREZ: How we doing tonight, everyone?

My name is Alan Perez. I'm a Brother of Sigma Lambda Beta International Fraternity, Incorporated. I'm also part of Rutgers Greek Life, as well as Rutgers student body.

It's amazing to me, you know, we come to certain universities, we fall in love with everything about it, including the scene, including what it is to be part of the Newark community, one of which is that river.

It's unfortunate that there have been so many pollutants and so many problems that are going on in the city, including that river.

So, on behalf of the student body, particularly Greek Life, I present this petition by the Rutgers student body, which there you have over a hundred names of students that I've actually talked to in less than an hour.

So, that's something that I hope carries a little bit of meaning; so you guys know that the Rutgers community, the student body of Rutgers, is behind you a hundred percent of the way.

But it's amazing, what you said about giving them the opportunity. I think it's been far enough. I think it's been what, fifty years of polluting of this river, and now they still want an opportunity?

It's been taken far enough, to the point where, you know, that hand needs to be dropped on them.

So, thank you.

(Applause)

MR. KLUESNER: Yes, sir.

MR. GOOD: My name is Mr. Bill Good, born and raised in Newark.

I was actually given an opportunity to act as a recruiter for the first phase of the cleanup of the Passaic River, and it was a very gratifying experience.

There were only fifteen jobs available, but within a two-week period of time I recruited over five hundred people. That's the kind of response that we got, a lot of potential training. There was an outpouring of support from the people that were recruited and their families.

As a matter of fact, Dave just mentioned this was the room that we had the graduation in. And it was a glorious time.

One of the things I'd just like to mention is that people are looking forward to this next phase of cleanup and economic empowerment and so forth, but I think we need to kind of learn from what we did the first time. And one of the things was that we need to look at long-term jobs.

Those jobs that -- those fifteen jobs, out of the fifteen people, only two people got permanent jobs. So, that means that people that worked and got involved only worked two or three months. They were happy to do it, but, at the same time, they were hoping, and their families were hoping, that there would be some long-term employment.

I would suggest, and I don't know how we go about this since you mentioned this is a free country and, you know, people have an opportunity to make decisions, but whatever the EPA can do to ensure that these contractors are held accountable, I think it's very important.

Rather than just saying, you know, we got fourteen jobs, fifteen jobs, I heard somebody say earlier that there's going to be hundreds of jobs. And if that happens, I think that the bulk of those jobs should come from local residents, and I think it's important that they have that opportunity to be involved.

Because one of the things that we look at, a lot of contractors that come to do this work are out-of-state, a couple of them are out of this country, they're not even from the United States. So, you know, it's questionable whether they have a vested interest in making sure that local people get these jobs.

And, finally, a lot of times things happen to preclude people from moving forward and doing other kinds of work that might require more skill or more training.

I think we should try and identify certain specialty licensing, maritime licensing, that would enable residents to work on these jobs, that would allow them to operate certain kinds of equipment and so forth.

One of the things we found out is once they got out there on the job site, there were certain things they couldn't do because they didn't have the licensing to do it. So, it's sort of built-in mechanism to preclude people from moving forward and getting these jobs. Instead of making $15 or $16 an hour, they could have been making $50. So, we need to look at those things.

And, again, I'd just like to thank the EPA for moving forward and making this happen. And I hope that we can do it in a bigger way the next go-round.

Thanks very much.

(Cheers and applause)

MR. KLUESNER: As I mentioned earlier, we were here for the Superfund job training initiative, and that's something I think is appropriate that EPA is involved with.

And on the Hudson, the cleanup of

the Hudson River, we worked closely with General Electric Company to hire locally as much as possible and use local suppliers and vendors and services. And that's something you can expect as well here, and we know it's important to the community.

At this point, we're just going to take the next -- the three of you, come on up.

MR. CURTIS: Good evening. My name is Drew Curtis. I am a Newark resident, and I support the EPA's plan for a full bank-to-bank cleanup of the Passaic River.

(Applause)

MR. CURTIS: Newarkers need jobs and they deserve a clean river. And the polluters must pay not only one hundred percent for the full cleanup, but they also must pay to restore our riverbanks, too, with new plant life, vegetation, et cetera.

Thank you.

(Applause)

UNIDENTIFIED SPEAKER: I'm lucky No. 29. Thank you all for sticking around.

MR. KLUESNER: Thank you for sticking around.

UNIDENTIFIED SPEAKER: First of all, I was born here. I lived here for over a decade and now I work here. I'm very happy to be here.

I'm also a mom of a three year old and a seven month old who enjoy the parks here. We enjoy the riverfront park. Actually, we love it. I bring my kids there all the time.

I am here to say that I support a bank-to-bank cleanup; not just a surface removal, not just a surface hot spot removal. I support offsite disposal, not local incineration. And I definitely support the local job creation and training.

Thank you.

(Applause)

MR. GOLDSTIEN: Good evening. My name is John Goldstien.

I live very close to the river. This time of year, I enjoy getting out, and I'm happy to be jogging outside and I like the amenities that the City's beginning to build along the riverfront.

But those amenities are just that; they're amenities. They don't really get to the core of problem, and those problems exist on so many levels.

I don't think I'll be around long enough to be able to fish in the river, although I would love to. I love fishing.

But I think that the bigger questions that impact on our people in our community are -- we've just touched the tip of the iceberg in talking about them tonight; the number of people that died from heart disease and asthma because of the ongoing pollution that's happening here in our community, the river just being, you know, a part of that toxic dump that's become the City of Newark.

The companies that are responsible

for it are responsible not only for the -- I mean, not only did they make billions of dollars off of the pollution that they've created, but they've also killed thousands of people.

As the veteran spoke -- and I was happy that he got up and spoke about it -- Agent Orange alone has killed tens of thousands of people and disabled scores of Vietnam veterans, not to speak of deforestation and the horrible impact it had on the country of Vietnam, but here in our own community we've had thousands of people die from the impact of this pollution.

So, one, I support the cleanup; two, I think the company should pay; three, I think they're getting off very easy; instead, maybe we should be trying them for crimes against humanity.

(Cheers and applause)

MR. KOCH: Hello. My name is Chris Koch. I live here in the Ironbound.

And, you know, there might be some

people out here that would say this cleanup process, by making the polluting properties pay for it is punishing the job creators. And that could be nowhere further from the truth.

The fact is these companies cheated in the economy by making this neighborhood pay for their pollution. By doing that, they were able to outcompete honest business. That's not how the economy is supposed to work.

So, for the sake of the community, for the sake of the environment, and for the sake of the proper functioning of the economy, we need to make cheaters pay; make them pay for the entire cleanup from bank to bank.

MR. KLUESNER: Thank you.

MR. DVORAK: My name is Scott Dvorak, and I'm the Newark Parks for People program director.

About six years ago, we began partnering with the City of Newark, Essex County, Ironbound Community Corporation, residents from across the

City of Newark, in designing -- envisioning and designing and building the parks that you see along the Passaic Riverfront.

They are huge success and of global prominence long overdue and it's bringing Newarkers back to the water. And now it's time to clean up the water so we have these great resources going up and these complementary...

I'd like to just say that we support this extraordinary plan that addresses this extraordinary contamination for an extraordinary river with a tremendous amount of opportunity for economic, recreational, cultural, and environmental regeneration and, so, it's time to get started.

(Applause)

MR. KLUESNER: Ana?

MS. BAPTISTA: I might be the last one. I was No. 40.

All right. Technically, I'm here -- I'm Ana Baptista, representing New Jersey Environmental Justice

Alliance, a statewide alliance of organizations, individuals, groups throughout the state that work on environmental justice and work for the benefit of many communities of color and low income communities throughout the state.

And as a member and as a board member of that organization, we both full-heartedly support the EPA's plan to clean up this river. We'd like to see it happen quickly, we'd like to see the polluters pay for this cleanup, and we'd like to see the benefit go to the communities that have been most harmed for so many decades by the pollution and by the stigma of having a polluted river in our backyard.

I grew up two blocks from the Passaic River. As a child, I remember the EPA coming in vacuuming the streets and getting declared a disaster zone. And that stays with you for a lifetime.

To see this moment where we have an opportunity, a window, into the possibility of a clean river for the first time in generations, it gives many people hope.

And I'm going to invoke Carol to end this evening because before she passed away, there were many nights going to CAG meetings and listening to studies -- and she loved listening to Alice's presentations and Ray's presentations about the cleanup of this river, but at the end of the day, she reminded me, she said, "It might not happen in my lifetime, but you better make sure it happens in yours."

So, my message is no more delays. No more studies. Let's get this done. No more gimmicks. This idea that we can hot spot clean it or we can put it off for a couple more years, we can just study the problem, the river will take care of itself, enough. Enough of all of this.

It's time that we do the right thing and clean this river up quickly so that we don't lose another generation.

All right?

Thank you.

MR. KLUESNER: Thank you.

(Applause)

MR. KLUESNER: Are there other questions and comments?

We have another opportunity in Kearny on May 21 at 6 p.m. at Franklin School, and there will be another -- a third meeting such as this in Belleville in June with the specific date and location to be determined and announced at a later time.

So, since we've extended the July 21 -- extended the comment period to July 21, we're pushing the -- we're shooting for June for Belleville, probably a little bit later in June during the extended comment period.

Thank you so much for coming out tonight and staying this long. Thank you.

(Applause)

(Time noted: 9:31 p.m.)

C E R T I F I C A T E

STATE OF NEW JERSEY)
) ss.
COUNTY OF HUDSON)

I, LINDA A. MARINO, RPR, CCR, a Shorthand (Stenotype) Reporter and Notary Public of the State of New York, do hereby certify that the foregoing transcription of the Public Meeting held at the time and place aforesaid is a true and correct transcription of my shorthand notes.

I further certify that I am neither counsel for nor related to any party to said action, nor in any way interested in the result or outcome thereof.

IN WITNESS WHEREOF, I have hereunto set my hand this 12th day of June, 2014.

LINDA A. MARINO, RPR, CCR

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II

- -x

PASSAIC RIVER SUPERFUND SITE

PUBLIC MEETING

- -x

Franklin School
100 Davis Avenue
Kearny, New Jersey

May 21, 2014
7:00 p.m.

A P P E A R A N C E S:

RAY BASSO

SARAH FLANAGAN

ANNE HAYTON

PAT HICK

SOPHIA KELLEY

DAVID KLUESNER

JANINE MacGREGOR

CHUCK NACE

EUGENIA NARANJO

BRIAN THOMPSON

ALICE YEH

MR. KLUESNER: Welcome. Good evening. My name is David Kluesner. I'm with the U.S. Environmental Protection Agency. We're here to talk about the Passaic River Cleanup Proposal that EPA issued on April 11.

But before we get started, I wanted just to say welcome and to say we have translation services available for those who need it. We'll start in about five minutes.

Okay?

And I'll turn it over to Sophia, with the U.S. EPA, who will repeat this in Spanish, and then we'll have it translated in Portuguese.

(Pause in proceedings)

MR. KLUESNER: Okay. Everybody ready to get started?

Thank you very much for coming. Again, my name is Dave Kluesner. I'm with the U.S. Environmental Protection Agency, the EPA, out of our New York City office.

I want to thank you for coming

tonight. Thank you for making the effort. Parking is a little bit challenged, and walking around from Davis Avenue was a little challenge, if you walked. But thank you for taking the time and the effort to come out tonight.

I'll be the moderator tonight. We will have a presentation. It is approximately a thirty-minute presentation by Alice Yeh, who's with the EPA.

That's Alice. She's the project manager overseeing the study, investigation, and this process for the lower eight-mile portion of the Passaic River cleanup project.

I want to introduce a couple of other folks here with EPA that are here tonight as part of the team.

Ray Basso, in the front row. Ray is the project coordinator for the EPA Passaic River cleanup project, and there are several components to the Passaic River cleanup. Alice will get into what those components are shortly.

We have Chuck Nace with EPA. Chuck's on the Passaic team as well, and he helps us with the ecological risks, you know, impacts to wildlife, bugs-and-bunnies kind of things.

We have from Office of Regional Counsel Pat Hick and Sarah Flanagan.

Also Brian Thompson, from our headquarters office in the Office of Enforcement.

Assisting me in back, Sophia Kelley was at sign-in. Sophia's with our Public Affairs Department.

Eugenia Naranjo is also on the Passaic River team.

And then we have with the State of New Jersey, Janine MacGregor.

Did I miss anybody?

Oh, Anne Hayton, also with the New Jersey Department of Environmental Protection.

So, we work closely with New Jersey Department of Environmental Protection and other agencies on this project.

Just a few ground rules before we get started with the presentation.

I just wanted to introduce also Lisa Marino. Lisa is -- we hired Lisa to make a transcript of this public meeting. This is a formal public comment process. Lisa will be taking, you know, the recording of this meeting and the questions and comments that you provide.

It's very important that you're here tonight because the public has a great say in the overall -- this overall process. We seriously consider your comments and your questions.

At the end of this process -- Alice will discuss with you the process that we're in -- but since we're in this formal public comment process that began on April 11, when EPA issued the cleanup proposal, and we started a sixty-day comment period, since that time, we've extended that comment period an additional thirty days.

So, the comment period runs through July 21, and we have multiple ways to get comments to EPA; there are comment cards in the back, we have an e-mail address, the comments that you provide here tonight, or comments that you mail into us. So, there are several ways to get comments to us.

We will prepare what we call a Responsiveness Summary. After the comment period closes, we will prepare a Responsiveness Summary in the document that we call a Record of Decision. This is a document, a decision document, that outlines the selected cleanup plan.

Right now we have a proposal, which is why you're here tonight; to tell us what you think about that cleanup proposal and the other alternatives that we considered.

So, the Responsiveness Summary will respond to your questions and comments.

All right. So, that's essentially the purpose of tonight's meeting, the purpose of the stenographer.

We want you to be as comfortable as possible. It's in this setting, it's a little bit awkward to be as comfortable as possible because we have a stenographer, we have microphones, and it's a little bit of an unfamiliar setting.

But I'm a little nervous, so that should make you a little more comfortable.

(Laughter)

MR. KLUESNER: Because if I'm a little nervous, then things will be okay. That's just part of the process.

We had our first public meeting in Newark two weeks ago, and we will have the third public meeting during the comment period in Belleville. We will announce the specific date and location as soon as we get that lined up. It will be towards the latter part of June.

Mayor Santos, I want to acknowledge Mayor Santos. I know you have a schedule. You know, if you want to say anything, you're more than welcome to up front.

I want to thank you for coming.

MAYOR SANTOS: David, I want to thank you for having this hearing in the Town of Kearny.

The Passaic River is very important to our community. We're trying to increase access to the Passaic River along Riverbank Park in Kearny, which is over a mile-long park that we have.

So, the future of the river is critical for our community, and I'm here to listen to the proposal and, hopefully, listen to the public and any comments they make.

MR. KLUESNER: Thank you, Mayor.

Okay. So, we're going to get started. Alice has about a thirty-minute presentation. We ask that you hold your comments and questions until the end of the presentation. Then we'll take questions and comments.

We have an index card system.

We'll start with number one and so forth and we'll ask that you come up to a microphone in the aisle.

So, if you could remember to turn off your cellphones or put them on silent, that will be appreciated.

And, with that, I'll turn it over to Alice. Again, Alice is our project manager with the EPA.

MS. YEH: I can do this?

Can everyone hear me if I use the microphone on the stand?

MR. KLUESNER: It's going to be kind of hard, but you can try.

MS. YEH: Okay. I will try.

Wave at me if you can't hear me or if I step away from the microphone like that and you can't hear me.

So, we're talking about the lower eight miles of the lower Passaic River. And when we talk about the lower Passaic River, we're talking about the seventeen-mile portion of the river from the mouth at Newark Bay to the Dundee Dam in Garfield. The lower Passaic

River is connected to Newark Bay, which is connected to New York Harbor, and all of that is connected to the Atlantic Ocean to the south of this map.

And the ocean drives the tides in this area. So, for the lower Passaic River, that means that water moves back and forth twice a day.

The lower Passaic River project grew out of the Diamond Alkali Superfund Site in Newark, New Jersey, marked with the red star on this map. This is a former manufacturer of Agent Orange with a by-product of dioxin that was disposed of in the river.

But this area is highly industrialized, and, so, there are a large number of contaminants in the river aside from dioxin; there's PCBs, pesticides like DDT, metals like mercury, and so on.

This is a long and complex river, and, so, EPA is cleaning it up in stages.

There is a comprehensive study of

the seventeen miles of the lower Passaic River ongoing that's marked in the orange box on this map. There's also a study of Newark Bay to the south of this map. And both of those studies are ongoing.

As the data come in, EPA is always looking for opportunities to accelerate the cleanup. And, so, in 2012, EPA oversaw the removal of 40,000 cubic yards of highly contaminated sediments from the Passaic River in a location right next to the former Diamond Alkali facility in Newark that's marked in the dotted red box on the map. We call it the Tierra Removal.

And just last year, EPA oversaw another removal of highly contaminated sediments from a mudflat on the east bank of the river near Lyndhurst that's marked in the dotted orange box here. We call it the River Mile 10.9 removal for its location in the river.

So, now we turn our attention to the major source of contamination in this river, which is the lower eight miles.

During that comprehensive seventeen-mile study, EPA found that the sediments of the lower eight miles are the major ongoing source of contamination to the river and to Newark Bay.

And, so, we decided to evaluate cleanup options for the sediments for that major source while the seventeen-mile study was ongoing. And, so, that evaluation produced the Proposed Plan that we're talking about tonight.

Just a little bit of history. The lower Passaic River has had industries along its banks for well over a hundred years. Until the 1970s, it was common practice to discharge wastewater into the river. And, so, fast-forward to today, EPA has identified over a hundred industrial facilities potentially responsible for sending contamination into the river.

Historically, the lower Passaic

River had a navigation channel going from Newark Bay up to the Wallington area. A navigation channel is a place in the river that is dredged deeper than its natural depth to allow ships to come in for commercial navigation.

So, this navigation channel was built by the Corps of Engineers in the late 1800s and maintained until the 1950s in most of the river and until 1983 in the lower two miles closer to Newark Bay.

After the Corps of Engineers stopped maintaining or dredging out the channel in the 1950s, the channel filled back in with sediments. At that same time, industries were at the peak of their operation and discharging contamination into the river. So, the river filled in with a large inventory of contaminated sediments.

So, the first question is usually: Why are you cleaning up the lower eight miles?

The bottom line is you have to

start somewhere, and EPA is starting where the majority of the contamination is.

So, how do we know that?

The contaminants of concern -- those are the dioxins, the PCBs, the metals, the pesticides -- they tend to bind to fine-grained sediments. Those are the fine-grained particles at the bottom of the river.

And, so, where in the lower Passaic River are those fine sediments located?

Starting at the mouth, at Newark Bay, the river gets narrower and shallower as you go upstream towards Dundee Dam. And then at River Mile 8.3, which is near the border of Newark and Belleville, the river experiences a constriction and a narrowing. And at that point, the sediment texture changes also.

Below River Mile 8.3, the riverbottom is dominated by fine-grained sediments, the fine particles, with pockets of coarser materials. We call those sands.

Above River Mile 8.3, the riverbottom is dominated by coarse materials, sands, with pockets of fine materials, so the other way around. Those pockets of fine materials are mostly outside of the channel above the Grimaldi Point Creek.

Our data show us that 85 to 90 percent of the contaminated sediments in the river are located below River Mile 8.3, which is where this proposed -- which is what this Proposed Plan is about.

A little bit more about where the contamination is and how it's moving around.

The lower Passaic River is tidal. Saltwater comes in from Newark Bay, freshwater comes in from over Dundee Dam, and the waters mix and move about in the lower Passaic River.

All of this water moving back and forth stirs up contaminated sediments from the bottom of the river, and, so, the surface of the contaminated sediments get stirred up into the water column and move back and forth with the tides twice a day. And then during storms, the deeper, more contaminated sediments can also get stirred up and move from the bottom.

In the lower eight miles of the river, the riverbottom is pretty much equally highly contaminated. The middle is as contaminated as the edges.

And we have done some sampling out of the river from 1995 to 2012, and the data show us that contamination levels in this river have not declined, have not really gone down much over the past fifteen years. This is true for the surface sediments and for the fish and crab tissue.

So, what this means is that the surface sediments and the fish and crab tissue are highly contaminated and they're not recovering by themselves over time. That's what I meant to say.

And then we've also done some sampling of the major sources of contamination into the river. We've sampled Newark Bay, we've sampled the water coming over Dundee Dam, we've sampled the major tributaries coming into the Passaic River -- that's Saddle River, Second River, and Third River -- we've also sampled at the ends of pipes coming into the river called combined sewer overflows, and stormwater outfall.

And all of this data shows us that, in general, those sources into the river aren't really contributing much contamination. It's really the resuspension or the churning up of contamination from the bottom of the river that's the major source of ongoing contamination to this river system.

So, what does all this contamination mean to human health and the health of wildlife in this area?

From the contamination levels in the sediment, in the fish, and the crab, EPA calculated risks to human health and to wildlife that come into contact with the contamination. For humans, the risk is primarily from eating contaminated fish and shellfish from the river.

The State of New Jersey does have signs posted out there warning people, advising people, not to eat the fish and crab from the lower Passaic River and Newark Bay. But there are still people out there fishing and they do eat their catch or bring the fish home for their families to eat.

And, so, the way this works is that contamination in the top six inches of the riverbottom gets absorbed by the benthic organisms. Those are worms that live in the mud. The contaminated worms get eaten by fish that also accumulate the contamination in their bodies, and then the contaminated fish get eaten by humans.

EPA has determined that the risks related to eating contaminated fish and shellfish from the river are significant, requiring action to reduce those risks.

EPA has also determined that the risk to fish and wildlife that come into contact with the contamination are significant, again, requiring action to reduce those risks.

So, what do we do about all that contamination in the lower eight miles?

EPA evaluated four cleanup options listed here.

No. 1, no action.

EPA is required to evaluate no action as a basis for comparison to the active options. And the other three are active options, which I will go over in more detail in a few slides.

I will say right now, though, that the active options all require a great deal of dredging, removing sediments from the river. And, so, each of these active options include three potential disposal methods to get rid of that dredged material, and the disposal options are listed at the bottom of the slide. I'll go over that in a few slides as well.

So, what are the cleanup options?

No. 1 was no action.

Nos. 2 and 3 are bank-to-bank cleanup options in the lower eight miles.

No. 2 is called deep dredging with backfill. This option would remove all of the contaminated fine-grained sediments in the lower eight miles and backfill with two feet of sand to address the little bits of contamination that are inevitably left behind after dredging.

The intent here is to remove all of the contaminated sediments, and, so, the sand backfill would not need to be maintained in the future.

Cleanup Option No. 3 is called capping with dredging for flooding and navigation. This option would install an engineered cap, a sand cap, over the lower eight miles bank-to-bank.

But our studies show that if you just throw sand down on the bottom of the river, you would make the flooding that's already out there even worse.

And, so, this option would first dredge about two feet of sediment from the bottom of the river so that when the cap is installed, it will not cause additional flooding.

And, also, in the lower 2.2 miles closest to Newark Bay, in the navigation channel there would be additional dredging to various depths to allow for commercial navigation. And more about the navigation channel in a minute.

But the engineered cap over the lower eight miles would need to be maintained in perpetuity to make sure that the contaminated sediments that are under the cap are isolated from the water and the critters that live in the water.

So, Options 2 and 3 were bank-to-bank cleanup options.

No. 4 is a partial cleanup option. It's called focused capping with dredging for flooding. This option would dredge and cap discrete areas of the river that send the most contamination into the water column. Those discrete areas add up to about a third of the riverbottom in the lower eight miles, or 220 acres. And there would be no additional dredging in the navigation channel in this option.

And what about that navigation channel?

So, at the beginning of this presentation, I said that the lower Passaic River historically has had a federally-authorized navigation channel. That just means that Congress approved the depths to which it was dredged. And after the Corps of Engineers stopped maintaining it, it filled in.

These are the authorized depths on your left. The red area from Newark Bay up, upstream, is thirty feet in depth, the green area is twenty feet, and the light blue area is sixteen feet.

The Cleanup Option Number 2, because it would remove all of the contaminated sediments, would restore these depths to the lower eight miles of the river.

For Cleanup Option No. 3, the proposal is to have a navigation channel just in the lower 2.2 miles closest to Newark Bay, and that's shown on your right. The proposed depths included in the cleanup option are 30 feet in the red area, 25 feet in the yellow area, and 20 feet in the green area.

That goes up to River Mile 2.2. Above River Mile 2.2, there would be no navigation channel maintained.

Now, Cleanup Option No. 3 does call for some dredging above River Mile 2.2 to make sure that installation of a cap does not cause additional flooding.

There's also a little bit of additional dredging to leave behind about ten feet of water depth to accommodate reasonable future recreational uses that the municipalities identified in a survey that the State of New Jersey did.

Okay. So, I said that the active options, Nos. 2, 3, and 4, all require quite a bit of dredging, removing of contaminated sediments from the river. And, so, each of those active options include three disposal methods.

Disposal Method A is a contained or confined aquatic disposal, or CAD, site in Newark Bay.

The bottom of Newark Bay consists of about sixty feet of clay that doesn't allow water to seep through. And, so, if you dig a hole in that clay, it forms a secure pit in which you can put dredged materials.

And, so, the way this works is that you would dredge contaminated sediments from the river, put it on a barge, and the barge would go down the river to Newark Bay, to the CAD site, and then open up its bottom and let the dredged material fall through the water column into the CAD cell.

When the CAD cell is full, you would put an engineered cap over the CAD cell to close it and restore the Newark Bay bottom.

Disposal Method B is offsite disposal. Here again, you would dredge contaminated sediments out of the river and put it on a barge, but this time the barge would go to a processing facility; ideally, on the shores of the lower Passaic River or Newark Bay.

At that shoreline, the dredged materials would be pumped from the barge to the processing facility. And at the processing facility, the sediments would be squeezed as dry as possible, the contaminated water that's generated that way would be treated in a water treatment plant on the processing facility, and then the dry sediment would be put into railcars and sent to EPA-approved landfills and incinerators in the United States or Canada.

Disposal Method C is decontamination with beneficial use. Here again, contaminated sediment is dredged out of the river, put on a barge, and, again, the barge would go to an on-land processing facility on the shores of the Passaic River or Newark Bay.

And there, the contaminated sediments would be pumped from the barge to the on-land facility and they would be run through these decontamination technologies, which essentially separate the contamination from the sediment particles, the contamination would be disposed of in a landfill, and the cleaner sediment particles can be beneficially used to make cement or as landfill cover.

And here, depending on the decontamination technology that's chosen, you might still need to squeeze the sediments dry. And, so, there would still be a water treatment plant on the processing facility to treat the contaminated water.

So, quick summary of the cleanup options.

No. 1 is no action. There is no

dredging or costs associated with doing nothing.

Cleanup Option 2 is deep dredging with backfill. This would remove about 9.7 million cubic yards of contaminated sediments from the lower eight miles over a period of about eleven years, and then, depending on the disposal method chosen, would cost 1.3 to 3.2 billion dollars.

Cleanup Option 3 is capping with dredging for flooding and navigation, and that would remove 4.3 million cubic yards from the river over a period of about five years, and, again, depending on the disposal method chosen, would cost 1 to 1.7 billion dollars.

Cleanup Option 4 is focused capping with dredging for flooding. That would remove point nine million cubic yards over a period of two years and cost about point four to point six billion dollars.

And let me clarify here that the construction time is the time for dredging, capping, and disposing of the sediment. It does not include time for designing the details of how to carry out the option, the cleanup option. That design time would come before the construction time that's shown here.

So, in the Superfund program, we evaluate the cleanup options using these nine criteria.

The first two are criteria that all of the options must meet in order to be chosen. The next five criteria are tradeoffs, pros and cons, that EPA balances against each other before proposing a preferred cleanup option.

And then during the public comment period that we're in now, EPA gets comments from the State of New Jersey and from the community. And we take the last two criteria into account after we review those comments and before we make a final cleanup decision.

So, with the Proposed Plan, you will see the evaluation laid out in this way.

So, the proposed cleanup plan is capping with dredging for flooding and navigation with offsite disposal. For those of you who are keeping track of numbers and letters, that's Cleanup Option 3 with Disposal Method B.

So, this option would cap the lower eight miles of the Passaic River bank-to-bank. And before installing the cap, there would need to be some dredging, probably about two feet of the sediment, so that installing the cap would not cause additional flooding.

And then in the navigation channel in the lower 2.2 miles of the river closest to Newark Bay, there would be an additional dredging to the various depths that I showed you before.

The dredged materials would be barged from the river to an on-land processing facility on the banks of the Passaic River or Newark Bay where they would be squeezed dry and then put on railcars and sent to EPA-approved incinerators and landfills.

Fish and crab consumption advisories would remain in place during the construction and for a period of time afterwards.

The contamination level in the river will take quite a while to come down, even after any action is taken. And there would be restrictions on dredging and anchoring in the lower eight miles to protect the cap.

So, let me just go back briefly and review why EPA is making this proposal.

The lower Passaic River and Newark Bay, if you remember, are large and complex watersheds. We need to clean it up in phases. As I showed you at the beginning of this presentation, the purple box is the lower eight miles, the subject of this proposed plan. There is also a seventeen-mile study of the lower Passaic River and a study of Newark Bay ongoing.

The contaminants of concern are everywhere in the lower eight miles bank-to-bank and they're highly toxic, requiring stringent cleanup goals.

The tidal nature of the river means that the water and the contaminated sediments are moving back and forth. So, it's not always obvious where to start the cleanup, and, so, EPA is starting the cleanup where the majority of the contamination is.

This Proposed Plan outlines a comprehensive bank-to-bank approach to cleaning up the sediments of the lower eight miles. This will reduce risks considerably. But even so, our studies show that we will not achieve all of our human health and ecological goals for all of the contaminants. However, this is a big first step.

We expect that this action along with cleanup decisions that will come out of that seventeen-mile study and from the Newark Bay study will together help us achieve all of the cleanup goals in the future.

So, just a few key questions that

come up about this Proposed Plan.

Why does the cleanup have to be bank-to-bank?

Why can't you just do dredging and capping of some hot spots in the river?

As I said before, the contamination is everywhere bank-to-bank in the lower eight miles of the river, and the contamination is at levels well above our cleanup goals. So, bank-to-bank cleanup is the only one that reduces risks low enough so that there might be the opportunity in the future to relax fish consumption advisories step-by-step.

Our study shows that the focused cleanup option, No. 4, does not reduce risk low enough to allow that to happen.

So, the other question is: Why don't you just take all of the contamination out of the river?

The taking-it-all-out option is Option No. 2, deep dredging. Our analyses show that taking it all out and capping some of it in place, which is the proposed option, both of those options are equally protective, but the capping option has less impact on the community and the environment during the construction.

This is because the proposed cleanup option dredges much less contaminated sediments and takes only five years, only five years, to implement, while taking it all out would take eleven years.

Many of you might know that dredging, the act of dredging, stirs up contamination from the bottom of the river, goes into the water column, travels a little distance, and then drops out somewhere else on the river.

And, so, again, the proposed option dredges just the top two feet of sediment, which is less contaminated than the deeper stuff that would be stirred up under the take-it-all-out option.

And, so, this means the temporary stirring up of sediments that occurs during dredging has much less of an impact on the environment because you're dredging less contaminated materials under the proposed option.

And, finally, capping some of these sediments in place, which is the proposed option, is more easily implemented than the take-it-all-out option. Again, this is because the proposed option dredges much less volume, and, so, the logistics of transporting and disposing of all that dredged material while still challenging is easier than the take-it-all-out option.

Another key question is the CAD cell, or confined aquatic disposal, versus offsite disposal. There are pros and cons to each method.

The cap over the CAD cell has to be maintained in perpetuity to make sure that the contaminated sediments at the bottom of Newark Bay stay there isolated from Newark Bay. Offsite disposal would not need additional maintenance because the landfill and incinerator owners already have long-term maintenance plans in place to deal with the materials that they've received from elsewhere.

The CAD does not treat any sediments, it is just a pit. Offsite disposal would incinerate up to ten percent of the contaminated materials.

However, the CAD does have the least impact on the local communities because offsite disposal would need an on-land processing facility of about 30 acres.

The CAD does have the most impact on Newark Bay because that's where it's located, and offsite disposal would not have any impact on Newark Bay.

The CAD and offsite disposal are both technically implementable. That means that technically, they are feasible, they can be done. And it has been done at other Superfund sites around the country.

But here, the CAD cell may not be administratively implementable. As mentioned in the Proposed Plan, the State of New Jersey has asserted ownership of the bottom of Newark Bay, and the State of New Jersey opposes siting of CAD cell in the Newark Bay for the highly toxic Passaic River.

And, finally, cost. The cost of the proposed cleanup plan with CAD disposal would be about $1 billion. The proposed cleanup plan with offsite disposal would cost about $1.7 billion. That is a big difference.

So, EPA is particularly interested in receiving comments during this public comment period about the pros and cons of CAD versus offsite disposal and about which one EPA should choose in the final decision.

Last key question, I promise: Could the navigation channel be shallower?

So, the preferred cleanup option includes dredging in the lower 2.2 miles of the river closest to Newark Bay to various depths to allow for commercial navigation, and I showed you those depths before. Those depths are based on a survey that the Corps of Engineers did of companies that use the channel.

So, the users of the channel told the Corps that right now, they can't bring in fully-loaded ships because there isn't enough water depth for those ships to move in. Or sometimes they need to wait for high tide, which allows for more water depth to bring their ships in. Also, they can't buy larger ships in the future when their companies grow.

And, so, that's on the one hand.

On the other hand, dredging a channel adds significantly to the amount dredged and the cost of the cleanup plan.

And, so, again, EPA is interested in receiving comments during the public comment period on whether the navigation depths included in the proposed option could be shallower and still accommodate commercial navigation in this section of the river because shallower means less dredging and a less costly cleanup.

Okay. Finally, send your comments to me at this e-mail address or write letters to the address listed here.

The Proposed Plan and supporting information are available on the website ourpassaic.org. They're also available at the Newark Library -- Newark Public Library, the Elizabeth Public Library.

All of this information is in the fact sheets that you got when you came into the room.

And I'm going to leave this slide up for the rest of the meeting. So, I just figured I'd remind you that these are the cleanup options and these are the disposal methods that you will be commenting on.

(Applause)

MR. KLUESNER: Thank you, Alice.

Thank you all for being very patient and holding your questions and comments until the end.

Linda, how are -- I referred to

you as Lisa. It's Linda Marino. Sorry about that.

MS. MARINO: That's okay.

MR. KLUESNER: How are you doing?

MS. MARINO: Fine.

MR. KLUESNER: Okay.

In terms of a sort of schedule check, we'll take a break at 8 o'clock. We'll be here for as long as you have questions or comments.

Our goal is to provide you with information, provide you with access to ask us questions and provide your comments. So, we want to make sure no one leaves without having had the chance, if you want to take that chance and have that opportunity.

But we will take a break at least at 8 o'clock, a brief break, or sooner if our stenographer needs a little bit of a break before then. So, we'll just check periodically with Linda.

What we will ask you to do is to, by index card number, starting with 1, 2, and 3, line up at the standing mic,

which I'm going to put in the aisle
shortly. So, if Nos. 1, 2, 3 can get
ready to make your comments and come
over here to this aisle.
If anyone needs any translation
assistance, we do have two translators
that can assist if necessary. But we
just want to make sure you're
comfortable and that you have every
opportunity to provide your comments,
your input, to us.
Okay?
Ray, if you wouldn't mind coming
up here to the chair. I'll get the
microphone set up.
1, 2, 3, look on your index card.
Okay. We're ready to start.
CAPTAIN SHEEHAN: I'm Captain Bill
Sheehan, S-H-E-E-H-A-N, Hackensack
Riverkeeper. I'm the director of the
organization known as Hackensack
Riverkeeper.
The position that I have on your
Proposed Plan is, first off -- and this
goes without saying -- it's about time.

Thank you for all the hard work that you've done to get us to this point.

And I want to make sure that we don't hit any pitfalls along the way and wind up with another stall, because this river has been waiting for almost my entire life, I think, for some sort of activity to take place that would make it healthier, that would make it cleaner, and, finally, that would make it comport with the Clean Water Act water standards.

The plan that you proposed, I have a couple of comments about that.

The disposal methods. I'm totally opposed to the idea of a CAD, or a subaqueous disposal site, in Newark Bay. My preferred alternative for the disposal is to take it out, do whatever dewatering you need to do, and then send it off to be entombed in a EPA-approved landfill.

I base my thoughts on that on personal and professional activity at Riverkeeper. Several years ago, we were involved in a RCRA lawsuit, federal lawsuit in the Federal Court, against Honeywell Corporation, and the contaminant of concern that we were suing over was chromium, chrom-6.

I believe if you can rate toxics, chrom-6 is a lot less toxic than dioxins, and the thing we're worried about with the Passaic River is dioxins.

So, if the Court ordered Honeywell to take all of their chrom-6 and take it to an EPA-approved landfill for disposal, I think the EPA should follow the Federal Court's lead and demand that the sediments that are mined out of the Passaic River also follow those chrom-6 sediments into a place where they can be permanently entombed or, as you said, incinerated.

I'm not opposed to the incineration as long as done correctly. And I'm sure if EPA approves it, it will be done right.

Another thing that I want to talk about, though, is the need to make sure that when you fix this river, that you return it to the people that it belongs to. Those are the people at the watershed first, the people of New Jersey second, the people of the New York metropolitan region in general.

Years ago, we'd go on the Passaic River and we would literally say "What a sad, sad situation this is."

The City of Newark five years ago started using our boats at Hackensack Riverkeeper to reintroduce the citizens of the City of Newark to the river. And in the past five years, I've taken literally hundreds and hundreds of people on tours up and down the Newark waterfront, from the mouth of the river up to -- almost up to the Second River, where it goes into Belleville. And we go back and forth with these people.

For most of the people, many of whom are much older than I am, it was the first time in their lives that they were able to get out on the river. It was the first time that they felt secure enough and safe enough to get aboard a boat and take a ride on that river.

And, you know, it's emotional for me because I have people, you know, literally breaking out in tears onboard my boat saying they never thought they'd see the day. That's how much emotional involvement there is once the people of Newark, once the people of the area, realize that this is their natural resource, that this is their recreational resource, that this is the place that they can go for fun, for relaxation, and, you know, just -- all they want to do is sit by the river and read a book. They don't -- they should not be afraid to do that. And with the current situation, everyone is afraid to do those things.

You know, this year we're going to be doing kayak trips. Last year, we did a kayak trip with the staff from EPA. Your regional administrator came out with a number of your colleagues from the office over in New York, and we had a great time on the river. But everybody was -- these are all professionals and everybody was totally aware not to touch the water and not to get into the water, just to get in and out of the boats as best we could. Nobody got hurt, nobody got wet, and nobody got sick from it, thank goodness.

We want to be able to do those events with the public on a continuing basis; if not Hackensack Riverkeeper, maybe another organization would like to get some kayaks and start getting people out on the river. A matter of fact, I welcome additional help in doing those kinds of projects.

It's a really important thing to me because when a community is divorced from their waterway, the bad guys always win. When people are engaged in their waterway, when they're using it for recreation, when they're using it for their personal fulfillment, they will help you to keep the bad guys at arm's length. And that's what we need to do here, that's what needs to happen in the Passaic River.

Your second proposal, you know, the one right under the no action proposal, is the proposal that I'd like to see go forward with offsite disposal, period.

We shouldn't even be entertaining the idea of digging a pit in Newark Bay because all that does is take what poison you pull out and moves it downstream to Newark Bay.

We got cutoff in the federal court by Occidental when we tried to sue them over the dioxin that was bleeding into Newark Bay out of the Passaic River. The EPA added it to the study area back when we had our 90-day letter going forward. It was on the 87th day of our 90-day notice period. And if we could have gotten them into court, I'm sure the federal courts would have dealt with them with offsite disposal.

So, it's up to you guys now to take that all into consideration and really, really stress the offsite disposal option rather than CAD. As a matter of fact, you should put a line through it right now on the slide and not even talk about it anymore.

Thank you.

(Applause)

MR. KLUESNER: Thank you.

Just to be clear, Bill, you're in support of Option No. 2, which is not Option 3 that we're proposing. You're for Option 2. Thank you.

No. 2, Commenter No. 2, step up to the mic and introduce yourself, please, if you don't mind.

MR. HARTMAN: My name is Christian Hartman. I'm the Assistant Vice President of New Jersey Alliance for Action. We're a nonprofit organization.

First of all, thanks for what you guys have done. It's great.

I know that water infrastructure is not a sexy topic, but the Passaic River means a lot to everybody here.

And my grandfather always talked

about swimming in it at the dinner table. And I was choked a little bit when you mentioned that, but it would be awesome if we could get to that point again at some point.

So, thank you very much for...

My boss, the President of Alliance, asked us to just do a quick statement. So, I'm just going to read it, just one page.

The New Jersey Alliance for Action is a nonprofit, nonpartisan, statewide coalition of more than 2,500 business, labor, professional, academic, and government leaders. The Alliance is an advocate of investment in infrastructure for New Jersey's economy, our environment, and our overall quality of life.

Since 1974, when we were created, we've worked closely with each New Jersey Governor, the Cabinet, the Legislature, and local government, as well as our members, to create funding and secure permits for road, bridge and rail improvements, water projects, school construction, aviation enhancements, shore preservation, business expansion, and other key infrastructure investments. That's what we do.

Back in March of 2013, the New Jersey Alliance for Action formally announced our support for the sustainable remedy proposal in a letter to the U.S. Environmental Protection Agency. The sustainable remedy proposal utilizes adaptive management to ensure that the initial goals set by the EPA would be met for reducing risk to humans and the ecology along the river.

So, we, again, are asking EPA to consider the sustainable remedy approach that has been proposed by the lower Passaic River cooperating parties group.

Four quick points.

We believe that the approach will minimize impacts to the business community and residents; number two, allow for the highest level of surface sediment to be cleaned up and capped within a five-year period; number three, bring green infrastructure projects and employment to individuals in trades in New Jersey; and number four, the most highly contaminated sediment would be moved from the river in a quicker time period.

So, on behalf of New Jersey Alliance for Action, thanks for listening, thanks for your time.

(Applause)

MR. KLUESNER: Are you going to give us the statement?

MR. HARTMAN: Yes.

MR. KLUESNER: Alice will take the statement from you.

Just to clarify, you're advocating for an alternative that's not any of these four.

MR. HARTMAN: Yes.

MR. KLUESNER: Okay. I just wanted to be clear on that. Thank you.

MR. HARTMAN: Thank you.

MR. KLUESNER: Commenter No. 3?

No. 4?

Commenter No. 4, come to the microphone, please; 4, 5.

And if anyone wants and you don't have an index card and you're thinking of a question or have a comment, we'll make sure you get a number and you have your opportunity as well.

Thank you.

MS. LAHM: I have 5. My name is Gail Lahm.

And, Alice, thank you very much for a nice presentation.

I'm a member of Passaic River Rowing Association. I am not a scientist. I have been on the Passaic River probably almost every day from the end of February until November for almost the past twenty years as a rower and as a coach.

And I agree with Captain Bill Sheehan: The river has -- you know, it's just been remarkable how wonderful the river has kind of revitalized itself and it's a wonderful place.

My comment here -- and I'm not a scientist, just my observation from being on the river all this time -- since they started doing the dredging at Mile 10.9, we've had -- this is the first spring in almost twenty years we have no herons, we have very few geese, we have very few ducks, no ducklings, no goslings. It's amazing. No turtles. So, I'm concerned with a massive cleanup like this, what it's going to do with just a small part of it being done. I'm very concerned about that.

And I have been in the river. I've had water splashed on me. No rashes, no fungus, no cancer.

I feel that there should be no action taken, just from my observation of this river for almost the past twenty years.

Thank you.

MR. KLUESNER: Okay.

Commenter No. 6, please.

MR. LAHM: Thank you.

Alice, I'd also like to thank you

for a very nice presentation of the options.

My name is Jeff Lahm, L-A-H-M. Gail spoke, and I'll try not to be redundant.

Like Gail, I am also a rowing coach and I spend about four hundred hours a year on the river for the last fifteen years. And like Riverkeeper Sheehan said, there is an abundance of change happening in the river. We've seen it. Lots of wildlife are there.

You have to recognize that there are from the spring -- from about the end of February through the end of May, there are about a thousand high school kids rowing on the river.

The focused cleanup that was just undertaken, they worked with us, they were very flexible in accommodating our schedule, moving craft around. We hosted two regattas in the time that they were here. They removed some of their equipment.

There has to be recognition that

there is a very active rowing community that is growing every year that should not be disrupted for a period of five or ten years.

In terms of options, if there's something that needs to be done, I would support focused capping and dredging. And I, like Captain Bill, don't think CAD is the right option. It doesn't make sense to me, a layperson, that you're taking contaminated soil out of one part of the river and dumping it in another part of the river.

Like Alice said, when you stir up that sediment, it gets in the water. So, if you're dumping it in the water, there's no guarantee it's going to wind up, quote, in the pit. And you're doing all this for maybe one fish that you can eat in possibly ten years.

So, thank you.

MR. KLUESNER: Thank you.

Ray?

Okay. Fine.

If at any point there's a

statement or there's questions in the statement or the comment and that you feel that we -- sometimes we get a lot of comments and questions in the form of one presenter. If there's anything that we haven't addressed and you want us to answer the question, please feel free to press us on it, and we'll try our best. If we can't answer here, we'll do it in the Responsiveness Summary.

At the last meeting, there was a couple of commenters that felt we did not answer their question there at the meeting that really wanted an answer. But please, let us know. We're here to answer your questions. But if you're here to just make a statement, that's also fine.

So, Commenter No. 7, please?

MR. LANE: Hello. My name is John Lane. I'm with the Hudson County Engineering Department and I'm the Transportation Planner for Hudson County. Just two things, really one question.

We own with Essex County the three bridges; Clay Bridge and Jackson Street, the joint bridges. We own them -- each county owns half of the bridges.

We would like to have some idea of how many bridge openings we're going to have to contend with. These are hundred year old bridges.

To be honest with you, I looked at the bridge opening logs. And prior to the 10.9 project, we sometimes had just two or three openings a year. So, really, they weren't manned on any type of basis and whatever else. We were notified 24 hours in advance when they would need a bridge opening. And we've tried to accommodate and whatever else going on with the project.

For the large project now that we're talking about, we'd like to have some idea as to how many bridge openings we would possibly face.

Because those bridges were severely damaged by Hurricane Sandy. They're not exactly as reliable as we'd like them to be. And we want to be cooperative, we want to be there when you need them open, and we also need them to be closed so that the public can drive over. So, we're in between a little on that.

And there's one other thing I'd just like to say real quickly. We're doing a thing right now for Clay Street Bridge. We're doing a public outreach. And it's a concept development for the possibility of rehabilitating that structure or replacing it.

It has nothing to do with the project. I just want to make sure that you understand, that the public understands. I think just the fact that they're parallel to each other, they involve the same river, and whatever else, there's a tendency for people to think oh, they must be connected or whatever else.

Again, it's a hundred something odd year old bridge. We should be doing something about it. We're trying to do

something about it.
MR. KLUESNER: Thank you, sir.
MR. LANE: Thank you.
MR. BASSO: Thank you.
We did learn some valuable lessons with the 10.9 removal action that we did last year.
MR. KLUESNER: 10.9 is Lyndhurst, just to clarify for folks.
Right?
MR. BASSO: Yes, Lyndhurst.
And I could assure you that before we take on a project of this size, we will be talking to all the bridge owners, not just the three bridges in your jurisdiction, to make sure that those bridges are functional when we get to the point where we have to open and close them numerous times during the day.
I can't tell you at this point how many times the bridges would need to be opened and closed. That would be vetted during the remedial design process, when we design the project.

But way upstream of that, no pun intended, we will be talking to all the bridge owners and making sure -- working with you guys to make sure the bridges are functional.

MR. KLUESNER: Will Commenter No. 8, come up to the microphone?

I just wanted to address the point about impacts to the community, working with the community.

I'd just like to point out that we have a really strong history of working with communities, and specifically with community advisory groups; not just on this project but on the Hudson River project, which, you know, we're dredging PCBs about two hundred miles north of here, or General Electric is.

The years leading up to the actual start of that work, we worked closely with a broad cross-section of representatives that comprised the Hudson River community by the river.

For the Passaic River, there is a community advisory group that meets monthly. Debbie Mans, Executive Director with New York-New Jersey Baykeeper -- she's in the back -- she's co-chair of the community advisory group. Ana Baptista, is also a co-chair, and she is here as well.

And this Passaic River Community Advisory Group has been meeting monthly, or almost monthly, for several years. And it was mentioned, you know, the Lyndhurst project, sometimes you will hear it referred to as 10.9, as River Mile 10.9, a 20,000 cubic yard project in Lyndhurst. We did what we call the Tierra Removal, which is off of Lister Avenue next to the Diamond Alkali site. That was a 40,000 cubic yard sediment removal project.

For both of those projects, we worked closely with the community advisory group and we asked them, "What are the community concerns and questions? What do we need to consider?"

Ray mentioned the remedial design.

That's the design of the cleanup plan. So, during the design process, you know, the role of the community is extremely important to address these impacts. And we've developed community health and safety plans to make sure that notifications are in place, to make sure that, you know, the rowing organizations, the impacted residents and other interests are heard.

So, this is important tonight, but we have a strong history of working with the communities, and we're committed to working very closely with the communities to make sure that we minimize the impact as much as we can. We can't avoid some impact.

I just wanted to really stress that point. Your concerns, the users of the river, have been considered for a number of years, as long as we've been involved in the project. And we will continue to work closely with the users of the river moving forward.

So, thank you.

MR. WILCOX: My name is Peter Wilcox. I'm the former president of the Nereid Boat Club. We're the -- one of the other major industries up there. We're the boats that are going a little bit faster than the boats are up the river.

(Laughter)

MR. WILCOX: As we said, we are users of the river. I want to echo their comments that during the 10.9 Mile project, there was a lot of cooperation. There were things -- it's a pilot project, so there were -- though the river was supposed to remain navigable during the process, it has not been. The river has been closed to boat traffic during the removal.

But my comment is I look at that what, 20,000 cubic yard project and try to imagine 4.3 million cubic yard removal project, hundreds of times the size, and in five years, and I'm wondering how is that possible?

How can one river accept that many

barges?

Barges can only move at low tide and there are only so many tugboats you can get on the river at any time. The numbers don't make sense to me. How can that possibly -- how could it possibly be a five-year project as it's being stated?

MR. BASSO: All that detail is in the Focused Feasibility Study Plan, and it's all explained in there in terms of how often we'll be dredging, how many hours a day, and so on. I can't get into the specifics right now, but it's all in there.

MR. WILCOX: Okay.

MR. BASSO: Even after you read it, you might not believe some of it. And some of it, the details may change when we get down to really sharpen our pencil points and get into the finer points of designing the project.

It's a fair comment.

MR. WILCOX: Thank you.

My other comment is that this is

all great for the first eight miles. We're doing a lot of our rowing in the other eight miles, eight or nine miles up the river.

And what are the long range plans for -- what stage is the planning for that part of the river as well?

I'd hate to see billions of dollars spent -- I applaud seeing billions of dollars of money being spent in the lower eight, but I wonder what's going to be left for the upper?

What stage is that?

MR. BASSO: That is still in the study stage, and we're probably -- my guess would be close to two years away from a Proposed Plan like this for the upper river. And that can change too. That schedule could be accelerated, possibly, but that's the time frame we're thinking about now.

As Alice explained, the upper river is a little bit different in terms of the riverbottom than the lower part of the river, which is why we addressed them in the order that we have.

Upstream is a little bit different because there are more pockets of fine-grained material which contain the contaminants. It's not ubiquitous. So, that approach may be different than what we've done here. It will be more something like a 10.9, potentially.

MR. WILCOX: Okay. Thanks.

MR. BASSO: You're welcome.

MR. KLUESNER: No. 9 to the microphone, please.

Thank you.

DR. STOUT: Hello. I'm Dr. Stout. I'm a biologist and toxicologist at Fairleigh Dickinson University.

And I've been looking at this issue a little bit. I also followed the dredging on the Hudson.

It's a tough issue. It's really difficult to evaluate the options. There's always tradeoffs between them.

Personally, I would love if No. 1 would work. I know that dredging does cause tremendous disturbance, and I just don't -- I don't see that as being feasible when you have --

MR. KLUESNER: Just to interrupt, you mean No. 2 or No. 1?

DR. STOUT: No. 1, where you do nothing, because then you wouldn't be causing the problem with dredging. But, as you said, the sediment's continuously being stirred up and it's simply not getting better.

So, then we look at No. 2, No. 3, and No. 4, and there's tradeoffs between all of them. I know you're advocating No. 3 with the -- we're calling it an engineered cap. It seems like that's an awful lot of disturbance as well, essentially paving the bottom of the river there.

No. 2, with the natural sand, it seems would be a better substrate of -- over time than an engineered cap.

And then No. 4 seems to cause the least amount of disturbance, but all of these are going to greatly disrupt the river.

Personally, I'm leaning towards No. 4, but I absolutely have a hard time saying that out loud because there's so many tradeoffs with these. It seems as though anything that is done is going to be destroying much of the river for quite some time.

The reason I was looking at No. 4 was other than being able to eat the fish possibly sometime in the future, the outcomes seem the same for the different options.

And I wonder if you could comment on that.

MR. KLUESNER: Sure.

MR. BASSO: I don't believe the outcomes are the same for all the options.

Alternatives 2 and 3 have similar risk reduction outcomes, but Alternative 4 doesn't measure up to 2 and 3.

DR. STOUT: It seems, though, that with 4 the main problem was never being able to eat the fish, but 2 and 3 had similar outcomes to it other than the

contamination of fish.
Right?
If you don't dredge bank-to-bank, you're going to be left with contaminants that never go away and always be exposed.
MR. BASSO: Correct.
DR. STOUT: But if you do more selective capping and dredging, there will be less disturbance to the river, so recovery will be faster in the medium term.
MR. BASSO: Well, 2 and 3, in terms of the surface geometry of the river, accomplishes the same thing.
DR. STOUT: Right.
MR. BASSO: You're bank-to-bank removing the top two feet or so, including the six-inch bioactive zone --
DR. STOUT: Right.
MR. BASSO: -- which is really in play in terms of getting contaminants into the environment. So, that achieves the same thing.
Alternative 4 only deals with

about one-third of that same geometry, and therein lies the problem, because the contaminants are so ubiquitous and way above our cleanup standards in the lower eight miles that you just can't remove a third and, with the tidal action, expect that to do the job of getting the risk down low enough.

Even though you're not going to be able to eat the fish in two or three years, it's going to take time for the whole system to get down to that level in conjunction with additional actions, potentially in Newark Bay and upstream of River Mile 8.3.

DR. STOUT: And you don't think that capping would be sufficient without the comprehensive dredging. Selective dredging with selective capping just --

MR. BASSO: No, no. It just doesn't cover enough surface.

MR. KLUESNER: I just want to ask the audience, I can hear this gentleman's comments, but can everyone hear that?

All right. Fine.

Anything else, Ray?

MR. BASSO: No.

MR. KLUESNER: No. 10, Commenter No. 10?

MR. HARRIS: My name is Donald Harris. I'm a small business operator and owner. I have a couple of questions and some comments.

During the recent rollout of FFS, Senator Booker classified the Passaic River as the largest crime scene in the history of New Jersey.

My understanding of "crime scene" is when there is a crime, there are victims. So, all of the residents that live along the Passaic are victims and deserve restitution.

The restitution should be in the form of a community-centered approach to mitigating the conditions of the Passaic, if you look at the fact that you're going to spend billions of dollars on the proposal to clean up the Passaic, none of which will reduce unemployment.

It's my understanding when you cleaned up the Agent Orange site, there were sixty young people that were trained but only one got a job and that job was for six months.

That's not sustainability.

MR. KLUESNER: We had thirteen or so. More than one.

MR. HARRIS: When you look at the population of the people who live along the lower Passaic, it's one of the highest rates of unemployment or underemployment in the region; so, therefore, it should be more community-centered.

If you look at the facts of 1996, the federal government created an interagency work group, where they brought together many of the different agencies within government to address these kinds of conditions.

Your plan does not indicate any actions towards bringing in other agencies, such as HUD and others, to assist with mitigating these problems, as well as to improve the quality of life along the river.

I said the last time that your plan was disruptive. There's infrastructure under the river that could be disturbed, and even the depth in there.

How can you do deep dredging when there are cables and other types of infrastructure there, what impacts your plan is going to have on the roadbeds throughout the community, and, most of all, what are you going to do about including other people that live and work and pay taxes in New Jersey?

Many of the subcontractors that are going to be implementing your plan will be from outside the State of New Jersey, none of which those dollars will remain here. And I think that that's a disservice and I think probably more criminal than what Mr. Booker stated about the conditions environmentally on the river.

Thank you.
MR. KLUESNER: Thank you.
Just to address a few points, then, Ray or Alice, if you have anything to add...
On the jobs, we have demonstrated a willingness and a commitment to the community to work with the parties that actually performed the cleanup work for the Tierra Removal. We participated in an EPA Superfund job training initiative program. And, yes, there were thirteen folks that graduated from that program that were ultimately employed during the removal of 40,000 cubic yards of contaminated sediment.
That was a relatively small number, but it was a strong signal that we are really wanting to work closely with the community not just on jobs, but throughout the cleanup that address the impact that the cleanup will have on the communities.
And we're not here saying there will not be any impacts, but we're

saying our mission is to clean up, to protect human health and the environment, and to restore the river. You know, you have to -- there will undoubtedly be some impacts.

But when we worked on the Hudson River cleanup project, that cleanup project resulted in over four hundred jobs being created. General Electric Company did that cleanup. We could not compel GE to create those jobs, but, ultimately, we worked closely with them and said this is important to the community, it's very important to the upriver community, that they hire locally as much as possible.

So, we have that strong commitment to work closely with the community on that and making sure that this project is implemented as safely as possible. So, we have a strong commitment to community-based cleanup projects.

There's a lot of things that you brought up that we will definitely address during the design phase of the cleanup. You mentioned the infrastructure issues, and that's certainly something that would be, obviously, very important in the design phase, that we look at where the electrical and other, you know, water infrastructure exists too. That's something that we definitely address during the design phase of the cleanup and it's obviously very important.

Is there anything else? Okay.

Up to No. 11.

MR. VANDER: Good evening. My name is John Vander.

Dave, Alice, and Ray, I'd like to echo the thanks other people have given you for the work you've put into this, even though I come out at a different position than you're recommending.

And I'd also like before I make my own comments to echo some of what Captain Bill said in terms of the importance of aiming at a remedy that gets the community back in possession of and on its river.

I'm another one of the rowers. I'm at Nereid Boat Club as well. We row out of a boathouse at about River Mile 12. We probably row mostly from River Mile 8 up to about 15 or so. Occasionally, we get down to, you know, River Mile 5 or so.

And similar to what the prior commenters have said, there are easily a thousand of us out there on the water during any particular rowing season. I've spent probably a thousand hours over the last ten years, you know, six inches from the water.

And my observations are there are three kinds of contaminants in pollutions, three categories.

There are the chemical pollutants that we're dealing with here; the PCBs, the dioxins, the heavy metals.

There are also biological contaminants that come out of the sewer outfalls, the CSOs, the broken, poorly functioning sewer systems whose biological contaminants have caused more sickness and injury among the rowers than anything else.

And, thirdly, there are the floatables that come out of the CSOs and wash off, you know, the poor and ill-planned land use along the sides of the river.

And, so, where I would come out looking at those is that I would hate twenty years from now, when Option 2 or 3 has been completed, to look back and say, "Well, we've dealt with part of category one, the chemicals."

We'll still have some of the chemical pollutants because we're still going to have the nonpoint source runoff from the streets, from the fertilizer, things like that. You're still going to have the biological pollutants from the CSOs, from the poorly functioning sewer systems. And you're still going to have all the floatables, which are anything from a Styrofoam cup to a dead body. I've seen both and everything in the middle.

So, where I would come out on this, what my hope would be, is that you would ultimately pick some version or combination of your Option 4 and a sustainable remedy that would both address the most serious points of the chemical pollutants but also begin to address some of the biological and floatable pollutants that very much affect the usability of the river.

And as long as those latter two are not addressed, it's still a pretty unattractive place to most people.

So, my hope, my recommendation, would be that you come out with -- you end up with a combination of your fourth option and the sustainable remedy; and if you're going to be disposing of stuff, by all means, dispose of it offsite, don't just move it out of one hole and put it in another.

Thanks very much.

MR. KLUESNER: Thank you.

11 or 12?

MR. VANDER: I was 11.

MR. KLUESNER: 12 or 13?

Sophia, how many sign-ins did we have?

12, 13, or 14, stand up.

MS. KELLEY: We have seventeen.

MR. KLUESNER: Seventeen. Thank you.

Cynthia, go for it.

At this point, I think we can probably do a free-for-all after this.

MS. MELLON: Good evening. My name is Cynthia Mellon and I live in the Ironbound section of Newark. I'm in walking distance from the river.

I am the Environmental Justice Organizer of the Ironbound Community Corporation, which is the neighborhood organization for the East Ward.

We know that river very well. It's taken many, many years to reach this point where we can have a cleanup.

Let's not forget why the river is contaminated. Pesticides were made in a factory on the banks of that river, along with many other really dirty industrial practices that took place. I talk to people, old-timers in Newark, who were sent by the companies to throw things in the river and bury them in the ground, and they said that they always knew something would happen.

The big contamination, the real incident, is that they made Agent Orange for the Vietnam War on the site of that river. The dioxin that contaminates the river is a by-product of the Agent Orange.

I lead environmental justice tours. I take people from all over the world to see our pollution, and we joke about it. And I very often get people who have been affected by dioxin because they are veterans, they were in the war, which makes me wonder about folks in Vietnam. So, that kind of reality is never very far from us.

I do sit on the Community Advisory Group. This work has taken many, many years to finally reach this point. It's really incredible how many times the

State had to sue to get to this point.

I believe we have a lot of science and spent many years studying this, and I really agree with Option No. 3. We have to go for a full cleanup. The river is too sick to remediate itself. You know, I'm a person who really doesn't like drastic measures, but I think that's what has to happen.

And I think we also have to remind ourselves that there were co-polluters of the river who don't want to pay their share of that cleanup. This cleanup has to be paid for; under Superfund law, it will be paid for by the people who polluted it and their successive companies. It's not coming out of taxpayer dollars. Sometimes we have to remind ourselves of that.

And, yes, there will be jobs. My organization worked very, very hard to get some jobs. We were disappointed with the few jobs at the beginning, but the people in my community, African-American and Puerto Rican people, got those jobs, were trained, and three people got on for much longer periods of time. They were very successful events. There will probably be -- I don't know, many jobs. And, you know, it makes me happy to see --

(Speaking in foreign language)

MS. MELLON: Laborers' Union is here, and we will work with the EPA to get those jobs for local Newark residents and to see that local organizations, whether they're -- even restaurants, people who have struggled and stayed in Newark all through the bad times, get those economic opportunities. And that's been part of our discussion for years.

So, sorry to take so long to say all this, but, you know, we want to see No. 3. And then the river can start to heal itself.

Thank you.

(Applause)

MR. KLUESNER: Thank you.

13, 14, 15.

ANDREA: Hi. My name is Andrea. I am currently studying environmental engineering, so I'm not an expert on this topic at all. But I have a couple of questions I was hoping you could answer.

I understand that cap and dredge is the most proven technology for remediation, especially at this scale. But I was wondering, what exactly is the microbial state of the river at this point?

If you know, is it completely dead or are there active microbes in the river?

And, two, are there thoughts on these polluters paying to improve bioremediation technology; specifically, so that less invasive technology can be submitted instead of capping and dredging, so that things can be restored in less movement to different places?

So, maybe there's something that we don't know about.

Is there a way to exploit that it

could survive there and maybe remediate better than some type of other would?

MR. BASSO: Honestly, I can't tell you the microbial state at this point in the sediment of the Passaic River, but there are things living in there for sure. Exactly what, I'm not sure.

But bioremediation is an interesting point that you bring up. The agency is always open to looking at new technologies, even as we progress with a Proposed Plan and even a Record of Decision. It's never too late for someone to come forward with a better mousetrap, especially if it involves cleaning the river to our requirements without having to dredge.

That being said, from what I understand, the state of bioremediation is not quite there yet. I've recently been told it's five to ten years away to implement on a large scale like this.

And, actually, it's not as simple as sort of seeding the top of the sediment and have it eat away all of the contaminants. I think you would have to manipulate the sediment in order to disburse the microbes through.

ANDREA: Sure.

MR. BASSO: So, it's complicated. It sounds great. I wish it was here in front of us today as a workable solution, but that doesn't mean that we close our eyes and continue down a path because that's what we chose initially. We will -- we're open to all new developments in terms of sediment remediation.

ANDREA: I understand that.

What I'm saying, will there be any push for these polluters to fund research?

You know, bioremediation, my understanding, is generally less expensive and maybe pushing towards that technology can be a better option than something like this.

MR. BASSO: I think the marketplace can take care of itself when it comes to that. I think these companies will probably be looking to those options themselves and developing them simply because it makes economic sense.

And, also, EPA and the Corps of Engineers has research and development arms which actually look at this work and probably will continue to do so.

Okay?

ANDREA: Thank you.

MR. KLUESNER: Alice?

MS. YEH: Just a minor point about your first question, what's living in the river.

The focused Feasibility Study document, Appendix D, has an ecological risk assessment and it does go through some of what we found living in the river.

ANDREA: Thank you.

MR. KLUESNER: And if you need any help at all -- there's a lot of information on our websites and in those documents. So, if you need any help at all, call us or e-mail us. We'll be glad to point you in the right direction and help you find the right answer.

Thank you.

Commenter?

MS. RAMIREZ: Hi. My name is Myra Ramirez. I live in North Arlington.

I just simply wanted to state that I support the EPA's plan for the full cleanup. I also wanted to echo my colleague Cynthia Mellon's comments about the polluters should pay for the cleanup, not the taxpayers.

Thank you.

(Applause)

MR. KLUESNER: Thank you.

DR. RAVIT: Dr. Beth Ravit. I'm an environmental scientist at Rutgers and I'm Co-Director for the Center for Urban Environmental Sustainability.

And I just want to say I appreciate the argument for No. 3 in terms of the timing, the five-year time frame, but I would ask to put this in the perspective of the life of what has happened in this river.

Fifty to sixty years it's had this contamination. It has been studied for what, probably three decades, maybe, and people are still trying to find other ways to deal with this and maybe not do the remedies you've proposed.

So, I would like to argue that if we're talking about a six-year difference between removing it all or putting a cap in place, six years in the life of the destruction of this river is probably not that long a time period.

The other thing I'd like to argue for, one of the arguments against CAD, I think, if I'm hearing it correctly, is that it's a path that requires perpetual maintenance, maintenance in perpetuity. If you go to Option 3, you are placing a cap over still-contaminated sediments which requires maintenance in perpetuity.

So, I don't think it can be an argument against a cap in Newark Bay but then not take that into consideration when you're looking at cleanup options.

So, I would argue strongly this stuff is dangerous. We know in particular dioxins is dangerous and I would argue it should come out of our river.

(Applause)

MR. KLUESNER: Lenny?

Can I just get a show of hands for who wants to make comments before the break?

There's one, two, Lenny, and a couple. All right.

Linda, are you okay going for a few extra minutes?

MS. MARINO: Yes. Thank you.

MR. KLUESNER: All right. Thank you.

MR. THOMAS: Lenny Thomas.

Actually, the previous speaker just took most of the points I wanted to make. Thank you.

There is talk about doing the dredging and capping, but, as it was just mentioned, if you do the capping, then you have to always be monitoring it to make sure it's still there, make sure it's deep enough, make sure it's keeping all that poison down there so it doesn't get out and cause more damage.

I guess at a previous time I would have said, "No, maybe it's all right, it's not that bad. You can go back and fix it."

Because the more I learn about at least some of the poisons, the toxins that are down there, it scares me. Especially dioxin. It sounds like a bad word. It's much worse than that.

At one point, I guess I would have said yeah, it's okay, but they talk about, the experts, how dioxin has over half its victims not born yet as far as what we put down in Vietnam and so forth and it's the same type of toxin here. It can have the same potential here. It's in the fish in the water, it's in the crabs in the water, and it's going to take time for it to come out of there.

But if you just cap it, there's

all that danger that something could
happen. It limits what we can do --
MR. KLUESNER: One second.
(Pause in proceedings)
MR. KLUESNER: Sorry, Lenny.
MR. THOMAS: No problem.
This is what stays in my mind, that we need to take all the poison out of there. There's still other things that we have to look at, the stormwater runoff and things like that. That's another conversation.
But the dioxin, the PCBs, those things need to come out completely. We need to move them out of here, dewater them, and get them out of the river.
The capping? No. We need to do a complete cleanup and backfill. I know it's going to take time, and that's something that people have been concerned about. But at the same time, it's taken a long, long, long time to get to this point. And after we get it done, there will be an even longer time to enjoy the river and all the benefits

it has.

There are so many communities that are here because of this river, because people could get around the river. And then all of a sudden, people turned their back on it and they forgot what we've gotten from it. And we're paying for it. We're paying for it. We are limited in what we can do now.

I can't go down to the river and fish now. I can't go down and crab. I can't do a lot of things. I'm afraid to go in the water. I just feel I can't do that. Even boating, I'm afraid if I tip over, more afraid of drowning, I'm afraid drinking the water. And I am afraid of drowning, but even more afraid -- I'm even more afraid that something will happen with that.

We need to take that out. There are people who are using now, from my friends who do rowing and boating -- I wonder what's going to happen if they dump out in the river. I have friends who have dogs who like to walk on river's edge, and not all of them realize they need to wash the dog's feet right now. They're not doing that.

If we get the poison out and go with the other part of the cleanup, then we will see a river that we can really utilize, it will bring back business, more people move in, more people enjoy, it will benefit us financially as well as a recreation point.

So, I'm in favor of complete dredging and backfill. Thank you.

(Applause)

MR. KLUESNER: Mayor Santos, if you'd like to comment?

Then the next commenter.

MAYOR SANTOS: I've been Mayor since January of 2000. I've lived in this area since I was five years old, first nine years on the Newark side of the river, and I was a user of Riverfront Park in Newark.

I remember the day in grade school when -- we called them the men in spacesuits showed up. And we were told we couldn't go in that part of the Ironbound.

The Town of Kearny has the largest -- as well as the City of Newark, largest waterfront, so it affects us the most.

I have two observations, and I just want to comment my thoughts on them. I wanted to hear everyone's comments. I didn't think I was going to stay 'til the end, but this really is an important subject for all our communities.

The first observation on the employment. There should be a first-source agreement. You should first look for employees from this area for every job that's created by this cleanup.

The second observation I want to make is regarding the use of the river right now. The Town of Kearny owns a piece of property which it leases to Kearny Board of Education, where the Kearny crew team is based. As well, they share that space with crew teams from Belleville and Nutley. That's at about Mile Marker 8, which is pretty close to the end of this phase of the cleanup.

We're very proud of that program. It's a very successful program. It gives our young persons the opportunities for college that they otherwise would not have had.

So that program, I'm not sure how you would do that within the framework of the first phase of this cleanup, but that program is critical that it continue for my community of Kearny as well as, I'm sure, for the other communities that use that crew house in Kearny.

As to the cleanup options, after hearing everyone, especially the last comments from Beth, it seems to me it's either 2 or 3. And the reason for that is I think a matter of environmental equity. And there are three subjects.

One is the health effects. These

chemicals are carcinogens. They have to be addressed. We can't ignore them, they have to be addressed.

Two is use of the river. While there are speakers who said the river gets active use, I would say that's mostly from Mile Marker 8 north.

Mile Marker 8 south, which is mostly the Town of Kearny -- the Town of Kearny has a very long stretch of the Passaic River waterfront, beginning in the South Kearny peninsula, the confines of the Passaic and Hackensack, industrial area opposite Diamond Shamrock, to the residential part, where we are now.

And I mentioned Riverbank Park. It's a mile-long park. Most of that is below Mile Marker 8. There's a boat launch that gets minimal use. There used to be a private boatyard there that went defunct this past year because the owner told me there's no more leisure boating on this portion of Passaic River. He's had it for sale. No buyers. It's a beautiful boatyard.

We do not have the use of the lower Passaic that we should have, and that's a matter of environmental equity. The river should be an amenity for our community, it should be an attraction, and it's not; largely, because of the condition it's in.

The third part of the equity argument is that -- as I said, I've been Mayor since 2000. In 2001, we implemented a redevelopment plan for a portion of our Passaic River riverfront in the residential area just south of the one-mile long park, from approximately Bergen Avenue to the border with the Borough of East Newark.

We tried repeatedly to get that area redeveloped and largely unsuccessful, and a large reason for that is the condition of the river.

It should be an amenity. It's not an amenity. My concern is that the cleanup options, one that was stated by Beth, as to whether the capping and the maintenance of it is of concern, that it won't provide us the maximum benefit that we need.

And if the life expectancy -- my question is what is the life expectancy of that cap?

Is it a permanent solution?

Even with proper maintenance, how long of a solution is that cap, is it indefinite or is it a number of years, at which point our future selves will have to come back here or another school to address it all over again?

My second question is: Are there any comparables out there, are there any cleanups of comparable water bodies?

And what do those comparables tell you in terms of what the best remedy is for this kind of environmental catastrophe?

MR. KLUESNER: Permanence and the comparables.

MS. YEH: I guess the cap would have to be maintained in perpetuity.

And maintenance doesn't just mean

going out there and looking at it and making sure that it's still there, it means replacing the sand as it gets worn off. Particularly after a storm, you would have to go out there and do a survey and replace the stuff. So, it's not that it wears out. You would replace it periodically throughout the years.

And, so, it would last.

And the other Superfund site --

MAYOR SANTOS: How long would it last if you do that?

MS. YEH: How long? It would have to last a long time.

Right now, we have Superfund sites in other parts of the country that have -- that do rely on a cap for protection. And, I mean, the history of Superfund is that those caps have been maintained for what, maybe ten, fifteen years. But that's because that's the only history we have.

They will keep going and we will keep collecting data on those caps to make sure that we learn from them; how to maintain them, how to make sure that they stay in place.

MR. BASSO: I just want to address the design of the cap.

It's a two-foot sand cap for the most part, but in higher erosional areas or areas that are subject to more forces of water on the cap in the river, that cap will be armored.

So, the cap is designed in such a way that when a hundred-year storm comes through it's not all gone and out into Newark Bay. The areas that are most susceptible to that will be armored, so that the impact will be less. And the other areas to a hundred-year storm, they only -- I think we use two or three inches, I think.

Scott, is that right?

So, a hundred-year storm comes through -- and we've had some pretty bad storms here, but we haven't had a hundred-year in a while -- you'd only lose --

UNIDENTIFIED: We've had three of them in the last ten years.

MR. BASSO: Those were not hundred-year storms.

UNIDENTIFIED: Yes, they were.

MR. BASSO: No, they weren't.

UNIDENTIFIED: Since Andrew, there's been three.

MR. KLUESNER: Hold on. One at a time. We're taking notes.

MR. BASSO: So, even if a hundred-year storm comes through, you're going to lose two, three inches of that cap, which means you'll have twenty inches that are still there, which gives you plenty of time to go out and do an imaging survey and replace what was lost after that storm.

So, there's enough safeguard built into it.

MAYOR SANTOS: Who'll maintain it?

MR. BASSO: If the responsible parties do the work, they will maintain the cap as part of their conduct of the work.

MR. KLUESNER: We have a couple more questions before we take a break. I just want to make sure --

Could you come to the microphone?

NATALIA: Hi. I'm Natalia. I am a freshman rower, and I row at Nereid Boathouse.

But it's the same water. And I know it's not as bad as areas further down in Newark, but the water, it's like a second home for hundreds and, like, thousands of us, if you think about it.

And rowing that, we see dead animals, pollution; we see oil, we see all these different contaminants. And, I mean, it's not anything, like, welcoming.

And my friend, she put her hand in the water accidentally and she came out with who knows what?

All these different chemicals are getting in the water and they're affecting us. And parents are always saying, "Clean up your room, clean up your house," and it's like this is our house, this is our room.

And I feel like as a generation who's growing up and who's looking forward to spending more time on the water, we don't want to see it just covered, we want to see it cleaned up, we want to see the proper approach taken.

Because capping it, sure, it may -- I mean, it's not going to make the problem go away, it's just going to stop it from spreading.

But ten years from now, twenty years from now, thirty years from now, I want to be able to still say, "Yes, this is what we did. We cleaned this up."

And I think just, like, putting a cover over problems we may not have made but problems that we have to deal with isn't a solution to future generations who want to use the river. And I just -- as someone who's young and who's growing up on this river, I don't want to see it covered.

I want to see it cleaned out and

restored to how it used to be, and I think it would benefit everyone.

MR. KLUESNER: Thank you.

(Applause)

MR. KLUESNER: It's 8:15 now. Let me see if I have any objections to taking a ten-minute break.

UNIDENTIFIED: Can I just have a quick yes-or-no answer?

MR. KLUESNER: Okay.

UNIDENTIFIED: There's Option No. 2 cost -- excuse me, the Option No. 3 cost is just about half of what deep dredging is.

Does that include those future maintenance costs?

MS. YEH: Yes, yes, it does.

UNIDENTIFIED: Okay. Thank you.

MR. KLUESNER: You're welcome.

Okay. We're going to take a ten-minute break. At 8:25, we'll be resuming.

(Recess taken)

MR. KLUESNER: Can I have a show of hands for questions and comments?

Show of hands?
Bill, why don't you start off?
Maybe folks might...

CAPTAIN SHEEHAN: I did it first when you started, and now I'll start the second half rolling.

MR. KLUESNER: Bill, I'm not hearing you.

CAPTAIN SHEEHAN: I said I started the whole thing rolling and now I'll start the second half rolling.

MR. KLUESNER: Okay.

CAPTAIN SHEEHAN: The comment that I wanted to make was when the Mayor of Kearny was speaking and a few of the other speakers brought up the concept of perpetual care for the cap, the cap will have to be cared for.

And I think that the only way that that really works is if the responsible parties are required to put enough money into a trust fund that will be held in escrow for catastrophic failure.

And what you need to do is you need to figure out the cost of the project today and how much it would cost to replicate that project twenty years from now, thirty years from now, forty years from now, and then require them to put up the bond that would cover that cost.

And I know that they are cringing at paying the cost of the cleanup as it is and if you ever went after them for an escrow fund to cover future maintenance on this thing, I think there would be -- you know, a holy war would break out over it.

So, that's just one more reason why maybe capping is not really that great an idea, because who's -- the question was asked by a couple of speakers, "Who's going to maintain it and how is it going to be maintained?"

And whoever is doing it and however it's done, it's going to cost money. And with, you know, inflation and everything else, it's not going to be 2014 dollars, it's going to be whatever dollars are worth in twenty years, thirty years, fifteen years, whenever it fails, and it could be catastrophic.

So, that was my comment that I wanted to add. Thank you.

MR. KLUESNER: Thank you, Bill.

Other questions or comments?

Okay. Again, thank you for your patience, thank you for coming out. I apologize for the Blackberry disruption.

(Laughter)

MR. KLUESNER: We will be announcing, you know, soon the specific date and location for the meeting in Belleville. Later in June is what we anticipate.

Again, the comment period goes through July 21. And if you have any questions at all, you know how to submit the comments. Alice provided...

So, again, thanks for coming. Thank you.

(Applause)

(Time noted: 8:32 p.m.)

C E R T I F I C A T E

STATE OF NEW JERSEY)
) ss.
COUNTY OF HUDSON)

I, LINDA A. MARINO, RPR, CCR, a Shorthand (Stenotype) Reporter and Notary Public of the State of New York, do hereby certify that the foregoing transcription of the Public Meeting held at the time and place aforesaid is a true and correct transcription of my shorthand notes.

I further certify that I am neither counsel for nor related to any party to said action, nor in any way interested in the result or outcome thereof.

IN WITNESS WHEREOF, I have hereunto set my hand this 24th day of June, 2014.

LINDA A. MARINO, RPR, CCR

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
- -x

PASSAIC RIVER SUPERFUND SITE

PUBLIC MEETING

- -x

Belleville Senior Citizens Center
125 Franklin Avenue
Belleville, New Jersey

June 23, 2014
2:00 p.m.

A P P E A R A N C E S:

WANDA AYALA

RAY BASSO

BRIAN DONOHUE

SARAH FLANAGAN

PAT HICK

SOPHIA KELLEY

DAVID KLUESNER

JENNIFER LaPOMA

JANINE MacGREGOR

EUGENIA NARANJO

ALICE YEH

MR. KLUESNER: We are going to get started now.

My name is David Kluesner. I am with the U.S. Environmental Protection Agency, the EPA, based out of our New York City office.

Welcome and thank you for coming out this afternoon for this third public meeting in the comment period that the agency started on April 20th.

On April 11th, the U.S. EPA issued its proposal to clean up the lower eight miles of the Passaic River.

We then started a 60-day comment period on that proposal, as well as the other options for cleanup that were considered. So this is an important part of the process by which the agency makes decisions on the cleanup plans.

Public input is extremely important to the process. We want to hear from you. That is your purpose today, is to provide us with your comments, ask us questions. We will certainly try to answer as many questions as possible on our proposal, and the other alternatives that were considered and what we call the Focused Feasibility Study.

To the extent that we cannot answer your questions today, we will prepare what we call a Responsiveness Summary. That will be a part of what we call a Record of Decision. That is the selected cleanup plan that we anticipate issuing in 2015.

So today you have a few ways to make a comment. By coming here today and -- you know, after our presentation, which we have about a 30-minute presentation -- together, we will ask you to hold your questions and comments until the end of the presentation, but you can certainly make your comments here.

We have a stenographer, Leah Allbee, who is recording this meeting. And that's one way to submit your comments. We have comment cards in the back, the yellow comment cards, that you can leave with us.

And then you also can -- we also

are receiving comments via e-mail and regular mail. And Alice will provide you with that information. But it's also on the fact sheets. At the sign-in desk, there are three fact sheets in English, Spanish and Portuguese.

So, please, if you want to refer to them as we are doing the presentation or take some with you, you are more than welcome. And that has information on how to submit comments, on one of the fact sheets.

Okay. I would like to introduce that EPA team that is with me here today.

Alice Yeh is the project manager for the lower eight miles. Alice will be giving the presentation here shortly after I get through a few ground rules.

Ray Basso is the program manager for the Passaic River projects.

And there are several projects in the Passaic River Restoration Project area and Alice Yeh will also describe those.

Pat Hick is with our Office of Regional Counsel.

Sarah Flanagan is with our Office of Regional Counsel.

Eugenia Naranjo is one of the project managers on the Passaic. We have several.

And then Jenn LaPoma is also one of the project managers on the Passaic.

Brian Donohue with the U.S. Department of Justice.

And then with the State of New Jersey, Department of Environmental Protection, Janine MacGregor.

Just a few ground rules before I turn it over to Alice. If you wouldn't mind silencing your cell phones. I forgot to do mine during the last one and it went off. It's kind of embarrassing. Please silence your cell phones so that there are no interruptions.

Hold your comments and questions until the end. As I said, we have about a 30-minute presentation. So that will be appreciated.

We have an index card sign-in system. So just as a matter for having some -- an orderly process, if you have or if you plan on making comments or have a question, then there are index cards in the back. You can get index cards at any time. Just walk in the back and get them from Wanda and Sophia.

And just raise your hand in the back. Wanda Ayala is a community involvement coordinator, who is helping us out on the Passaic River Outreach, for the EPA.

Sophia Kelley is also with the EPA.

And I want to thank them for their very strong support for this.

All right. So that's essentially the ground rules.

And with that, I will turn it over to Alice for presentation.

MS. YEH: Thank you, David.

Wave at me, if you can't hear me.

So we are here to talk about the lower Passaic River. When I say the lower Passaic River, I mean the seventeen-mile portion of the river. The seventeen-mile portion of the river from the mouth at Newark Bay up to Dundee Dam in Garfield, New Jersey.

The lower Passaic River is connected to Newark Bay, which is connected to the New York-New Jersey Harbor Estuary. And all of those water bodies are connected to the Atlantic Ocean, to the south of this map. And the ocean drives the tides in this area. And so for the lower Passaic River that means that water moves back and forth twice a day.

The Lower Passaic River Project grew out of the Diamond Alkali Superfund site in Newark, New Jersey. This is a former manufacturer of Agent Orange with a byproduct of dioxin that was disposed of in the river.

But this area is highly industrialized. And so aside from dioxin, we have found a large number of contaminants, such as PCBs and pesticides like DDT, metals like mercury, and so on.

This is a long and complex river.

And so EPA is cleaning it up in phases.

There is a comprehensive seventeen-mile study of the lower Passaic River, and that's marked in the orange box on the map. And also a study of Newark Bay to the south of this map.

Both of those studies are ongoing. As data come in, EPA is always looking for ways to accelerate the cleanup project.

For example, in 2012, EPA oversaw the removal or dredging out of highly dioxin-contaminated sediments out of the river in an area adjacent to the former Diamond Alkali facility. We call that the Tierra Removal, and it's marked in the dotted red box on the map.

Just last year, EPA oversaw another dredging and capping action. This addressed highly contaminated sediments on a mudflat on the east bank of the river, near Lyndhurst. We call that the River Mile 10.9 removal for its location in the river.

So now we turn our attention to the major source of contamination in this river system. And that's the lower eight miles of the river marked in the purple box here.

During the comprehensive seventeen-mile study, EPA found that the sediments of the lower eight miles are the major source of contamination to the rest of the river and to Newark Bay. And so we decided to evaluate options for cleaning up that section of the river while the comprehensive seventeen-mile study is still ongoing. And that evaluation produced the Proposed Plan that we are here to talk about today.

Just a little history of the lower Passaic River. This river has had industries along its banks for well over a hundred years. Until the 1970s, the discharge of wastewater into the river was common practice.

And so fast forward until today, EPA has identified over a hundred industrial facilities that are potentially responsible for sending contaminants into the river.

Historically, the lower Passaic River has had a navigation channel from Newark Bay up until about the Wallington area. A navigation channel is where the river has been dredged deeper than its natural depth to accommodate commercial navigation.

And this navigation channel was built by the Corps of Engineers in the late 1800s and maintained or dredged out until the 1950s, in most of the river, and until 1983 in the lower two miles of the river closest to Newark Bay.

After the Corps of Engineers stopped maintaining the channel in the 1950s, the channel filled in with sediments pretty quickly. And at that same time, industries were at the peak of their operation and discharging contaminants into the river. And so the river filled in with a large inventory of contaminated sediments.

So the first question is usually: Why are you cleaning up the lower eight miles of the river?

And the short answer is because you have to start somewhere and EPA is starting where 85 to 90 percent of the contaminated sediments are.

And so, how do we know this?

The contaminants of concern -- those are the dioxins, the PCBs, the pesticides, the metals -- they tend to bind to fine-grained sediments. Those are the fine particles at the bottom of the river.

And so, where in the lower Passaic River are those fine particles?

So starting at the mouth of the river, in Newark Bay, and going north, the river gets shallower and narrower, until you get to about River Mile 8.3, which is the border between Newark and Belleville. At that point, the river narrows dramatically and there is a change in the sediment texture at the bottom of the river.

Below River Mile 8.3, the riverbottom is dominated by fine particles, fine sediments -- we call them silts -- with pockets of coarser materials or sands.

Above River Mile 8.3, the bottom is dominated by sands, the coarse stuff, with pockets of fine materials mostly outside of the channel.

And so our data show that 85 to 90 percent of the fine sediments are found below River Mile 8.3. So for the lower Passaic River, the majority of the contaminants that are bound to those fine sediments are found below River Mile 8.3. And that is the subject of this Proposed Plan.

A little bit more about the contamination and how it's moving around.

The lower Passaic River is tidal. There is saltwater coming in from Newark Bay and freshwater coming in from over Dundee Dam, and those waters mix and move around in the lower Passaic River.

The surface of the contaminated sediments gets stirred up with the movement of all of this water back and forth. And then during storm events, the deeper, more contaminated sediments also get stirred up and into the water column.

In the lower eight miles, contamination is everywhere, bank-to-bank. The middle of the river is as highly contaminated as the edges of the river.

We have taken samples from the river from about 1995 to 2012. And the data show that contamination levels in this river have not declined much over the past 15 years. This is true for the surface sediments. This is true for the fish tissue. This is true for the crab tissue.

So what this means is that the sediments, the fish and the crab are highly contaminated and they are not recovering by themselves over time.

We have also taken samples at the -- sort of -- major sources of contamination into the lower Passaic River. We have taken samples in Newark Bay. We have taken samples of water coming over Dundee Dam. We have taken samples in the three major tributaries:

the Saddle River, the Second River, the Third River.

We have also taken samples at the ends of pipes coming into the river called combined sewer overflows and storm water outfalls.

And our data show that, in general, these sources don't really contribute much hazardous contamination into the river. It's really the resuspension, the moving up and down, the stirring up of contaminated sediments from the bottom of the river itself that is the major source of contamination to the water.

So, what does all of this contamination mean to human health and to the critters that live out there?

From the contamination levels in the crab, the fish and the sediments, EPA has calculated the risks to human health and to wildlife who will come into contact with the contamination in the river.

For humans, the risk is primarily from eating contaminated fish and shellfish.

The State of New Jersey does have signs posted along the river advising people not to eat the fish and shellfish. But we know that there are people out there fishing; they are eating their catch or bringing the fish home for their families to eat.

And so the way it works is that the contamination in the top six inches of the sediment gets absorbed by the benthic organisms. Those are the worms that live in the mud. The contaminated worms get eaten by the fish that also accumulate the contamination in their bodies. Then the contaminated fish get eaten by the humans.

EPA has determined that the risks related to eating contaminated fish and shellfish from the river are significant, requiring action to lower those risks.

EPA has also determined that the risks to wildlife that come into contact with the contamination in the river is significant, again requiring action to lower those risks.

So, then, how do we lower those risks?

What do we do about all of this contamination?

EPA has evaluated four options for cleaning up the sediments of the lower eight miles and they are listed here.

We are required to evaluate no action as a point of comparison to those active options.

Nos. 2, 3, and 4, up here, are the active options. I will go over them in more detail in the next two slides.

But I will say for now that all of the active options involve quite a bit of dredging, removing contamination out of the river. And so each of the active options include three possible disposal methods for getting rid of those dredged materials. And the disposal methods are listed at the bottom here. I will go over those in more detail as well.

What are the cleanup options?

Nos. 2 and 3 are bank-to-bank cleanup options.

No. 2 is called deep dredging with backfill. This option would remove all of the contaminated fine-grained sediments out of the lower eight miles of the river. And then backfill with about two feet of sand to address the little bits of contamination that are inevitably left behind after dredging. There would be no need to maintain that sand backfill over time.

No. 3, Option No. 3 is called capping with dredging for flooding and navigation. This option would install a sand cap over the lower eight miles bank-to-bank.

But our studies show that if you just throw sand down at the bottom of this river, you will make the flooding that is already out there even worse.

So this option would call for dredging about two feet of contaminated sediments first, so that the cap that's installed doesn't cause that additional flooding.

There would also be additional

dredging in the navigation channel in the lower 2.2 miles of the river, closest to Newark Bay. This additional dredging would be to allow commercial navigation to keep going in the future.

There would have to be maintenance of the sand cap in perpetuity, in the future, so that we make sure that the contamination left in the river is isolated from the rest of the ecosystem.

So Cleanup Options Nos. 2 and 3 were bank-to-bank options.

No. 4 is more of a partial cleanup option. No. 4 is called focus capping with dredging for flooding. And it would dredge and cap the discrete areas of the river that send the most contamination into the water. And there would not be additional dredging for any sort of navigation channel in this option.

The navigation channel -- as I said before, this river historically has a navigation channel with depths that were approved by congress. After the Corps of Engineers stopped maintaining the channel in the

1950s, the channel filled back in with sediments.

So Cleanup Option No. 2, because it proposes to remove all of the contamination from the lower eight miles, would in fact restore the federally authorized navigation channel in the lower eight miles.

And those depths are shown on the left-hand panel here.

Cleanup Option No. 3 would only include a navigation channel in the lower 2.2 miles of the river, closest to Newark Bay, to the depths that are shown on the right-hand panel over there.

The red section is 30 feet -- would be 30 feet deep. The yellow section would be 25 feet deep. The green section would be 20 feet deep. Up to River Mile 2.2, which is just north of the Lincoln Highway Bridge, the Route 1 and 9 bridge.

And above River Mile 2.2, there would be no navigation channel. You might recall, though, that above River Mile 2.2, under this cleanup option, there would still be dredging to make sure that the cap doesn't cause additional flooding. And there would also be a little bit more dredging to make sure to leave behind about ten feet of water depth to accommodate future recreational uses that the municipalities identified in a survey that the State of New Jersey did.

As I said before, each of the active alternatives -- Nos. 2, 3 and 4 -- all involve quite a bit of dredging. And so, Nos. 2, 3 and 4 each include three possible disposals methods for getting rid of those dredged materials.

Disposal Method A is a contained or confined aquatic disposal, or CAD cell, in Newark Bay.

The bottom of Newark Bay consists of about 60 feet of clay that doesn't allow water to seep through. And so, if you dig a hole in that clay, it can serve as a secure pit into which dredged materials can be disposed of.

So the way it would work is that contaminated sediments would be dredged out of the Passaic River and put on a barge. That barge would go down the Passaic River into Newark Bay to the CAD cell. The CAD cell is enclosed by a sheet pile wall. So that barge would go into the CAD cell, into the sheet pile wall, open up the bottom and dispose of the dredged materials into the CAD cell.

When the CAD cell was full, it would be closed with an engineered sand cap to isolate the contamination from the rest of Newark Bay.

Disposal Method B is offsite disposal. Here again, contaminated sediments are dredged out of the Passaic River and put on a barge. But this time the barge would go to an on-land processing facility on the shores of the lower Passaic River or Newark Bay. At that processing facility, the sediments would be pumped from the barge to the facility, where they would be squeezed dry.

This generates contaminated water, which would be treated at a water treatment plant on the facility. And then the dry sediments would be loaded on to railcars and sent to EPA-approved incinerators and landfills around the country, or in Canada.

Disposal Method C is called decontamination with beneficial use. Here again, dredged materials out of the Passaic River, put on a barge, and the barge brings the materials to the on-land processing facility on the shores of the lower Passaic River or Newark Bay. There the sediments would be run through these decontamination technologies, which essentially separate the contamination from the sediment particles. The contamination is disposed of. The sediment particles that are cleaner could be reused -- could be used to make cement or a landfill cover.

Here, depending on the decontamination technology that is chosen, you might need to run the sediments through a dewatering plant to squeeze them dry. Which is why there is a dewatering plant shown here. And you would also need a water treatment plant on the facility.

Brief summary of the cleanup options.

Cleanup Option 1 is no action. There is no dredging and no cost associated with doing nothing.

Cleanup Option No. 2 is deep dredging with backfill. This option would remove 9.7 million cubic yards of contaminated sediment from the lower eight miles over a construction time of about 11 years. And depending on the disposal method chosen would cost 1.3 to 3.2 billion dollars.

Cleanup Option No. 3, capping with dredging for flooding and navigation, would remove 4.3 million cubic yards from the river over about five years and cost about 1 to 1.7 billion dollars, depending on the disposal method chosen.

No. 4 is focused capping with dredging for flooding. It would remove .9 million cubic yards over two years and cost .4 to .6 billion dollars.

And I should clarify here that the construction time includes time for dredging, capping and disposing of the dredged materials. It does not include time to design the details of how to carry out the cleanup option. That design time would come before the construction time, obviously.

So, in the Superfund program, we evaluate these cleanup options using nine criteria, that are listed here.

The first two criteria are ones that all of the options have to meet in order to be chosen at the end.

And then the next five criteria are balancing criteria. They are sort of pros and cons that EPA has to weigh before coming up with a preferred option.

And then during the public comment period, which we are in now, EPA gets comments from the community and from the state. And we take the last two criteria into account after considering the comments and before we make our final cleanup decision.

Oh, the Proposed Plan evaluations are laid out in this way.

So the proposed cleanup plan is capping with dredging for flooding and navigation with offsite disposal. That's Cleanup Option No. 3 and Disposal Method B.

So just a brief review, this option would cap the lower eight miles with a sand cap bank-to-bank. Before the cap is installed, there would need to be dredging of about two feet of sediment to allow the cap to be installed without causing additional flooding.

In the lower 2.2 miles of the river, closest to Newark Bay, in the navigation channel there would be additional dredging to the depths that I showed you before.

The dredged materials would be barged to that on-land processing facility, on the shores of the lower Passaic River or Newark Bay. And they would be squeezed dry and put on railcars, sent to landfills and incinerators around the country.

Fish and crab consumption advisories would remain in place during the construction and for years afterwards. The levels of contamination in this river are high and will only go down slowly over time, even after a cleanup plan is implemented.

There would need to be restrictions on dredging and anchoring in the lower eight miles to protect the cap.

So let me just review why EPA is proposing this, this cleanup plan. Make sure I am not forgetting anything.

So, as you recall, the lower Passaic River and Newark Bay are complex systems. We have to clean them up in phases.

If you remember, the purple box is the lower eight miles addressed by this Proposed Plan. There is also a seventeen-mile study in the orange box and a Newark Bay study of the south of this map.

Contaminants of concern here are everywhere in the lower eight miles, bank-to-bank, at levels that are really high. They are well above our cleanup levels.

The tidal nature of the river means that water and contamination is moving back and forth twice a day and during storms. And so it's not always obvious where to start the cleanup. The EPA has decided to start the cleanup where the majority of the contamination is in the lower eight miles.

So this Proposed Plan outlines a comprehensive bank-to-bank approach to cleaning up the sediments of the lower eight miles. It reduces risks significantly. But our studies show that we will not meet all of our human health and ecological cleanup goals for all of the contaminants of concern.

But this is a big first step. We

expect that this action, combined with decisions that are made after that comprehensive seventeen-mile study and the Newark Bay study, will all together help us meet cleanup goals in the future.

Just a few key questions that come up about this proposed plan.

Why does the cleanup have to be bank-to-bank?

Why can't it be little hot spot removal along the river?

As I've said before, the contamination is bank-to-bank everywhere in the lower eight miles, at high levels that are well above our cleanup goal.

And so this bank-to-bank cleanup would provide an opportunity to relax fish consumption advisories in the future.

Our studies show that the focused cleanup plan, No. 4, does not allow for this to happen.

So the other question is: Why not take it all out?

And the taking it all out option is Option No. 2, dredging with backfill. The taking-it-all-out option and the cap-it-in-place option that is being proposed, they both reduce risks to the same level. But the capping-it-in-place option that is being proposed has a much greater impact on the local community and on the environment. And this is because the capping-it-in-place option that's being proposed dredges much less sediment over about five years of construction, as opposed to the taking-it-all-out option, which will take 11 years and involves a lot more dredging.

Some of you may know that the act of dredging itself stirs up contamination from the bottom, into the water column. It travels a little bit and falls out again. So the capping-it-in-place option that's being proposed only dredges the top two feet of sediment; that is much less contaminated than the deeper sediments that would be dredged under the taking-it-all-out option.

And so the proposed option has less of an impact on the environment, where the dredging stirs up contamination. It stirs up the less contaminated surface sediments as opposed to the more contaminated deeper stuff.

Oh, and just basically, the proposed option is more easily implemented because it involves so much less dredging. The logistics of moving dredged materials from one place to the other and of disposing of dredged materials is just more easily handled in the smaller project.

The CAD site in Newark Bay versus offsite disposal. There are pros and cons to each disposal method.

The cap over the CAD, that closes the CAD cell, would need to be maintained in perpetuity to make sure that the contamination stays at the bottom of Newark Bay.

Offsite maintenance -- the offsite disposal option does not need additional long-term maintenance because the incinerators and landfills already have long-term maintenance plans in place to deal with all of the other stuff that they are receiving from elsewhere.

The CAD would not treat any of the sediments. It's just a pit at the bottom of the bay.

And offsite disposal would incinerate about 10 percent of the dredged materials.

The CAD does have the least impact on the local community.

Offsite disposal would require the on-land processing facility. It would be, we estimate, about 30 acres. So that is a big impact that the CAD cell would not have.

Of course, the CAD cell would have the most impact on Newark Bay because that's where it's located and offsite disposal would have no impact on Newark Bay.

Both the CAD and offsite disposal are technically implementable. That means that they can be done. They have been used elsewhere around the country at Superfund sites.

But here, in Newark Bay, the CAD is probably not administratively implementable.

As laid out in the Proposed Plan, the State of New Jersey has claimed ownership of the bottom of Newark Bay, and the State of New Jersey is very much opposed to using the bottom of Newark Bay to dispose of highly toxic Passaic River sediments.

Finally, the proposed cleanup plan with CAD disposal would cost about 1 billion dollars. And the proposed cleanup plan with offsite disposal would cost about 1.7 billion dollars. That's a big difference.

And so EPA is particularly interested in receiving comments during the public comment period on the pros and cons of these two disposal methods and also what EPA should include in the final cleanup decision.

Last one: Could the navigation channel be shallower?

The preferred cleanup option includes dredging in the navigation channel, in the lower 2.2 miles, closest to Newark Bay. The depths of that navigation channel were based on a Corps of Engineers survey of companies that used the channel for commercial navigation. These companies told the Corps that they sometimes can't bring in fully loaded ships because they don't have enough water depth to use. And they sometimes have to wait until high tide to bring their ships in to maximize the water depth that they can use.

And also users are restricted from using larger ships in the future, as their companies grow. That's on the one hand.

On the other hand, dredging a channel adds substantially to the volume dredged and to the cost of any proposed plan.

And so, again, EPA is interested in receiving comments during the public comment period on whether the depths included in the proposed cleanup option could be shallower and still accommodate commercial navigation, now and in the future, in the Passaic River. Because shallower means less dredging and a less costly cleanup plan.

So send comments to me at this e-mail address or at the hard copy address that's listed here.

The Proposed Plan and supporting information are available on the Website ourpassaic.org. They are also available at the Newark and Elizabeth public libraries. All of this information is also included in the fact sheets that you can pick up in the back of the room.

And just as a reminder, these are the cleanup options and the disposal methods that you will be commenting on.

MR. KLUESNER: You can keep that

mic. I will use this one here.

Okay. It's time for questions and answers.

Yes.

UNIDENTIFIED SPEAKER: Can I make a comment?

MR. KLUESNER: We have an index card sign-in. Unless it's something --

UNIDENTIFIED SPEAKER: I thought we have a transcriber so that we can take down verbatim comments?

MR. KLUESNER: It's limited.

Did you sign in to get a number, on an index card?

How many index cards have we given out?

MS. AYALA: 15 or so.

MR. KLUESNER: Pardon me?

15.

Okay. We are going to get to you.

So while we are getting sort of set up here, No. 1, 2 and 3, if you could sort of be ready to give your comment.

And I will ask that you provide -- give me your name. It's not required.

But for the stenographer's purposes, if you could provide us with your name, that would be great.

And if you don't have an index card, ask Wanda or Sophia and they will give you a card.

No. 1. Yes. All right.

MR. MORGINSTIN: My name is -- can you hear me okay? -- Harvey Morginstin. I am with the Passaic River Boat Club.

I have been a boater for many years. My boat is a 15-foot wooden craft, built by the Trojan Boat Company in 1957, and I purchased it.

I am a member and secretary of the Passaic River Boat Club, which meets at the Veterans of Foreign Wars facility in Nutley, New Jersey, right near the boat ramp at the Park Avenue Bridge, on Washington Avenue.

I have -- I am also a member of the Harbor Estuary Program. The New York-New Jersey Harbor Estuary Program, the Public Access Working Group.

And I have left some printouts of

my pet peeve, is that when I am in the boat, there is no place to dock my boat in the Hudson River or Newark Bay or any of the areas -- any of the boating areas around the Metropolitan area. There is only commercial places to go to, or yacht clubs. But there are very few places to just land a boat. And my opinion is it should be just as easy to dock your boat as it is to park your car someplace, when you go someplace.

As far as the boat club is concerned, and in the various options that were presented here very well by Alice, we do not wish to be a party to the selection for the cleanup decisions of the EPA and the government. This is way out of the sphere of boaters, per se.

But we do have some very strenuous comments on the effects of this cleanup on the boating community.

Our first was -- and this is just a general kind of a comment -- governments -- and no disrespect to Alice and the committee and the research that is done -- historically never finish when they say they are going to, whatever the plan is. And the cost is generally twice or ten times as much as they planned it to be. And that probably will follow through unfortunately for whatever cleanup method is presented. It's just the facts.

As far as the boat club is concerned, the money could be -- that's used for this cleanup -- although it's important to get rid of the toxic elements in the river, we understand that. But since that is not really going to allow you to eat the fish or the tremendous amount of crabs that are on the bottom -- because we have seen them with our television cameras -- the bottom of the river is loaded with fish life. But you are not going to be able to eat it even after the five-year cleanup or probably even after ten years, or more, because of the pollution that comes into the river from the CSOs that Alice mentioned. And their money probably would be better spent cleaning up the CSOs and cleaning up the river to get rid of the toxic elements. And unless the CSOs are addressed, you are not going to be able to fish or swim in this river anyway.

One of the effects of the 10.9 cleanup -- and I took pictures and sent it to everybody -- was that the sand that they put on top of the rocks quickly dissipated and the entire area is very hazardous and dangerous for boaters on the river. Once the rocks are covered -- at low tide, you can see the rocks very clearly. But at mid-tide, there is danger if you are in that area of having the rocks scrape the bottom of your shell or boat. And on my wooden boat, it would be very hazardous for that boat to be in that area.

So I would suggest that for 10.9, that the government install marking buoys in the river, so that no one goes near that area with a small boat.

Alice mentioned that once this cap is installed, there will be restrictions on anchoring. And frankly, that's not acceptable.

Boaters of all sizes need an emergency way -- in an emergency, you have to be able to throw out an anchor to stop their boat from -- if they lost power, to drift into the side or a crash or whatever.

The channel should definitely be designed and be deep enough, with enough sand at the bottom, so anchors can still be thrown out. My small boat has an anchor that doesn't go down more than a foot. I would think that a two-foot provision for anchoring any boat in the river should be mandatory as part of the design phase. And if that requires you to dig it deeper, then do that. There is no sense fixing the river and then saying you can't use it for boaters.

The second thing that wasn't mentioned -- and I saw this in one of the documents -- is they want to restrict speeds of boaters. Now, most of them are very -- most boaters are very polite and if there is an anchorage, we would slow down. Or if there are people on paddle craft, we slow down. But normally in the river we are going full speed and the wakes are very small because the boats are up on a plane. Actually, when we go slower, there is a larger wake.

But we should not have any wake restrictions, no wake zones on the entire length of the river because you put a cap in.

And finally, my last point, there is a boat ramp near that Park Avenue Bridge. And for over ten years, I have been trying to have it restored. I have researched it six ways to Sunday and that ramp itself is owned by the State of New Jersey. And so the boat club members decided to rename the Nutley boat ramp and call it the New Jersey Boat Ramp at Nutley.

And all that's required to fix that ramp so that it doesn't end in mud at low tide is to dredge out 200 cubic yards. And it's a real shame to me that you have taken out at the lower end of the river --

I forgot -- 20,000 cubic yards and -- is that what it --

MR. KLUESNER: 40,000.

MR. MORGINSTIN: 40,000 cubic yards at Mile 3 or so. And at Mile 10.9, there is 20,000 cubic yards at Mile 10.9. And the Nutley boat ramp was at Mile 10.5 and you couldn't take out another 200 cubic yards at Nutley at the same time. It was a missed opportunity, I feel, by the EPA. And I know the funds are in different baskets in the government. But somehow, somebody should have been able to do that so that ramp could be restored.

There are no useable public boat ramps for 24/7 on the river. The newest ramps that have been installed all end in mud or rocks at low tide. And that is a real shame for the boating community.

Thank you.

MS. YEH: I am not sure if those were comments or questions. But if I could just clarify a couple of things.

The CSOs that you mentioned --

MR. MORGINSTIN: Yes.

MS. YEH: -- our data show that the CSOs aren't really sources of the contaminants that we are talking about. Obviously, they are sources of bacteria and other things that keep you from swimming in the river.

But the Superfund program is cleaning up the river to address the hazardous contaminants, the dioxin and the PCBs. And not too much of that is coming out of the CSOs.

On the sort of emergency anchoring issue and also the other boating issues that you talked about, those are issues that are important but not addressed in any sort of detail in the Focused Feasibility Study or the Proposed Plan. As you alluded to, those will be addressed in detail during the design of the proposed -- of the plan that is finally decided on. And during that design, the EPA would work with the boating community to work out, you know, how much sand needs to be there to smooth out rocks or how much -- how thick the cap has to be to allow for anchoring potentially, especially in emergencies. Things like that.

I think the Proposed Plan tries to tee up some of the issues so that we get comments like what you just said. So that we can sort of work those details out during the design.

MR. MORGINSTIN: Thank you. I know that the CSOs are not issuing, for the most part, you know, large amounts of toxic material. But the CSOs will prevent you from eating the fish and the crabs and will prevent you from swimming in the river. Unless you have a good tetanus shot.

So, if the purpose is to make the river usable for fishing and eating the fish, then this won't accomplish it. I mean, it's a good step in the right direction. Maybe in a hundred years this will be finished.

MR. BASSO: That's true. But there are other programs in the EPA at the state level that are dealing with the CSOs issues.

MR. MORGINSTIN: Okay.

MR. BASSO: So we can't cram it all into one project. But we will do our part, they will do their part, and that's what we are all hoping for.

MR. MORGINSTIN: That's exactly right. That's why the Nutley boat ramp wasn't there.

MR. BASSO: Okay.

MR. KLUESNER: Thank you. Would you like to submit that for the record, your handout? You have a handout that you came with.

MR. MORGINSTIN: Yes. That's it.

MR. KLUESNER: Okay. Make sure Alice has a copy of it.

All right. No. 2.

MR. RUSSO: I actually have handouts. Do you want to take them now or do you want me to do that at the end? It's my written testimony.

MR. KLUESNER: Oh, yes. Absolutely. Thank you.

MR. RUSSO: Good afternoon. My

name is Tony Russo, R-U-S-S-O. And I handle government affairs for the Commerce and Industry Association of New Jersey.

And who are we?

We have been around since 1927. We represent about 900 businesses throughout New Jersey, from virtually every business sector.

And Alice, you did a nice job today presenting all of the technical options out there.

My approach, I am not going to approach it from a technical perspective. But really, from an economic development impact of the options laid out.

If everybody could appreciate that you keep reading in the news, one week from today, New Jersey has to balance its budget and right now there is a revenue shortfall.

So what brings in revenue?

It's private sector jobs; it's business development. And I know that's really not of the concern of EPA. You have to focus in on the cleanup and I could appreciate that that is important, that the cleanup of the river, for both the human health, ecological perspective is important.

But I think EPA needs to also appreciate and do some analysis on the economic impact of the local communities, whether that's the infrastructure, bridges, waterways.

You know, what is that impact going to be?

When you are talking about a 2 billion dollar option and you are going to dredge material that likely will be shipped offsite, you know, how is that material going to go offsite? Is it going to be by rail? What are the repercussions there? Is it by truck?

So, it's complicated, like you said. It's a complex problem. It's been around for many, many years.

I can't stress enough on behalf of our members that one option that you didn't present, that we support, is from the Lower Passaic Cooperating Parties

Group, which is that hot spot remediation.

We firmly believe that concept or that approach will be sustainable, less disruptive, good for the community, and that's the one that should be considered. And we hope that EPA will look at our comments and take that into account.

So thank you very much.

MR. KLUESNER: We definitely will look at your comments. And thank you for submitting them.

No. 3.

MS. LAHM: Hi. I will be quick. My name is Gail Lahm. And I am here as a rower and a coach. I am a person that is on the river from the end of February to the beginning of November, almost six days a week. And I am not a scientist, but I have been on this river like that for almost 20 years.

The impact of the 10.9 project, as much as everybody was very conscious of keeping the impact to a minimum on the rowing community, there was a definite impact on the wildlife this spring. There was no geese, no ducklings, no goslings. The red-tailed hawk is gone, the herons gone. No cormorants.

So I really think that even though that was a very small project, it had a definite impact on the wildlife in the area. And we didn't see any turtles either.

There was a noticeable increase in the grit, as Alice had mentioned when you stir it up, when you are dredging, not only on the boats when we pulled them out of the water, but the coaching launches were clogged like no other year that we have had. That was a very small project. And that was the impact that it had on the wildlife.

I can only imagine what this monumental project will have on the wildlife, on the river.

But I do have a couple of questions. How many barges are going to be going back and forth?

I mean, this is going to be a huge amount of barges that are going to have to come back and forth once the dredging starts.

Can the bridge on the lower Passaic handle opening and closing?

I know there were a lot of problems during the 10.9 project. These bridges are all old and they are not used to being opened and closed and opened and closed. And I know that they try to do it to not impact on the traffic, so I have a concern there.

If the plan to dredge and cap is implemented, who is going to maintain that cap once all of the Superfund money is gone?

And my last question is: I would like to know why the Passaic River was not on the top 50 most polluted rivers in the state -- in the whole country. So I am a little curious that -- why it's not on there.

So my only option that I feel is to do nothing. And I think that the amount of disruption to the wildlife is just going to be tremendous.

But I think the companies that are responsible for this should be held accountable, but I really think that the communities on this river could be better served with creating jobs, improving the access for the people. And, you know, to help -- maybe get some more skimmer boats, keep the floatables off the river. And to educate the public not to throw things into the river.

So, that's just my opinion. And thank you.

MS. YEH: Okay. So addressing some of the questions.

MR. KLUESNER: In terms of like maybe the number of barges.

MS. YEH: Right. The number of barges, the opening and closing of bridges, again those are details that will be worked out during the design of whatever cleanup option is chosen.

As far as the opening and closing of bridges, that is definitely a big lessons learned that we had from the River Mile 10.9 project. And with better planning during design, I think that the problem with the bridges can be solved with engineering solutions. You know, you can survey the bridges ahead of time, see which ones will need to be opened, which ones will not need to be opened. The ones that need to be opened will have to be looked at to see what it will take to fix them.

And so there will be a long design period, I would have to say, before anything is implemented. This is a -- as someone said before, a complex project. So it will take several years to design the cleanup option. During that several years' time, the first thing that we will have to do is address the problem with the bridges, to make sure that there is enough lag time to fully -- to make sure that the bridges will work for any kind of cleanup plan that is implemented.

Who will maintain the cap, that was the third question. That will be included in any sort of agreement that is signed for somebody to carry out the cleanup. So whoever carries out the cleanup will also have to agree to long-term maintenance of the cap.

MR. BASSO: I just want to point out one thing. We're not here to ruin people's good time that they have on the river. But you may not see it, but there is a serious problem in that river in terms of the contamination that lies in the sediment and gets into the biota and works its way up the chain. It's invisible. It's a real threat to human health and the environment. And that's what we are trying to clean up. So I know it's hard to keep a focus on that. But that's the main reason why we are here, is because of that invisible threat. And we will do the best that we can working with people.

You know, 10.9 was the first sort of toe in the water to figure out how we go about remediating problems such as this. And they are not easy because the river moves back and forth, the sediment moves back and forth.

And, so, yes, there were issues that came up with respect to the communication of that project. But we are glad those issues came up because now they are on our radar screens. And there will be others beyond that, as the scope of this project is much greater. But we will work with the community, as we had in the Phase 1 Removal Action and in 10.9, and make that better so that the upset is the least as possible as we go forward.

MR. KLUESNER: Thank you, Ray.

And on the community side of things, we have a strong commitment to working with the community. Not only on the Passaic, but throughout our region and throughout the country. We cannot implement any -- we cannot effectively design the program without community input and involvement. We have been meeting regularly with the Passaic River Community Advisory Group, CAG, as we call it. One of the chairs is here today, Debbie Mans, the New York-New Jersey Baykeeper.

We get a lot of great information

and advice from the Community Advisory Group on things, such as these local impacts and community concerns.

So we anticipate working closely with the community throughout the design process once the plan is selected. So that is our commitment to you.

No. 4, if you could come up, please. No. 4.

No. 5.

No. 6.

MR. ARENCIBIA: Right here.

MR. KLUESNER: We will -- if you have additional questions and comments, you can get an index card at any time.

Leah, how are you doing?

MS. ALLBEE: Good, good.

MR. ARENCIBIA: Hello. My name is Demetrio Arencibia. And I am the county engineer for the County of Hudson.

And I am here to talk about the joint bridges, the joint moveable bridges in the lower Passaic River, that we own jointly with the County of Essex. These bridges are, from south to north, are

Jackson Street Bridge, Bridge Street Bridge and Clay Street Bridge. These bridges connect downtown Newark with the County of Hudson, and the communities in the West Hudson are Harrison, East Newark and Kearny.

Jackson Street Bridge is Frank Rodgers Boulevard in Harrison, which connects into Raymond Boulevard in Newark. Bridge Street Bridge connects downtown Newark into Harrison Avenue, which feeds into Jersey City. And Clay Street Bridge feeds into -- is the northernmost bridge in Hudson county, that we own jointly with Essex County. That connects east Newark to Newark and Kearny is right on the border as well.

So these three bridges are over a hundred years old, each one, built over a hundred years ago. They are all considered historic bridges because they offer historic preservation. And they are all, as you can expect, anything that is over a hundred years old, we have a hard time keeping maintenance on them. They are still operating, they are still moveable bridges. They are all center pier, moveable bridges. That is, that the center pier in the middle of the river is what makes -- is the pier that rotates the span to open up the bridge.

And as you can imagine, the traffic, vehicular traffic on the bridges is substantial.

The marine traffic has, over the last two decades, has dropped substantially. So there is not much marine traffic. And up until recently, until last year, it was very low. Obviously, with the first phase, we -- that was undertaken, we started opening up the bridges for that.

Unfortunately, I don't have a handout. So everything is really what I am saying here.

We did experience problems during Sandy. There was a tidal surge that went up the river and caused electrical damage on the motor equipment. All three bridges sustained damage. It really knocked the bridges out of commission for about three or four months, until we finally got the electrical parts replaced.

Also, with the Phase 1 operation, we did have a center pier shaft -- motor shaft that did shear off, which is very unusual. And that took a couple of months, two or three months of repair.

But we did coordinate with the operators of the Phase 1 operation. So there was a lot of coordination with that. In the end, it did provide assistance with operating the bridges manually, when that came to occur, and ending overtime start.

What I am not going to really say is which option of EPA's proposals are beneficial or best for us. Obviously, the one that requires the least amount of bridge openings is the best. Because the bridges are in old condition, they need staffing. So the operating of the bridges requires staffing.

So the best solution that we would support is the one that expeditiously cleans up the Passaic River and requires the least amount of bridge openings.

And we need to make certain that the Hudson and Essex counties will be supported financially, either by the state or federal government, in the event that any of these bridges require any mechanical failures that may occur when they are being operated.

I was glad to hear a prior speaker bring up the issue of joint bridges. And that the -- those are under consideration in terms of what improvements may be needed for those bridges in the design phase, in the EPA's proposal.

Some of these parts, as you can imagine, they are not made anymore for these bridges. They are outdated, they are antiquated. And so any failures will require a special shop kind of work that may need to make that particular part for that bridge or some other kind of repair that is a little bit more elaborate than your normal repair. So knowing that, it may take a while to repair the bridge, if it does malfunction or break. So it may take three to four months, as we experienced last year in those two malfunctions, it could happen again.

The county does not want to be exposed to any liability from -- or any claims that may result from these failures. So we want to be involved in any of these -- during the design phase -- of any proposed improvements to the joint bridges.

And just so -- just a little background. I mean, obviously, these bridges have been serving the communities for over a hundred years. There have been a number of rehabilitation projects over the decades. And they only last a certain time span and then there is another rehabilitation project that comes along the way.

So we do have program improvements. Right now Clay Street Bridge is under a consultant development study that will evaluate different options, as you presented here options for the cleanup, options for what to do for

Clay Street Bridge, whether it's build, replacement, rehabilitate, rehabilitate. And -- which Clay Street Bridge is our worst rated bridge.

Bridge Street is the second worst; that will be coming into the next study probably in another year or two from now.

So there is -- some coordination is going to be necessary if this does go many years into the future.

So those are all of the comments I have. I appreciate the opportunity to speak.

MR. KLUESNER: Thank you.

No. 7.

MR. BOYKIN: Good afternoon. My name is Jason Boykin. I am a long-time citizen of Newark, New Jersey. And I have been doing a little studying on the Passaic myself.

My question is: I hear about dredging and all of this. And we are trying to get this cleaned up. But I also know that there are government agencies out there that give out permits.

We are still pouring back into the river. What's the purpose of cleaning it if we are going to allow other things to keep being put back in the river, when we can curb this at once? You know, if we know this.

Or is this being addressed with the government?

MR. BASSO: The contaminants that we are cleaning up in the bottom of the river, that are in the sediments, it's different than what's going into the river today. They are mainly different chemicals or they are the same chemicals that are in much, much lower concentrations.

So we are cleaning up what we call legacy contamination that was put into the river many years ago when, as Alice said before, when companies didn't treat their waste before discharging. It was the way things were done back in the '40s, '50s, '60s, even into the '70s, where wastewater discharges from manufacturing plants were just discharged straight into the river.

That's no longer the case.

But that doesn't mean -- these industries on the river now, which aren't as plentiful as they were before, they have treatment requirements before their waste goes into sewer lines for additional treatment at sewer treatment plants.

However, that being said, there are, I think we call it combined sewer overflows, those pipes that you see coming into the river. As well as surface water overflows that drain parking lots, and that do wind up in the river. And those do carry certain contaminants into the river. But those contaminants, as we have tested, are not either the same contaminants or at the same concentrations which drive the significant risk in the sediments that is the subject of this action. So while it's a little bit the same, it is very different.

MR. BOYKIN: Thank you.

MR. KLUESNER: No. 8.

9.

MR. YENNIOR: David Yennior. I

live in Belleville. I am a member of the Citizens Advisory Group. I am also a member -- I'm actually the Passaic River Issues Coordinator for the Sierra Club. I was also on the Passaic River Alliance, Saddle River.

And I have been involved with the river for about nine years formally, because I used to work for the judiciary as a probation officer. And I wasn't allowed to be involved politically. But then I retired and so now I have been involved.

And one of the first things I worked on, in conjunction with the Passaic Valley Sewage Commission and the legislature, was a bottle bill that would get the bottles out of the river by putting a deposit on them. In the meantime, that's gone nowhere because we don't have a governor that will -- we didn't have it with Corzine and we don't have it with Christie -- who will support putting a deposit on plastic bottles. So you still see them out there. People --

one of the rowers, the rowing coach mentioned the floatable issue. And so there is constant cleanup being done.

I don't know if anybody is here from the Passaic Valley Sewage Commission today. Yes? No?

UNIDENTIFIED SPEAKER: It depends.

MR. YENNIOR: You might be here.

UNIDENTIFIED SPEAKER: It depends on what you say. I am just an observer.

MR. YENNIOR: There are a lot of people involved in the river. One is the Passaic Valley Sewerage Commission. We get a lot of river cleanups over the years. And it's the only agency that is responsible to clean up river banks and things like that.

Harvey raised a lot of good issues regarding the boating. Particularly, that the experiment at 10.9 shows that the remedy that is being proposed -- the preferred remedy, which is remedy number 3, is not going to be workable for boaters on this river.

The rowing coach mentioned that

there could be a lot of disruption. And I don't think the rowers go down to the 8-mile point.

UNIDENTIFIED SPEAKER: Yes, they do. They go around. They go down the Passaic and up the Hackensack, on one of the races, yes.

MR. YENNIOR: Oh, they do. Okay.

So the issue is, for me, is that we have had 60 years of no dredging. Yet this proposal will not address the navigability of the river. Except for the lower 2.2 miles.

And then once this cap is put on -- and basically, you know, what they are saying folks, they are going to take two feet out and put two feet back. So the level that we are at as a result of the 60 years of no dredging will remain the same and get worse. There will be no more dredging. So -- and it's going to be bank-to-bank with the same stuff that they put at 10.9.

So what Harvey is talking about, damaging his boat there, every boat on the river will have the same problem: no anchoring, no building of docks because that will disturb it.

I mean, my vision is -- I have been looking at the history, I have done a lot -- I have seen a lot of presentations by the Hackensack Riverkeeper, by the Passaic River Study Group at Montclair State, historians.

I mean, there used to be tall ships on the Passaic River.

I don't understand why, just like in the Hudson River, okay, it's got a deep draft. So you have marinas, you have pleasure boats, you have yachts, canoeing, and kayaking -- they don't need much water, but still you want to have clean water.

So, you know, I understand we want the cleanup. But I guess what I am saying is, we really ought to go for No. 2. We need a deep dredge, but we don't need to fill it all back in if we take out 12 feet. We don't fill it back in with 12 feet. We fill it back, leaving some navigability.

It seems like the EPA is concerned about what is easier. Okay?

And I know the gentleman from Hudson County, the engineer, in charge of bridges. I don't know if anybody is here from Essex County, who is the partner of maintaining those bridges.

Anyone from Essex County? No.

This is the kind of neglect that we have here. We have people that should be concerned about the bridges, the rivers. They don't come. They are not interested. So I don't know why that is.

So, you know, there is a lot of people involved here: the EPA, the DEP, the U.S. Army Corps of Engineers.

I mean -- so the Corps will not maintain the depth of the river heretofore because we are going to be putting a cap on?

So this is apparently a one-time solution. So I think we need to get all of the contaminated sediment out of that river. Not just cap it, not just leave the river at the same level that it is. But let's make this river navigable. Let's get this river back to what it was in 1900 in terms of navigability. This is our one chance.

The polluters are responsible. You are holding them responsible. Whatever it's going to cost. If it's a billion dollars to do that, fine.

But then eventually, you are also going to have to deal with the area all the way up to the Dundee Dam.

We should make this river the best it can be, not leave it, you know, in its sediment -- at the sediment level that it is now.

And the other thing is that more sediment is going to be coming in. But I am really surprised already that at 10.9 some of the sand is gone. So that, obviously, the procedures of the EPA -- I don't know if you are getting your engineers or what people are doing it, they are not doing it right.

Also, as far as inconvenience to

the public, 10.9 was an inconvenience to the public. Because many times, what I saw, I have to go up and down Route 21, the barges were going up and down the river during rush hour. They weren't going like in the middle of the night, which they could have done. So, I mean, they apparently have to go at high tide. There is a coordination of getting the bridges open. So it's a lot of difficulty.

Again, as far as the bridges go, replace those bridges. They are a hundred years old; fix them. Talk to Governor Christie about the needs for those kinds of things.

The bridge on the Belleville Turnpike was replaced. I think it took about two years to rebuild it. So this could be the impetus for getting those bridges fixed once and for all.

Also, if Hurricane Sandy damaged those bridges, where is the funding from the federal government that was given to the state for fixing those bridges? That money could be used to replace them.

That's about it.

MR. KLUESNER: Thank you.

Alice or Ray, there are a few things to address.

MR. BASSO: David said a lot. I will just respond to what is sort of germane to what the EPA is trying to do out there.

Back in the day, yes, there were larger vessels that would go up and down the Passaic River, but that wasn't because of what Mother Nature provided. It was because of what the Corps of Engineers provided.

The Passaic River naturally is eight to ten feet deep. How do I know that? Well, I was at the same symposium at Montclair that he was at, and someone gave a presentation on the history of the Passaic River.

So the reason why that channel is deeper and could accommodate navigation was because the Corps of Engineers in the heyday of industry along the Passaic River went and dug that channel. But that's not the level that the Passaic River wants to be at naturally.

That said, the Passaic River will not continue to silt in so that you won't need bridges eventually. It will reach an equilibrium state, which we believe it's almost at now.

In other words, the flow of the river is such that any sediment that continues to accumulate will wash out with an ensuing high flow event.

So give or take inches or maybe a foot, the Passaic River in most places is close to an equilibrium state.

Talking about something we call reasonably anticipated future use in the Superfund program. That's a policy that was developed by the EPA to address situations that were just currently described about, how far do you go with the Superfund cleanups? Do we clean things up to the days of before there was industry? Or do we look at cleanups based on what land will be used for and what a river will be used for in the future?

And what we did in this case and why we have navigable depths below River Mile 2.2 is because we worked with the Corps of Engineers. And we had a user survey and the result of that survey was a Corps report that came out in 2010, I believe it was, which incorporated what the users felt the user may anticipate future needs; for them it would be commercially in the river. And there really was no need that would justify digging a navigation channel and maintaining it into the future above River Mile 2.2.

Now, we are asking for comments on that, specifically in the plan. Because that might change and it might change to do more and it might change to do less. This is why we are teeing that up so that people could weigh in on that, as David has just done.

So we didn't just decide on our own how deep to leave the river. After we're done remediating it, it will be coordinated with the proper government authority who is in charge of navigation.

And we had input from users of the river before that determination was made.

MS. YEH: If I could clarify. When we say navigation, we mean commercial navigation, big ships that carry oil to oil terminals, that need 30 feet of depth, 20 feet of depth.

For recreational boating, you don't need 30 feet of depth.

And so, the 10 feet of depth that would be envisioned to be left behind above River Mile 2.2 would be to accommodate the recreational boating that occurs.

And as far as the Corps of Engineers maintaining the navigation channel, the commercial navigation channel, we do have a letter from the Corps of Engineers that says they will maintain a commercial navigation channel below River Mile 2.2, subject to funding, of course. But they would be willing to maintain that if there is use of the river, which their survey says there should be, now and in the future.

MR. KLUESNER: No. 10.

MR. DELISLE: My name is Ben Delisle. I am the president of the Passaic River Rowing Association. We are a recreational rowing club with about 400 members. We have high schools, colleges and adults.

I don't want to belabor the point. But I want to underscore it with some of the other people who have spoken. There are nine high schools, two colleges and two adult clubs on the river. There is well over 700 people that row on the river on a regular basis.

And if 10.9 is our teacher, we have a lot of work to do. It was disruptive. The users of the river were kind of informed, but not always consulted.

There are now new navigational hazards that are in place in the river. And I don't think it's just from the washing away of the sand. I think it's from the poor placement of some of the stone that's above the sand.

So it's difficult to support a plan when a lot of the details aren't worked out. And I think that's something we, as a rowing club, certainly struggle with. You can't say, we will work out of the details later.

Especially things like -- just the time frames. I mean, five years. It's the same trip as 10.9, but not even close. Two or three times that. So I think that is something that needs to be clarified.

And one thing that -- my specific question I guess is: What specifically can EPA do to work with the users of the boating community on the Passaic?

Not "we will work with you, we will consult with you."

But, like, what specifically can EPA do to work with or will do to work with the rowing community?

MR. KLUESNER: If I could address -- thank you, Ben.

As you know, your participation

with the Passaic River Community Advisory Group, that is something we -- that is sort of the process that we use. But also, if you look at perhaps the Hudson River cleanup project, they are dredging PCBs from the river and they have a lot of recreational use on the river.

One of the commitments that the agency made through the Record of Decision in 2002, and that project -- that dredging project is underway, and it's been a very successful dredging program.

We work with the community and the Community Advisory Group, in particular, in developing quality of life performance standards, including coming up with a navigation standard for river users. And it was very much spelled out in terms of what our commitments were and what the sort of complaint process and resolution of issues process was. All of that is spelled out and it's available online. You can see what the agency did with the Hudson River project.

Because we recognize that

recreational use of the river is a very important resource for the community. It's very important for your organization.

Also, we want to work closely to try to minimize as many of the impacts as possible. There will be impacts. There will be inconveniences. I think we have been very consistent and clear in saying that.

The greater good is the cleanup of the Passaic River and protecting human health and the environment. As Ray said, we have a tremendous problem with some issues with contaminants in the sediment. We have to take care of it. That's the big responsibility of our agency. But it's also our commitment to the community to work closely with you. And then perhaps performance standards on navigation, on recreational use of the river is one of those things. We will work closely with you to come up with specific standards on that, if that's something that the agency decides to do based on your input in the comment period.

MR. DELISLE: Okay.

MR. KLUESNER: Thank you, Ben.

No. 11.

Speaker number 11.

MR. BONE: Jon Bone, B-O-N-E. I am also with the Passaic River Rowing.

(Pause.)

MR. BONE: My name is Jon Bone, B-O-N-E. Also with Passaic River Rowing.

I have a question regarding the relationship between the lower 8.3 mile cleanup and the larger study that's going on. It seems to me rather strange to be talking about deciding on the lower 8.3, without taking into account what is happening upstream from there.

And if somebody could comment on the status of that larger study and how the lower 8.3 mile proposals fit into the larger plans for the Passaic.

MR. KLUESNER: Alice or Ray? They both -- they are competing as to who is going to answer the question.

MR. BASSO: The data, most of the data, if not all of the data, for the seventeen-mile study is in. So our lower eight-mile proposed plan has taken into account and incorporated that information into the process, even though our Focused Feasibility Study for the lower eight miles has been going on a long time and this other project has been going on, including that area and above it as well, we have been funneling information into this -- into our decision-making process as well.

So, yes, they are connected. But as we said before, 90 percent of the fine-grained sediments, which contain most of the contamination, are in the lower eight miles. And the riverbottom there is mostly uniformly filled with those fine-grained sediments and they move back and forth with the tides.

Upstream of the constriction at River Mile 8.3, the bottom of the river looks very different. You have more pockets of fine-grained contamination rather than bigger contamination.

So we are basically starting off

where most of the contamination resides and is able to move in both directions.

MR. BONE: I understand that. My immediate concern is the stretch of river between approximately Mile 9 and just south of DeJessa Bridge, which your sediment transport maps suggest has the same kind of bottom that you are taking out in the lower 8.3 and that was up at Mile 10.9.

MR. BASSO: Yes. There are pockets of fine-grained sediment. And some of them may be a quarter mile, a half mile. But it's not bank-to-bank like it is downstream.

So we're not saying that there are no contaminants upstream of River Mile 8.3. But, by and large -- I mean, it's a huge geographical area. It's 17 miles of river. You have to start somewhere. And we believe that logistically, the proper way to do it is to start where most of the contamination is.

MR. BONE: Can you tell me or do you have any idea of any time frame on deciding for remediation on the upper stretch of the river?

MR. BASSO: This is speculation. But hopefully within a few years, a couple of years, we will be in a position to make a decision or propose a remedy for the upper --

MR. BONE: That sounds like you want to see how at 10.9 or below 8.3 --

MR. BASSO: No, no, not at all. It's our expectation that we will be in a position to propose a remedy for the entire Passaic River and the upper part of the Passaic River before we begin the remediation in the lower Passaic River.

MR. BONE: On any part of it?

MR. BASSO: Yes. Unless there's a small removal action that is necessary.

This plan, this plan will not -- there won't be a bucket in the river relating to this plan before we are able to at least propose a remedy for the upper Passaic River.

That's our goal.

MR. BONE: Thank you very much.

MR. BASSO: Whether -- you never know what happens down in the future. But that's our expectation.

MR. BONE: Thank you.

MR. KLUESNER: All right. We are going to take a quick five-minute break. All right. Just to stretch, use the restroom, and give our stenographer a little time to rest. Okay?

So at ten 'til, I believe.

We have a number of people that have signed up. If you have questions or comments, get an index card and that will give us time to get to your card. Okay? Thank you.

(Recess taken 3:41 p.m. to 3:48 p.m.)

MR. KLUESNER: Okay. If you could take your seats.

And if No. 12 could -- are you ready?

Thank you.

MS. MANS: Hi. Debbie Mans, New York-New Jersey Baykeeper, M-A-N-S, executive director, Baykeeper.

So this site was first designated a Superfund site 30 years ago and now it's time to clean it up. And before I launch into really what this is about, two issues.

We talked about the combined sewers on the river, which I agree are a problem. But EPA's data and science shows that it's not a significant contributor to the chemical contamination of the river.

Baykeeper agrees that the CSOs are a problem. That's why we sued the state to have them improve their combined sewer general permit. And the state right now is issuing individual permits for these entities. So that's moving on a parallel track. And we agree that people should continue to push EPA and New Jersey DEP on making sure that the rivers are swimmable.

That's what happens with combined sewers. It's about the bacteria in the water.

The Superfund site is about something different. It's about people dying from eating contaminated fish. And that's in the sediment and that's chemical contamination.

Second, to address the commerce gentleman, who has left. The polluter remedy means fewer jobs. It's a smaller cleanup and it's not an economic driver for the community.

Plus, it has no navigation channel written into it. So if you are trying to encourage permanent industry and water-dependent use on the river, you don't support the polluter's remedy.

Those are just two points that came up that I really want to clarify.

So, the corporate polluters, they say they have a better plan. But where have they been for the last 30 years?

And the question you have to ask yourself: Do they have your community's best interest in mind or do they have their own best interests in mind?

And it's not that complicated. Dioxin causes cancer, which causes people to die. And you are either standing for a clean river or you are standing with the corporate polluters.

MR. KLUESNER: Thank you, Debbie.

No. 13.

MR. MONTANO: Thankfully, we are close in height. I don't have to --

My name is Jim Montano. I am with the Fair Lawn Environmental Commission. We have taken a strong interest in looking at the river and at the problem in the cleanup data that is being proposed.

We have spoken to both the NJDEP. We have had conversations with them through one of our members, who is LSRP. We have had some presentations from the Cooperating Parties Group come to us as well. We have looked at all of the information on the Websites.

And we are going to be doing a more detailed written public comment; I will rely upon that. We don't want to take a position here, where -- I am not the technical guy and won't be making those comments.

But as a general statement, what we have come to look at here with the cleanup is that it should be done in the most effective manner. That is to clean up the most amount of contamination, in the lowest period of time.

But you also have to look at the bigger picture. And the bigger picture is the money has to come from somewhere. And we are a pragmatic environmental commission. We understand that we need to clean up the environment, but we also need to do it in a way that is going to get it done, by whatever political means, and do other things.

So, you know, I think there are significant issues, like the bridges that became an issue at the 10.9 mile cleanup. And that's not a minor problem. These bridges delayed that project by months, if I am correct.

And there became a lot of infighting between Passaic County, the state or who is responsible for fixing the bridges and where is that money going to come from.

So we are looking at whatever

cleanup is going to do the best job, in the shortest amount of time, and is going to have the least impact on both the municipalities budgets, the state budget, the bridge disputes, and things of that nature.

So we will do a more detailed written public comment. But those are the main areas that we are looking at in our analysis. And we have done a significant analysis on this and we look forward to providing that comment.

Thank you.

MR. KLUESNER: Thank you so much.

No. 14. Sorry.

No. 15.

MS. RUBIN: Think I am 14.

MR. KLUESNER: You are 14? Awesome.

MS. RUBIN: My name is Sally Rubin, R-U-B-I-N. I am executive director of the Great Swamp Watershed Association.

So while we are predominantly concerned with what is happening way upstream from this issue, we do believe that we should be looking at this river from source to sea. And we are really one river, one community.

I was fortunate enough to attend a presentation at Montclair State a few weeks ago, where I heard you guys do this. But it wasn't an official comment period.

So, at least I got to hear it twice and it makes a little more sense to me.

I also heard a gentleman that day from the DEP, Mark Pedersen. So, hopefully, if I give him credit as a footnote, it doesn't count that I am plagiarizing what he said, because I do agree with a lot of what he said.

We do support the EPA-recommended alternative. We do support bank-to-bank dredging with capping and a navigation channel.

I would like to request that the EPA consider a deeper navigation channel. I am just concerned that there is going to be a lot of sedimentation and it's going to happen a lot faster than we think, especially if we have more and more frequent and big storms, that we should be thoughtful in advance rather than afterward, and dig it deeper now while we can.

We do oppose the hot spot only method. I don't think that will address what is necessary to clean up the river.

We support the bank-to-bank.

I don't think that CAD is practical. I think, as the guy from DEP said, there is so much contamination and the material is too contaminated and there is too much of it, and we don't want it left in Newark Bay.

I think the community deserves a remedy sooner rather than later. And that this is a reasonable compromise between five years and the eleven years, if we wait to do the full deeper dredging.

But I would want to make sure that we don't lose sight of the remainder of the seventeen-mile stretch of the river.

And we would like to make sure that ultimately the river is environmentally healthy, recreationally utilized and economically thriving.

And then I just have one question and I think I asked it at the Montclair meeting as well. But I will ask it again.

I am not quite sure why we are showing 7 percent as being incinerated. I don't understand what material is proposed to be incinerated, why, where or how.

So if you could answer just on the incineration question, that would be great.

Thank you.

MR. KLUESNER: Thank you, Sally.

MR. BASSO: That's an estimate based on what we learned from the Phase 1 Removal Action. That was the 40,000 cubic yards removed outside of the Lister Avenue site.

Dioxin itself is not regulated under RCRA, Resource Conservation and Recovery Act. It's a federal statute that sort of governs cradle-to-grave exposure of contaminants from industrial processes.

Part of RCRA is something called a

Land Ban rule, where if you have a contamination that fails the Toxicity Characteristic Leaching Procedure test, that -- yes, it's complicated -- that that has to be treated before it's disposed of.

So if you -- if any of the RCRA characteristic constituents of that test -- and it could be mercury, it could be chlorobenzene, which is the one that we found in the Phase 1 work area -- exceeds that criteria, than sediment has to be treated.

Now, even though dioxin is not a RCRA characteristic constituent waste, or governed under RCRA, if you have dioxin commingled with RCRA waste that exceeds the standards, then you have to default to an incineration because dioxin is the underlying constituent in the contaminant matrix.

I tried.

MS. RUBIN: How about where --

MR. BASSO: So where it is, is just -- we did like a mathematical calculation regarding how much of that

Phase 1 work area had to be incinerated. And based on the data that we had throughout the river, we created an estimate, mainly for cost estimation purposes of the remedy, as to how much material might have to be incinerated. So...

MS. RUBIN: How about where you would do the incinerating?

MR. BASSO: Oh, I think the incinerator for the Phase 1 waste was out in Oklahoma. That's not the only one. There are incinerators in Texas and in other areas of the country.

MS. RUBIN: Thank you.

MR. BASSO: You are welcome.

MR. KLUESNER: No. 15, you can come up, please.

I just wanted to sort of point out a couple of things. Sally mentioned the navigation channel issues.

It is our goal, as Ray and Alice both mentioned, that we would really like to have a -- make sure we have a really good discussion of disposal issues and navigational issues.

The New Jersey Institute of Technology, Passaic River Coalition are planning a July 22nd forum on these issues. Details, specific information on that will be forthcoming.

If you have signed up, if I have your e-mail, we will be sending that out.

We have held -- there are similar organizations that have held some discussions during the public comment period on various issues. And so this was another opportunity. So stay tuned for that. Okay.

MS. LEVINE: Yes, hi. I am Sue Levine. I am also from the Great Swamp Watershed Association.

I did not have the advantage of attending the other meeting. So this is my first time here; very informative. And as I look at your brochure, also quite informative. But I have a few questions as I was looking through it.

My first question is: Under the cleanup plan that you are proposing, you show the number of pounds that you are removing and you indicate that you have 5.4 million cubic yards remaining. However, you do not actually indicate the number of pounds that will be left behind.

So, for me, I would like to understand what the proportion is. I am going to assume it's probably not equal.

Then, in addition, you -- obviously, the community is going to face a lot of challenges in terms of logistics in the process and the time frame.

One of the things I think that's important is that the community get something back, not just a dredged -- possibly dredged, for the folks that want dredging -- but something that helps in terms of flooding.

One of the questions I have is: How are you factoring in climate change? And how are you factoring in -- we had Hurricane Sandy, Irene. How are you factoring into your equation some benefits that the community might get from increases in flooding, which are anticipated with global warming?

I had a couple more questions. You also indicate in your brochure the risk to wildlife will also be substantially reduced. It's undefined and unclear. I think that was highlighted by several other speakers.

My last question is: You indicate that the cap method will last for a period of time and require maintenance.

How long will the cap method last? What is the maintenance? What is the anticipated cost per year? What are the anticipated costs per storm?

Because it sounded to me, from what I heard today, that there is an increased cost potentially with each potential new storm. And again, this is a factor that I would be concerned, again looking at global warming and the fact that we may not have more storms but the storms will be bigger.

MR. KLUESNER: Thank you.

MS. YEH: Okay. So I have to say the Focused Feasibility Study that we did has all of the details. The fact sheet that you have right now is just sort of an overall summary. That's a little more readable than the Focused Feasibility Study.

As far as the number of pounds of the various chemicals left behind, I don't remember what was in the fact sheet. But the Focused Feasibility Study has an estimate of the number of pounds that would be removed under Cleanup Option No. 2, which is deep dredging, which is removing it all. And if you compare that to the number of pounds that is removed under Cleanup Option No. 3, you subtract, and what's left behind is the difference.

MR. KLUESNER: She is talking about pounds.

MS. LEVINE: I am talking about if there is more contamination on the bottom.

MR. KLUESNER: What are we leaving down below.

MS. LEVINE: It wasn't proportionate.

MS. YEH: Right.

So if you look at the number of pounds, let's say -- I don't know the exact numbers. But let's say Option No. 2 would remove 20 pounds of dioxin. Option No. 3 would remove 3 pounds of dioxin. Then 20 minus 3 is what is left behind in the river.

How do we address climate change? I guess I would say the storms that we get, we have addressed some of that in the modeling. For example, the modeling that we did to try to figure out how thick a cap needs to be in order to withstand a one-in-a-hundred-year storm. The design of the cap and the modeling that went into that does include these extreme storm events.

Risks to wildlife, the details of that are in the Focused Feasibility Study, Appendix D.

Risks to wildlife is a whole sort of -- ecological risks is a whole study that we did. And there are a large number of details that we were not able to fit into a four-page fact sheet.

And so, I would say that if you want details of risks to wildlife, you will have to go to Appendix D of the Focused Feasibility Study.

As far as the cap, the cost for cap maintenance is included in the cost estimates that I showed you.

And as far as how long the cap will last, with maintenance it will have to last a long time. And so it -- what we are talking about is regular maintenance, as well as maintenance after a storm.

So you would build into any agreement to implement the cleanup, you would build into that regular maintenance, going out there and regularly making sure that the cap is still thick enough to do its job.

But also, after major storms or after storms, you would have special trips to make sure that the cap is still there. And if it needs to be supplemented, then the agreement would include that as well.

MS. LEVINE: So the cap would last a long time?

MS. YEH: Yes. I mean, I could say in perpetuity. But that doesn't really help you either. So it would have to be maintained for a long time and there would be agreements in place to make sure of that.

MR. BASSO: Just to give you a sense regarding the design of the cap, the model that Alice talked about and the simulations that were run, we found that the cap is designed so that a 100-year storm event would -- in some cases, we would lose 2 to 3 inches of that cap. So there are 24 inches in total. So we still have plenty of buffer left to go back into the river; do what we call a bathymetry survey and supplement the cap, where necessary.

So it's not like a hundred year storm is going to come through and we are going to go out there and look and the cap is going to be completely stripped off.

In fact, there are some areas of the river that are subject to higher forces, especially during high flow, like around bends. In those areas, there won't just be a sand cap. It will be a sand cap that will be anchored down by anchoring material and stones to keep that in place.

MR. KLUESNER: All right.

No. 16. Joe.

MR. NARDONE: My name is Joseph Nardone. I live in the Ironbound section of Newark, New Jersey.

I am a member, since 2009, of the Citizens Advisory Group.

I am going to give you a history of the Passaic River. I have been involved in the cleanup of the Passaic River -- and I am hearing a lot of nonsense that is coming out here today, that people think that settling this has just come about. Well, I have been involved in the cleanup of the Passaic River since 1984, when dioxin was discovered in the river. It was discovered at the Diamond Shamrock site. This is before these guys from the EPA came. It was the Diamond Shamrock.

They came into our neighborhood

with guys dressed in the moon suits, vacuuming the sidewalks and scraping the dirt off the people's lawns and yards because the dioxin that was put up there by the Diamond Shamrock Company, which was manufacturing Agent Orange, which is a defoliant, a hazardous defoliant, for use in the Vietnam War.

What they did was they disposed of the dioxin by throwing it in the Passaic River. At low tide you found coagulated mounds of dioxin, which they sent workers out with pickaxes and crowbars and other tools to break up that dioxin, which got circulated in the river.

The EPA came in in 1984, and was doing studies of the river. They did the first core borings down 13 feet to the bottom of the river. They had estimated at that time they were going to clean up the entire river with the deep dredging, what they call now, and remove 13 million cubic yards of toxic wastes. That was stopped because the Republicans took over the presidency and the congress.

And for 15 years, nothing was done about the river. It wasn't until 2009 -- and this is in my community -- it wasn't until 2009, when these guys came back in, established the CAG, and for five years, we have been working on cleaning up the river.

I hear nonsense about the Lower Passaic -- Lower Passaic Cooperative Group -- I am sorry, the CPG -- which a little kid in our community called the cocky poop group.

So we hear this. These people polluted the river because they were using the river as an open sewer, violating my environmental justice, and the people who live in the Ironbound section of Newark.

This river would not be in this state it is if these people took the social responsibility and cleaned up the river in the first place.

They talked about the bridges. You want money for the bridges? Get it from the CPG. Make them pay for the repair and replacement of the bridges.

They polluted the river, not the citizens of Newark or any other town on the river. Okay?

I know politics is coming in. The Fairfield -- where is he? The Fairfield --

UNIDENTIFIED SPEAKER: Fair Lawn.

MR. NARDONE: The Fair Lawn group talks about a cleanup. It sounds like he is heavily influenced by the CPG.

Get the money from the CPG. Get the money from the polluters.

They talk about the river and the boating. We wanted boating on this river in 1984. We couldn't get it because of the pollution.

And I hear all of this nonsense about the cap. Are these important issues? Yes. They will have to be addressed. And what these guys said will be done in five years, working out the plans, to get this capped, river cleaned up and properly capped.

And it's not going to be the easy issue. Seventy years, a hundred years, this river has been polluted.

On the Diamond Alkali site -- let me refer to this -- on the Diamond Alkali site, you can go down to Lister Avenue in Newark, and you will find a capped interim site that's going to be there probably until the end of the world.

When they cleaned up the area in the Ironbound section of Newark, they came up with 936 semi-trailers; each trailer 12-feet high. 936 trailers that they put all of the debris, the clothing and the material used to clean up the river. They could not find a disposal site. That was washed off, the water recycled, returned to the river and shredded. And it's entombed on the Diamond Alkali site, which is totally useless for human beings.

They had to create a negative flow system to keep the water from running into the river with a steel bulkhead.

And that site is going to be monitored for I don't know how long. This is in my community. We want that river cleaned up.

Mr. Lipke over here used to work for the -- PVSC. We had worked with him ABOUT the combined -- the CSOs -- the combined sewer overflows, about cleaning that up many years ago.

And I must give credit that the PVSC did work to clean that up.

So this river has been worked on for years. If you think these guys are going to come in here and in two years clean this river up, you are crazy, you are stupid, or you are both. Because this is going to take a long time to do the job.

There are going to be details that we have to work out. We have details we have been working out for the last five years, which none of you have been at the CAG meetings to work on and to talk about. This is not simple.

We wanted our river back. We now have the Riverfront Park, which they gave the statement on in April about the cleanup of the river. It took us 25 years to get that park.

We want the river cleaned up so we can go boating. Will there be problems? Yes. Will they be worked out? Yes. They can be done.

The CPG doesn't want to assume their social responsibility to clean up the pollution that they created in this river.

And another point, they come up with a fish hatchery, where they wanted to put a fish hatchery in the city of Newark and replace polluted carp that people were putting in the river, up and down the river. They were going to have somebody going around and saying, oh, you caught carp? Here, here is not polluted carp, we will give you and give us the polluted carp.

And then what were they going to do with the carp? Incinerate it in a garbage incinerator that sits on the Passaic River, a quarter of a mile, as the current flows, from my house, spewing mercury because it is not controlled.

And it's that mercury that goes

into the river and causes problems with
the community. We want this river cleaned
up.

You got to know the history on
this river. You got to do some research,
and find out that since 1984, we have been
working on the cleanup of this river. And
we, the residents of the Ironbound, want
this river cleaned up.

You live up here, pay attention.
Grow up.

MR. KLUESNER: Thank you, Joe.

Are there any additional
commenters that I am unaware of?

Does anybody else have any
questions or comments?

We are here to answer those the
best we can.

Okay. Then having seen none, we
are concluded for now.

Thank you for coming. Very much
appreciated.

(Time noted: 4:15 p.m.)

C E R T I F I C A T E

STATE OF NEW JERSEY)
) ss.
COUNTY OF HUDSON)

I, LEAH ALLBEE, RPR, CCR, a Shorthand (Stenotype) Reporter and Notary Public of the State of New York, do hereby certify that the foregoing transcription of the Public Meeting held at the time and place aforesaid is a true and correct transcription of my shorthand notes.

I further certify that I am neither counsel for nor related to any party to said action, nor in any way interested in the result or outcome thereof.

IN WITNESS WHEREOF, I have hereunto set my hand this 11th day of August, 2014.

LEAH ALLBEE, RPR, CCR

ATTACHMENT D

PUBLIC COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD

ATTACHMENT E

UPDATED MECHANISTIC MODEL

ATTACHMENT F

BRIDGE INFORMATION FOR THE LOWER PASSAIC RIVER

ATTACHMENT G

SEDIMENT QUALITY TRIAD REFERENCE DATA TABLES