DESIGN ANALYSIS REPORT

PLEASE UPDATE THESE SECTIONS PER EPA COMMENTS ON GROUNDWATER MODELING (APPENDIX I and SACTM) AND TABLE 1 ATTACHED TO DAR COMMENTS.

7.4 Short-Term Water Quality Effects

7.4.1 *Water Quality during Dredging Activities*

A number of factors will control the water quality around the dredging operations. These factors include dredging equipment and methods, sediment characteristics, hydrodynamic conditions, water depth, and others. Hydraulic dredging is currently anticipated to be the primary method of environmental dredging in Slip 3, but mechanical dredging will also be utilized in some areas, such as for areas near structures in Slip 3, in Berth 414, and excavation of the berm key.

The USACE model DREDGE was used to predict suspended sediment concentrations around the dredging operation (Kuoand Hayes 1991). DREDGE model input parameters are summarized in Table 13. Both mechanical and hydraulic simulations were performed. A range of loss rates was used for hydraulic dredging (ranging from 0.5 to 2 percent loss) and mechanical dredging (ranging from 5 to 10 percent loss). The critical conditions for mechanical dredging included somewhat higher ambient current speeds (i.e. to simulate clamshell work in the more open portions of the RAA) and shallower water depths (i.e. typical of Berth 414).

DREDGE model results are shown on Figure 29. Higher TSS concentrations were predicted for hydraulic dredging because, although hydraulic dredging is characterized by lower percent loss rates, this is off set by much higher production rates. The model predicts initial TSS concentrations in the immediate vicinity of the hydraulic dredge could be as high as 1,200 mg/L. In most scenarios, both hydraulic and mechanical, concentrations drop off rapidly within about 25 meters from the dredge. When dredging in shallow water and open currents (i.e., mostly the mechanical scenario), TSS concentrations may extend farther downstream. The DREDGE model predicts that TSS concentrations typical of ambient conditions in the Willamette River (i.e. 24 mg/L; see Table 7) will generally be reached within 25 meters of the dredge. It is acknowledged that DREDGE model results have not accurately predicted water quality impacts on some recent dredging projects, and, therefore, the DREDGE modeling results are of uncertain usefulness in predicting actual water quality impacts that will occur during construction.

Sensitivity analyses show that the x parameter will have the greatest impact on model results (EXPLAIN).

~~Dredging BMPs to control water quality impacts are presented in the Water Quality Monitoring Plan and incorporated in to the Construction Specifications.~~

Water quality monitoring will be performed to document actual water quality impacts during construction. Further details are provided in the Water Quality Monitoring Plan (Appendix D, cite section references). Dredging BMPs to minimize -water quality impacts are presented in the Water Quality Monitoring Plan and incorporated in to the Construction Specifications. These BMPs include:

- Summarize BMPs and cite reference to WQMP and construction specifications.

7.4.2 *Water Quality during Capping Activities*

A number of factors will control the water quality around the capping operation. These factors include capping equipment and methods, sediment and cap material characteristics, hydrodynamic conditions, water depths, and others. The capping materials are anticipated to be placed using mechanical equipment such as clamshell bucket.

Predicting water quality associated with capping activities is difficult due to the lack of specific models. Resuspension of contaminated sediment during construction (both dredging and capping) is anticipated. However, monitoring data available from other similar projects indicates that resuspension during capping operations can be minimized depending on placement techniques employed. Two investigations conducted by USEPA's National Risk Management Research Laboratory (NRMRL) measured the release of in situ contaminated sediments during cap placement at Boston Harbor, Massachusetts and Eagle Harbor, Washington (USEPA 2005). The results of both investigations indicated that resuspension occurred during the initial placements of cap material~~run(s)~~, and progressively decreased and dissipated with each subsequent cap material application.~~run.~~ (Elevated releases were observed for the first lift only in Boston Harbor with the X placement technique and for the first three lifts at Eagle Harbor due to the more aggressive Y placement technique (STATE PLACEMENT TECHNIQUE) in the latter case.) These results suggest that resuspension during cap placement may be minimized by placing cap materials in several lifts, such that the initial lift involves methods with minimal disturbance (i.e., low energy) followed by more aggressive techniques for subsequent lifts. Potential low energy place techniques include X, Y, Z. Aggressive placement techniques include A, B, C.

Cap construction at the T4 site will initially use the X placement method to minimize sediment disturbance, followed by the B placement method to speed material placement once the risk of contaminated sediment disturbance is low.

Cap placement BMPs to control water quality impacts during capping operations will be presented in the Water Quality Monitoring Plan and incorporated into the Construction Specifications.

Water quality monitoring will be performed to document actual water quality impacts during construction. Further details are provided in the Water Quality Monitoring Plan (Appendix D, cite section references). Appropriate construction BMPs are presented in the Construction Specifications (Appendix G, cite section references) in order to minimize turbidity and other water parameters, including chemical contaminants.

7.4.3 *Water Quality during Filling of the CDF with T4 Sediments*

During the T4 early action, iIf filling of the CDF with dredged sediment progresses at a relatively fast rate, the water level within the CDF will rise. If water rises high enough, it will be discharged over a weir, through a pipeline, and out an outfall into the river. During placement of hydraulically dredged sediments from Slip 3, discharge of XXX gallons of effluent over the weir is expected. The During dredging, the water within the CDF will contain some suspended sediments. The turbidity and TSS concentrations in the water that goes over the weir will need to be controlled to ensure that water quality standards are met and unacceptable levels of contaminants are not released back to the river.

The turbidity and TSS concentrations at the weir are influenced by several factors, including dredge production rate and schedule, solids concentration of influent, size of CDF and ponding depth, dredging volume, and sediment settling characteristics. It is expected possible that during the dredging of Slip 3 sediments, the CDF will not be able to fully contain the dredge slurry, and therefore approximately XXX gallons of and no water will need to be discharged over the weir. However, the weir structure and water management operations will be employed in the cases that an overflow of the weir and water discharge will be required. The management of CDF filling operations will be adjusted as required to control water quality at the compliance zone boundary.
Water quality monitoring will be performed to document actual water quality impacts during construction. Further details are provided in the Water Quality Monitoring Plan (Appendix D, cite section references). Appropriate construction BMPs are presented in the Construction Specifications (Appendix G, cite section

references) in order to minimize turbidity and other water parameters, including chemical contaminants.

7.4.3.1 Effluent Outfall

As discussed in Sections 7.4.2 and 7.4.3, the results of the MET - and CST are used to estimate the quality of the dredging elutriate water in the CDF pond that may be discharged to the river. Total (particulate borne) contaminant MET results were used in this analysis rather than dissolved concentration results. The estimated discharge parameters over the weir are listed below, although substantial variability could occur based on field conditions encountered during construction:

- Peak Estimated CDF Water Elevation:
- Anticipated River Elevation:
- Peak Flow rate: X gallons per minute (Y million gallons per day)
- Typical and Least Hydraulic Retention Times in the CDF (X and Y hours) and expected TSS concentrations at Weir based on CSTs.
    - Peak TSS Concentration over Weir: X mg/L
    - Average TSS Concentration over Wier: Y mg/L

Table X compares estimated peak and average Total Contaminant Concentrations in the weir discharge with applicable water quality standards/criteria. Results indicate (EXPLAIN).

The discharge of TSS and particulate borne contaminants is not expected to substantially worsen sediment contamination in the vicinity of the discharge. (PROVIDE ANALYSIS).

~~The USEPA model PLUMES (Frick et al. 2005) was then used to estimate the amount of mixing that occurs in the compliance zone, as well as in the zone of initial dilution (ZID). PLUMES model input parameters are presented in Table 14. The model is based on a discharge of 7.6 MGD through a 17-inch outfall submerged beneath 28 feet of water.~~

~~The PLUMES predicted dilution factors are shown on Figure 30. The ZID extends 125 feet (38 meters) from the outfall, at which point an average dilution of 37: 1 is achieved. Beyond the ZID, a minimal amount of additional dilution occurs. At the compliance boundary, the estimated dilution factor is 39:1.~~

~~A dilution analysis is presented in Table 15. A very conservative estimate of the TSS concentration at the weir overflow is obtained from the CST results (See Section 7.3.3), estimated at 1,900 mg/L at the mean retention time. This~~

estimate is very conservative because it does not account for the substantial ponding depth in Slip 1, and the accelerated settling caused by large-scale flocculation and density stratification. Based on the estimated background TSS concentration in the Willamette River, plus ten percent (49 + 5= 54 mg/L; see Table 7), a dilution factor of about 35 would be needed to reduce TSS concentrations to near background. PLUMES model results indicate this amount of dilution will generally be achieved at the compliance boundary.

TSS clearly appears to be the determining parameter for compliance. On the other hand, ample dilution is available to reduce all toxic constituents to acceptable levels in shorter distances. Copper requires a four-fold dilution to meet its acute criterion, a condition that will be achieved within about 10 to 30 feet of the outfall. Copper and several other constituents require dilutions of 6:1 to 9:1 to achieve chronic criteria, conditions that will be achieved within 30 to 60 feet of the outfall.

The Contractor will be required to use a submerged diffuser for placement of dredge slurry into the CDF in order to minimize TSS concentrations within the CDF. The use of a submerged diffuser will reduce the velocity of the slurry before it is discharged and reduce the distance the slurry falls through the water column. These two factors will reduce the amount of suspended solids in the CDF and keep the material that is suspended close to the CDF bottom.

Contingency measures will be implemented if water discharged over the weir does not meet applicable water quality requirements as specified in the WQMCCP. Potential contingency measures are:

- Flow/turbidity curtains and/or baffles in the CDF around the weir
- Flow/turbidity curtains and/or baffles within the CDF, particularly when the dredge discharge diffuser is discharging in the vicinity of the weir.
- Active treatment of CDF effluent, including:
  - Chitosan flocculation and sand filtration
  - ???

7.4.3.2 Groundwater Seepage through the Berm

A steady state groundwater transport model was runset up to evaluate the quality of groundwater that may be seeping through the berm during filling operations. The model conservatively simulates a relatively extreme and unlikely condition in which a head differential of 16 feet (water elevation at

20 feet in the CDF pond and at 3.8 feet in the river) is imposed continuously across the berm for 15 consecutive days, stimulating groundwater transport velocities significantly higher than those observed under typical long-term conditions.

(UPDATE CONCLUSIONS HERE PER REVISED MODELING ANALYSES BASED ON EPA COMMENTS ON DAR (INCLUDING TABLE 1), AND SACTM).

~~Copper and lead were the only dissolved constituents in the MET that exceeded their chronic criteria. Model predictions of berm seepage quality for copper and lead are shown on Figure 31, and further details are provided in Appendix I. In spite of the extreme gradient and rapid flow, copper and lead concentrations at the end of the 15-day dredging period were still many orders of magnitude below their respective chronic criteria. These model results indicate water quality monitoring is best focused on the effects of direct effluent discharge through the outfall (Section 7.5.3.1), rather than diffuse groundwater see page at the berm face.~~

7.4.4 *Water Quality during Sediment Transport of T4 Sediments*

~~Dredged S~~sediment dredged from the T4 site will be transported by barge and/or hydraulically through a pipeline from the dredging location to the CDF. Sediment overexcavated beneath the containment berm will be dredged mechanically and transported by barge to the head of Slip 1 for placement. Sediment in Slip 3 will likely be dredged hydraulically with some locations of mechanical dredging.

~~Collection of field parameters every 6 hours and one laboratory sample to be analyzed by COCs will be the first tier of monitoring. Visual monitoring will occur along the pipeline if the material is hydraulically dredged and at the transfer facility if mechanically offloaded. If a plume of significant duration (one hour) and extent (width of the compliance zone) is observed around the construction operation, then sampling will occur to monitor water quality.~~ Water quality monitoring will be performed to document actual water quality impacts during construction. Further details are provided in the Water Quality Monitoring Plan (Appendix D, cite section references). Appropriate construction BMPs are presented in the Construction Specifications (Appendix D, cite section references).

7.4.5 *Water Quality during Demolition and Pile Removal*

Numerous structures and piling will be demolished and removed as part of the Removal Action (see Sections 4.7 and 5.4). ~~Collection of field parameters every 6 hours and one laboratory sample to be analyzed by COCs.~~ Anticipated water quality impacts from debris, dust, and sediment disturbances are summarized below:

- ???
- ???

Water quality monitoring will be performed to document actual water quality impacts during construction. Further details are provided in the Water Quality Monitoring Plan (Appendix D, cite section references). Appropriate construction BMPs are presented in the Construction Specifications (Appendix G, cite section references) in order to minimize turbidity and other water parameters, including chemical contaminants.

7.4.6 *Water Quality during Marine Structures Construction*

Piling will be driven and superstructure constructed as part of the Removal Action for the Berth replacement (see Section 4.9). Collection of field parameters every 6 hours and one laboratory sample to be analyzed by COCs. Anticipated water quality impacts from debris, dust, and sediment disturbances are summarized below:

- ???
- ???

Water quality monitoring will be performed to document actual water quality impacts during construction. Further details are provided in the Water Quality Monitoring Plan (Appendix D, cite section references). Appropriate construction BMPs are will be presented in the Construction Specifications (Appendix G, cite section references) in order to minimize turbidity and other water parameters, including chemical contaminants.