UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION III

IN THE MATTER OF: AIW Frank/Mid-County Mustang Superfund Site) Docket No. CERCLA-03-2020-0082DC)
B&J Excavating, Inc., RESPONDENT	
Proceeding under Sections 104, 107, and 122 of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §§ 9604, 9607, and 9622	Administrative Settlement Agreement and Order on Consent for Removal Action

ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT FOR REMOVAL ACTION

I. JURISDICTION AND GENERAL PROVISIONS

- 1. This Administrative Settlement Agreement and Order on Consent for Removal Action ("Settlement") is entered into voluntarily by the United States Environmental Protection Agency ("EPA") and B & J Excavating, Inc. ("Respondent"). This Settlement provides for the performance of a removal action by Respondent on several wells (i.e., MW- 103A/103B, MW-112A/B, MW-113A/113B, and MW-115) located on the Lochiel Farm portion of the AIW Frank/Mid-County Mustang Superfund Site (the "Site"), generally located at and around 740 North Ship Road, Exton, West Whiteland Township, Chester County, Pennsylvania (the "Affected Property"). In entering into this Settlement, the mutual objectives of EPA and Respondent are to conduct a removal action, as defined in Section 101(23) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended ("CERCLA"), 42 U.S.C. § 9601(23), to abate, mitigate, and/or eliminate the release or threat of release of hazardous substances at the Site (as hereinafter described) by the installation, abandonment, or repair of the several monitoring wells described above as part of the remediation of a contaminated groundwater plume at the Site.
- 2. This Settlement is issued under the authority vested in the President of the United States by Sections 104, 107, and 122 of CERCLA, 42 U.S.C. §§ 9604, 9607 and 9622. This authority was delegated to the Administrator of EPA on January 23, 1987, by Executive Order 12580, 52 Fed. Reg. 2923 (Jan. 29, 1987), and further delegated to the Director of the EPA Region III Superfund & Emergency Management Division on April 15, 2019.
- 3. EPA has notified the Commonwealth of Pennsylvania (the "Commonwealth") of this action.
- 4. EPA and Respondent recognize that this Settlement has been negotiated in good faith and that the actions undertaken by Respondent in accordance with this Settlement do not constitute an admission of any liability. Respondent does not admit, and retains the right to controvert in any subsequent proceedings other than proceedings to implement or enforce this Settlement, the validity of the findings of facts, conclusions of law, and determinations in Sections IV (Findings of Fact) and V (Conclusions of Law and Determinations) of this Settlement. Respondent agrees to comply with and be bound by the terms of this Settlement and further agree that it will not contest the basis or validity of this Settlement or its terms.

II. PARTIES BOUND

- 5. This Settlement is binding upon EPA and upon Respondent and its successors and assigns. Any change in ownership or corporate status of Respondent including, but not limited to, any transfer of assets or real or personal property, shall not alter Respondent's responsibilities under this Settlement.
 - 6. Respondent is liable for carrying out all activities required by this Settlement.
- 7. Each undersigned representative of Respondent certifies that he or she is fully authorized to enter into the terms and conditions of this Settlement and to execute and legally bind Respondent to this Settlement.

8. Respondent shall provide a copy of this Settlement to each contractor hired to perform the Work required by this Settlement and to each person representing Respondent with respect to the Site or the Work, and shall condition all contracts entered into hereunder upon performance of the Work in conformity with the terms of this Settlement. Respondent or its contractors shall provide written notice of the Settlement to all subcontractors hired to perform any portion of the Work required by this Settlement. Respondent shall nonetheless be responsible for ensuring that its contractors and subcontractors perform the Work in accordance with the terms of this Settlement.

III. DEFINITIONS

9. Unless otherwise expressly provided in this Settlement, terms used in this Settlement that are defined in CERCLA or in regulations promulgated under CERCLA shall have the meaning assigned to them in CERCLA or in such regulations. Whenever terms listed below are used in this Settlement or its attached appendixes, the following definitions shall apply:

"Activity and Use Limitations" shall mean the activity and use limitations established for the Affected Property in the Environmental Covenant recorded on September 18, 2019, under the Pennsylvania Uniform Environmental Covenants Act, Act No. 68 of 2007, 27 Pa. C.S. §§ 6501-6517.

"Affected Property" shall mean the Lochiel Farm parcel, an estimated 32.2 acres of real property located at or near 740 North Ship Road, Exton, West Whiteland Township, Chester County, Pennsylvania, and identified in Chester County property records by Uniform Parcel Identifier ("UPI") Number 41-5-93. The "Affected Property" is a portion of the AIW Frank/Mid-County Mustang Superfund Site.

"AIW Frank/Mid-County Mustang Superfund Site Special Account" shall mean the Superfund site special account within the EPA Hazardous Substance Superfund, established for the Site by EPA pursuant to Section 122(b)(3) of CERCLA, 42 U.S.C. § 9622(b)(3), and by the Consent Decree entered on January 17, 2012, in *United States v. CDS Investment Company, et al.* (Civil Action No. 11-5696).

"CERCLA" shall mean the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. §§ 9601-9675.

"COC" shall mean a contaminant of concern.

"Commonwealth" shall mean the Commonwealth of Pennsylvania.

"Day" shall mean a calendar day. In computing any period of time under this Settlement, where the last day would fall on a Saturday, Sunday, or federal or Commonwealth holiday, the period shall run until the close of business of the next working day.

"DEP" shall mean the Pennsylvania Department of Environmental Protection and any predecessor or successor departments or agencies of the Commonwealth.

"Effective Date" shall mean the effective date of this Settlement as provided in Section XXX.

"EPA" shall mean the United States Environmental Protection Agency and its successor departments, agencies, or instrumentalities.

"EPA Hazardous Substance Superfund" shall mean the Hazardous Substance Superfund established by the Internal Revenue Code, 26 U.S.C. § 9507.

"Environmental Covenant" shall mean the Environmental Covenant recorded on September 18, 2019, under the Pennsylvania Uniform Environmental Covenants Act, Act No. 68 of 2007, 27 Pa. C.S. §§ 6501-6517, as an institutional control implementing activity and use restrictions selected in the September 29, 1995 Record of Decision ("ROD"), as modified by the June 16, 2017 ROD Amendment.

"Five-Year Review" shall mean the no-less-often-than-five-year review by EPA of a remedial action that results in any hazardous substances remaining at a site, as required by Section 121(c) of CERCLA, 42 U.S.C. § 9621(c).

"Future Response Costs" shall mean all costs incurred by the United States after the Effective Date in connection with the Affected Property, including, but not limited to, direct and indirect costs, that the United States incurs in reviewing or developing deliverables submitted pursuant to this Settlement, in overseeing implementation of the Work, or otherwise implementing, overseeing, or enforcing this Settlement, including but not limited to, payroll costs, contractor costs, travel costs, laboratory costs, the costs incurred pursuant to Section IX (Property Requirements), including but not limited to, cost of attorney time and any monies paid to secure or enforce access or Activity And Use Restrictions at the Affected Property, Section XIII (Emergency Response and Notification of Releases), Paragraph 71 (Work Takeover), Paragraph 98 (Access to Financial Assurance), community involvement including, but not limited to, the costs of any technical assistance grant under Section 117(e) of CERCLA, 42 U.S.C. § 9617(e), Section XV (Dispute Resolution), costs incurred for conducting any Five-Year Review for the Site under Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), costs associated with implementation of any Post-Removal Site Controls at the Site and Affected Property, costs related to compliance assurance related to the Environmental Covenant, and all litigation costs. Future Response Costs shall also include costs pertaining to the Site incurred by the Agency for Toxic Substances and Disease Registry ("ATSDR").

"Interest" shall mean interest at the rate specified for interest on investments of the EPA Hazardous Substance Superfund established by 26 U.S.C. § 9507, compounded annually on October 1 of each year, in accordance with 42 U.S.C. § 9607(a). The applicable rate of interest shall be the rate in effect at the time the interest accrues. The rate of interest is subject to change

on October 1 of each year. Rates are available online at https://www.epa.gov/superfund/superfund-interest-rates.

"National Contingency Plan" or "NCP" shall mean the National Oil and Hazardous Substances Pollution Contingency Plan promulgated pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, codified at 40 C.F.R. Part 300, and any amendments thereto.

"Paragraph" shall mean a portion of this Settlement identified by an Arabic numeral or an upper- or lower-case letter.

"Parties" shall mean EPA and Respondent.

"Post-Removal Site Control" shall mean actions necessary to ensure the effectiveness and integrity of the removal action to be performed pursuant to this Settlement consistent with Sections 300.415(l) and 300.5 of the NCP and "Policy on Management of Post-Removal Site Control" (OSWER Directive No. 9360.2-02, Dec. 3, 1990).

"RCRA" shall mean the Solid Waste Disposal Act, as amended, 42 U.S.C. §§ 6901-6992 (also known as the Resource Conservation and Recovery Act).

"Remedial Action" shall mean the remedial selected by EPA in the September 29, 1995 ROD, as modified by the June 16, 2017 ROD Amendment.

"Respondent" shall mean B & J Excavating, Inc.

"ROD" shall mean the September 29, 1995 Record of Decision in which EPA selected a remedial action for the Site.

"ROD Amendment" shall mean EPA's June 16, 2017 modification of the ROD.

"Section" shall mean a portion of this Settlement identified by a Roman numeral.

"Settlement" shall mean this Administrative Settlement Agreement and Order on Consent for Removal Action and all appendixes attached hereto (listed in Section XXIX (Integration/Appendixes). In the event of conflict between this Settlement and any appendix, this Settlement shall control.

"Site" shall mean the AIW Frank/Mid-County Mustang Superfund Site, located at and near Exton, West Whiteland Township, Chester County, Pennsylvania, and depicted generally on the map attached as Appendix A.

"Transfer" shall mean to sell, assign, convey, lease, mortgage, or grant a security interest in, or where used as a noun, a sale, assignment, conveyance, or other disposition of any interest by operation of law or otherwise.

"United States" shall mean the United States of America and each department, agency, and instrumentality of the United States, including EPA.

"Waste Material" shall mean (a) any "hazardous substance" under Section 101(14) of CERCLA, 42 U.S.C. § 9601(14); (b) any pollutant or contaminant under Section 101(33) of CERCLA, 42 U.S.C. § 9601(33); (c) any "solid waste" under Section 1004(27) of RCRA, 42 U.S.C. § 6903(27); and (d) any "hazardous waste" under the Pennsylvania Solid Waste Management Act, 35 P.S. § 6018.103.

"Work" shall mean all activities and obligations Respondent is required to perform under this Settlement, except those required by Section XI (Record Retention).

IV. FINDINGS OF FACT

- 10. EPA makes the following findings of fact:
 - a. The Site is located on Route 30, near Exton in West Whiteland Township, Chester County, Pennsylvania. The Site includes, among other areas, two contiguous properties the former AIW Frank facility and the former Mid-County Mustang facility. As a result of historic operations at these facilities, soil and groundwater were impacted by hazardous substances, including volatile organic compounds ("VOCs"), semi-volatile organic compounds ("SVOCs"), pesticides, polychlorinated biphenyls ("PCBs"), and heavy metals. The Site also includes the areal extent of a contaminated groundwater plume, which underlies the two properties described above, as well as the Affected Property. A map of the Site is attached hereto as Appendix A.
 - b. After various Site investigations conducted by DEP, EPA, and the former owners of the Site, EPA added the Site to the National Priorities List ("NPL") on October 24, 1989. The NPL is the list of national priorities among known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States.
 - c. EPA issued a Record of Decision ("ROD") on September 29, 1995, selecting a remedial action for the Site under CERCLA to address the release of hazardous substances in soils and groundwater. The major contaminants of concern ("COCs") identified in the ROD were Trichloroethene, 1,1-Trichloroethane, 1,1-Dichloroethene, 1,1-Dichloroethane, 1,1-Z-Trichloroethane, cis-1,2-Dichloroethene, 1,2-Dichloropropane, Tetrachloroethene, Vinyl Chloride, Toluene, Chloroform, Arsenic, and Manganese. The chosen remedial action included, among other things, installation of a waterline, remediation of contaminated soils at the AIW Frank facility, and construction and implementation of a groundwater extraction and treatment system ("GETS"), which included installation of monitoring wells on the Affected Property and

- elsewhere at the Site. ¹ The ROD also required implementation of institutional controls prohibiting consumption of groundwater and the creation of any hydraulically adverse influence on the GETS until the cleanup is completed. EPA completed construction of the remedial action on November 8, 2000. The ROD estimated it would take 30 years to remediate the groundwater at the Site to the cleanup standards identified in the ROD.
- d. From 2007 to 2015, EPA successfully conducted a series of pilot studies and a focused feasibility study aimed at improving the long-term effectiveness of groundwater treatment with in situ chemical oxidation ("ISCO") and in situ bioremediation ("ISBR").
- e. As a result of these studies, EPA amended the ROD on June 16, 2017 ("ROD Amendment"), modifying the groundwater remedy by replacing the GETS with ISCO and ISBR. In addition, the ROD Amendment modified the groundwater COCs by adding 1,4-dioxane as a COC and removing arsenic and manganese as COCs. The ROD Amendment also modified the applicable or relevant and appropriate requirements ("ARARs") for the groundwater remediation by adding the Federal Safe Drinking Water Act's Underground Injection Control regulations, the Pennsylvania Act 2 cleanup standard for 1,4-dioxane, and the new Maximum Contaminant Levels ("MCLs") for 1,1-dichloroethane and chloroform to the ARARs for the Site.
- f. EPA began implementation of the modified groundwater remedy in or around February 2019 with the installation of eight new injection wells at the Site, including three injection wells (i.e., IW-1, IW-2, and IW-3) on the Affected Property. EPA performed the first injections related to the ISCO and ISBR components of the remedial action from August 19-27, 2019.
- g. EPA and DEP negotiated an Environmental Covenant for the Affected Property with its former owner, Donovan Investment Partners, L.P. The Environmental Covenant was recorded by Donovan Investment Partners, L.P. on September 18, 2019. The Environmental Covenant provided for certain Activity and Use Limitations, including, among others, a prohibition on interference with any monitoring well or other remedial response activity at the Affected Property or Site without prior written approval by EPA or DEP. In addition, the Environmental Covenant provides, among other things, that the owner of the Affected Property shall provide EPA and DEP with written notification of: any noncompliance with the Activity and Use Limitations in the Environmental Covenant; any transfer of the Affected Property; any changes in use of the Affected Property; any filing of applications for building permits for the Affected

¹ Some monitoring wells installed at the Site during the Remedial Investigation were later adapted for use as part of the groundwater remedy.

- Property; and any proposals for any site work, if the building or proposed site work will affect the contamination on the Affected Property.
- h. On September 19, 2019, U.S. Home Corporation (d/b/a Lennar), a corporation organized under the laws of the State of Delaware and a wholly owned subsidiary of Lennar Corporation, acquired fee simple title to the Affected Property.
- i. Following its acquisition of the Affected Property, Lennar began excavation and other earth-moving activities as part of its development of the Site.
- j. Lennar contracted with Respondent B & J Excavating, Inc. to conduct some of this excavation and earth-moving activities. Lennar did not inform B & J Excavating, Inc. about the Environmental Covenant or the Activity and Use Limitations. As a result, during the excavation and earth-moving activities, monitoring wells on the Affected Property were damaged or buried.
- k. On January 24, 2020, representatives of EPA and DEP met with Daniel Stewart, a representative of Respondent Lennar Corporation, and Louis Prudente, a representative of Respondent B & J Excavating, Inc., at the Affected Property and conducted a walkthrough to review the locations of the various monitoring and other wells on the Affected Property. Earth-moving operations had already begun at the Affected Property, and it was obvious during the walkthrough that the outer steel casings and the interior PVC linings on some of the wells had been damaged.
- 1. When EPA's remedial action contractor returned to the Affected Property on February 3, 2020, to take samples from the monitoring wells on the Affected Property, he discovered that wells had been damaged, buried, or were inaccessible and that EPA's Remedial Action had been impeded with. A figure depicting the approximate locations of the affected wells is attached hereto as Appendix B.
- m. On April 3, 2020, EPA, its contractor, and DEP conducted an inspection of the Affected Property with Respondent and representatives of Lennar. During the site inspection, EPA observed damage to or obstructions in the following wells: MW-103A/103B, MW-112A/B, MW-113A/113B, and MW-115. The results of the April 3, 2020 site inspection are contained in the April 13, 2020 Lochiel Farm Monitoring Well Inspection Site Visit Report, which is Appendix D to this Settlement.

V. CONCLUSIONS OF LAW AND DETERMINATION

- 11. Based on the Findings of Fact set forth above and the Administrative Record supporting the Removal Action required under this Settlement, EPA has determined that:
- a. The AIW Frank/Mid-County Mustang Site, including the Affected Property, is a "facility" as defined by Section 101(9) of CERCLA, 42 U.S.C. § 9601(9).

- b. The COCs 1,4-Dioxane, Trichloroethene, 1,1,1-Trichloroethane, 1,1-Dichloroethene, 1,1-Dichloroethane, 1,1,2-Trichloroethane, cis-1,2-Dichloroethene, 1,2-Dichloropropane, Tetrachloroethene, Vinyl Chloride, Toluene, and Chloroform found at the Site are "hazardous substances" as defined by Section 101(14) of CERCLA, 42 U.S.C. § 9601(14) and are so identified at 40 C.F.R. § 302.4.
- c. Respondent is a "person" as defined by Section 101(21) of CERCLA, 42 U.S.C. § 9601(21).
- d. Respondent is a responsible party under Section 107(a) of CERCLA, 42 U.S.C. § 9607(a), because Respondent is the "operator(s)" of the Affected Property, as defined by Section 101(20) of CERCLA, 42 U.S.C. § 9601(20), and within the meaning of Section 107(a)(1) of CERCLA, 42 U.S.C. § 9607(a)(1).
- e. The conditions described in Paragraphs 10.a, 10.b, 10.c, and 10.e of the Findings of Fact above, in the ROD, and in the ROD Amendment constitute an actual or threatened "release" of a hazardous substance from the facility as defined by Section 101(22) of CERCLA, 42 U.S.C. § 9601(22).
- f. EPA has determined that the removal action required by this Settlement is necessary to protect the public health, welfare, or the environment.

VI. SETTLEMENT AGREEMENT AND ORDER

12. Based upon the Findings of Fact and the Conclusions of Law and Determination set forth above, and the Administrative Record supporting the removal action required to be performed under this Settlement, it is hereby Ordered and Agreed that Respondent shall comply with all provisions of this Settlement, including, but not limited to, all appendixes to this Settlement and all documents incorporated by reference into this Settlement.

VII. DESIGNATION OF CONTRACTOR, PROJECT COORDINATOR, AND ON-SCENE COORDINATOR

13. Respondent shall retain one or more contractors or subcontractors to perform the Work and shall notify EPA of the names, titles, addresses, telephone numbers, email addresses, and qualifications of such contractors or subcontractors within five (5) days after the Effective Date. Respondent shall also notify EPA of the names, titles, contact information, and qualifications of any other contractors or subcontractors retained to perform the Work at least five (5) days prior to commencement of such Work. EPA retains the right to disapprove of any or all of the contractors and/or subcontractors retained by Respondent. If EPA disapproves of a selected contractor or subcontractor, Respondent shall retain a different contractor or subcontractor and shall notify EPA of that contractor's or subcontractor's name, title, contact information, and qualifications within five (5) days after EPA's disapproval. With respect to any proposed contractor, Respondent shall, upon request, demonstrate that the proposed contractor demonstrates compliance with ASQ/ANSI E4:2014, *Quality Management Systems for*

Environmental Information and Technology Programs – Requirements with Guidance for Use (American Society for Quality, February 2014), by submitting a copy of the proposed contractor's Quality Management Plan ("QMP"). The QMP should be prepared in accordance with EPA Requirements for Quality Management Plans (QA/R-2) (EPA/240/B-01/002, reissued May 2006) or equivalent documentation as determined by EPA. The qualifications of the persons undertaking the Work for Respondent shall be subject to EPA's review for verification based on objective assessment criteria (e.g., experience, capacity, technical expertise) and that they do not have a conflict of interest with respect to the project.

- 14. Within five (5) days after the Effective Date, Respondent shall designate a Project Coordinator who shall be responsible for administration of all actions by Respondent required by this Settlement and shall submit to EPA the designated Project Coordinator's name, title, contact information (including address, telephone number, and email address), and qualifications. Respondent's Project Coordinator shall be a technical and/or managerial representative of the Respondent and may be a contractor and/or consultant; provided, however, the Respondent's Project Coordinator shall not be its legal representative(s) in this matter. To the greatest extent possible, the Project Coordinator shall be present on Site or readily available during Site work. EPA retains the right to disapprove of the designated Project Coordinator. If EPA disapproves of the designated Project Coordinator, Respondent shall retain a different Project Coordinator and shall notify EPA of that person's name, title, contact information (including address, telephone number, and email address), and qualifications within five (5) days following EPA's disapproval. Notice or communication relating to this Settlement from EPA to Respondent's Project Coordinator shall constitute notice or communication to Respondent.
- 15. EPA has designated the following person as its Remedial Project Manager ("RPM"):

David Greaves (3SD21)
U.S. Environmental Protection Agency
1650 Arch Street
Philadelphia, PA 19103
(215) 814-5729
greaves.david@epa.gov

EPA and Respondent shall have the right, subject to Paragraph 14, to change their respective designated RPM or Project Coordinator. Respondent shall notify EPA five (5) days before such a change is made. The initial notification by Respondent may be made verbally, but shall be promptly followed by a written notice.

16. The RPM shall be responsible for overseeing Respondent's implementation of this Settlement. The RPM shall have the authority vested in an RPM by the NCP, including the authority to halt, conduct, or direct any Work required by this Settlement, or to direct any other removal or remedial action undertaken at the Site. Absence of the RPM from the Site shall not be cause for stoppage of work unless specifically directed by the RPM.

VIII. WORK TO BE PERFORMED

- 17. Respondent shall perform, at a minimum, all actions necessary to implement the following items:
 - a. Prepare and submit to EPA for EPA's approval, in consultation with DEP, a Removal Action Design for the relocation, replacement, repair, and/or redevelopment of all wells that EPA has determined require such actions, as described in the April 13, 2020 Lochiel Farm Monitoring Well Inspection Site Visit Report, which is Appendix D to this Settlement.
 - i. Relocated and replacement wells shall be installed at locations and depths to be determined by EPA, in consultation with DEP, in a manner consistent with EPA's well installation requirements documented in Section 3.0 of the 2018 Remedial Design for the Site. The September 2018 Remedial Design and well installation Standard Operating Procedures ("SOPs") from EPA's contractor are included as Appendix E to this Settlement.
 - ii. For reference, well construction details for all monitoring wells that were damaged or require relocation are included as Appendix F to this Settlement.
 - b. Relocate, replace, repair and/or redevelop wells on the Affected Property in accordance with the EPA-approved Removal Action Design.
- 18. For any regulation or guidance referenced in this Settlement, the reference will be read to include any subsequent modification, amendment, or replacement of such regulation or guidance. Such modifications, amendments, or replacements apply to the Work only after Respondent receives notification from EPA of the modification, amendment, or replacement.

19. Work Plan and Implementation.

- a. Within ten (10) days after the Effective Date, in accordance with Paragraph 20 (Submission of Deliverables), Respondent shall submit to EPA for EPA's approval, in consultation with DEP, a draft work plan (the "Removal Work Plan") for performing the removal action generally described in Paragraph 17, above. The draft Removal Work Plan shall provide a description of the actions required by this Settlement.
- b. EPA, in consultation with DEP, may approve, disapprove, require revisions to, or modify the draft Removal Work Plan in whole or in part. If EPA requires revisions, Respondent shall submit a revised draft Removal Work Plan within five (5) days after receipt of EPA's notification of the required revisions.
- c. Within five (5) days after EPA approves the Removal Work Plan, Respondent shall submit to EPA for EPA approval, in consultation with DEP, a draft schedule

for implementation of the Removal Work Plan. EPA, in consultation with DEP, may approve, disapprove, require revisions to, or modify the draft schedule in whole or in part. If EPA requires revisions, Respondent shall submit a revised draft schedule within five (5) days after receipt of EPA's notification of the required revisions.

- d. Respondent shall implement the Removal Work Plan as approved in writing by EPA in accordance with the schedule approved by EPA, in consultation with DEP. Once approved, or approved with modifications, the Removal Work Plan, the schedule, and any subsequent modifications shall be incorporated into and become fully enforceable under this Settlement.
- e. Upon approval or approval with modifications of the Removal Work Plan and the schedule, Respondent shall commence implementation of the Work in accordance with the approved schedule. Respondent shall not commence or perform any Work except in conformance with the terms of this Settlement.
- f. Unless otherwise provided in this Settlement, any additional deliverables that require EPA approval under the Removal Work Plan shall be reviewed and approved by EPA in accordance with this Paragraph.
- g. Additional actions that may be required under this Settlement are addressed in Section XXVII (Additional Removal Action) of this Settlement.

20. Submission of Deliverables.

a. General Requirements for Deliverables.

- i. Except as otherwise provided in this Settlement, Respondent shall direct all submissions required by this Settlement to the RPM. Respondent shall submit all deliverables required by this Settlement or any approved work plan to EPA in accordance with the schedule set forth in such plan.
- ii. Respondent shall submit all deliverables in electronic form. Technical specifications for sampling and monitoring data and spatial data are addressed in Paragraph 20.b. All other deliverables shall be submitted to EPA in the form specified by the RPM. If any deliverable includes maps, drawings, or other exhibits that are larger than 8.5 x 11 inches in their native format, Respondent shall also provide EPA with paper copies of such exhibits.

b. <u>Technical Specifications for Deliverables</u>.

i. Sampling and monitoring data should be submitted in the current Regional Electronic Data Deliverable ("EDD") format. Other delivery methods may be allowed if electronic direct submission presents a significant burden or as technology changes.

- ii. Spatial data, including spatially-referenced data and geospatial data, should be submitted: (a) in the ESRI File Geodatabase format; and (b) as unprojected geographic coordinates in decimal degree format using North American Datum 1983 ("NAD83") or World Geodetic System 1984 ("WGS84") as the datum. If applicable, submissions should include the collection method(s). Projected coordinates may optionally be included, but must be documented. Spatial data should be accompanied by metadata, and such metadata should be compliant with the Federal Geographic Data Committee ("FGDC") Content Standard for Digital Geospatial Metadata and its EPA profile, the EPA Geospatial Metadata Technical Specification. An add-on metadata editor for ESRI software, the EPA Metadata Editor ("EME"), complies with these FGDC and EPA metadata requirements and is available at https://www.epa.gov/geospatial/epa-metadata-editor.
- iii. Each file must include an attribute name for each Site unit or subunit submitted. Consult https://www.epa.gov/geospatial/geospatial-policies-and-standards for any further available guidance on attribute identification and naming.
- iv. Spatial data submitted by Respondent does not, and is not intended to, define the boundaries of the Site.
- shall submit for EPA review and comment, in consultation with DEP, a plan that ensures the protection of the public health and safety during performance of on-site Work under this Settlement. This plan shall be prepared in accordance with OSWER Integrated Health and Safety Program Operating Practices for OSWER Field Activities, Pub. 9285.0-OIC (Nov. 2002), available on the NSCEP database at https://www.epa.gov/nscep, and EPA's Emergency Responder Health and Safety Manual, OSWER Directive 9285.3-12 (July 2005 and updates), available at https://www.epaosc.org/ HealthSafetyManual/manual-index.htm. In addition, the plan shall comply with all currently applicable Occupational Safety and Health Administration ("OSHA") regulations found at 29 C.F.R. Part 1910. The plan shall also include all safety recommendations of the Centers for Disease Control ("CDC") and the Commonwealth related to the COVID-19 pandemic. If EPA, after consultation with DEP, determines that it is appropriate, the plan shall also include contingency planning. Respondent shall incorporate all changes to the plan recommended by EPA and shall implement the plan during the pendency of the removal action.
 - 22. Quality Assurance, Sampling, and Data Analysis.
 - a. Reserved.
 - b. Reserved.
 - c. Reserved.
 - d. Reserved.
 - e. <u>Reserved</u>.

- f. Respondent shall submit to EPA the results of all sampling and/or tests or other data obtained or generated by or on behalf of Respondent with respect to the Site and/or the implementation of this Settlement.
- g. Respondent waives any objections to any data gathered, generated, or evaluated by EPA or Respondent in the performance or oversight of the Work that has been verified according to the QA/QC procedures required by the Settlement or any EPA-approved Work Plans or Sampling and Analysis Plans. If Respondent objects to any other data relating to the Work, Respondent shall submit to EPA a report that specifically identifies and explains its objections, describes the acceptable uses of the data, if any, and identifies any limitations to the use of the data. The report must be submitted to EPA within fifteen (15) days after the monthly progress report containing the data.
 - 23. Reserved.
 - 24. Reserved.
- 25. Progress Reports. Respondent shall submit a written progress report to EPA concerning actions undertaken pursuant to this Settlement on a bi-weekly basis, or as otherwise requested by EPA, from the date of receipt of EPA's approval of the Removal Work Plan until issuance of Notice of Completion of Work pursuant to Section XXVIII, unless otherwise directed in writing by the OSC. These reports shall describe all significant developments during the preceding period, including the actions performed and any problems encountered, analytical data received during the reporting period, and the developments anticipated during the next reporting period, including a schedule of actions to be performed, anticipated problems, and planned resolutions of past or anticipated problems.
- 26. <u>Final Report</u>. Within 30 days after completion of all Work required by this Settlement, other than continuing obligations listed in Paragraph 104 (Notice of Completion), Respondent shall submit for EPA review and approval, in consultation with DEP, a final report summarizing the actions taken to implement the action identified in Paragraph 17 of this Settlement. The final report shall conform, at a minimum, with the requirements set forth in Section 300.165 of the NCP entitled "OSC Reports." The final report shall include a good-faith estimate of total costs or a statement of actual costs incurred in complying with the Settlement, a listing of quantities and types of materials removed off-Site or handled on-Site, a discussion of removal and disposal options considered for those materials, a listing of the ultimate destination(s) of those materials, a presentation of the analytical results of all sampling and analyses performed, and accompanying appendixes containing all relevant documentation generated during the removal action (e.g., manifests, invoices, bills, contracts, and permits). The final report shall also include the following certification signed by a responsible corporate official of Respondent:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

27. <u>Off-Site Shipments</u>.

- a. Respondent may ship hazardous substances, pollutants, and contaminants from the Site to an off-Site facility only if they comply with Section 121(d)(3) of CERCLA, 42 U.S.C. § 9621(d)(3), and 40 C.F.R. § 300.440. Respondent will be deemed to be in compliance with CERCLA Section 121(d)(3) and 40 C.F.R. § 300.440 regarding a shipment if Respondent obtain a prior determination from EPA that the proposed receiving facility for such shipment is acceptable under the criteria of 40 C.F.R. § 300.440(b).
- b. Respondent may ship Waste Material from the Site to an out-of-state waste management facility only if, prior to any shipment, it provides written notice to the appropriate state environmental official in the receiving facility's state and to the RPM. This written notice requirement shall not apply to any off-Site shipments when the total quantity of all such shipments will not exceed ten cubic yards. The written notice must include the following information, if available: (1) the name and location of the receiving facility; (2) the type and quantity of Waste Material to be shipped; (3) the schedule for the shipment; and (4) the method of transportation. Respondent also shall notify DEP and the RPM of any major changes in the shipment plan, such as a decision to ship the Waste Material to a different out-of-state facility. Respondent shall provide the written notice after the award of the contract for the removal action and before the Waste Material is shipped.
- c. Respondent may ship Investigation-Derived Waste ("IDW") from the Site to an off-Site facility only if it complies with Section 121(d)(3) of CERCLA, 42 U.S.C. § 9621(d)(3), 40 C.F.R. § 300.440, EPA's *Guide to Management of Investigation Derived Waste*, OSWER 9345.3-03FS (Jan. 1992). Wastes shipped off-Site to a laboratory for characterization, and RCRA hazardous wastes that meet the requirements for an exemption from RCRA under 40 C.F.R. § 261.4(e) shipped off-Site for treatability studies, are not subject to 40 C.F.R. § 300.440.

IX. PROPERTY REQUIREMENTS

28. Agreements Regarding Access and Non-Interference. Respondent shall: (i) provide EPA, DEP, and their representatives, contractors, and subcontractors with access at all reasonable times to the Affected Property to conduct any activity regarding the Settlement and the Remedial Action, including those activities listed in Paragraph 28.a (Access Requirements); (ii) refrain from using the Affected Property in any manner that EPA, in consultation with DEP, determines will pose an unacceptable risk to human health or to the environment due to exposure to Waste Material, or interfere with or adversely affect the implementation, integrity, or protectiveness of the removal action required by this Settlement or the Remedial Action; and (iii) comply with the

Activity and Use Limitations set forth in the Environmental Covenant, which is attached hereto as Appendix C.

- a. <u>Access Requirements</u>. The following is a list of activities for which access by EPA and DEP is required regarding the Affected Property:
 - i. Monitoring the Work;
 - ii. Verifying any data or information submitted to EPA or DEP;
 - iii. Conducting investigations regarding contamination at or near the

Site;

- iv. Obtaining samples;
- v. Assessing the need for, planning, implementing, or monitoring response actions;
- vi. Assessing implementation of quality assurance and quality control practices as defined in the approved quality assurance quality control plan as defined in the approved QAPP;
- vii. Implementing the Work pursuant to the conditions set forth in Paragraph 71 (Work Takeover);
- viii. Inspecting and copying records, operating logs, contracts, or other documents maintained or generated by Respondent or its agents, consistent with Section X (Access to Information);
- ix. Assessing Respondent's compliance with the Settlement and the Environmental Covenant;
- x. Determining whether the Affected Property is being used in a manner that is prohibited or restricted, or that may need to be prohibited or restricted; and
- xi. Implementing, monitoring, maintaining, reporting on, and enforcing any land, water, or other resource use restrictions regarding the Affected Property.
 - b. Reserved.
 - 29. Reserved.
 - 30. Reserved.

31. In the event of any Transfer of the Affected Property, unless EPA otherwise consents in writing, Respondent shall continue to comply with its obligations under the Settlement, including its obligation to secure access.

32. Reserved.

33. Notwithstanding any provision of the Settlement, EPA retains all of it access authorities and rights, as well as all of its rights to require land, water, or other resource use restrictions, including enforcement authorities related thereto under CERCLA, RCRA, the Environmental Covenant, and any other applicable statute or regulations. This Settlement shall not limit DEP's access authorities and rights, as well as all of its rights to require land, water, or other resource use restrictions, including enforcement authorities related thereto under CERCLA, RCRA, the Environmental Covenant, and any other applicable statute or regulations.

X. ACCESS TO INFORMATION

34. Respondent shall provide to EPA, upon request, copies of all records, reports, documents, and other information (including records, reports, documents, and other information in electronic form) (hereinafter referred to as "Records") within Respondent's possession or control or that of its contractors or agents relating to activities at the Affected Property or to the implementation of this Settlement, including, but not limited to, manifests, trucking logs, receipts, reports, correspondence, or other documents or information regarding the Work. Respondent shall also make available to EPA, for purposes of investigation, information gathering, or testimony, Respondent's employees, agents, or representatives with knowledge of relevant facts concerning the performance of the Work.

35. Privileged and Protected Claims.

- a. Respondent may assert all or part of a Record requested by EPA is privileged or protected as provided under federal law, in lieu of providing the Record, provided Respondent complies with Paragraph 35.b, and except as provided in Paragraph 35.c.
- b. If Respondent asserts such a privilege or protection, Respondent shall provide EPA with the following information regarding such Record: its title; its date; the name, title, affiliation (e.g., company or firm), and address of the author, of each addressee, and of each recipient; a description of the Record's contents; and the privilege or protection asserted. If a claim of privilege or protection applies only to a portion of a Record, Respondent shall provide the Record to EPA in redacted form to mask the privileged or protected portion only. Respondent shall retain all Records that it claims to be privileged or protected until EPA has had a reasonable opportunity to dispute the privilege or protection claim and any such dispute has been resolved in Respondent's favor.
- c. Respondent may make no claim of privilege or protection regarding: (1) any data regarding the Site, including, but not limited to, all sampling, analytical, monitoring, hydrogeologic, scientific, chemical, radiological, or engineering data, or the portion of any other

Record that evidences conditions at or around the Site; or (2) the portion of any Record that Respondent is required to create or generate pursuant to this Settlement.

- 36. <u>Business Confidential Claims</u>. Respondent may assert that all or part of a Record provided to EPA under this Section or Section XI (Record Retention) is business confidential to the extent permitted by and in accordance with Section 104(e)(7) of CERCLA, 42 U.S.C. § 9604(e)(7), and 40 C.F.R. § 2.203(b). Respondent shall segregate and clearly identify all Records or parts thereof submitted under this Settlement for which Respondent asserts business confidentiality claims. Records that Respondent claims to be confidential business information will be afforded the protection specified in 40 C.F.R. Part 2, Subpart B. If no claim of confidentiality accompanies Records when they are submitted to EPA, or if EPA has notified Respondent that the Records are not confidential under the standards of Section 104(e)(7) of CERCLA or 40 C.F.R. Part 2, Subpart B, the public may be given access to such Records without further notice to Respondent.
- 37. Notwithstanding any provision of this Settlement, EPA retains all of its information-gathering and inspection authorities and rights, including enforcement actions related thereto, under CERCLA, RCRA, and any other applicable statutes or regulations. This Settlement shall not limit DEP's information-gathering and inspection authorities and rights, including enforcement actions related thereto, under CERCLA, RCRA, and any other applicable statutes or regulations.

XI. RECORD RETENTION

- 38. Until ten (10) years after EPA provides Respondent with notice, pursuant to Section XXVIII (Notice of Completion of Work), that all Work has been fully performed in accordance with this Settlement, Respondent shall preserve and retain all non-identical copies of Records (including Records in electronic form) now in its possession or control, or that come into its possession or control, that relate in any manner to its operations at the Affected Property, provided, however, that Respondent must retain, in addition, all Records that relate to the potential liability of any other person under CERCLA with respect to the Site. Respondent must also retain, and instruct its contractors and agents to preserve, for the same period of time specified above, all non-identical copies of the last draft or final version of any Records (including Records in electronic form) now in its possession or control or that come into its possession or control that relate in any manner to the performance of the Work, provided, however, that Respondent (and its contractors and agents) must retain, in addition, copies of all data generated during the performance of the Work and not contained in the aforementioned Records required to be retained. Each of the above record retention requirements shall apply regardless of any corporate retention policy to the contrary.
- 39. At the conclusion of the document retention period, Respondent shall notify EPA at least ninety (90) days prior to the destruction of any such Records, and, upon request by EPA, and except as provided in Paragraph 35 (Privileged and Protected Claims), Respondent shall deliver any such Records to EPA.

40. Respondent certifies that, to the best of its knowledge and belief, after thorough inquiry, it has not altered, mutilated, discarded, destroyed, or otherwise disposed of any Records (other than identical copies) relating to its potential liability regarding the Site since notification of potential liability by EPA or the Commonwealth and that it has fully complied with any and all EPA and DEP requests for information regarding the Site pursuant to Sections 104(e) and 122(e) of CERCLA, 42 U.S.C. §§ 9604(e) and 9622(e), and Section 3007 of RCRA, 42 U.S.C. § 6927, and Pennsylvania law.

XII. COMPLIANCE WITH OTHER LAWS

- 41. Nothing in this Settlement limits Respondent's obligations to comply with the requirements of all applicable state and federal laws and regulations, except as provided in Section 121(e) of CERCLA, 42 U.S.C. § 9621(e), and 40 C.F.R. §§ 300.400(e) and 300.415(j). In accordance with 40 C.F.R. § 300.415(j), all on-site actions required pursuant to this Settlement shall, to the extent practicable, as determined by EPA, considering the exigencies of the situation, attain applicable or relevant and appropriate requirements ("ARARs") under federal environmental or state environmental or facility siting laws. Respondent shall include ARARs selected by EPA in the Removal Work Plan.
- 42. No local, state, or federal permit shall be required for any portion of the Work conducted entirely on-site (i.e., within the areal extent of contamination or in very close proximity to the contamination and necessary for implementation of the Work), including studies, if the action is selected and carried out in compliance with Section 121 of CERCLA, 42 U.S.C. § 9621. Where any portion of the Work that is not on-site requires a federal or state permit or approval, Respondent shall submit timely and complete applications and take all other actions necessary to obtain and to comply with all such permits or approvals. Respondent may seek relief under the provisions of Section XVI (Force Majeure) for any delay in the performance of the Work resulting from a failure to obtain, or a delay in obtaining, any permit or approval required for the Work, provided that they have submitted timely and complete applications and taken all other actions necessary to obtain all such permits or approvals. This Settlement is not, and shall not be construed to be, a permit issued pursuant to any federal or state statute or regulation.

XIII. EMERGENCY RESPONSE AND NOTIFICATION OF RELEASES

43. <u>Emergency Response</u>. If any event occurs during performance of the Work that causes or threatens to cause a release of Waste Material on, at, or from the Affected Property that either constitutes an emergency situation or that may present an immediate threat to public health or welfare or the environment, Respondent shall immediately take all appropriate action to prevent, abate, or minimize such release or threat of release. Respondent shall take these actions in accordance with all applicable provisions of this Settlement, including, but not limited to, the Health and Safety Plan. Respondent shall also immediately notify the RPM or, in the event of his/her unavailability, the National Response Center ((800) 424-8802) of the incident or Site conditions. In the event that Respondent fails to take appropriate response action as required by this Paragraph, and EPA takes such action instead, Respondent shall reimburse EPA for all costs

of such response action not inconsistent with the NCP pursuant to Section XIV (Payment of Response Costs).

- 44. Release Reporting. Upon the occurrence of any event during performance of the Work that Respondent is required to report pursuant to Section 103 of CERCLA, 42 U.S.C. § 9603, or Section 304 of the Emergency Planning and Community Right-to-know Act (EPCRA), 42 U.S.C. § 11004, Respondent shall immediately verbally notify the RPM or, in the event of his/her unavailability, the National Response Center ((800) 424-8802). This reporting requirement is in addition to, and not in lieu of, reporting under Section 103 of CERCLA, 42 U.S.C. § 9603, and Section 304 of the Emergency Planning and Community Right-To-Know Act of 1986, 42 U.S.C. § 11004.
- 45. For any event covered under this Section, Respondent shall submit a written report to EPA within seven (7) days after the onset of such event, setting forth the action or event that occurred and the measures taken, and to be taken, to mitigate any release or threat of release or endangerment caused or threatened by the release and to prevent the reoccurrence of such a release or threat of release.

XIV. PAYMENT OF RESPONSE COSTS

- 46. Reserved.
- 47. <u>Payments for Future Response Costs</u>. EPA reserves its rights under CERCLA to recover from Respondent and all other potentially responsible parties all response costs incurred by the United States in connection with the Site, including, but not limited to, all Future Response Costs, as defined in Section III of this Settlement.

XV. DISPUTE RESOLUTION

- 48. Unless otherwise expressly provided for in this Settlement, the dispute resolution procedures of this Section shall be the exclusive mechanism for resolving disputes arising under this Settlement. The Parties shall attempt to resolve any disagreements concerning this Settlement expeditiously and informally.
- 49. <u>Informal Dispute Resolution</u>. If Respondent objects to any EPA action taken pursuant to this Settlement, they shall send EPA a written Notice of Dispute describing the objection(s) within seven (7) days after such action. EPA and Respondent shall have 15 days from EPA's receipt of Respondent's Notice of Dispute to resolve the dispute through informal negotiations (the "Negotiation Period"). The Negotiation Period may be extended at the sole discretion of EPA. Any agreement reached by the Parties pursuant to this Section shall be in writing and shall, upon signature by the Parties, be incorporated into and become an enforceable part of this Settlement.
- 50. <u>Formal Dispute Resolution</u>. If the Parties are unable to reach an agreement within the Negotiation Period, Respondent shall, within 20 days after the end of the Negotiation Period, submit a statement of position to the RPM. EPA may, within 20 days thereafter, submit a

statement of position. Thereafter, the Chief of the EPA Region III Site Remediation Branch within the Superfund & Emergency Management Division will issue a written decision on the dispute to Respondent. EPA's decision shall be incorporated into and become an enforceable part of this Settlement. Respondent shall fulfill the requirement that was the subject of the dispute in accordance with the agreement reached or with EPA's decision, whichever occurs.

51. Except as agreed by EPA, invocation of formal dispute resolution procedures under this Section does not extend, postpone, or affect in any way any obligation of Respondent under this Settlement. Except as provided in Paragraph 61, stipulated penalties with respect to the disputed matter shall continue to accrue, but payment shall be stayed pending resolution of the dispute. Notwithstanding the stay of payment, stipulated penalties shall accrue from the first day of noncompliance with any applicable provision of this Settlement. In the event that Respondent does not prevail on the disputed issue, stipulated penalties shall be assessed and paid as provided in Section XVII (Stipulated Penalties).

XVI. FORCE MAJEURE

- 52. "Force Majeure" for purposes of this Settlement, is defined as any event, including, but not limited to, the COVID-19 pandemic and any related state or federal restrictions, arising from causes beyond the control of Respondent, of any entity controlled by Respondent, or of Respondent's contractors that delays or prevents the performance of any obligation under this Settlement despite Respondent's best efforts to fulfill the obligation. The requirement that Respondent exercise "best efforts to fulfill the obligation" includes using best efforts to anticipate any potential force majeure and best efforts to address the effects of any potential force majeure (a) as it is occurring, and (b) following the potential force majeure such that the delay and any adverse effects of the delay are minimized to the greatest extent possible. "Force majeure" does not include financial inability to complete the Work or increased cost of performance.
- 53. If any event occurs or has occurred that may delay the performance of any obligation under this Settlement for which Respondent intends or may intend to assert a claim of force majeure, Respondent shall notify EPA's RPM verbally or, in his absence, the RPM's Section Chief or, in the event both of EPA's designated representatives are unavailable, the Chief of the EPA Region III Site Remediation Branch within the Superfund & Emergency Management Division, within seven (7) days of when Respondent first knew that the event might cause a delay. Within seven (7) days thereafter, Respondent shall provide in writing to EPA an explanation and description of the reasons for the delay; the anticipated duration of the delay; all actions taken or to be taken to prevent or minimize the delay; a schedule for implementation of any measures to be taken to prevent or mitigate the delay or the effect of the delay; Respondent's rationale for attributing such delay to a force majeure; and a statement as to whether, in the opinion of Respondent, such event may cause or contribute to an endangerment to public health or welfare, or the environment. Respondent shall include with any notice all available documentation supporting its claim that the delay was attributable to a force majeure. Respondent shall be deemed to know of any circumstance of which Respondent, any entity controlled by Respondent, or Respondent's contractors knew or should have known. Failure to

comply with the above requirements regarding an event shall preclude Respondent from asserting any claim of force majeure regarding that event, provided, however, that if EPA, despite the late or incomplete notice, is able to assess to its satisfaction whether the event is a force majeure under Paragraph 52 and whether Respondent has exercised its best efforts under Paragraph 52, EPA may, in its unreviewable discretion, excuse in writing Respondent's failure to submit timely or complete notices under this Paragraph.

- 54. If EPA agrees that the delay or anticipated delay is attributable to a force majeure, the time for performance of the obligations under this Settlement that are affected by the force majeure will be extended by EPA for such time as is necessary to complete those obligations. An extension of the time for performance of the obligations affected by the force majeure shall not, of itself, extend the time for performance of any other obligation. If EPA does not agree that the delay or anticipated delay has been or will be caused by a force majeure, EPA will notify Respondent in writing of its decision. If EPA agrees that the delay is attributable to a force majeure, EPA will notify Respondent in writing of the length of the extension, if any, for performance of the obligations affected by the force majeure.
- 55. If Respondent elects to invoke the dispute resolution procedures set forth in Section XV (Dispute Resolution), it shall do so no later than 15 days after receipt of EPA's notice. In any such proceeding, Respondent shall have the burden of demonstrating by a preponderance of the evidence that the delay or anticipated delay has been or will be caused by a force majeure, that the duration of the delay or the extension sought was or will be warranted under the circumstances, that best efforts were exercised to avoid and mitigate the effects of the delay, and that Respondent complied with the requirements of Paragraphs 52 and 53. If Respondent carries this burden, the delay at issue shall be deemed not to be a violation by Respondent of the affected obligation of this Settlement identified to EPA.
- 56. The failure by EPA to timely complete any obligation under the Settlement is not a violation of the Settlement, provided, however, that if such failure prevents Respondent from meeting one or more deadlines under the Settlement, Respondent may seek relief under this Section.

XVII. STIPULATED PENALTIES

- 57. Respondent shall be liable to EPA for stipulated penalties in the amounts set forth in Paragraphs 58 and 59 for failure to comply with the obligations specified below, unless excused under Section XVI (Force Majeure). "Comply," as used in the previous sentence, includes compliance by Respondent with all applicable requirements of this Settlement, within the deadlines established under this Settlement. When making determinations concerning delays in meeting deadlines established under this Settlement, EPA intends to be flexible and to act consistent with the April 10, 2002 *Interim Guidance on Site Field Work Decisions Due to Impacts of COVID-19*.
- 58. <u>Stipulated Penalty Amounts Payments, Financial Assurance, Major Deliverables, and Other Milestones.</u>

a. The following stipulated penalties shall accrue per violation per day for any noncompliance identified in Paragraph 58.b:

Penalty Per Violation Per Day	Period of Noncompliance
\$1,000.00	1st through 14th day
\$1,500.00	15th through 30th day
\$2,000.00	31st day and beyond

- b. The obligations affected by the penalties listed in Paragraph 58.a are:
- i. All requirements of Paragraphs 13 (including, but not limited to, the identification of contractors and subcontractors); 14 (including, but not limited to, the designation of a Project Coordinator); 19 (including, but not limited to, the submission of a Removal Work Plan for EPA approval); 20 (including, but not limited to, following the general and technical requirements for submission of deliverables to EPA); 21 (including, but not limited to, the submission of a Health and Safety Plan to EPA); 25 (including, but not limited to, submission of Progress Reports); 26 (including, but limited to, submission of a Final Report); 27 (including, but not limited to, requirements for off-Site shipment of wastes); 28 (including, but not limited to, providing notice, and responding to, emergencies); 65 (including, but not limited to, payment of stipulated penalties); Section XXIV (including, but not limited to, obtaining insurance); and Section XXVII (including, but not limited to, performing additional removal actions).

59. Stipulated Penalty Amounts – Other Requirements.

a. The following stipulated penalties shall accrue per violation per day for any noncompliance identified in Paragraph 59.b:

Penalty Per Violation Per Day	Period of Noncompliance
\$500.00	1st through 14th day
\$750.00 \$1,000.00	15th through 30th day 31st day and beyond

- b. The obligations subject to the penalties listed in Paragraph 59.a are:
- i. All requirements of Paragraph 34 (including, but not limited to, providing information and documents following a request from EPA); and
- ii. All requirements of Section XI (including, but not limited to, retaining records).
- 60. In the event that EPA assumes performance of a portion or all of the Work pursuant to Paragraph 71 (Work Takeover), Respondent shall be liable for a stipulated penalty in

the amount of \$100,000.00. Stipulated penalties under this Paragraph are in addition to the remedies available to EPA under Paragraph 71 (Work Takeover).

- due or the day a violation occurs and shall continue to accrue through the final day of the correction of the noncompliance or completion of the activity. Penalties shall continue to accrue during any dispute resolution period, and shall be paid within 15 days after the agreement or the receipt of EPA's decision or order. However, stipulated penalties shall not accrue: (a) with respect to a deficient submission under Paragraph 19 (Work Plan and Implementation), during the period, if any, beginning on the 31st day after EPA's receipt of such submission until the date that EPA notifies Respondent of any deficiency; and (b) with respect to a decision by the Branch Chief of the EPA Region III Site Remediation Branch under Paragraph 50 (Formal Dispute Resolution), during the period, if any, beginning on the 21st day after the Negotiation Period begins until the date that the Branch Chief issues a final decision regarding such dispute. Nothing in this Settlement shall prevent the simultaneous accrual of separate penalties for separate violations of this Settlement.
- 62. <u>Demand for Payment</u>. Following EPA's determination that Respondent has failed to comply with a requirement of this Settlement, EPA may give Respondent written notification of the failure and describe the noncompliance. EPA may send Respondent a written demand for payment of the penalties. However, penalties shall accrue as provided in the preceding Paragraph regardless of whether EPA has notified Respondent of a violation. If EPA sends a written demand for payment of stipulated penalties, a copy of the demand will be sent:
 - a. Via email to: CINWD AcctsReceivable@epa.gov; and
 - b. Via email to: R3 Hearing Clerk@epa.gov
- 63. Payment/Dispute of Demanded Penalties. All penalties accruing under this Section shall be due and payable to EPA within 30 days after Respondent's receipt from EPA of a demand for payment of the penalties, unless Respondent invoke the Dispute Resolution procedures under Section XV (Dispute Resolution) within the 30-day period. All payments to EPA under this Section shall indicate that the payment is for stipulated penalties and shall be made to https://www.pay.gov in accordance with instructions to be provided to Respondent by EPA. Each payment shall include a reference to the Site/Spill ID Number 032S and the EPA Docket Number for this Settlement CERCLA-03-2020-0082DC. In addition, notice of payment shall be sent to the following:
 - a. Via email to EPA at: <u>CINWD_AcctsReceivable@epa.gov</u>; *and* via regular U.S. mail to: U.S. EPA Cincinnati Finance Office, MS: WG-32B26 Martin Luther King Drive, Cincinnati, Ohio 45268;
 - b. Via email to EPA Region III at: R3 Hearing Clerk@epa.gov; and

c. Via email to EPA Region III, Office of Regional Counsel at: hasson.robert@epa.gov

Such notice of payment shall state Respondent's name, street or P.O. Box addresses, email addresses, and telephone numbers; the name of the matter (AIW Frank/Mid-County Mustang Superfund Site); the EPA docket number (CERCLA-03-2020-0082DC); the amount of the payment; and the method of payment. If Respondent disputes all or a portion of the demand for stipulated penalties under Section XV (Dispute Resolution) of this Settlement, a copy of the Notice of Dispute shall be sent to the persons identified above in this Paragraph 63.

- 64. If Respondent fails to pay stipulated penalties when due, Respondent shall pay Interest on the unpaid stipulated penalties as follows: (a) if Respondent has timely invoked dispute resolution such that the obligation to pay stipulated penalties has been stayed pending the outcome of dispute resolution, Interest shall accrue from the date stipulated penalties are due pursuant to Paragraph 63 until the date of payment; and (b) if Respondent fails to timely invoke dispute resolution, Interest shall accrue from the date of demand under Paragraph 62 until the date of payment. If Respondent fails to pay stipulated penalties and Interest when due, the United States may institute proceedings to collect the penalties and Interest.
- 65. The payment of penalties and Interest, if any, shall not alter in any way Respondent's obligation to complete the performance of the Work required under this Settlement.
- 66. Nothing in this Settlement shall be construed as prohibiting, altering, or in any way limiting the ability of EPA to seek any other remedies or sanctions available by virtue of Respondent's violation of this Settlement or of the statutes and regulations upon which it is based, including, but not limited to, penalties pursuant to Section 122(l) of CERCLA, 42 U.S.C. § 9622(l), and punitive damages pursuant to Section 107(c)(3) of CERCLA, 42 U.S.C. § 9607(c)(3), provided however, that EPA shall not seek civil penalties pursuant to Section 122(l) of CERCLA or punitive damages pursuant to Section 107(c)(3) of CERCLA for any violation for which a stipulated penalty is collected pursuant to this Settlement or in the event that EPA assumes performance of a portion or all of the Work pursuant to Paragraph 71 (Work Takeover).
- 67. Notwithstanding any other provision of this Section, and consistent with the April 10, 2020 *Interim Guidance on Site Field Work Decisions Due to Impacts of COVID-19*, EPA may, in its unreviewable discretion, waive any portion of stipulated penalties that have accrued pursuant to this Settlement.

XVIII. COVENANTS BY EPA

68. Except as provided in Section XIX (Reservations of Rights by EPA), EPA covenants not to sue or to take administrative action against Respondent pursuant to Sections 106 and 107(a) of CERCLA, 42 U.S.C. §§ 9606 and 9607(a), for the Work. These covenants shall take effect upon the Effective Date. These covenants are conditioned upon the complete and

satisfactory performance by Respondent of its obligations under this Settlement. These covenants extend only to Respondent and do not extend to any other person.

XIX. RESERVATIONS OF RIGHTS BY EPA

- 69. Except as specifically provided in this Settlement, nothing in this Settlement shall limit the power and authority of EPA or the United States to take, direct, or order all actions necessary to protect public health, welfare, or the environment or to prevent, abate, or minimize an actual or threatened release of hazardous substances, pollutants, or contaminants, or hazardous or solid waste on, at, or from the Site. Further, nothing in this Settlement shall prevent EPA from seeking legal or equitable relief to enforce the terms of this Settlement, from taking other legal or equitable action as it deems appropriate and necessary, or from requiring Respondent in the future to perform additional activities pursuant to CERCLA or any other applicable law.
- 70. The covenants set forth in Section XVIII (Covenants by EPA) do not pertain to any matters other than those expressly identified therein. EPA reserves, and this Settlement is without prejudice to, all rights against Respondent with respect to all other matters, including, but not limited to:
- a. liability for failure by Respondent to meet a requirement of this Settlement;
- b. liability for response costs related to the Site, including, but not limited to, costs within the definition of Future Response Costs;
 - c. liability for performance of response action other than the Work;
 - d. criminal liability;
- e. liability for violations of federal or state law or for non-compliance with any Environmental Covenant recorded for the Affected Property in accordance with the Pennsylvania Uniform Environmental Covenants Act ("UECA"), Act No. 68 of 2007, 27 Pa. C.S. §§ 6501-6517, that occur during or after implementation of the Work;
- f. liability for damages for injury to, destruction of, or loss of natural resources, and for the costs of any natural resource damage assessments;
- g. liability arising from the past, present, or future disposal, release or threat of release of Waste Materials outside of the Site; and
- h. liability for costs incurred or to be incurred by the Agency for Toxic Substances and Disease Registry related to the Site not paid as Future Response Costs under this Settlement.

71. Work Takeover.

- a. In the event EPA determines that Respondent: (1) has ceased implementation of any portion of the Work; (2) is seriously or repeatedly deficient or late in its performance of the Work; or (3) is implementing the Work in a manner that may cause an endangerment to human health or the environment, EPA may issue a written notice ("Work Takeover Notice") to Respondent. Any Work Takeover Notice issued by EPA (which writing may be electronic) will specify the grounds upon which such notice was issued and will provide Respondent a period of 30 days within which to remedy the circumstances giving rise to EPA's issuance of such notice.
- b. If, after expiration of the 30-day notice period specified in Paragraph 71.a, Respondent has not remedied to EPA's satisfaction the circumstances giving rise to EPA's issuance of the relevant Work Takeover Notice, EPA may at any time thereafter assume the performance of all or any portion(s) of the Work as EPA deems necessary ("Work Takeover"). EPA will notify Respondent in writing (which writing may be electronic) if EPA determines that implementation of a Work Takeover is warranted under this Paragraph 71.b.
- c. Respondent may invoke the procedures set forth in Paragraph 50 (Formal Dispute Resolution) to dispute EPA's implementation of a Work Takeover under Paragraph 71.b. Such process must be commenced by Respondent's submission to EPA, no later than 20 days after Respondent's receipt of a notice from EPA pursuant to Paragraph 71.a, of a Notice of Dispute, and a statement of position. The dispute shall then be resolved in accordance with Paragraph 50. However, notwithstanding Respondent's invocation of such dispute resolution procedures, and during the pendency of any such dispute, EPA may in its sole discretion commence and continue a Work Takeover under Paragraph 71.b until the earlier of (1) the date that Respondent remedies, to EPA's satisfaction, the circumstances giving rise to EPA's issuance of the relevant Work Takeover Notice, or (2) the date that a written decision terminating such Work Takeover is rendered in accordance with Paragraph 50 (Formal Dispute Resolution).
- d. Notwithstanding any other provision of this Settlement, EPA retains all authority and reserves all rights to take any and all response actions authorized by law.

XX. COVENANTS BY RESPONDENT

- 72. Respondent covenants not to sue and agrees not to assert any claims or causes of action against the United States, or its contractors or employees, with respect to the Work and this Settlement, including, but not limited to:
- a. any direct or indirect claim for reimbursement from the EPA Hazardous Substance Superfund through Sections 106(b)(2), 107, 111, 112, or 113 of CERCLA, 42 U.S.C. §§ 9606(b)(2), 9607, 9611, 9612, or 9613, or any other provision of law;
- b. any claims under Sections 107 and 113 of CERCLA, Section 7002(a) of RCRA, 42 U.S.C. § 6972(a), or state law regarding the Work and this Settlement;

- c. any claim arising out of response actions at or in connection with the Site, including any claim under the United States Constitution, the Pennsylvania Constitution, the Tucker Act, 28 U.S.C. § 1491, the Equal Access to Justice Act, 28 U.S.C. § 2412, or at common law; or
- 73. Except as provided in Paragraph 77 (Waiver of Claims by Respondent), these covenants not to sue shall not apply in the event the United States brings a cause of action or issues an order pursuant to any of the reservations set forth in Section XIX (Reservations of Rights by EPA), other than in Paragraph 70.a (liability for failure to meet a requirement of the Settlement), 70.d (criminal liability), or 70.e (violations of federal/state law during or after implementation of the Work), but only to the extent that Respondent's claims arise from the same response action, response costs, or damages that the United States is seeking pursuant to the applicable reservation.
- 74. Nothing in this Settlement shall be deemed to constitute approval or preauthorization of a claim within the meaning of Section 111 of CERCLA, 42 U.S.C. § 9611, or 40 C.F.R. § 300.700(d).
- 75. Respondent reserves, and this Settlement is without prejudice to, claims against the United States, subject to the provisions of Chapter 171 of Title 28 of the United States Code, and brought pursuant to any statute other than CERCLA or RCRA and for which the waiver of sovereign immunity is found in a statute other than CERCLA or RCRA, for money damages for injury or loss of property or personal injury or death caused by the negligent or wrongful act or omission of any employee of the United States, as that term is defined in 28 U.S.C. § 2671, while acting within the scope of his or her office or employment under circumstances where the United States, if a private person, would be liable to the claimant in accordance with the law of the place where the act or omission occurred. However, the foregoing shall not include any claim based on EPA's selection of response actions, or the oversight or approval of Respondent's deliverables or activities.

76. Reserved.

77. Waiver of Claims by Respondent.

- a. Respondent agrees not to assert any claims and to waive all claims or causes of action (including, but not limited to, claims or causes of action under Sections 107(a) and 113 of CERCLA) that it may have:
- 1. <u>De Micromis Waiver</u>. For all matters relating to the Site against any person where the person's liability to Respondent with respect to the Site is based solely on having arranged for disposal or treatment, or for transport for disposal or treatment, of hazardous substances at the Site, or having accepted for transport for disposal or treatment of hazardous substances at the Site, if all or part of the disposal, treatment, or transport occurred before April 1, 2001, and the total amount of material containing hazardous substances contributed by such person to the Site was less than 110 gallons of liquid materials or 200 pounds of solid materials.

2. <u>De Minimis/Ability to Pay Waiver</u>. For response costs relating to the Site against any person that has entered or in the future enters into a final Section 122(g) de minimis settlement, or a final settlement based on limited ability to pay, with EPA with respect to the Site.

b. <u>Exceptions to Waivers.</u>

- 1. The waivers under this Paragraph 77 shall not apply with respect to any defense, claim, or cause of action that a Respondent may have against any person otherwise covered by such waivers if such person asserts a claim or cause of action relating to the Site against such Respondent.
- 2. The waiver under Paragraph 77.a.1 (De Micromis Waiver) shall not apply to any claim or cause of action against any person otherwise covered by such waiver if EPA determines that: (i) the materials containing hazardous substances contributed to the Site by such person contributed significantly or could contribute significantly, either individually or in the aggregate, to the cost of the response action or natural resource restoration at the Site; or (ii) such person has failed to comply with any information request or administrative subpoena issued pursuant to Section 104(e) or 122(e) of CERCLA, 42 U.S.C. § 9604(e) or 9622(e), or Section 3007 of RCRA, 42 U.S.C. § 6927, or has impeded or is impeding, through action or inaction, the performance of a response action or natural resource restoration with respect to the Site; or if (iii) such person has been convicted of a criminal violation for the conduct to which the waiver would apply and that conviction has not been vitiated on appeal or otherwise.

XXI. OTHER CLAIMS

- 78. By issuance of this Settlement, the United States, including EPA, assumes no liability for injuries or damages to persons or property resulting from any acts or omissions of Respondent. The United States, including EPA, shall not be deemed a party to any contract entered into by Respondent or its directors, officers, employees, agents, successors, representatives, assigns, contractors, or consultants in carrying out actions pursuant to this Settlement.
- 79. Except as expressly provided in Paragraph 77 (Waiver of Claims by Respondent) and Section XVIII (Covenants by EPA), nothing in this Settlement constitutes a satisfaction of or release from any claim or cause of action against Respondent or any person not a party to this Settlement, for any liability such person may have under CERCLA, other statutes, or common law, including but not limited to any claims of the United States for costs, damages, and interest under Sections 106 and 107 of CERCLA, 42 U.S.C. §§ 9606 and 9607, or any claims of EPA under the Pennsylvania Uniform Environmental Covenants Act, Act No. 68 of 2007, 27 Pa. C.S. §§ 6501-6517.
- 80. No action or decision by EPA pursuant to this Settlement shall give rise to any right to judicial review, except as set forth in Section 113(h) of CERCLA, 42 U.S.C. § 9613(h).

XXII. EFFECT OF SETTLEMENT/CONTRIBUTION

- 81. Except as provided in Paragraphs 77 (Waiver of Claims by Respondent), nothing in this Settlement shall be construed to create any rights in, or grant any cause of action to, any person not a Party to this Settlement. Except as provided in Section XX (Covenants by Respondent), each of the Parties expressly reserves any and all rights (including, but not limited to, pursuant to Section 113 of CERCLA, 42 U.S.C. § 9613), defenses, claims, demands, and causes of action which each Party may have with respect to any matter, transaction, or occurrence relating in any way to the Site against any person not a Party hereto. Nothing in this Settlement diminishes the right of the United States, pursuant to Section 113(f)(2) and (3) of CERCLA, 42 U.S.C. § 9613(f)(2)-(3), to pursue any such persons to obtain additional response costs or response action and to enter into settlements that give rise to contribution protection pursuant to Section 113(f)(2).
- 82. The Parties agree that this Settlement constitutes an administrative settlement pursuant to which Respondent has, as of the Effective Date, resolved liability to the United States within the meaning of Sections 113(f)(2) and 122(h)(4) of CERCLA, 42 U.S.C. §§ 9613(f)(2) and 9622(h)(4), and is entitled, as of the Effective Date, to protection from contribution actions or claims as provided by Sections 113(f)(2) and 122(h)(4) of CERCLA, or as may be otherwise provided by law, for the "matters addressed" in this Settlement. The "matters addressed" in this Settlement are the activities defined as "the Work" in Section III of this Settlement.
- 83. The Parties further agree that this Settlement constitutes an administrative settlement pursuant to which Respondent has, as of the Effective Date, resolved liability to the United States within the meaning of Section 113(f)(3)(B) of CERCLA, 42 U.S.C. § 9613(f)(3)(B).
- 84. Respondent shall, with respect to any suit or claim brought by it for matters related to this Settlement, notify EPA in writing no later than 60 days prior to the initiation of such suit or claim. Respondent also shall, with respect to any suit or claim brought against it for matters related to this Settlement, notify EPA in writing within ten (10) days after service of the complaint or claim upon it. In addition, Respondent shall notify EPA within ten (10) days after service or receipt of any Motion for Summary Judgment and within ten (10) days after receipt of any order from a court setting a case for trial, for matters related to this Settlement.
- 85. In any subsequent administrative or judicial proceeding initiated by EPA, or by the United States on behalf of EPA, for injunctive relief, recovery of response costs, or other relief relating to the Site, Respondent shall not assert, and may not maintain, any defense or claim based upon the principles of waiver, res judicata, collateral estoppel, issue preclusion, claim-splitting, or other defenses based upon any contention that the claims raised in the subsequent proceeding were or should have been brought in the instant case, provided, however, that nothing in this Paragraph affects the enforceability of the covenant by EPA set forth in Section XVIII (Covenants by EPA).

86. Reserved.

XXIII. INDEMNIFICATION

- The United States, including EPA, does not assume any liability by entering into this Settlement or by virtue of any designation of Respondent as EPA's authorized representative under Section 104(e) of CERCLA, 42 U.S.C. § 9604(e), and 40 C.F.R. § 300.400(d)(3). Respondent shall indemnify, save, and hold harmless the United States, including EPA, its officials, agents, employees, contractors, subcontractors, and representatives for or from any and all claims or causes of action arising from, or on account of, negligent or other wrongful acts or omissions of Respondent, its officers, directors, employees, agents, contractors, or subcontractors, and any persons acting on Respondent's behalf or under its control, in carrying out activities pursuant to this Settlement. Further, Respondent agrees to pay the United States all costs it incurs, including but not limited to attorneys' fees and other expenses of litigation and settlement arising from, or on account of, claims made against the United States, including EPA, based on negligent or other wrongful acts or omissions of Respondent, its officers, directors, employees, agents, contractors, subcontractors, and any persons acting on its behalf or under its control, in carrying out activities pursuant to this Settlement. The United States, including EPA, shall not be held out as a party to any contract entered into by or on behalf of Respondent in carrying out activities pursuant to this Settlement. Neither Respondent nor any such contractor shall be considered an agent of the United States, including EPA.
- 88. The United States shall give Respondent notice of any claim for which the United States plans to seek indemnification pursuant to this Section and shall consult with Respondent prior to settling such claim.
- 89. Respondent covenants not to sue and agrees not to assert any claims or causes of action against the United States, including EPA, for damages or reimbursement or for set-off of any payments made or to be made to the United States or EPA, arising from or on account of any contract, agreement, or arrangement between Respondent and any person for performance of work on or relating to the Site, including, but not limited to, claims on account of construction delays. In addition, Respondent shall indemnify and hold harmless the United States, including EPA, with respect to any and all claims for damages or reimbursement arising from or on account of any contract, agreement, or arrangement between Respondent and any person for performance of Work on or relating to the Site, including, but not limited to, claims on account of construction delays.

XXIV. INSURANCE

90. No later than seven (7) days before commencing any on-site Work, Respondent shall secure, and shall maintain until the first anniversary after issuance of Notice of Completion of Work pursuant to Section XXVIII (Notice of Completion of Work), commercial general liability insurance with limits of liability of \$1 million per occurrence, automobile liability insurance with limits of liability of \$1 million per accident, and umbrella liability insurance with limits of liability of \$5 million in excess of the required commercial general liability and

automobile liability limits, naming EPA as an additional insured with respect to all liability arising out of the activities performed by or on behalf of Respondent pursuant to this Settlement. In addition, for the duration of the Settlement, Respondent shall provide EPA with certificates of such insurance and a copy of each insurance policy. Respondent shall resubmit such certificates and copies of policies each year on the anniversary of the Effective Date. In addition, for the duration of the Settlement, Respondent shall satisfy, or shall ensure that its contractors or subcontractors satisfy, all applicable laws and regulations regarding the provision of worker's compensation insurance for all persons performing the Work on behalf of Respondent in furtherance of this Settlement. If Respondent demonstrates by evidence satisfactory to EPA that any contractor or subcontractor maintains insurance equivalent to that described above, or insurance covering some or all of the same risks but in a lesser amount, Respondent need provide only that portion of the insurance described above that is not maintained by the contractor or subcontractor. Respondent shall ensure that all submittals to EPA under this Paragraph identify the AIW Frank/Mid-County Mustang Superfund Site, West Whiteland, Chester County, Pennsylvania, and the EPA docket number for this action (Docket No. CERCLA-03-2020-0082DC).

XXV. MODIFICATION

- 91. Other than requirements specifically contained within the text of this Settlement, the RPM may modify any plan or schedule in writing or by verbal direction. Any verbal modification will be memorialized in writing by EPA promptly, but shall have as its effective date the date of the RPM's verbal direction. Any other requirements of this Settlement may be modified in writing by mutual agreement of the parties.
- 92. If Respondent seeks permission to deviate from any approved work plan or schedule, Respondent's Project Coordinator shall submit a written request to EPA for approval outlining the proposed modification and its basis. Respondent may not proceed with the requested deviation until receiving verbal or written approval from the RPM pursuant to Paragraph 91.
- 93. No informal advice, guidance, suggestion, or comment by the RPM or other EPA representatives regarding any deliverable submitted by Respondent shall relieve Respondent of its obligation to obtain any formal approval required by this Settlement, or to comply with all requirements of this Settlement, unless it is formally modified.

XXVI. ADDITIONAL REMOVAL ACTION

94. If EPA determines that additional actions not included in the approved Removal Work Plan or other approved plan(s) are necessary to achieve the work items identified in Paragraph 17, EPA will notify Respondent of that determination. Unless otherwise stated by EPA, within 30 days after receipt of notice from EPA that additional actions are necessary to achieve the work items described in Paragraph 17, Respondent shall submit for approval by EPA a work plan for the additional actions. The plan shall conform to the applicable requirements of Section VIII (Work to Be Performed) of this Settlement. Upon EPA's approval of the plan

pursuant to Paragraph 19 (Work Plan and Implementation), Respondent shall implement the plan for additional actions in accordance with the provisions and schedule contained therein. This Section does not alter or diminish the RPM's authority to make verbal modifications to any plan or schedule pursuant to Section XXV (Modification).

95. If EPA determines that additional removal action not identified in Paragraph 17 is necessary to protect public health, welfare, or the environment, EPA will notify Respondent of that determination and request that Respondent perform such action. If Respondent agrees to perform such action, this Settlement will be modified to incorporate such action and Respondent shall submit, for approval by EPA, a work plan for such action. The plan shall conform to the applicable requirements of Section VIII (Work to Be Performed) of this Settlement. Upon EPA's approval of the plan pursuant to Paragraph 19 (Work Plan and Implementation), Respondent shall implement the plan for additional removal action in accordance with the provisions and schedule contained therein. This Section does not alter or diminish the RPM's authority to make verbal modifications to any plan or schedule pursuant to Section XXV (Modification).

XXVII. NOTICE OF COMPLETION OF WORK

96. When EPA determines, after EPA's review of the Final Report, that all Work has been fully performed in accordance with this Settlement, with the exception of any continuing obligations required by this Settlement – including, but not limited to, land-, water-, or other resource-use restrictions and record retention – EPA will provide written notice to Respondent. If EPA determines that such Work has not been completed in accordance with this Settlement, EPA will notify Respondent, provide a list of the deficiencies, and require that Respondent modify the Removal Work Plan if appropriate in order to correct such deficiencies. Respondent shall implement the modified and approved Removal Work Plan and shall submit a modified Final Report in accordance with the EPA notice. Failure by Respondent to implement the approved modified Removal Work Plan shall be a violation of this Settlement.

XXVIII. INTEGRATION/APPENDIXES

- 97. This Settlement and its Appendixes constitute the final, complete, and exclusive agreement and understanding among the Parties with respect to the settlement embodied in this Settlement. The parties acknowledge that there are no representations, agreements, or understandings relating to the settlement other than those expressly contained in this Settlement. The following Appendixes are attached to and incorporated into this Settlement:
 - a. Appendix A is a map of the Site and the Affected Property.
 - b. Appendix B is a figure showing the locations of the monitoring wells on the Affected Property.
 - c. Appendix C is the Environmental Covenant.
 - d. Appendix D is the April 13, 2020 Lochiel Farm Monitoring Well Inspection Site Visit Report.

- e. Appendix E is the September 2018 Remedial Design and Well Installation Standard Operating Procedures ("SOPs").
- f. Appendix F contains the well construction details.

XXIX. EFFECTIVE DATE

98. This Settlement shall be effective three (3) days after EPA's transmittal via email of a fully executed copy of this Settlement to counsel representing the Respondent.

Signature Page for Settlement Regarding AIW Frank/Mid-County Mustang Superfund Site:

FOR RESPONDENT B & J EXCAVATING, INC.:			
[Signature]	Date		
Please Type the Following:			
Name:			
Title:			
Address:			

IT IS SO ORDERED AND AGREED.

PAUL LEONARD

Digitally signed by PAUL LEONARD Date: 2020.05.01 13:45:39 -04'00'

Date

PAUL LEONARD
Acting Director
Superfund & Emergency Management Division
U.S. Environmental Protection Agency
Region III

Signature Page for Settlement Regarding AIW Frank/Mid-County Mustang Superfund Site:

FOR RESPONDENT B & J EXCAVATING, INC.:	4/27/20
[Signature]	Date
Please Type the Following:	
Name: WIlliam m BARTSCH	
Title: PRESZOENT	
Address: 140 ROBBENS Rd DOWNENGTOWN, F	PA 19335

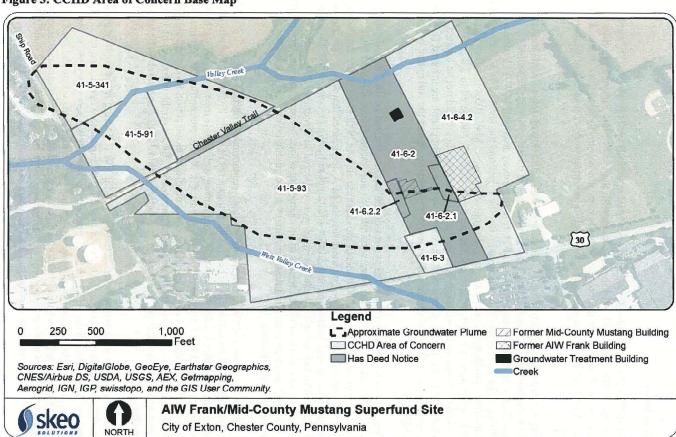
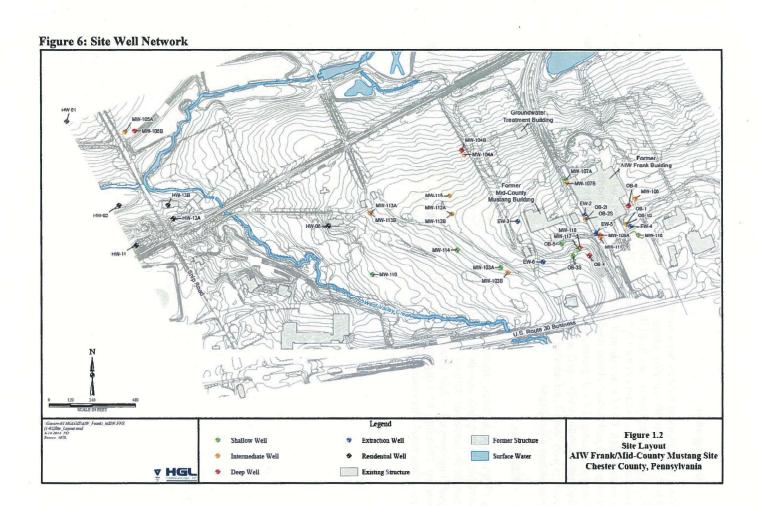


Figure 5: CCHD Area of Concern Base Map

Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.



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Rec Fees: \$62.50 State: \$0.00

Rick Loughery Recorder of Deeds, Chester County, PA



Prepared By:
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200 Market Street
Philadelphia, PA 19103
Phone: (215)-299-2874
Return To:
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Philadelphia, PA 19103
Phone: (215)-299-2874

Parcel No's. 41-5-93

ENVIRONMENTAL COVENANT

DONOVAN INVESTMENT PARTNERS, L.P.

APPENDIX C

Prepared By:

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Phone: (215)-299-2874

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Philadelphia, PA 19103

Phone: (215)-299-2874

Parcel No's. 41-5-93

ENVIRONMENTAL COVENANT

DONOVAN INVESTMENT PARTNERS, L.P.

When recorded, return to:

Gregory Kleiber, Esq. Fox Rothschild, LLP 2000 Market Street Philadelphia, PA 19103 215-299-2874

The County Parcel Identification No. of the Property is: 41-5-93

GRANTOR: Donovan Investment Partners, L.P.

PROPERTY ADDRESS: 740 North Ship Road, Exton, West Whiteland Township, Chester

County, Pennsylvania 19341

ENVIRONMENTAL COVENANT

This Environmental Covenant is executed pursuant to the Pennsylvania Uniform Environmental Covenants Act, Act No. 68 of 2007, 27 Pa. C.S. §§ 6501 – 6517 (UECA). This Environmental Covenant subjects the Property identified in Paragraph 1 to the activity and/or use limitations in this document. As indicated later in this document, this Environmental Covenant has been approved by the Pennsylvania Department of Environmental Protection (Department) and the United States Environmental Protection Agency (EPA) (collectively, "the Agencies").

1. <u>Property affected</u>. The property affected (Property) by this Environmental Covenant is located in West Whiteland Township, Chester County.

The postal street address of the Property is: 740 North Ship Road, Exton, PA 19341.

The County Parcel Identification No. of the Property is: 41-5-93.

The latitude and longitude of the center of the Property affected by this Environmental Covenant are: Latitude=40.032180, Longitude=-75.606191.

The Property is also known as the Lochiel Farm site.

The DEP Primary Facility ID# is 617502.

A complete description of the Property is attached to this Environmental Covenant as **Exhibit A**. A map of the Property is attached to this Environmental Covenant as **Exhibit B**.

- 2. <u>Property Owner / GRANTOR/GRANTEE</u>. Donovan Investment Partners, L.P. is the owner of the Property, the GRANTOR and GRANTEE, and a "holder," as that term is defined in 27 Pa. C.S. § 6502, of this Environmental Covenant.
- 3. <u>Mailing Address</u>. The mailing address of the Owner is as follows: <u>1595 Paoli</u> Pike, West Chester, PA 19380.
- 4. <u>Description of Contamination & Remedial Action</u>. Groundwater at the Property is impacted by historic releases of chlorinated solvents and other volatile organic compounds (VOCs) from the AIW Frank/Mid-County Mustang Site (the Site). In 1995, EPA issued a Record of Decision (ROD) for the Site under the Comprehensive Environmental Response, Compensation, and Liability Act. In the ROD, EPA selected a remedial action, which included, among other things, the cleanup of the impacted groundwater.

After completing several pilot studies and a focused feasibility study to evaluate more efficient cleanup technologies, EPA modified the groundwater remedial action in a June 16, 2017 ROD Amendment. EPA is now using in situ chemical oxidation and in situ enhanced bioremediation to clean up the groundwater plume and no longer exclusively uses a groundwater extraction and treatment system for the groundwater remediation.

As part of its ongoing review of the protectiveness of the remedial action, EPA conducted vapor-intrusion sampling in 2011 and 2015 at a residential duplex located on an adjacent property at the Site. The results of this sampling showed that concentrations of VOCs in indoor air were within EPA's acceptable levels, but that VOC concentrations from samples collected in soil gas beneath the concrete slab on both sides of the duplex were elevated. Based on these results, EPA has determined that Vapor Intrusion does not appear to be occurring within the residential duplex. However, EPA has also determined that, as reasonable steps, prior to occupancy of any future residential structures built on the Property, the Owner should install, operate, and maintain subslab vapor-mitigation systems under each of these residential buildings because of the potential presence of VOCs.

To comply with the activity and use limitation described in paragraph 5(c) below, the Owner intends to install sub-slab vapor-mitigation systems with the following specifications in any residential structures built on the Property: The sub-slab vapor mitigation system will consist of a minimum of 8-inches of clean AASHTO No. 57 aggregate (or larger), placed beneath the entire building slab to provide adequate airflow. A 4-inch, perforated ABS pipe will be installed within the AASHTO No. 57 aggregate along the perimeter of the excavated footprint for each residential unit. A minimum of two inches of aggregate will be placed above and below the pipe. The top of the sub-slab venting system will be capped with a 12-ounce non-woven geotextile cushion layer and a 20-mil Vapor Barrier Membrane prior to the installation of the new poured concrete floor slab. The Sub-Slab Ventilation System will be an active venting system with appropriately sized fan(s) to provide a negative pressure beneath the slab. A manometer and pressure differential monitoring points will be installed to ensure the system is creating adequate negative pressure.

The administrative records pertaining to the AIW Frank/Mid-County Mustang Site may be viewed online at EPA's website at:

https://semspub.epa.gov/src/collections/03/AR/PAD004351003 (last checked May 1, 2019) and at the locations listed below:

West Whiteland Township Building

Commerce Drive, Room 101

Exton, PA 19341

Hours: Call (610) 363-9525

EPA Administrative Records

Administrative Coordinator

1650 Arch Street

Philadelphia, PA 19103

Telephone: 215-814-3157

Hours: Monday-Friday 8:30 am to 4:30 pm by

appointment only

- 5. Activity & Use Limitations. The Property, which the Owner may subdivide into several residential Lots, is subject to the following activity and use limitations, which the thencurrent Owner of each Lot in the Property, and the then-current Owner's tenants, agents, employees and other persons under the Owner's control, shall abide by the following:
- (a) Groundwater at the Property shall not be used for any purpose. In addition, the construction of new wells at the Property is prohibited; provided, however, that nothing herein shall prohibit EPA's or the Department's collection of groundwater samples and the installation and use of groundwater monitoring, recovery or extraction wells or similar devices used for or related to the performance of groundwater assessment or remediation activities.
- (b) Interference with any monitoring well or other remedial response activity at the Property or Site is prohibited without prior written approval by EPA or the Department.
- (c) As a reasonable step to prevent VOCs emanating from the impacted groundwater into indoor air space of residential structures, a vapor-mitigation system shall be installed in every residential structure constructed at the Property. Each owner of a Lot in the Property shall be required to perform operation and maintenance of the Lot's vapor-mitigation system until EPA, in consultation with the Department, determines that groundwater at the Property has been remediated to the Maximum Contaminant Levels specified in EPA's June 16, 2017 ROD Amendment, and EPA formally deletes the Property from the National Priorities List.
- (d) Grantor shall provide each owner of a Lot in the Property with appropriate manuals or other instructions concerning the operation and maintenance of the vapor-mitigation systems.
- 6. <u>Notice of Limitations in Future Conveyances</u>. Each instrument hereafter conveying any interest in the Property subject to this Environmental Covenant shall contain a notice of the activity and use limitations set forth in this Environmental Covenant and shall provide the recorded location of this Environmental Covenant.
- 7. <u>Compliance Reporting</u>. After written request by EPA or the Department, the then-current owner of the Property (or, if after transfer of the control of the common elements to

the Property to the homeowner or community association, then the homeowner or community association) shall submit to EPA and the Department written documentation stating whether or not the activity and use limitations in this Environmental Covenant are being abided by. In addition, within one (1) month after any of the following events, the then-current owner of the Property (or, if after transfer of the control of the common elements to the Property to the homeowner or community association, then the homeowner or community association) shall submit to EPA, the Department, and any Holder listed in Paragraph 3, written documentation of: any noncompliance with the activity and use limitations in this Environmental Covenant; any transfer of the Property; any changes in use of the Property; any filing of applications for building permits for the Property; and any proposals for any site work, if the building or proposed site work will affect the contamination on the Property subject to this Environmental Covenant.

- Access by the Agencies. In addition to any rights already possessed by EPA or the
 Department, this Environmental Covenant grants to the Agencies a right of access to the Property
 at reasonable times in connection with implementation or enforcement of this Environmental
 Covenant.
- 9. Recordation and Notification of Recordation. Within 30 days after the date of EPA's approval, or 30 days after DEP's approval, or 30 days after Owner's acquisition of the Property, whichever is latest, the Owner shall file this Environmental Covenant with the Recorder of Deeds for Chester County, PA, and send a file-stamped copy of this Environmental Covenant to the Agencies within 60 days of recordation. Within that 60-day time period, the Owner also shall send a file-stamped copy to each of the following: West Whiteland Township, Chester County, each person holding a recorded interest in the Property, and each person in possession of the Property.

10. Termination or Modification.

- (a) This Environmental Covenant runs with the land unless terminated or modified in accordance with 27 Pa. C.S. § 6509 or 6510, or in accordance with paragraphs 10(b) or 10(c). The then-current owner of the Property shall provide the Agencies with written notice of the pendency of any proceeding that could lead to a foreclosure, as referred to in 27 Pa. C.S. § 6509(a)(4), within seven (7) calendar days of the owner's receiving notice of the pendency of such proceeding.
- (b) This Environmental Covenant may be amended or terminated as to any portion of the Property that is acquired for use as state highway right-of-way by the Commonwealth provided that: (1) EPA and the Department waive the requirements for an environmental covenant and for conversion pursuant to 27 Pa. C.S. § 6517 to the same extent that this Environmental Covenant is amended or terminated; (2) EPA and the Department determine that termination or modification of this Environmental Covenant will not adversely affect human health or the environment; and (3) EPA and the Department provide 30-days advance written notice to the current property owner, each holder, and, as practicable, each person that originally signed the Environmental Covenant or successors in interest to such persons.
- (c) This Environmental Covenant shall terminate upon attainment of performance standards set forth in the ROD, as modified by the ROD Amendment, for the above-described contamination at the Site, and after EPA formally deletes the Site from the National Priorities List.

EPA and the Department must provide prior written approval before such termination becomes effective.

- (d) In accordance with 27 Pa. C.S. § 6510(a)(3)(i), Grantor hereby waives the right to consent to any amendment or termination of the Environmental Covenant by consent; it being intended that any amendment to or termination of this Environmental Covenant by consent in accordance with this Paragraph requires only the following signatures on the instrument amending or terminating this Environmental Covenant: (i) any Holder at the time of such amendment or termination; (ii) the then-current owner of the Property; and (iii) the Agencies.
- 11. <u>Department and EPA Addresses</u>. Communications with the Department regarding this Environmental Covenant shall be sent to:

HSCA Group Manager Pennsylvania Department of Environmental Protection Environmental Cleanup and Brownfields 2 East Main Street Norristown, PA 19401-4915

Communications with EPA regarding this Environmental Covenant shall be sent to:

Associate Director (3SD20)
Site Remediation Branch, Superfund & Emergency Management Division
U.S. Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, PA 19103

12. <u>Severability</u>. The paragraphs of this Environmental Covenant shall be severable and should any part hereof be declared invalid or unenforceable, the remainder shall continue in full force and effect between the parties.

ACKNOWLED	GMENTS by Owner and any Holder(s), in the following form:
Date:	By: Donovan Investments, Inc., general partner By: Thomas Bentley, President Title: President
COMMONWE	ALTH OF PENNSYLVANIA)
COUNTY OF _	Chester)ss:
personally appe Donovan Invest a partnership, an	day of, 2019, before me, the undersigned officer, ared Thomas Bentley, who acknowledged himself to be the President of ments, Inc., a corporation, general partner of Donovan Investment Partners, L.P., and acknowledged that he executed same, as such officer of the corporation as of the partnership, for the purposes therein contained.
	In witness whereof, I hereunto set my hand and official seal. Notary Public
	Commonwealth of Pennsylvania - Notary Seal Lori J. Breish, Notary Public Chester County My commission expires February 24, 2023 Commission number 1016676

GRANTOR: Donovan Investment Partners, L.P.

PROPERTY ADDRESS: 740 North Ship Road, Exton, West Whiteland Township, Chester

County, Pennsylvania 19341

West Whiteland Township, Chester County.

APPROVED, by Commonwealth of Pennsylvania,

Date: 7 17 2019

Department of Environmental Protection

Name: Ragesh R. Patel

Title: Environmental Cleanup & Brownfields Program Manager

PA DEP - Southeast Regional Office

COMMONWEALTH OF PENNSYLVANIA

COUNTY OF MONTGOMERY

appeared Ragesh R. Patel who acknowledged himself to be the person whose name is

subscribed to this Environmental Covenant, and acknowledged that he executed same for the

purposes therein contained.

In witness whereof, I hereunto set my hand and official seal.

Commonwealth of Pennsylvania - Notary Seal Varietta Bouknight Ross. Notary Public Montgomery County

My commission expires December 1, 2021 Commission number 1193448

MEMBER, PENNSYLVANIA ASSOCIATION OF NOTARIES

Notary Public

APPROVED, by the United States Environmental Protection Agency

By:

Paul Leonard, Acting Director

Superfund & Emergency Management Division U.S. Environmental Protection Agency, Region III

1650 Arch Street Philadelphia, PA 19103

COMMONWEALTH OF PENNSYLVANIA

COUNTY OF PHILADELPHIA

) SS:

On this, the <u>13rd</u> day of <u>July</u>, 2019, before me <u>Patricia Schwenke</u>, the undersigned officer, personally appeared PAUL LEONARD of the United States

Environmental Protection Agency, known to me (or satisfactorily proven) to be the person described in the foregoing instrument, and acknowledged that he executed the same in the capacity therein stated and for the purposes therein contained.

In witness whereof, I hereunto set my hand and official seal.

Date: 50 14 23, 2019

Notary Public

Commonwealth of Pennsylvania - Notary Seal PATRICIA J. SCHWENKE, Notary Public Philadelphia County

Not Commission Express August 14, 2022

My Commission Expires August 14, 2022 Commission Number 1192054

EXHIBIT A LEGAL DESCRIPTION OF THE PROPERTY



Legal Description LOCHIEL FARM For DONOVAN INVESTMENT PARTNERS, L.P.

All that certain par	cel of land situate in the Township of West W	hiteland, County of
Chester, Commonwealth	of Pennsylvania, as shown on plan entitled "P.	reliminary Existing
Conditions Plan - Lochie	Farm" dated 11/28/17, last revised	, prepared for
Donovan Investment Part	ners, L.P., by DL Howell & Associates, Inc., 0	Civil Engineers, West
Chester, PA, and recorded	l in the office of the Recorder Of Deeds in and	I for the County of
Chester as Plan #	, being more particularly described as	s follows:

Beginning at a point on the title line in East Lincoln Highway (SR 3070) (50 Feet Wide) at its intersection with the southwesterly line of lands now or late of Exton Properties. Inc. as shown on said plan; thence from said Point of Beginning, running along said title line in East Lincoln Highway the following two (2) courses and distances: 1) South 81°20'37" West, 311.02 feet to a point; and 2) South 83°57'31" West, 670.86 feet to a point, being a corner of Saints Philip & James Roman Catholic Parish; thence, leaving said title line in East Lincoln Highway and running along said land of Saints Philip & James Roman Catholic Parish the following nine (9) courses and distances: 1) North 9°54'53" West, crossing the northerly right-of-way line of East Lincoln Highway 19.36 feet from the beginning of this line, and crossing a 20 feet wide Sanitary Sewer Easement (per Misc. Deed Book 248, Page 1), 242.33 feet to a concrete monument found; 2) North 68°02'53" West, 255.50 feet to a 3/4" rebar found; 3) South 86°27'17" West, 22.44 feet to a 3/4" rebar found; 4) North 9°54'53" West, crossing Tributary B of Valley Creek No. 2, 149.29 feet to a point; 5) South 89°02'57" West, 16.50 feet to a 34" rebar found; 6) North 9°54'53" West, 10.39 feet to a 3/4" rebar found; 7) North 83°09'53" West, 38.94 feet to a point in said creek,; 8) along said creek, North 7°05'07" East, 33.00 feet to a point in said creek; and 9) North 84°39'53" West, crossing and recrossing said creek, 533.37 feet to a 5/8" rebar found on the southerly line of lands now or late of Donald & Marian Rossi; thence, along said lands of Rossi the following three (3) courses and distances: 1) North 61°14'20" East, crossing said creek, 216.93 feet to a point; 2) North 25°29'33" West, running partially within said 20 feet wide Sanitary Sewer Easement (per Misc. Deed Book 248, Page 1), crossing the southerly side of a 20 feet wide PSW Water Line Easement (per Deed Book 4733, Page 1683), 120.14 feet to a point; and 3) South

> Howell Kline Surveying, LLC 1250 Wrights Lane, West Chester, PA 19380 Phone: 610-918-9004 - Fax: 610-918-9005 www.HowellKline.com



66°00'05" West, recrossing said creek, recrossing the southerly side of said 20 feet wide PSW Water Line Easement (per Deed Book 4733, Page 1683), and crossing the northeasterly right-of-way line of Ship Road (SR 1001) (35 Feet Wide) 18.23 feet from the end of this line, 405.31 feet to a point on the title line in Ship Road; thence, along the same. North 27°16'27" West, crossing the southeasterly side of a 40 feet wide PECO Easement (per Misc. Deed Book 107, Page 55), crossing the southeasterly right-of-way line of a variable width trail easement (belonging to the County of Chester, known as "The Chester Valley Trail"), (formerly the Chester Valley Branch of the Reading Company Railroad), 78.73 feet to a point being a corner of lands now or late of James & Nancy Carville; thence, along said lands of Carville, and along lands now or late of Whiteland Ridge Assoc., and running within said variable width trail easement, and running along the northwesterly side of said 40 feet wide PECO Easement, North 64°35'07" East, 1,660.07 feet to a point, a corner of lands now or late of 891 E. Lincoln Associates, L.P.; thence, along said lands of 891 E. Lincoln Associates, L.P., and partly along lands now or late of C. D. S. Investment Company, South 27°20'43" East, recrossing said southeasterly right-of-way line of said variable width trail easement, 964.20 feet to a 5/8" rebar found; thence, continuing along said lands of C. D. S. Investment Company, South 63°00'10" West, 16.50 feet to a 5/8" rebar found; thence, continuing along said lands of C. D. S. Investment Company, said lands of 891 E. Lincoln Associates, L.P., and said lands of Exton Properties, Inc., South 27°54'50" East, running partly within said 20 feet wide PSW Water Line Easement (per Deed Book 4733, Page 1683), running partly along the northeasterly side of an Access Right-of-Way (per Misc, Deed Book 189, Page 310), recrossing said 20 feet wide Sanitary Sewer Easement (per Misc. Deed Book 248, Page 1), and recrossing said northerly right-of-way line of East Lincoln Highway 28.13 feet from the end of this line, 481.95 feet to the Point and Place of Beginning.

Containing: 32.365 Acres of Land, be the same more or less.

Being: UPI # 41-5-93 as shown on said plan.

Subject to: A 20 feet wide Sanitary Sewer Easement (per Misc. Deed Book 248, Page 1), a 20 feet wide PSW Water Line Easement (per Deed Book 4733, Page 1683), a 40 feet wide PECO Easement (per Misc. Deed Book 107, Page 55), a variable width trail easement (belonging to the County of Chester, known as "The Chester Valley Trail"), (formerly the Chester Valley

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Branch of the Reading Company Railroad), an Access Right-of-Way (per Misc, Deed Book 189, Page 310), a PECO Gas Easement (per Misc. Deed Book 157, Page 981), a PECO Right-of-Way (per Misc. Deed Book 241, Page 334), and any other easements or encumbrances as may appear of record.

Being: The same premises which Carolyn B. Welsh, Sheriff of the County of Chester, in the Commonwealth of Pennsylvania by deed dated February 13th, 2017 and recorded February 16th, 2017, in the office of the Recorder of Deeds, in and for Chester County in Record Book 9493, Page 2174 granted and conveyed to Whiteland Holdings, LP.

12569 Legal Description Outbounds.docx



EXHIBIT B MAP OF THE PROPERTY





Exceeding Expectations

April 13, 2020

Mr. David Greaves Remedial Project Manager U.S. Environmental Protection Agency 1650 Arch St. Philadelphia, PA 19103-2029

Subject: Lochiel Farm Monitoring Well Inspection Site Visit Report AIW Frank/Mid-County Mustang Superfund Site Work Assignment 075RARA032S

Dear Mr. Greaves:

In accordance with your directions, HydroGeoLogic, Inc. (HGL) attended the site visit on April 3, 2020 in order to investigate the status of the monitoring wells within the Lochiel Farm property and prepared a summary of findings. David Greaves (EPA WAM), Joshua Crooks (PADEP Supervisor), Mike Bartsch (BJ Excavating), Dan Stewart (Lennar), Tench Tilghman (Lennar), and Nikolaos Fytilis (HGL) attended the site visit.

The attendants met at the entrance of the Lochiel Farm at 7:30 am and after brief introductions, the attendants walked at the location of MW-103B. The top of the casing and the plug at MW-103B are 2.5 feet (ft) under the current ground surface level. MW-103A is located approximately 15 ft away from MW-103B. The PVC riser and cap at MW-103A are partially damaged and are located approximately 5.5 ft under the current ground surface level. The attendants then walked to MW-104A and MW-104B, which are located at the edge of the Lochiel Farm property. The location of these wells is staked, and both are outside the ongoing construction activities. Both wells seem to be intact.

The next well inspected was MW-115. This is a well that is planned to be relocated and was originally part of the February 2020 sampling event. The condition of the well in February 2020 did not allow HGL to collect a sample from this well. Since February 2020, BJ Excavating contracted B.L. Myers Bros. to repair the surface of this monitoring well. A new plug and steel lid, along with grouting of the PVC riser in place, were installed. Similar activities were conducted at the adjacent, collocated MW-112A and MW-112B. The attendants then walked to MW-114 where the concrete pad was intact, and the location of the well is clearly marked. The injection wells, IW-1 through IW-3, which are in the vicinity of these monitoring wells, were not inspected during this site visit because there were inspected in February 2020 and were deemed to be functional and intact.

The attendants then walked to well MW-110, which is a stick-up well and is located outside the ongoing construction activities. This well seems to be intact. The wells MW-113A and MW-

113B are collocated and both the PVC risers and cap appeared to be damaged. EPA and PADEP discussed that there is no need to locate and inspect HW-06 since this well is not going to be part of any future monitoring events. The attendants walked back to the entrance of the Lochiel Farm property and briefly discussed the path forward with the submittal of work plans describing any required repairs to the monitoring wells and the submittal of a report summarizing the repairs conducted to date at MW-115 and MW-112A and B.

HGL then rented a water level meter and along with other equipment walked back to the monitoring wells to inspect them internally. Both representatives from Lennar were present while HGL further inspected the monitoring wells.

MW-103B

The steel casing at MW-103B is slightly bent but HGL was able to lower all equipment throughout the casing and tag the original depth of this well. The plug at this well is not properly set at the top of the steel casing. Since the top of this well is below the final grade of the ground surface, it is anticipated that extra casing will be added and the plug, along with a new lid, will be securely installed. Photo 1 depicts the current status of this well and the surrounding area. Yellow tape is used to mark the location of the excavated area around well MW-103B. Water was detected at 7.83 ft below the top of the steel casing.



Photo 1: Well MW-103B

MW-103A

The PVC riser at this well, along with the concrete pad, are destroyed. A cloth is currently used to block the opening at the top of the PVC riser. The well is located approximately 5.5 ft below the current ground surface level. The water level meter was only able to reach 21.12 ft below the top of the PVC riser and water was detected at 7.51 below the top of the PVC riser. The obstruction at the well could be just mud or a piece of PVC/rock. In the former case, pressurized water could remove the obstruction but in the latter case, removing the obstruction may not be possible. In either case, if the obstruction at 21 ft below the top of the PVC riser is removed, further investigation is warranted to check that there are no other obstructions within the PVC riser and the screen from 20 to 40 ft below the top of the PVC riser is clear. Since the top of this well is below the final grade of the ground surface, it is anticipated that extra casing will be added, and the surface of the well will be completed as flush mount or stickup. Photo 2 depicts the current status of this well and the surrounding area. Yellow tape is used to mark the location of the excavated area around well MW-103A.



Photo 2: Well MW-103A

MW-104A, MW-104B, MW-110

These three wells are outside the construction zone. Upon further investigation, they seem to be intact. HGL was able to measure the water level at MW-104A and MW-104B, both completed as flush mount, and tag the anticipated depth. These two wells were last sampled in April 2012 with TCE concentrations ten times lower than the remedial goal or non-detect results. Well MW-110 is a stickup well and was last sampled in October 2011 with a TCE concentration of 4.8 micrograms per liter. The lid at this well is rusted and HGL could not open and take a water level measurement on April 3, 2020. None of these three wells are part of the remedial action sampling events and these three wells will need to be redeveloped if EPA/PADED want to include them in a future sampling program.

MW-115

This well was last sampled in April 2018. The top part of this well was repaired by B.L. Myers Bros. and its current surface completion will prevent any further subsurface damages. However, HGL was not able to tag the bottom of the well on April 3, 2020 due to an obstruction at 4.83 ft below the top of the PVC riser. This well is planned to be relocated during the construction activities. If the obstruction at 4.83 ft below the top of the PVC riser is removed, further investigation is warranted to confirm that there are no other obstructions within the PVC riser and the screen from 55 to 95 ft below the top of the PVC riser is clear. Prior to relocating the well, a sample needs to be collected from this well in order to compare it with the sample from the new location. An orange construction fence is wrapped around stakes surrounding this well to mark its location.

MW-112A and B

This well was last sampled in April 2018. The top part of this well was repaired by B.L. Myers Bros. and its current surface completion will prevent any further subsurface damages. HGL was able to measure the water level and tag the bottom at both wells. A small amount of mud exists at the bottom, but it can be easily removed with surging or jetting during well redevelopment. An orange construction fence is wrapped around stakes surrounding this well to mark its location.

MW-114

This well was last sampled in May 2018. The concrete pad, PVC riser, and well plug were all found intact and HGL was able to measure the water level and tag the bottom of this well. An orange construction fence is wrapped around stakes surrounding this well to mark its location.

MW-113A and B

These collocated wells are temporarily covered with a broken plastic lid and their openings are stuffed with cloths to block the entrance of mud or rocks. Mud was detected at 12.34 and 20.82 ft below the top of the PVC riser. HGL was not able to identify which PVC riser corresponds to each well. If the obstructions are removed, further investigation is warranted to check that there are no other obstructions within each PVC riser and the screens in each well are clear. Yellow tape is used to mark the location of the excavated area around these two wells. Photo 3 depicts the current status of this well and the surrounding area.



Photo 3: Wells MW-113A and B

Overall findings and suggestions

- HGL was pleasantly surprised with the fact that all wells within the Lochiel Farm were located, in some cases uncovered, and overall, properly marked in order to avoid damaging them in the future.
- Appropriate temporary measures should be implemented in order to protect MW-103A/B and MW-113A/B and replace the cloths and plastic lids currently in place. The temporary measures should be properly secured and eliminate any infiltration. Periodic inspection of the temporary measures should be conducted in order to confirm their status.
- Obstructions identified in wells MW-103A, MW-113A, MW-113B, and MW-115 need to be removed (by jetting, surging, or other methods) and the screen interval in each well should be clear in order to be deemed functional. Otherwise, these wells need to be abandoned and relocated.
- Mud at the bottom of the wells MW-103B, MW-104A and B, MW-112A and B, MW-114 needs to be removed during redevelopment prior to sampling these locations.
- It is anticipated that the casing of many wells, including the monitoring and the injection wells, within the Lochiel Farm property will be either cut or extended to match the final grade of the property. Surveying of the new and existing wells (horizontal and vertical)

- and information regarding the length of casing added or removed should be documented and provided to EPA and PADEP.
- Wells MW-104A, MW-104B, and MW-110 are not part of the sampling activities described in the 2018 Remedial Design Work Plan. If EPA and PADEP select to include these wells in a future sampling event, then these wells will need to be redeveloped.
- As of right now, only well MW-115 is scheduled to be abandoned and relocated. HGL suggests that for any well that will be abandoned and relocated, a sampling from the old well should be collected. In addition, geophysical and packer investigation should be conducted in the new location prior to installing and collecting a sample from the new well for comparison with the old well.
- B&J Excavating used their own locks to secure the lids at MW-115 and MW-112A/B casings. HGL has a copy of the key but it is recommended to use the same lock that is used in the injection wells in order to minimize the number of site keys, regardless if the wells will be completed as flush mount or stickups.
- HGL recommends the submittal of two work plans. One work plan will document the
 anticipated repairs on the existing wells (adjusting casings, removing obstructions within
 the wells, surface construction details) and another one that will document the field
 activities to abandon and relocate any wells.

This document has been created to aid in the assessment of the forthcoming well repairs within the Lochiel Farm property at the AIW Frank/Mid-County Mustang Superfund Site. A table summarizing the findings during the April 3, 2020 Site visit is provide below. If you have any questions regarding this document, please contact me at or at

Sincerely,

HGL Project Manager

Well Construction Details						
Well ID	Total Depth	Depth Bottom Casing	Depth of Bedrock	Depth top screen	Depth bottom screen	Completion
MW112A	90	80	12	80	90	2 pvc
MW112B	200	180	12	180	200	2 pvc
MW115	95	55	9	55	95	2 pvc
MW114	65	55	41	55	65	2 pvc
MW103A	40	20	35	20	40	4 pvc
MW103B	132	68	55			6
MW113A	125	105	16	105	125	2 pvc
MW113B	170	160	16	160	170	2 pvc
MW104A	95	25	14			6
MW104B	140	105	10			6
MW110	55	45	16	45	55	2 pvc
HW06	unknown	unknown	unknown	unknown	unknown	unknown

	Site Findings on 04/03/2020				
Well ID	Water Level (ft Depth Tagged below top of casing) casing)		Notes		
MW112A	19.41	87.17	collocated with MW-112B, surface is repaired by Myers		
MW112B	22.55	199.78	collocated with MW-112A, surface is repaired by Myers		
MW115	mud at 4.83		surface is repaired by Myers; Well was planned to be abandoned and relocated by Lennar		
MW114	53.17 64.82		intact concrete pad		
MW103A	7.51 21.12		5.5 ft below current ground surface; did not reach total depth		
MW103B	7.83 131.85		2.5 ft blow current ground surface		
MW113A	mud at 12.34		collocated with MW-103B, cloth is temporarily blocking the opening		
MW113B	mud at 20.82		collocated with MW-103A, cloth is temporarily blocking the opening		
MW104A	21.74 94.95		outside the construction zone		
MW104B	20.53 139.92		outside the construction zone		
MW110	Unable to open	; well lid rusted	outside the construction zone		
HW06	This well is not part of the future Site activities scheduled by EPA and PADEP				

Mr. Greaves Page 8 of 7

APPENDIX E

FINAL REMEDIAL DESIGN AIW FRANK/MID-COUNTY MUSTANG SUPERFUND SITE OPERABLE UNIT 1 CHESTER COUNTY, PENNSYLVANIA

Prepared for:



U.S. Environmental Protection Agency Region 3 1650 Arch Street Philadelphia, PA 19103

> U.S. EPA Contract EP-S3-07-05 Work Assignment 070RDRD032S

> > September 2018

FINAL REMEDIAL DESIGN AIW FRANK/MID-COUNTY MUSTANG SUPERFUND SITE OPERABLE UNIT 1 CHESTER COUNTY, PENNSYLVANIA

Prepared for:

U.S. Environmental Protection Agency Region 3 1650 Arch Street Philadelphia, PA 19103

Prepared by:

HydroGeoLogic, Inc. 11107 Sunset Hills Road Suite 400 Reston, VA 20190

September 2018

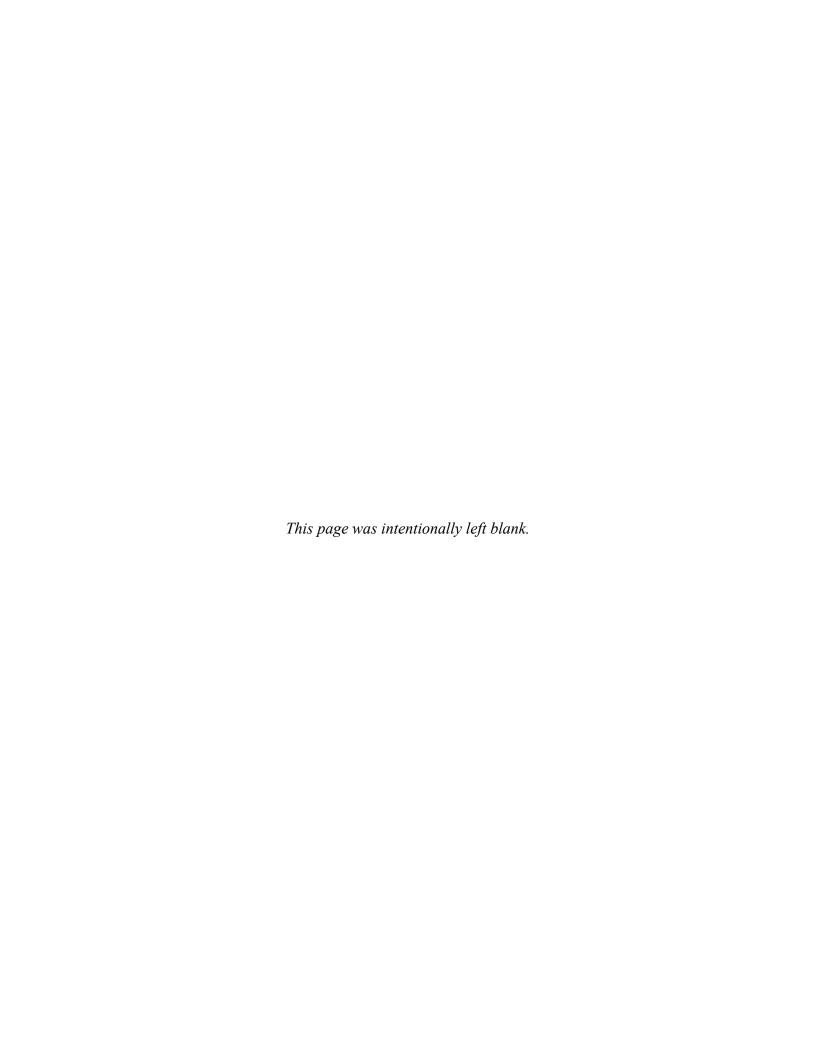


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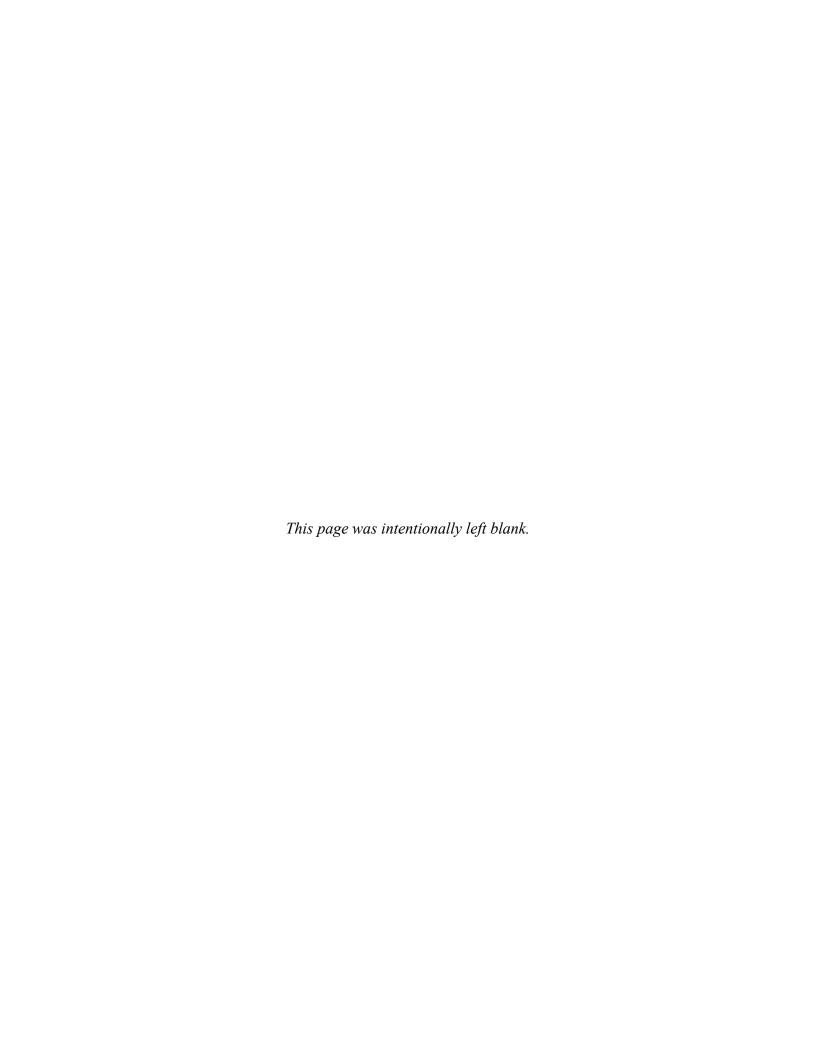
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LIST OF ACRONYMS AND ABBREVIATIONS

% percent

 $\begin{array}{ll} \pm & \qquad \qquad less \ than \ plus \ or \ minus \\ \mu g/L & \qquad micrograms \ per \ liter \end{array}$

ABC[®] Anaerobic BioChem

ARAR applicable or relevant and appropriate regulations

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act

CFR Code of Federal Regulations
COC contaminant of concern

CWA Clean Water Act

DCE dichloroethene

EPA (U.S.) Environmental Protection Agency

FeEDTA iron ethylenediaminetetraacetate

FFS Focused Feasibility Study

FS Feasibility Study FSP Field Sampling Plan

ft foot/feet

gal gallon

GETS groundwater extraction treatment system

gpm gallons per minute gr/L grams per liter

H₂O₂ hydrogen peroxide HGL HydroGeoLogic, Inc.

IDW investigation-derived waste ISBR in situ bioremediation ISCO in situ chemical oxidation

KMnO₄ potassium permanganate

lb pound

LTM long-term monitoring

MCL maximum contaminant level

mg/L milligrams per liter

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

NaMnO₄ sodium permanganate NaOH sodium hydroxide

NPDES National Pollutant Discharge Elimination System

OU operable unit

PADEP Pennsylvania Department of Environmental Protection

PCE tetrachloroethene
psi pounds per square inch
PVC polyvinyl chloride

QAPP Quality Assurance Project Plan

RA Remedial Action

RAO remedial action objective

RCRA Resource Conservation and Recovery Act

RD Remedial Design RG remedial goal

RI Remedial Investigation ROD Record of Decision

SAP Sampling and Analysis Plan

TCA Trichloroethane TCE Trichloroethene

UIC Underground Injection Control

VC vinyl chloride

VOC volatile organic compound

wt% weight percent

FINAL REMEDIAL DESIGN REPORT AIW FRANK/MID-COUNTY MUSTANG SUPERFUND SITE OPERABLE UNIT 1 CHESTER COUNTY, PENNSYLVANIA

1.0 INTRODUCTION

This Remedial Design (RD) Report provides the basis of the RD activities that will be performed at the AIW Frank/Mid-County Mustang Superfund Site (herein referred to as "the Site") located in Chester County, Pennsylvania. The primary task of the RD for this Site is to present the design for the selected groundwater remedy for Operable Unit 1 (OU-1) described in the Record of Decision (ROD) Amendment signed in June 2017. The RD Report is being prepared by HydroGeoLogic, Inc. (HGL) under U.S. Environmental Protection Agency (EPA) Region 3 Response Action Contract II, Work Assignment 070RDRD032S.

1.1 PURPOSE AND GOALS

Environmental investigations indicated that groundwater has been impacted at the Site, primarily by volatile organic compounds (VOCs).

EPA conducted a Remedial Investigation/Feasibility Study (RI/FS) from January 1991 to January 1993. Following completion of the RI/FS, EPA documented the Selected Remedy for the Site in a 1995 ROD (EPA, 1995). As part of that remedy a groundwater extraction treatment system (GETS) began operation in 2000. In 2008, the GETS was turned off because EPA determined that the GETS was having minimal impact on the groundwater contaminant plume. The extraction wells were taken offline because influent concentrations were either below maximum contaminant levels (MCLs), or the wells were being used for pilot study activities and the extraction pumps were removed. EPA subsequently performed a series of in situ chemical oxidation (ISCO) in situ bioremediation (ISBR) pilot studies from 2005 through 2011 to evaluate alternative remedial technologies to treat contaminated groundwater at the Site.

Based on the positive results of the ISCO and ISBR pilot studies, a Focused Feasibility Study (FFS) was completed by EPA in 2015 to determine whether it would be beneficial to amend the Selected Remedy in the 1995 ROD for groundwater treatment. The 2015 FFS concluded that ISCO and ISBR technologies would achieve groundwater remedial goals (RGs) in a shorter time frame and at a lower cost than extraction and treatment. Therefore, EPA completed a ROD Amendment in 2017 that removes the GETS as a component of the Selected Remedy (EPA, 2017). In place of the GETS, the ROD Amendment requires ISCO and ISBR treatment technologies to remediate groundwater contamination at the Site. Since the pilot studies indicated that ISCO was more effective at treating 1,4-dioxane, ISCO will be utilized initially at the Site by injecting an oxidant throughout the groundwater plume to treat VOC and 1,4-dioxane contamination. ISCO will be conducted until the RG for 1,4-dioxane is achieved throughout the plume. ISBR will be completed after ISCO, by injecting nutrients and/or other amendments into the groundwater plume to

stimulate biological degradation of Site contaminants of concern (COCs). Although the existing GETS will remain shut down, it will be maintained in operable condition in the event that it is needed for future Remedial Actions (RAs) at the Site. Groundwater remediation utilizing ISCO and ISBR will continue until contaminant levels in groundwater reach the RGs specified in the 1995 ROD, as modified by Table 2 in the ROD Amendment.

This RD Report presents the design elements of the selected groundwater remedy and includes a detailed discussion on the ISCO and the ISBR. The primary components of the selected remedy are:

- Installation of injection wells.
- Injection of ISCO amendment under high and low pressures for treatment of 1,4-dioxane to RG. Two injections are currently planned. If RGs are met after the first injection, then the second injection may not be required.
- Injection of ISBR amendment under high and low pressures for treatment of all remaining Site COCs to their respective RGs. Two injections are currently planned. If RGs are met after the first injection, then the second injection may not be required. If RGs are not met after the second injection, then additional injections may be required.
- Baseline and periodic performance groundwater monitoring.
- Maintaining the existing GETS in operation condition.
- Maintaining the institutional controls that prevent consumption of contaminated groundwater, including deed restrictions, until RGs are met.

1.2 REPORT OUTLINE

This RD consists of the following five sections:

- Section 1 is this introduction.
- Section 2 provides the Site description, history, environmental setting, and a summary of relevant previous investigations.
- Section 3 discusses the installation of permanent monitoring injection wells.
- Section 4 presents the design basis, treatment volumes, loading rates, injection process, monitoring requirements, and quality control elements for the chemical oxidation and bioremediation injection tasks.
- Section 5 presents a summary of the costs associated with implementing the RA.
- References are provided in Section 6.

Five appendices are also included with the report.

- The proposed RA project schedule is included in Appendix A.
- Calculations for the substrate injection are provided in Appendix B.

- Project specifications are included in Appendix C.
- The Sampling and Analysis Plan (SAP) is included in Appendix D.
- The cost estimate detailing the costs to implement the RA is included in Appendix E.

1.3 **SCHEDULE**

The RA schedule is provided in Appendix A and assumes a start date of October 1, 2018. Depending on the procurement of the RA Contractor the schedule can be adjusted to reflect the actual start date. Every effort should be made to maintain the RA Schedule; however, health and safety of the field staff is a priority in performance of the RA activities, and accordingly, all RA work should be conducted in accordance with the Environmental Safety and Health Plan that will be developed by the RA Contractor.

Successful completion of the RA will require close cooperation and communication between the RA Contractor, its subcontractors, the EPA, and the Pennsylvania Department of Environmental Protection (PADEP).

1.4 SAMPLING REQUIREMENTS

All sampling activities performed as part of the RA will follow the procedures specified in the RA SAP (Appendix D), which contains the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP). The FSP and QAPP contain a complete list of the required samples, the frequency of sample collection, and the appropriate analytical methods to be used during the RA.

1.5 **BASIS OF DESIGN**

The following sections describe the framework that comprises the basis for the OU-1 RD. The basis of design presents the federal, state, and local regulations considered during the design process, and the design assumptions used for the RA.

Regulatory Considerations

This section describes the federal, state, and local requirements that must be met as part of the OU-1 RA. The work completed as part of the Site RA requires a detailed statement of how all applicable or relevant and appropriate regulations (ARARs) will be met. This section provides summaries of the key ARARs and how the design will meet those requirements. A complete listing of all ARARs is presented in the original 1995 ROD and updated in the 2017 ROD Amendment (EPA, 1995 and 2017). The ARARs also are an integral part of the design assumptions and permitting described in sections that follow.

Section 121(d)(2)(A) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) incorporates into law the CERCLA Compliance Policy that specifies that Superfund RAs must meet any federal standards, requirements, criteria, or limitations that are determined to be legally ARARs. In addition, any promulgated state regulation, standard, criteria, or limitation that is more stringent than the corresponding federal regulation, standard, criteria, or limitation must be adhered to during the RA for the OU-1 groundwater.

ARARs can be chemical specific, location specific, or action specific. The following sections present summaries of the federal and state ARARs that apply to the OU-1 RD.

1.5.1.1 Chemical-Specific ARARs

Chemical-specific ARARs are usually health or risk based numerical values limiting the amount or concentration of a chemical that may be found in, or discharged to, the environment. Chemical-specific ARARs mandate that contamination levels found in Site groundwater meet certain criteria to protect human health and the environment. The following are the chemical-specific ARARs that have been considered as part of this design:

Chemical-specific federal ARARs include:

- Safe Drinking Water Act MCLs, 40 Code of Federal Regulations (CFR) §§ 141.11, 141.61 and 141.62. Although groundwater in the vicinity of the Site is not used as a private drinking water supply, the Site is located within a Class II aquifer, which is a potential source of drinking water. The National Contingency Plan indicates that, "EPA expects to return usable ground waters to their beneficial uses wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site" (EPA, 2009). As a result, the MCLs are applicable and have been incorporated into the Preliminary RGs that were developed for Site groundwater.
- Clean Water Act (CWA). National Pollutant Discharge Elimination System (NPDES) Requirements, 402: 33 U.S.C. §1342, 40 CFR Parts 122-125. The substantive provisions of these requirements are applicable to any portion of the remedy that may affect the water quality in the nearby West Valley Creek. The only intrusive construction activities required during the RA is the installation of extraction wells and monitoring wells. The soil and water generated during the installation process will be stored in drums, roll-offs, and/or frac tanks to contain the material and eliminate the potential for migration to West Valley Creek. Water generated during drilling and sampling activities will be treated by the on-Site GETS. PADEP will issue a "Temporary" NPDES permit for the Site. The treated water must meet the limits set by PADEP for discharge into the on-Site pond.

Chemical-specific Commonwealth of Pennsylvania ARARs include:

- Pennsylvania Guidelines for Development of Criteria for Toxic Substances and Water Quality Criteria for Toxic Substances 25 Pa. Code §§ 16.1, 16.24, 16.31 16.33, 16.41, 16.51 and 16.101-102. These guidelines indicate methods to be used for the development of water quality criteria. This information was taken into account in the identification of RGs and GETS discharge limits.
- Pennsylvania Water Quality Standards, 25 Pa. Code § 93. These are specific water quality criteria established pursuant to Section 304 of the CWA. These provisions set the concentrations of pollutants that are allowable to levels that preserve human health based on water and fish ingestion and to preserve aquatic life. The water quality standards are considered relevant to the Site and must be complied with as part of meeting the substantive requirements of the NPDES permit process for treatment systems discharges.

1.5.1.2 Location-Specific ARARs

Location-specific ARARs include restrictions on certain types of activities based on site characteristics. Location-specific ARARs govern activities in critical environments such as endangered or protected species habitats, and historic locations. The following are the location-specific ARARs that were considered for the Site and have been considered as part of this RD:

Location-specific federal ARARs include:

- Archeological and Historic Preservation Act of 1974, 16 U.S.C.§ 469. Requires that Federal agencies take action to recover, protect, and preserve any significant scientific, prehistorical, historical, or archeological artifact that may be irreparably lost or destroyed as a result of the alteration of terrain caused by Federal activities. EPA does not currently have any information that there are any significant scientific, prehistorical, historical, or archeological artifact at the Site. If, during the RA, EPA discovers that such artifacts are present at the Site, actions must be taken to comply with the substantive requirements of this act.
- The National Historical Preservation Act and regulations, 16 U.S.C. §470; 36 CFR Part 800. Requires that Federal agency actions avoid adverse effects in historic properties. EPA does not currently have any information that there are historic properties at the Site. If, during the RA, a determination is made that there are historic properties on or near the Site, actions must be taken to mitigate any adverse effects on those properties resulting from the remedial activities.

1.5.1.3 Action-Specific ARARs

Action-specific ARARs are technology or activity-based requirements of, or limitations on, actions taken with respect to the COCs. These requirements are triggered by the specific remedial activities selected to accomplish a remedy. Action-specific requirements do not in themselves determine the remedial alternative; rather, they indicate the standards a selected alternative must achieve (e.g., emission standards for air strippers and incinerators, underground storage tank regulations, or land disposal restrictions). The following are the action-specific ARARs that were considered at the Site and have been considered as part of this design:

Action-specific federal ARARs include:

• Resource Conservation and Recovery Act (RCRA), 40 CFR § 262.34 (accumulation time and requirements) 40 CFR §§ 264.171- 175 (containers). These provisions govern the accumulation time for hazardous wastes and management of containers. It is not expected that any hazardous wastes will be generated during the RA based on previous Site activities conducting similar activities. It is possible that the spent carbon from the liquid-phase carbon adsorption vessels used for investigation-derived waste (IDW) treatment may be considered hazardous. For these reasons RCRA and the associated regulations under the PADEP will be considered applicable to the Site. Representative samples of spent carbon will be analyzed to determine whether the spent carbon will need to be treated as a characteristically hazardous waste. Until such a determination is made, the

spent carbon will be handled as hazardous waste. Soil generated during well installation activities will also be analyzed to determine if it will need to be treated as a characteristically hazardous waste, although it is anticipated to be classified as nonhazardous.

- Safe Drinking Water Act Underground Injection Control (UIC) Regulations, 40 CFR §§144.1(g), 144.11, 144.12(a), 144.82, 146.6, 146.7, 146.8, 146.10(c). These regulations identify classes of injection and wells and the requirements for those wells under the UIC program. These regulations apply to all injection wells that will be installed and/or used to carry out the ROD specified remedy.
- EPA Guidance for Evaluating Completion of Groundwater Restoration RA, EPA Office of Solid Waste and Emergency Response Directive 9355,0-1129. November 2013. This guidance document presents EPA's recommendations for evaluating Superfund groundwater remedy performance and making decisions to help facilitate achievement of remedial action objectives (RAOs) and associated cleanup levels. This guidance should be used to evaluate remedy performance and achievement of RAOs.
- CWA, 40 CFR §§ 122.2, 122.4, 122.5, 122.21, 122.26, 122.29, 122.41, 122.43 122.45, 122.47, 122.48. Establishes effluent limitations for discharges to waters of the United States. The treated groundwater from the GETS will comply with the substantive requirements of these discharge standards.
- National Primary and Secondary Ambient Air Quality Standards, 40 CFR § 50.6 50.7. Establishes the fugitive dust regulation for particulate matter. Installation of monitoring wells could produce dust during drilling activities. During the RA, the RA Contractor must take measures to comply with the substantive requirements of these regulations.

The principal action-specific Commonwealth of Pennsylvania ARARs include:

- Pennsylvania Clean Streams Law 25 Pa. Code § 91. The objective of this statute is to reclaim and restore polluted streams. The law provides for the protection of streams and water quality. This statute is applicable as the GETS will be utilized to treat IDW during the RD. The discharge of treated water will comply with the substantive requirements of these discharge standards.
- Pennsylvania NPDES Requirements, 25 Pa. Code §§ 92a, 93.6, 93.7, 93.8a through 93.8d, 93.9g, and 95.2. Establishes effluent limitations for discharges to waters of Pennsylvania. The treated IDW from the GETS must comply with the substantive requirements of these discharge standards.
- Water Well Driller License Act, 32 P.S. §645.1 et. seq.; 17 Pa. Code §47. Sets forth requirements for the licensing of water well drillers, prevention of pollution of underground waters, submittal of well construction records, and well abandonment notification. The substantive requirements of these regulations must be followed by the RA Contractor for the installation or abandonment of injection or monitoring wells, and the injection of materials through injection wells.
- Erosion and Sediment Control, 25 Pa. Code §§102.4(b)(1), 102.4(b)(2), 102.11, 102.22. Identifies erosion and sediment control requirements and criteria for activities involving

land clearing, grading and other earth disturbances and establishes erosion and sediment control criteria. No written Erosion and Sediment Plan will be required because the RA activities will disturb less than 5,000 square feet. However, best management practices must be employed by the RA Contractor to comply with regulations that apply to construction activities that disturb the ground surface during well installations.

- Pennsylvania Hazardous Waste Management Regulations, 25 Pa. Code §§ 262a.34, 264a.173. These provisions govern the accumulation time for hazardous wastes and management of containers. It is not expected that any hazardous wastes will be generated during the RA based on previous efforts conducting similar activities at the Site. It is possible that the spent carbon from the liquid-phase carbon adsorption vessels used to treat IDW could be considered hazardous. For these reasons RCRA and the associated regulations under the PADEP will be considered applicable to Site. Representative samples of spent carbon will be analyzed to determine whether the spent carbon will need to be treated as a characteristically hazardous waste. Until such a determination is made, the spent carbon will be handled as hazardous waste. Soil generated during well installation activities must also be analyzed to determine if it will need to be treated as a characteristically hazardous waste, although it is anticipated to be classified as nonhazardous.
- Municipal Waste Handling, 25 Pa. Code, Article VIII. These provisions govern the handling and disposal of municipal wastes. All municipal waste generated during RA activities will be containerized in trash cans or temporary roll-off and disposed of at a local municipal landfill.
- Residual Waste Handling, 25 Pa. Code, Article IX. These provisions govern the handling and disposal of residual wastes. Soil generated during well installation activities will be analyzed to determine if it can be treated as nonhazardous material. If the material is classified as nonhazardous it will be disposed of at a RCRA Subtitle D Landfill.
- Fugitive Air Emissions, 25 Pa Code §§ 123.1 and 123.2. Establishes the fugitive dust regulation for particulate matter. Installation of monitoring wells could produce dust during drilling and grouting activities. Mixing of the sodium persulfate could produce dust during the injection activities. The RA Contractor must comply with the substantive requirements of these regulations.
- Construction, Modification, Reactivation, and Operation of Sources, 25 Pa Code §§ 127.1 et seq. Establishes the requirements for the use of best available technology on new air pollutant emissions sources. Installation of monitoring wells could produce dust during drilling and grouting activities. Mixing of the sodium persulfate could produce dust during the injection activities. The RA Contractor must take measures to comply with the substantive requirements of these regulations.
- Visible Emissions, 25 Pa Code § 123.41. Establishes opacity limits for visible air emissions. Installation of monitoring wells could produce dust during drilling activities. The RA Contractor must take measures to comply with the substantive requirements of these regulations.

Action-specific Chester County ARARs include:

• Chester County Health Department Rules and Regulations, Chapter 500 Water, Wells, Nuisances, Sewage, and Liquid Waste. The purpose of these Rules and Regulations is to establish minimum standards for the location, construction, alteration, decommissioning, water quality, and minimum water quantity of water wells and water well installation; to require a permit for the construction of any well, including test wells and monitoring wells. The appropriate permits will be obtained from the county for the injection wells that will be installed and well completion information will be provided to the county upon completion. Should any well need abandoned during RA activities, the well will be decommissioned in accordance with § 501.4.1.

1.5.2 Design Assumptions

During preparation of this design, assumptions were made regarding the sequence of work; work by others; property access; remedial performance; and available information at the remedial areas. A description of each of the relevant assumptions is presented below, including (where applicable) a justification or documentation supporting the assumption as accurate and acceptable.

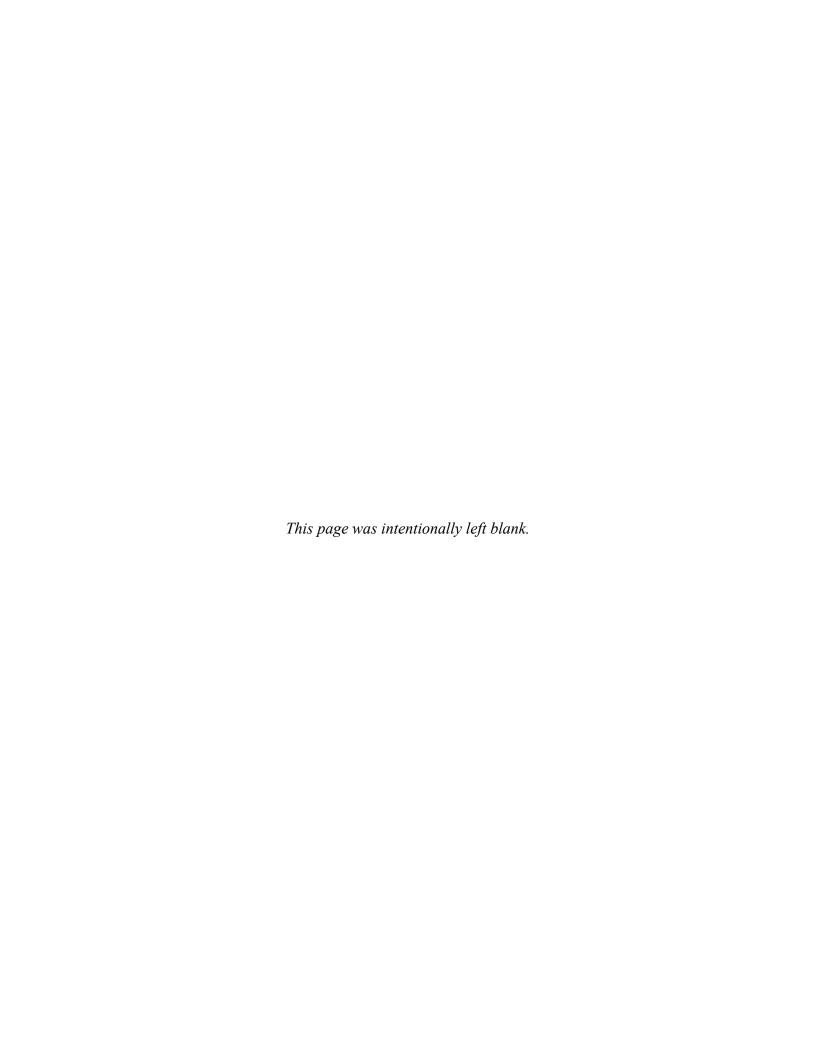
- EPA will secure access rights to the property where the injection/monitoring wells will be installed and monitored. This will minimize coordination issues with the property owner.
- The on-Site GETS will be maintained in operable condition in the event that it is needed for future RAs at the Site and so it can be used to treat IDW water generated during drilling and sampling activities.
- COCs at the Site include:
 - Trichloroethene (TCE)
 - 1.1.1-trichloroethane
 - 1,1-dichloroethene (DCE)
 - 1,1-dichloroethane
 - 1,1,2- trichloroethane (TCA)
 - o Cis-1,2-DCE
 - o 1,2-dichloropropane
 - Tetrachloroethene (PCE)
 - Vinyl chloride (VC)
 - o Toluene
 - o 1,4-dioxane
- Injection well placement was based on a combination of subsurface geophysical conditions, areas of highest contamination, and existing infrastructure. The preliminary land development plan of Lochiel Farm was also reviewed when selecting new injection/monitoring well locations to ensure placement was outside of future building footprints. Should the Site be developed before the RA is implemented, or Site conditions change, well placement might need to be adjusted.
- The injection rates developed assume that the formation has sufficient permeability to accept the injection fluids. Rates were based on injections completed during the pilot

- studies at the Site, but due to the fractured nature of the bedrock, the rates could vary significantly between wells.
- Injection volumes used for the RD are only estimates, actual volumes will be based on the selected injection interval lengths determined after packer testing is completed. Final amendment volumes will be approved by EPA prior to initiating injections.

1.5.3 Performance Standards

The ISCO and ISBR component of the Remedy Modification will have the following performance standards:

- 1. Reduce 1,4-dioxane concentrations in groundwater at the Site to Pennsylvania Land Recycling Act (Act 2) Medium Specific Concentration of 6.4 micrograms per liter (μ g/L) or less, through use of ISCO.
- 2. Reduce concentrations of COCs in groundwater at the Site to levels at or below the RGs specified below in Table 1.1, through use of ISCO and/or ISBR.



2.0 SITE BACKGROUND INFORMATION

2.1 SITE LOCATION AND DESCRIPTION

The Site is located approximately one mile east of Exton on Lincoln Highway, U.S. Business Route 30 in West Whiteland Township, Chester County, Pennsylvania (Figure 2.1). The Site consists of two adjoining properties: the AIW Frank property covers roughly 15 acres, and the Mid-County Mustang property covers less than one acre.

West Valley Creek flows east to west through the northernmost portion of the Site, just south of the Chester Valley Trail walking path. Before EPA's involvement at the Site, the creek was impounded on the property to form a pond measuring approximately 310 feet (ft) by 60 ft (0.4 acres).

The National Superfund Database Identification Number for the Site is PAD004351003. EPA is the lead agency for the Site, and PADEP is the support agency. Pursuant to a July 22, 1997, Superfund State Contract for the Site, PADEP assumed responsibility for operation and maintenance activities at the Site on December 31, 2011. The SSC was modified on June 12, 1018 and provides clarification regarding EPA's and DEP's individual responsibilities regarding implementation of the Selected Remedy specified in EPA's 2017 ROD Amendment.

2.2 SITE HISTORY

The AIW Frank Corporation manufactured Styrofoam products at the AIW Frank property from 1962 to 1981 and the Continental Refrigeration Corporation manufactured commercial refrigeration units at the AIW Frank property from 1983 to 1988. Two primary structures were historically located on the AIW Frank property, referred to as the front and rear buildings. EPA suspects that solvents used to degrease the equipment were at times poured into an open floor drain in the front building. This floor drain is thought to be a potential source of groundwater contamination because it was located in the area of highest contaminant concentrations in groundwater. Two large storage tanks, one for clean solvents and one for used solvents, were located on the AIW Frank property. EPA also suspects that mishandling of the solvents in this storage tank area led to the soil contamination found in this area and contributed to the groundwater contaminant plume.

A detailed Site history of site investigations are presented in the 2017 ROD Amendment (EPA, 2017).

2.2.1 Targeted Baseline Sampling

Baseline groundwater sampling was conducted in April/May 2018 to access the current contaminant concentrations at the Site to aid in the development of the RD. The sampling was conducted in accordance with the February 2018 SAP (HGL, 2018). Only wells that had TCE detections exceeding the RG were sampled as part of the baseline sampling.

Prior to sampling the Site wells were gauged to collect water levels. The potentiometric surface for the shallow wells is shown on Figure 2.2 and indicates a west-southwest groundwater flow

direction. Figure 2.3 shows the potentiometric surface for the intermediate and deep wells. Groundwater in these zones generally flows to the west-northwest.

1,4-Dioxane concentrations observed in the shallow wells, along with resulting concentration contours, are presented on Figure 2.4. 1,4-Dioxane concentrations for the intermediate and deep wells are plotted along with the associated concentration contours on Figure 2.5. For wells that were not sampled the most recent data available was used to generate the contours. 1,4-Dioxane was not detected in any wells exceeding the RG in the shallow wells. In the intermediate and deep wells, 1,4-dioxane was detected above the RG of 6.4 μ g/L only at MW-112B with a concentration of 6.5 J μ g/L. 1,4-Dioxane was also detected at OB-1I at a concentration of 3.5 μ g/L. All other intermediate and deep wells were nondetect for 1,4-dioxane.

TCE concentrations observed in the shallow wells, along with resulting concentration contours, are presented on Figure 2.6. TCE concentrations for the intermediate and deep wells are plotted along with the associated concentration contours on Figure 2.7. For wells that were not sampled the most recent data available was used to generate the contours. The TCE plume is present downgradient of the former AIW Frank Building and moves to the west in the direction of groundwater flow. The highest TCE concentrations detected in the shallow wells during the 2018 sampling were 19 μ g/L at MW-117 and 29 μ g/L at MW-114. In the intermediate and deep wells, the TCE plume also moves to the west. The highest concentration is seen in the source area at OB-11 with a TCE concentration of 66 μ g/L. Elevated TCE levels are also seen in the mid portion of the plume at MW-112B at a concentration of 41 μ g/L. TCE was also detected in the far downgradient portion of the plume at MW-105B at a concentration of 6 μ g/L, which is above the RG.

To show changes in 1,4-dioxane and TCE concentrations as a function of depth and area, concentrations for selected wells are illustrated on a plume cross section. Figure 2.8 indicates which wells were used to develop the cross section, while the cross sections themselves are presented as Figures 2.9 and 2.10. As seen on Figure 2.9 the 1,4-dioxane contamination is isolated to the deeper wells around MW-112B and OB-1I. Figure 2.10 shows the TCE having migrated deeper as the plume moved to the west with generally higher concentrations in the deeper wells around the source area.

3.0 PERMANENT INJECTION WELLS

This section describes field activities that are mainly associated with the installation, geophysical investigation, and packer testing of the permanent injection wells.

3.1 PRE-SURVEYING

Before the well installation, all existing site wells will be surveyed by a professional surveyor licensed in Pennsylvania. There have been some discrepancies noted in the past when locating the wells based on survey coordinates. The pre-survey will ensure the correct placement of the injection wells in relation to existing wells and will also ensure that the data is accurate when providing the well information to the future developers. The northing and easting coordinates will be surveyed in Pennsylvania State Plane north (North American Datum 1983) coordinate system to an accuracy of plus or minus 0.10 ft. The elevation of the well will be surveyed using National Geodetic Vertical Datum 1929 to an accuracy of plus or minus 0.01 ft. Two elevation measurements will be surveyed, one representative of ground level immediately north of the well's concrete pad and one at the top of the steel casing. During the survey, the wells will be marked with high visibility marking paint, marking stakes (where applicable), and the corresponding well ID's will be recorded on the well casing or cap.

3.2 UTILITY LOCATION/VERIFICATION

The RA Contractor will notify the utility locator two weeks prior to the well installations and contact Pennsylvania One Call (800-242-1776) three days prior to the event to arrange for public utility clearances. The RA Contractor will meet with the utility personnel at the Site to identify well locations and potential utility conflicts. Well locations will be pre-marked with white paint in order to ensure subsurface utilities at all well locations in public areas are identified Pennsylvania One Call.

Pennsylvania One Call is a free service available 24 hours a day, 7 days per week. Utility tickets are active from the day after notification. Upon arrival at the Site of the proposed subsurface intrusion location, the RA Contractor field crew will inspect the area for evidence of unmarked utilities. If clear evidence of unmarked utilities is observed, a call will be placed to the notification center and no subsurface intrusive work will begin until the area has been cleared. Typically, the operator of any unmarked utility line should respond within a 3-hour window. Over the course of the RA implementation, the RA Contractor's personnel will re-mark utility markings to ensure they remain visible.

A private utility locator also will be contracted to provide utility clearances for well locations on private property. Well locations will be pre-marked with white paint to ensure subsurface utilities clearance activities are conducted at the right locations. The RA Contractor will direct the utility-locating subcontractor in the field. The private utility-locating subcontractor will utilize utility maps if available and standard approved methods to obtain the horizontal locations of any subsurface utilities within a 15-ft radius of each proposed well boring. A 15-ft radius is deemed necessary in case subsurface obstructions are encountered that require relocation the well location. Located utilities will be identified by weather resistant surface markings. Over the course of the RA implementation, the RA Contractor's personnel will re-mark utility markings to ensure they

remain visible. Subsurface verification of identified utilities will not be required. If a utility is identified at the location of the proposed well location that would require the location to be moved, the location will be moved as close to the original location as possible where there is no utility conflict, pending PADEP and EPA concurrence.

3.3 INJECTION WELL INSTALLATION

The new wells will be installed utilizing air rotary drilling techniques. Proposed well locations are identified on Figure 3.1. A 6-inch boring will be drilled to and 10-ft into bedrock, which is estimated to range between 10 to 50 ft below ground surface. Four-inch steel casing will be installed 10 ft into competent bedrock and will extend approximately 3 ft above ground surface. Extending the casing into the bedrock will minimize the potential for failure of the annular grout seal during the high-pressure injections. The casing will be grouted in place and allowed to cure for a minimum of 12 hours.

After the grout has cured, a 4-inch borehole will be advanced to depths specified in Table 3.1. Once the desired depth has been achieved, the surface of the well will be completed utilizing the 4-inch steel casing as the monument, rising 3 ft above ground surface. A 4-inch Royer's 2-piece aluminum locking well cap will be installed on the top of the casing. A 2-ft by 2-ft by 6-inch thick square concrete pad will be constructed around the well. The concrete pads will extend approximately 2 to 3 inches below grade. Should a well be located in an area that a flush mount is required, the 4-inch steel casing will be cut approximately 3 to 4 inches below the ground surface and an 8-inch diameter flush mount monument with a 12-inch skirt will be installed over the casing. The monument should meet AASHTO H-20 roadway loading requirements. The monument will be set into concrete around the top of the riser and a 2-ft diameter concrete pad placed around the cover.

3.4 INJECTION WELL DEVELOPMENT

The newly installed injection wells will be developed by alternately surging and pumping the well. Surging will be accomplished with a surge block attached to a ¾-inch polyvinyl chloride (PVC) or equivalent pipe. Submersible pumps will be used to pump or purge the wells. During development activities groundwater stabilization parameters pH, specific conductance, temperature, and turbidity will be measured. Surging and purging will continue until all formation cuttings have been removed from the well and water quality parameters have stabilized. Water quality stabilization will be achieved when three consecutive readings of water quality parameter measurements, taken 3 to 5 minutes apart, have stabilized as follows:

- less than plus or minus (±) 1 degree Celsius (°C) for temperature,
- 0.10 pH units,
- ±5 percent (%) for specific conductance,
- $\pm 10\%$ for oxidation-reduction potential, and
- less than or equal to 50 nephelometric turbidity units.

It is assumed a maximum of six well casing volumes will be purged from the well.

3.5 GEOPHYSICAL INVESTIGATION

After development is completed for the injection wells, a downhole geophysical investigation will be conducted to better understand the hydrogeology and to determine the packer intervals based on fracture zones. Natural gamma, fluid temperature/conductivity, acoustic borehole televiewer, heat pulse flow meter (ambient and pumping conditions), and caliper tools will be utilized to log each bedrock borehole. Existing wells EW-4 and EW-5 that will be used for injections will also have geophysical investigations conducted.

Geophysical surveys will commence after several boreholes have been drilled and will be conducted while drilling operations continue in other portions of the site so that drilling operations can proceed without delays. After geophysical logs are available, the RA Subcontractor will submit proposed packer testing intervals to EPA and PADEP for approval prior to initiating the packer tests within the wells.

3.6 PACKER TESTING

After the geophysical investigation is completed for the injection wells, packer testing will be conducted to characterize the groundwater contamination within the boreholes. The packer testing system will utilize a straddle packer assembly. Two nitrogen-inflated packers will be set on 2-inch diameter, schedule 40 galvanized lift pipe. The distance between the packers will be determined by the interval to be sampled. Sampling intervals will be based on the geophysical data collected at each borehole. The packer diameter will be 3.5 inches (uninflated)/6.2 inches (maximum inflation) by 3.4 ft (uninflated)/2.25 ft (maximum inflation) in length. Three pressure transducers calibrated to read depth to water will be used to monitor water levels above, within, and below each interval tested. A Grundfos Redi Flo pump capable of pumping up to 9 gallons per minute (gpm) will be used to collect the samples. The packer testing procedure will be as follows:

- 1. Packer assembly will be lowered into the borehole to the desired depth.
- 2. Pressure transducers will be activated, and initial millivolt readings will be obtained.
- 3. Millivolt reading from each transducer will be converted to read depth to water and data logging will be initiated.
- 4. Nitrogen will be introduced through the inflation tubes to each packer causing the packers to expand outward against the wall of the borehole.
- 5. Once the packers are inflated, the transducer readings will be allowed to equilibrate to reveal head pressure differential values between borehole segments.
- 6. The pump will be lowered by hand, through the lift pipe, to the top of the isolated interval. The pump will be powered by a generator at the surface and controlled by a pump control box. The pumping rate will be adjusted at the control box, and the zone will be pumped at a rate that could provide consistent flow. When possible, a volume of groundwater equal to 3 interval volumes will be removed. If the sampling interval goes

dry, the pump will be turned off until the interval recharges. If the recharge is very slow, no more than hour will be spent waiting for the interval to recharge.

- 7. Ground-water sampling will be conducted in the isolated interval by accessing a port on the discharge assembly. Samples will be analyzed for TCL VOCs and/or 1,4-dioxane.
- 8. The pump will be turned off and removed from the lift pipe.
- 9. The packers will be deflated and lowered or raised to the next sampling interval and steps 2 through 9 will be repeated until the final interval is sampled.
- 10. All field equipment will be decontaminated onsite in between borehole locations. Galvanized steel lift pipe, packers and cable reel will be physically scrubbed with a mixture of liquinox and distilled water, thoroughly steam cleaned and allowed to air dry. All packers and lift pipe sections will be steam cleaned internally as well as externally. Temperature-sensitive pressure transducers will be cleaned with a liquinox and distilled water scrub and allowed to air dry.

Packer testing will commence after the downhole geophysical investigation has been completed in several boreholes and will be conducted while drilling operations and downhole geophysical investigations continue in other portions of the Site so that these operations can proceed without delays. After packer testing results are available, the RA Subcontractor will submit proposed injection intervals to EPA and PADEP for approval prior to initiating injections.

3.7 INVESTIGATION-DERIVED WASTE MANAGEMENT

IDW soil cuttings and water will be generated during the drilling, development, and decontamination activities associated with well installation. IDW will be containerized, sampled, and disposed of in accordance with the SAP included as Appendix D.

3.8 SURVEYING

After the injection wells have been installed a professional surveyor licensed in Pennsylvania will survey the well. The wells will be surveyed utilizing the same methods and requirements detailed in Section 3.1.

4.0 SUBSTRATE INJECTION

This section presents the basis of design, RD, and implementation procedures for the substrate injection portion of the Selected Remedy.

4.1 BASELINE SAMPLING

Before the injections commence, baseline chemical conditions will be established by following the sampling procedures and schedule outlined in the RD SAP (Appendix D).

4.2 IN SITU CHEMICAL OXIDATION – TREATABILITY STUDY – BASIS OF DESIGN

EPA conducted three pilot studies between 2005 and 2009 to determine if Site groundwater contamination could be addressed using ISCO instead of the GETS system required by the 1995 ROD. In November 2005, the first ISCO pilot study was initiated to evaluate the effectiveness of potassium permanganate (KMnO₄) in oxidizing VOCs in the most contaminated portions of the Site groundwater plume. The study included injection of 3,480 gallons (gals) of 26% KMnO₄ solution over two days into EW-4. Monitoring was conducted in EW-4 and 15 surrounding wells for a period of 12 weeks following the injection. In EW-4, total oxidizable VOC concentrations were reduced by greater than 99%, dropping from 487 μg/L to less than 1 μg/L. Significant percent reductions in total oxidizable VOCs were also observed in OB-1I (99%), EW-5 (98%), MW-111 (67%), and MW-108A (50%). Another positive result was the limited rebound in VOC concentrations (30% over three months) in the study area. Concentrations of 1,4-dioxane also decreased during the course of the study. At EW-4, 1,4-dioxane concentrations decreased by 65% immediately following the injections, from a baseline concentration of 93 μg/L to 32 μg/L. Similar reductions in 1,4-dioxane were observed in all wells in the study area.

Based on the success of the initial injections, a second ISCO pilot study was conducted from August 2007 through November 2007. In this study, 14,281 gals of 20% KMnO₄ solution was injected under pressure into wells EW-4, EW-5, and MW-108A. By injecting high volumes of fluid under pressure into the aquifer, greater volumes of KMnO₄ slurry were able to flow through existing bedrock fractures. Monitoring of study area wells was conducted for a period of 11 weeks following the injection process and showed similar results to the first pilot study, with significant reductions in VOC and 1,4-dioxane concentrations.

In September 2009, a third round of injections was conducted in the well with the highest remaining TCE concentrations (OB-1I). Due to concerns that OB-1I, which is a 2-inch PVC well, would not hold up to the high pressures that had been utilized in the second pilot study, a low-pressure pulse injection tool was used. Also, sodium permanganate (NaMnO₄) was used as the oxidant because it has a greater solubility than KMnO₄. Beginning on September 2, 2009 and ending on September 10, 2009, 1,740 gals of 11% NaMnO₄ solution was injected into OB-1I. In addition to the injection at OB-1I, 1,260 gals of NaMnO₄ was gravity fed into EW-4 to expedite the completion of injection work.

The three ISCO pilot studies reduced the levels of contaminants in groundwater in the most highly contaminated portion of the plume to non-detectable levels in some wells and near groundwater RGs in others, thus confirming that ISCO could be used as a viable option for future treatment. Further, the oxidants injected during the ISCO pilot studies and the Site COCs affected by the injections broke down into chemicals and compounds (such as manganese dioxide, and carbon dioxide) that do not pose human health risks at the levels observed post-test. The estimated TCE mass removed by the three ISCO pilot studies is 4,500 pounds (lbs), compared to the removal of approximately 71 lbs of TCE from groundwater via the GETS between November 2000 and April 2008.

As presented in Section 1.5.3, one of the performance standards is to reduce 1,4-dioxane concentrations in groundwater to 6.4 μ g/L or less, through use of ISCO. Although NaMnO₄ has been demonstrated to be effective for remediating TCE, its effectiveness treating 1,4-dioxane is much more uncertain (ITRC, 2005, Table 1-6). Therefore, the oxidant selected for the ISCO injection is sodium persulfate which has proven effectiveness for eliminating 1,4-dioxane in both the laboratory and on at a site scale (ITRC, 2005, Table 1-6).

Persulfate and sulfate radical oxidation has several advantages over other oxidant systems. In addition to its robust treatment capabilities, the sulfate radical is more stable than the hydroxyl radical stable and therefore able to transport to greater distances in the sub-surface. Furthermore, although the persulfate anion by itself was a strong oxidizer, its reaction kinetics is slow for the more recalcitrant contaminants, such as TCE and 1,4-dioxane. However, generation of sulfate radicals can significantly enhance the kinetics of persulfate oxidation.

The standard oxidation reduction potential for the reaction:

$$S_2O_8^{2-} + 2H^+ + 2e^- => 2 HSO_4^-$$

is 2.1 V, as compared to 1.8 V for hydrogen peroxide (H_2O_2). This potential is higher than the redox potential for the permanganate anion (MnO_4^-) at 1.7 V, but slightly lower than that of ozone at 2.2 V.

A number of methods are available to "activate" the persulfate to form the sulfate radical, SO⁴ which has a much higher oxidation potential (2.6 V) than the sulfate anion, is kinetically fast, and is much more stable than the hydroxyl radical, allowing it to migrate greater distances in the aquifer. Methods commonly employed at environmental sites include the application of heat via steam, raising the pH of the aquifer through adding a base such as sodium hydroxide (NaOH), adding peroxides such as calcium peroxide or H₂O₂, and the addition of a ferrous salt to catalyze the reaction. The reaction mechanisms are complex and involve a number of chain-initiating, propagating, and -terminating reactions. During this time, iron needs to be available to catalyze the reaction. To meet this requirement, iron ethylenediaminetetraacetate (FeEDTA) will be used to catalyze the reaction because the EDTA slowly releases iron into solution. The key to successful remediation of 1,4-dioxane is radical production, therefore, as described in greater detail in Section 4.2.1.3, FeEDTA and a relatively small amount of base (NaOH) will be used to catalyze the reaction and create radicals (both sulfate and hydroxyl).

A relatively recent review of available data from sites where ISCO was performed, indicated that increases in metals concentrations was observed in 12 of the 19 field implementation case studies (Gardner et. al., 2016). Under further review, however, it was determined that the mobilized metal concentrations returned to near baseline concentrations within 90 days without any additional treatment (Gardner et. al., 2016). This indicates that mobilized metals appear to be a temporary phenomenon and further metals mitigation measures are unnecessary.

Another advantage of persulfate is that although initial oxidant distribution may not be uniform, persulfate is more stable than other oxidants, such as H_2O_2 or ozone; this permits it to reside in the aquifer for an extended period of time. Furthermore, the sulfate anion does not have a tendency to adsorb onto the formation material (Huling & Pivetz, 2006). Hence, additional transport via diffusion or migration with groundwater flow can occur.

4.2.1 Remedial Design

As described in the Selected Remedy, ISCO injections will be performed until 1,4-dioxane meets its RG (6.4 μ g/L). Additional design details are provided below.

4.2.1.1 1,4-Dioxane Treatment Areas

The proposed treatment areas are based on the groundwater contaminant concentration trends provided in Appendix C of the FFS that was completed for the Site (HGL, 2015), as well as the targeted baseline sampling event conducted in April 2018.

1,4-Dioxane has been historically high in EW-4 and OB-1I. 1,4-Dioxane has not been detected in samples collected from EW-4 since the 2011 LactOilTM injection. Though not detected, the 1,4-dioxane detection limits have been higher than the RG due to the need to dilute the samples because of the presence of the LactOil within the well. Therefore, there is the potential that 1,4-dioxane is at elevated levels in the area around EW-4. 1,4-Dioxane was detected below the RG during the 2018 sampling of OB-1I at a concentration of 3.5 μ g/L, but the concentration has historically been above the RG as recently as previous sampling event in 2012, when it was detected at 11 μ g/L. As a result, oxidant injections are planned for the area around EW-4 and OB-1I. Because EW-4 has been recently used as an injection well, the well will continue to be used for injection during the ISCO. Additionally, one injection well (IW-8) is proposed upgradient of OB-1I and one injection well (IW-7) is proposed downgradient of EW-4 and OB-1I to provide additional treatment in this area (Figure 3.1). 1,4-Dioxane also has been detected at elevated concentrations in MW-112B and was detected above the RG at a concentration of 6.5 μ g/L during the April 2018 sampling event. Oxidant will be injected into two injection wells (IW-1 and IW-2) that will be installed in the area of MW-112B to provide additional treatment for this area (Figure 3.1).

4.2.1.2 Treatment Volumes

Injection volumes will be determined after the geophysical and packer testing data has been collected and evaluated. Because the injection volumes injection will vary from well to well, based on the length of the injection intervals, the proposed volumes in the RD are only estimates. The final volumes of amendments will be approved by EPA prior to injections. For estimation purposes, it has been assumed that one injection interval will be completed for every 50 ft of open

borehole per well. Each injection interval will be injected with 2,000 gals of sodium persulfate. The total volume of injectant is estimated to be 40,000 gals (Table 4.2).

A list of injection wells, completion information, estimated injection volumes are provided in Table 4.1.

4.2.1.3 Sodium Persulfate Application Rate

The amount of oxidant needed to completely and effectively remediate the contaminants is a function of the following:

- Stoichiometric demand of the contaminants
- Natural organic demand,
- Volume of the plume,
- Natural decomposition of the oxidant, and
- Reaction rates

Although the factors affecting the oxidant demand are relatively well understood they are difficult to quantify at a site scale. Furthermore, a single, well-documented, and well-demonstrated oxidant loading, and delivery design approach has not been established for any oxidant. Overall, the state of the science of ISCO involves the combined use of best engineering and scientific judgment (site characterization, FS testing, RD, etc.) in conjunction with trial and error. Due to the inherent uncertainty with contaminant distribution, subsurface heterogeneities, and mass transfer/transport mechanisms that occurs at most sites, ISCO requires multiple iterations between oxidant application and performance monitoring.

Based on laboratory studies and successful ISCO injections at other sites targeting 1,4-dioxane, and Site water quality data, the injected sodium persulfate concentration will be 20% by weight (200 gr/L) and will be activated with NaOH (Rossabi, Per. Comm.). To ensure that there is sufficient iron to catalyze the reaction FeEDTA will be introduced at 100 milligrams per liter (mg/L) (Rossabi, Per. Comm.).

The stoichiometric requirement of NaOH to activate the persulfate is 2 moles of NaOH per mole of sodium persulfate; or 1.34 lbs of 25 weight percent (wt%) NaOH for every lb of sodium persulfate; this proportion will create sufficient basic conditions for the reactions to occur (Rossabi, Per. Comm.). Typically, about one-fourth of the stoichiometric requirement is sufficient to meet the activation requirements (i.e., 0.36 lbs of 25 wt% NaOH per lb of sodium persulfate) (Rossabi, Per. Comm.).

4.2.2 Injection Process

Sodium persulfate will be delivered to the Site as a dry powder in either 55 lb bags or 225-lb drums. The product to be used is a PeroxyChem brand buffered sodium persulfate with a trade name of Klozur[®]. The sodium persulfate will be stored at the Site during the injections and covered to protect the material from the elements prior to use. The sodium persulfate will only be handled by personnel who have had persulfate safety training.

Field personnel will set up a temporary mixing system to produce a solution of sodium persulfate by mixing the sodium persulfate powder with water. As discussed in Section 4.2.1.3, the concentration of the buffered sodium persulfate solution to be injected will be 20% by weight (200 gr/L or 0.44 lbs/L), 0.36 lbs of 25 wt% NaOH per lb of sodium persulfate, and FeEDTA at a concentration at 100 mg/L. Each gal of water will have the following constituent concentrations:

Sodium persulfate = 1.7 lbs/gal 25 wt% NaOH = 0.61 lbs/gal

FeEDTA = 0.0008327 lbs/gal

The injection procedure will involve batch-mixing sodium persulfate in dry powder form with water and liquid NaOH (caustic) in 300-gal poly tanks. Water for the injection will either be pumped from one or more of the existing wells on Site and/or hauled from an off-Site source. Should the GETS be used to pump water from the Site, the water will not be pumped though the GETS, but will be bypassed prior to entering the equalization tank. When thoroughly mixed, a temporary delivery system will be used that will transfer the persulfate solution from the holding tank and deliver it to the appropriate injection well(s). The delivery system will consist of a transfer pump, distribution hoses, and fittings to connect to each injection point. All equipment surfaces that come into contact with the sodium persulfate solution will be constructed of materials compatible with the sodium persulfate solution, as the solution is highly corrosive and will damage common materials like carbon steel. Klozur (2018) provides an evaluation of the performance of various materials in contact with persulfate.

The persulfate solution will be injected using gravity feed, low pressure, and/or high-pressure techniques as necessary based on observed field conditions to ensure the formation accepts the solution.

To limit contaminant migration resulting from injection of the oxidant, the sodium persulfate will be injected at the downgradient and cross-gradient locations first, thereby establishing a reactive zone around the treatment area. The upgradient injections will then be conducted.

4.2.2.1 <u>Low/High-Pressure Injections</u>

For the low/high-pressure injections, a 4-ft inflatable packer will be installed at the top and bottom of the injection interval inside the well and inflated to a pressure of about 2,000 pounds per square inch (psi). The caustic persulfate solution will be injected through a stainless-steel manifold equipped with digital flow meters and pressure gauges at both the manifold and well head connection. A positive displacement pump (or equivalent) with persulfate-compatible ethylene propylene diene monomer seals that has a capacity to inject at up to 50 gpm shall be utilized. All pressurized lines will be equipped with pressure gauges, flow meters, associated shut-off valves and safety features.

To maintain uniform mixing, the solution will be recirculated back with a transfer pump to the mixing tanks and then bled off at the required rate to ensure injection pressure limits are not exceeded. The injection pressures will be regulated during the injection. Low pressures (<100 psi) will initially be used. If the amendment is flowing freely into the formation at the low pressures, the injection pressures will be raised to a pressure that allows the highest flow rate. Based on

previous high-pressure injections at the Site the expected range is between 300 to 400 psi. Flow rates will be highly variable between wells and will likely range between 5 to 50 gpm.

As injection proceeds water levels will be monitored every two hours in nearby monitoring/injection wells to check for increases in water levels.

Before moving the packer system to a new location, the pressure created by injection will be allowed to dissipate and the borehole will be flushed with one well volume of water. The amount of chase water will be the same volume held by the entire well bore.

If the subsurface rocks do not accept the persulfate solution at the planned injection rate (due to limited permeability), or daylighting occurs around the injection well, the injection will be suspended for 10 to 15 minutes and then restarted. If difficulties with the injection continue, the injection will be attempted by gravity feeding following the procedures outlined in Section 4.2.2.2.

4.2.2.2 **Gravity Fed Injections**

Should a well not be able to handle the low/high-pressure injections, then injection will be completed by gravity feeding the solution into the well(s). In this case, a temporary riser will be attached to the top of the well with a water-tight Fernco rubber fitting. The riser will be extended several feet above the liquid level of the mixing tank. A hose will be connected at the bottom of the poly tank (or larger holding tank) and a siphon will be created prior to placing the other end down the well. The expected gravity feed rate is about 1 to 2 gpm. The holding tank will be filled as needed throughout the work day. Before moving to a new location, the borehole will be flushed with the same volume held by the total well bore.

4.3 IN SITU BIOREMEDIATION – TREATABILITY STUDY – BASIS OF DESIGN

EPA conducted two pilot studies in 2010 and 2011 to determine if Site groundwater could be treated using ISBR, a process in which subsurface conditions are modified to enhance desired breakdown of Site contamination via microbial activity. The goal of ISBR is to encourage dechlorinating bacteria such as *Dehalococcoides* to metabolically degrade the chlorinated compounds in Site groundwater via a process of anaerobic respiration called dehalorespiration. In this process, the bacteria replace the chlorine atoms in the chlorinated compounds with hydrogen. This process creates a sequential change of TCE to DCE to VC to ethene with the removal of one chlorine atom with each step. DCE and VC are breakdown or daughter products of this reaction and are considered Site COCs. Concentrations of DCE and VC may temporarily increase as part of the dehalorespiration process until the breakdown of chlorinated compounds is complete.

On March 9, 2010, 30 gals of a substrate solution consisting of 25 gals of purge water, 5 gals of Anaerobic BioChem (ABC®) and 30 grams of sodium bromide tracer was injected into MW-112B and followed by 30 gals of unamended groundwater. ABC is a patented mixture that contains soluble lactic acid, a phosphate buffer, as well as components that slowly release volatile fatty acids. The amendment (electron donor, or food source) increases microbial activity in a contaminated aquifer and enhances the reductive dechlorination of chlorinated hydrocarbons. The electron donor consists of ethyl lactate and dipotassium phosphate mixed with water. When ABC

is mixed with excess water or groundwater; the ethyl lactate will produce ethanol. The ethanol is degraded by serving as an alternative food source or an additional source of hydrogen.

The ABC integrated phosphate buffer provides phosphates, which are a micronutrient for bioremediation. In addition, the buffer helps to maintain the pH in a range that is best suited for microbial growth. Following the injection, samples from MW-112B were collected three, five, and seven months after the injection.

The results of the pilot study were generally positive. However, the limited ability of MW-112B to accept fluids lessened the effectiveness of the injection. Positive results included a 50% reduction in TCE concentration and a temporary five-fold increase in cis-1,2-DCE concentrations, the initial breakdown product of TCE via anaerobic dechlorination. This was accompanied by minor increases in ethene and ethane concentrations, which indicate biodegradation is occurring. Although populations of *Dehalococcoides* bacteria did not increase by a significant amount, other bacterial populations did increase, indicating that the ABC had a positive effect on microbial populations in the Site groundwater. Decreases in pH in the injection well during the pilot study to levels detrimental to biologic activity also limited the success of the test. Lower pH levels are likely due to insufficient buffering and the limited ability of the well to transmit water. The limited transmissivity of MW-112B is evidenced by the well purging dry at low pump rates and a lack of change in the sodium bromide tracer concentration during the test.

Based on the limited results of the initial ISBR pilot study, EPA conducted a large volume high pressure injection pilot study in September 2011. A total of approximately 15,400 gals of LactOil solution made with 770 gals of LactOil and 14,630 gals of treated water from the Site GETS was injected into EW-4 and MW-117. LactOil is a proprietary emulsion of soybean oil and ethyl lactate. A packer system isolated the targeted injection zones to maximize delivery of the LactOil mixture to specified zones. Post-injection monitoring was conducted at three weeks, six weeks, and three months. All of the wells in the study area showed a decrease in TCE over the three-month monitoring period. Elevated concentrations of cis-DCE were detected in a few of the monitoring wells indicating that reductive dechlorination of TCE is occurring. Although populations of *Dehalococcoides* bacteria did not increase by a significant amount, other bacterial populations did increase, indicating that the LactOil had a positive effect on microbial populations in the Site groundwater. The injection also had a positive effect in changing the groundwater to more reducing conditions.

Post-injection monitoring results indicated that both amendments used in the ISBR pilot studies were able to reduce VOC groundwater contamination and could be used as viable options for future treatment.

The treatability study, along with the baseline sampling data, provides the basis for the design of the substrate injection portion of the Selected Remedy. The results of the baseline sampling event have been included and summarized in Section 2.2.1 of this RD. Details of the treatability study approach and results are presented in the Pilot Study In Situ Enhanced Bioremediation Application Summary Report (HGL, 2012).

4.3.1 Design

As described in the Selected Remedy, once 1,4-dioxane meets its RG (6.4 μ g/L) substrate injections will be used to promote microbial reductive dechlorination to remediate the remaining COC's. Additional design details are provided below.

4.3.1.1 Treatment Areas

The proposed treatment areas are based on the groundwater contaminant concentration trends provided in Appendix C of the FFS (HGL, 2015), as well as data from the targeted baseline sampling event conducted in April 2018 presented in Section 2.2.1. TCE has been historically high in the area of EW-4 and OB-11. TCE was not detected in the 2018 sample collected from EW-4, but the detection limit of 20 µg/L was higher than the RG due to the need to dilute the samples because of the presence of LactOil within the well. Therefore, there is the potential that TCE is still at elevated levels in the area around EW-4. TCE was detected at 66 µg/L in the 2018 sample from OB-11. This was the highest concentration of all the wells sampled. One injection well (IW-8) is proposed upgradient and one injection well (IW-7) is proposed downgradient of EW-4 and OB-11 to provide additional treatment in this area (Figure 3.1). Because this area will also be treated with ISCO, it is possible the VOCs might be below RGs and will not require ISBR. TCE levels in MW-111, MW-108A, and EW-5 (located downgradient from EW-4) have varied above and below the RG of 5 µg/L for TCE since 2008. The most recent TCE data from MW-111 was just below the RG at a concentration of 4.6 J µg/L and just above the RG at a concentration of 5.9 μg/L at MW-108A. The TCE concentration during the 2018 sampling was 12 J μg/L. EW-5 was selected for injection in this area. In the area farther downgradient of MW-111, samples from OB-5, MW-117, and OB-3S all had TCE concentrations exceeding the RG during the 2018 sampling event (ranging in concentrations from 9.4 µg/L to 19 µg/L). Three injection wells (IW-4, IW-5, and IW-6) are proposed within this area to provide additional treatment (Figure 3.1). TCE concentrations have varied over time at EW-6, which is located downgradient of OB-3S. They were above the RG until 2008, then were below the RG until 2011, then were above the RG until the most recent sample, which was detected at 4.5 µg/L, which was just under the RG. This well was not selected for injection as the concentrations have recently been below the RG and additional injections will be completed upgradient of this well. TCE concentrations have been greater than the RG in all samples collected from MW-114, and the most recent sample had a detection of 29 ug/L. One injection well (IW-3) is proposed upgradient of MW-114 to provide additional treatment in this area (Figure 3.1). TCE historically has been detected above the RG in MW-112A and B and was detected at concentrations of 9.7 µg/L and 41 µg/L, respectively, during the 2018 sampling event. Two injection wells (IW-1 and IW-2) are proposed in the area of MW-112A and B to provide additional treatment in this area (Figure 3.1). MW-113B had a TCE concentration in the most recent sample collected at a concentration of 7.8 µg/L. Previously, TCE had not been detected above the RG in this well since 2011 at a concentration of 6.4 µg/L. This area was not selected for injection as the concentrations have not significantly exceeded the RG and additional injections will be completed upgradient of this well. In the far downgradient portion of the plume, MW-105B has historically had TCE concentrations above the RG, although on average the concentrations have been below 10 µg/L. This area has not been proposed for injections as there is the potential for the amendments to migrate off-site into public drinking wells that are located to the west of Ship Road.

4.3.1.2 Treatment Volumes

Injection volumes will be determined after the geophysical and packer testing data has been collected and evaluated. Because the injection volumes injection will vary from well to well, based on the length of the injection intervals, the proposed volumes in the RD are only estimates. The final volumes of amendments will be approved by EPA and PADEP prior to injections. For estimation purposes, it has been assumed that one injection interval will be completed for every 50 ft of open borehole per well. Each injection interval will be injected with 2,000 gals of ABC. The total volume of injectant is estimated to be 66,000 gals (Table 4.2).

4.3.1.3 Substrate Selection and Application Rate

A proprietary substrate, ABC, developed by Redox Tech, LLC, was selected for the injections. This product is a soluble mixture of fatty acids, lactates, and phosphate buffer designed to provide hydrogen through readily available carbon substrate (lactates) and slow-release carbon substrate (fatty acids). ABC has been pilot tested at the AIW Frank Site and fully implemented at numerous sites with favorable results for dechlorination of TCE and its breakdown products. The primary advantage of ABC is the ability to distribute the substrate away from the injection well without injecting a large volume of "chase water." To adequately distribute LactOil or an emulsified vegetable oil product, it would be necessary to inject enough water to replace at least one-half the effective void volume of the treatment zone. If an emulsified vegetable oil approach were used, the plume may be physically displaced from the remediation areas. In addition, because of the difficulties in forcing emulsified oil to flow away from the injection point, it is likely that there would be treatment gaps throughout the injection areas. For these reasons, an emulsified vegetable oil product was not considered to be suitable for the injection areas.

To determine the ABC application rate, the electron demand of each grid injection area was estimated. Field and analytical data collected from the LactOil pilot study was used for these calculations. Average concentrations of sulfate, nitrate, and iron (three important competing electron acceptors for the hydrogen provided by the substrate) detected in the eight monitoring wells were used in the calculation. The electron demand associated with about one year of groundwater flux was calculated. To simplify the electron demand calculations, the injection radii were summed to estimate cross section areas both perpendicular and parallel to flow. The concentrations for all of the contaminants were conservatively estimated at $50~\mu g/L$. The electron demand calculations are provided in Appendix B.

On the spreadsheet provided in Appendix B, the amount of ABC required to meet the electron demand is 131,167 lbs. Therefore, the 66,000 gals of injectant would consist of about 2 lbs (0.25 gal) of ABC per gal of water. This application rate is on the high end of the 1 to 2 lbs/gal recommended by the manufacturer.

4.3.1.4 pH Adjustment

Most of the groundwater monitoring data indicates that the natural groundwater pH at the Site ranges between 6.8 and 7.5. Maymo-Gatell (1997) reported that the pH for optimal growth of Dehalococcoides strain 195, a bacterium capable of complete reductive dechlorination of TCE to ethene, is between pH 6.8 and 7.5. Likewise, optimal pH ranges for several Desulfitobacterium

species capable of reductive dechlorination of chlorinated ethenes and ethanes are near neutral (Gerritse et al., 1999; Suyama et al., 2001). Thus, maintenance of a nearly neutral pH subsurface environment can be an important factor in promoting reductive dechlorination.

Although the natural groundwater pH at the Site is optimal for the microbes responsible for reductive dechlorination, fermentation of complex substrates to metabolic acids and hydrochloric acid during anaerobic dechlorination could decrease the pH as was observed during the ABC pilot study. To maintain more optimal conditions, phosphate buffer, nutrients and amendments are integral components of the ABC mixture.

4.3.1.5 Bioaugmentation

Although populations of *Dehalococcoides* bacteria did not increase during the ABC pilot study (Section 4.3), other bacterial populations did increase, indicating that the ABC had a positive effect on microbial populations in the Site groundwater. The injection also had a positive effect in changing the groundwater to more reducing conditions.

Bioaugmentation involves the injection of a microbial amendment comprised of non-native organisms known to carry dechlorination of the targeted chlorinated ethenes to completion. For example, the presence of Dehalococcoides-related microorganisms has been linked to complete dechlorination of PCE to ethene in the field. Commercial bioaugmentation products that contain these microorganisms are readily available. Since the pilot studies were designed primarily to assess the ability of natural biological cultures at the Site to degrade the COCs, bioaugmentation was not performed. The option to inject *Dehalococcoides* organisms will be retained. If the results from the first several monitoring events do not show sufficient reductions in TCE concentrations, injection of *Dehalococcoides* will be considered.

4.3.2 Injection Process

ABC will be delivered to the Site as a liquid (i.e., viscosity of milk) in 300-gal poly tanks. The ABC will be stored at the Site during the injections in an area where vehicular damage to the tanks is unlikely.

Field personnel will set up a temporary mixing system to produce a solution of ABC injectant by mixing the ABC with water. As discussed in Section 4.3.1.3, each gal of water will be mixed with about 2 lbs (0.25 gal) of ABC. The injection procedure will involve batch-mixing with water in 300-gal poly tanks. Water for the injection will either be pumped from one or more of the existing wells on Site and/or hauled in from an off-Site source.

When thoroughly mixed, a temporary delivery system will be used to transfer the ABC solution from the holding tank and deliver it to the appropriate injection well(s). The delivery system will consist of a transfer pump, distribution hoses, and fittings to connect to each injection well(s).

ABC solution injection procedures under both high and low pressures are essentially the same as those described in Section 4.2.2 for the ISCO injection, except that the ABC solution is much safer to handle and will not react with the pumps or well materials. To limit contaminant migration resulting from injection, the ABC mixture will be injected at the downgradient and cross-gradient

locations first, thereby establishing a reactive zone around the treatment area. The upgradient injections will then be conducted.

4.4 POST-INJECTION PERFORMANCE MONITORING

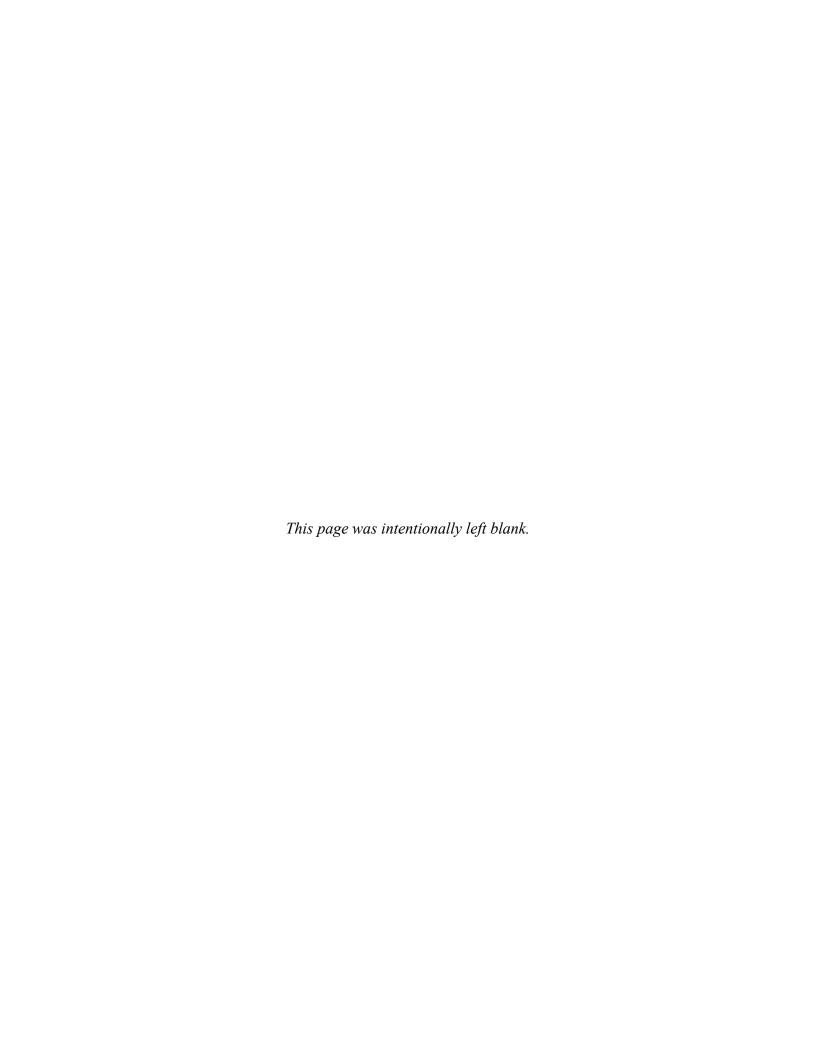
Once the injections are completed, chemical conditions will be monitored in accordance with the schedule and sampling procedures in the RD SAP (Appendix D) to evaluate the performance of the injections. The results from the performance monitoring will be used to access the effectiveness of the injections. Because the amendments may still be viable longer than the proposed performance monitoring scheduling, there may be the option to delay performance monitoring and/or follow-on injections. EPA concurrence will be required for any proposed change in the sampling/injection schedule,

4.5 LONG-TERM MONITORING

Long-term monitoring (LTM) sampling will also be completed per the protocols discussed in the RD SAP (Appendix D) until the Site groundwater no longer poses an unacceptable risk to human health. LTM will commence after the ISBR has been completed.

4.6 DATA ANALYSIS

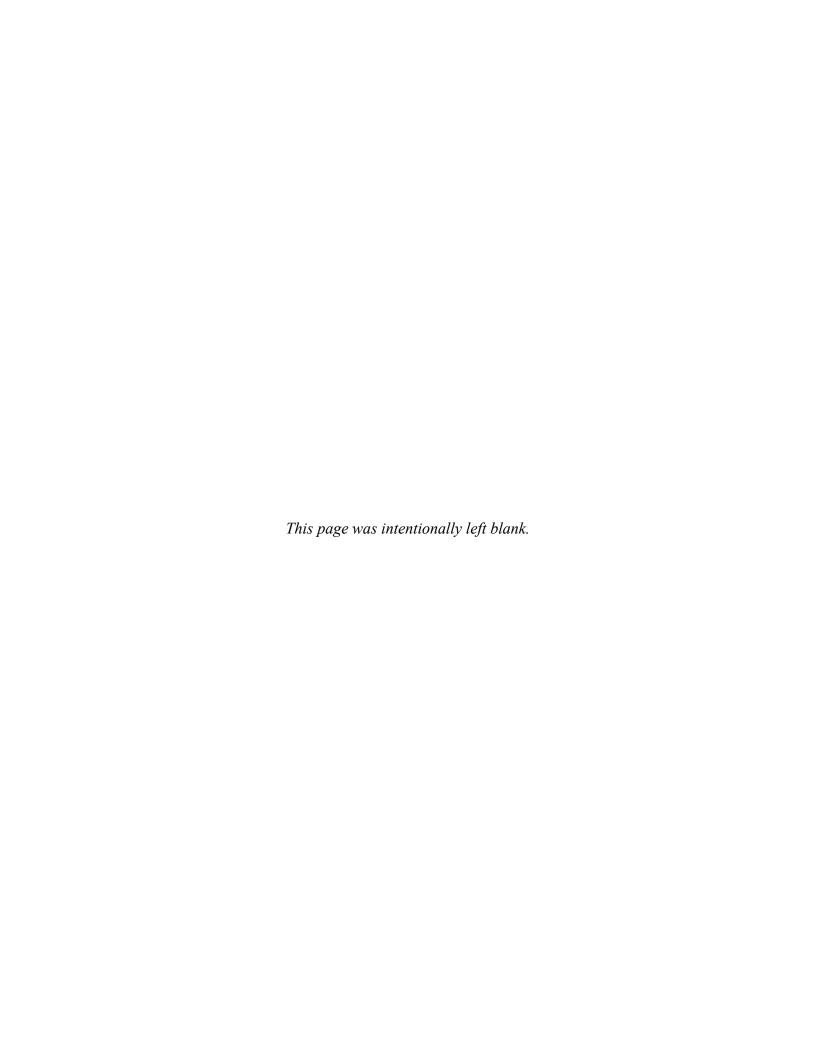
The monitoring/injection well data will be evaluated to determine the distribution of injectants in the groundwater, changes in contaminant concentrations, and other changes in groundwater chemistry due to the injections. If appropriate, the results of the data analyses will be used to adjust the implementation plans for the subsequent phase of injections. For example, the injection point locations, injection intervals, injectant dosing, and/or the performance monitoring plan might be revised based on the injection data. Proposed revisions will be submitted to the EPA and PADEP for approval prior to initiating the following injections.



5.0 COST ESTIMATE

The cost estimate in this report is based on a variety of information, including quotes from suppliers, pilot study and Site investigation costs, vendor information, conventional cost estimating guides, and professional judgment.

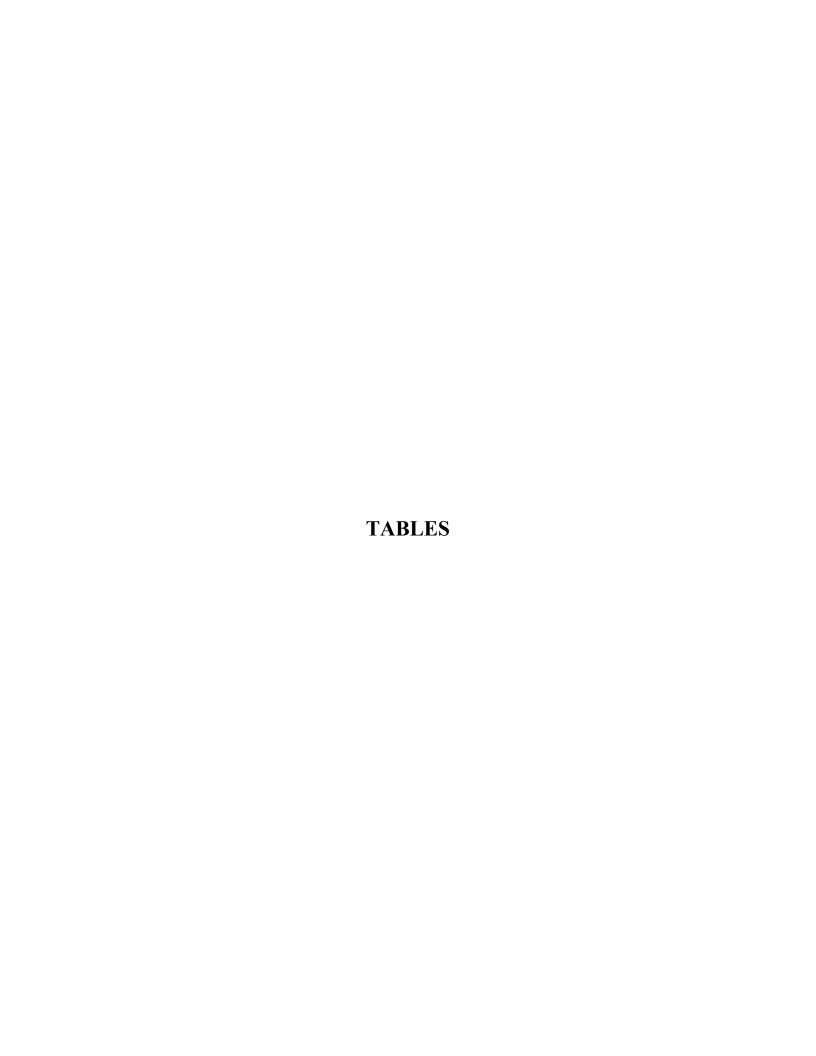
The present value costs, assuming a discount rate of 7% stipulated by the EPA guidance (EPA, 2000), and the total costs escalated for inflation (assuming a yearly inflation rate of 1.5%) are presented in Table 5.1. The cost estimate included in this report is budgetary with an uncertainty of +15% and -5%. The total present value cost to implement the RA is \$ A detailed cost estimate is provided in Appendix E.



6.0 REFERENCES

- CDM, 2007. Pilot-Scale In-Situ Chemical Oxidation Application Summary Report AIW Frank/Mid-County Mustang Superfund Site, Exton, Pennsylvania. December
- Gardner, K., Hadnagy, E., Greenwood, Scott., Smith, B., Fimmen, R., Nair, D., and Rectanus, H. 2016. Impacts on Groundwater Quality following the Application of ISCO: Understanding the Cause of and Designing Mitigation for Metals Mobilization. Strategic Environmental Research and Development Program.
- Gerritse, J., V. Renard, T.M. Pedro-Gomes, P.A. Lawson, M.D. Collins, and J.C. Gottschal, 1999. Desulfitobacterium sp. Strain PCE1, an Anaerobic Bacterium that Can Grow by Reductive Dechlorination of Tetrachloroethene or Ortho-chlorinated Phenols. Archives of Microbiology, Vol. 165:132-140.
- Halliburton NUS Corporation (HNUS), 1995. Remedial Investigation Report, AIW Frank/MidCounty Mustang Site. Chester County, Pennsylvania. April.
- HydroGeoLogic, Inc. (HGL), 2012. Pilot Study In Situ Enhanced Bioremediation Application Summary Report AIW Frank/Mid-County Mustang Site. Chester County, Pennsylvania. March.
- HGL, 2015. Final Focused Feasibility Study Report for Operable Unit 1 (OU-1), AIW Frank/Mid-County Mustang Site. Chester County, Pennsylvania, September.
- HGL, 2018. Sampling and Analysis Plan, AIW Frank/Mid-County Mustang Superfund Site Operable Unit 1, Chester County, Pennsylvania, February.
- Huling, S.G. and Pivetz, B. 2006. In-Situ Chemical Oxidation Engineering Issue. U.S. Environmental Protection Agency, National Risk Management Research Laboratory, R.S. Kerr Environmental Research Center, Ada, Oklahoma. EPA/600/R-06/072.
- ITRC (Interstate Technology & Regulatory Council). 2005. Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater, 2nd ed. ISCO-2. Washington, D.C.: Interstate Technology & Regulatory Council, In Situ Chemical Oxidation Team. Available on the Internet at http://www.itrcweb.org.
- Klozur. 2018. Corrosion and Material Compatibility with Klozur® Persulfate. http://www.peroxychem.com/media/131599/peroxychem-klozur-compatible-materials.pdf
- Maymó-Gatell, X, Y. Chien, J.M. Gossett, and S.H. Zinder, 1997, Isolation of a Bacterium that Reductively Dechlorinates Tetrachloroethene to Ethene, Science 1997 June 6; 276(5318):1568-71.

- Rossabi, J. (2018). Professor Northwestern University. Communication with D. Back (HGL) on May 1st 2018.
- Suyama, A., Iwakiri, R., Tokunaga, T., Sera, N., Furukawa, K., 2001. Isolation and characterization of Desulfitobacterium sp. strain Y51 capable of efficient dehalogenation of tetrachlorethene and polychloroethanes. Bioscience Biotechnology and Biochemistry 65(7): 1474-1481.
- U.S. Environmental Protection Agency (EPA), 1995. Record of Decision: A.I.W. Frank/Mid-County Mustang. EPA/ROD/R03-95/20. September.
- EPA, 2009. Summary of Key Existing EPA CERCLA Policies for Groundwater Restoration. OSWER Directive No. 9283.1-33. June 26.
- EPA, 2017. Record of Decision: Record of Decision Amendment AIW Frank / Mid-County Mustang Superfund Site West Whiteland Township, Chester County, Pennsylvania U.S. Environmental Protection Agency Region 3. Philadelphia, Pennsylvania.



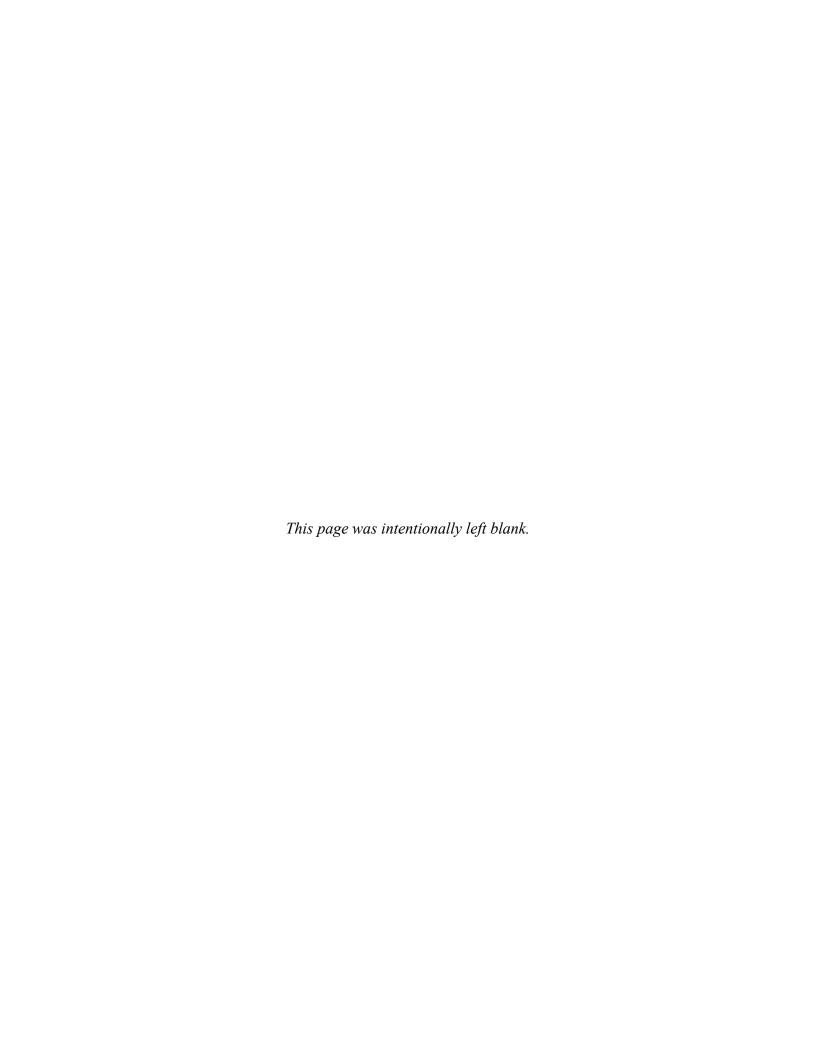


Table 1.1 **Groundwater COCs and RGs**

Chemical	2017 RG ⁽¹⁾
Trichloroethene	5 μg/L
1,1,1-TCA	200 μg/L
1,1 - DCE	7 μg/L
1,1-DCA	*31 µg/L
1,1,2-Trichloroethane	5 μg/L
cis-1,2-DCE	70 μg/L
1,2-Dichloropropane	5 μg/L
Tetrachloroethene	5 μg/L
Vinyl Chloride	2 μg/L
Toluene	1,000 μg/L
1,4-dioxane	*6.4 μg/L

 μ g/L = micrograms per liter RG = remediation goal COC = contaminant of concern

⁽¹⁾ Updated RG's specified in 2017 ROD Amendment * PA Act 2 Groundwater MSC

Table 3.1 Injection Well Construction Specifications

Well ID	Well Diameter (inches)	Well Depth (feet bgs)	Open Interval ¹ (feet bgs)
IW-1	4	200	25 -200
IW-2	4	200	25 -200
IW-3	4	75	25 -75
IW-4	4	80	25 -80
IW-5	4	80	25 -80
IW-6	4	170	25-170
IW-7	4	160	25-160
IW-8	4	160	25-160

Notes

(1) Open intervals may change due to actual depth of bedrock

bgs = below ground surface

Table 4.1 **Sodium Persulfate Injection Specifications**

Well ID	Well Diameter (inches)	Well Depth (feet bgs)	Screened Interval (feet bgs)	Length (feet) (open or screened interval)	Injections Per Well ¹	Volume per Injection 1 (gallons) ²	Volume per Injection 2 (gallons) ²
EW-4	8	300	18-300 (open)	282	6	12,000	12,000
IW-1	4	200	25-200 (open)	175	4	8,000	8,000
IW-2	4	200	25-200 (open)	175	4	8,000	8,000
IW-7	4	160	25-160 (open)	135	3	6,000	6,000
IW-8	4	160	25-160 (open)	135	3	6,000	6,000
					Total	40,000	40,000

Assume one injection per 50 ft of open borhole
 Assume 2,000 gallons of amendment per injection μg/L – micrograms per liter

bgs = below ground surface

Table 4.2 ABC® Injection Specifications

Well ID	Well Diameter (inches)	Well Depth (feet bgs)	Screened Interval (feet bgs)	Length (feet) (open or screened interval)	Injections Per Well ¹	Volume per Injection 1 (gallons) ²	Volume per Injection 2 (gallons) ²
EW-4	8	300	18 - 300 (open)	282	6	12,000	12,000
EW-5	8	298	79 - 298 (open)	219	5	10,000	10,000
IW-1	4	200	25 -200 (open)	175	4	8,000	8,000
IW-2	4	200	25 -200 (open)	175	4	8,000	8,000
IW-3	4	75	25 -75 (open)	50	1	2,000	2,000
IW-4	4	80	25 -80 (open)	55	2	4,000	4,000
IW-5	4	80	25 -80 (open)	55	2	4,000	4,000
IW-6	4	170	25-170 (open)	145	3	6,000	6,000
IW-7	4	160	25-160 (open)	135	3	6,000	6,000
IW-8	4	160	25-160 (open)	135	3	6,000	6,000
					Total	66,000	66,000

Notes:

bgs = below ground surface

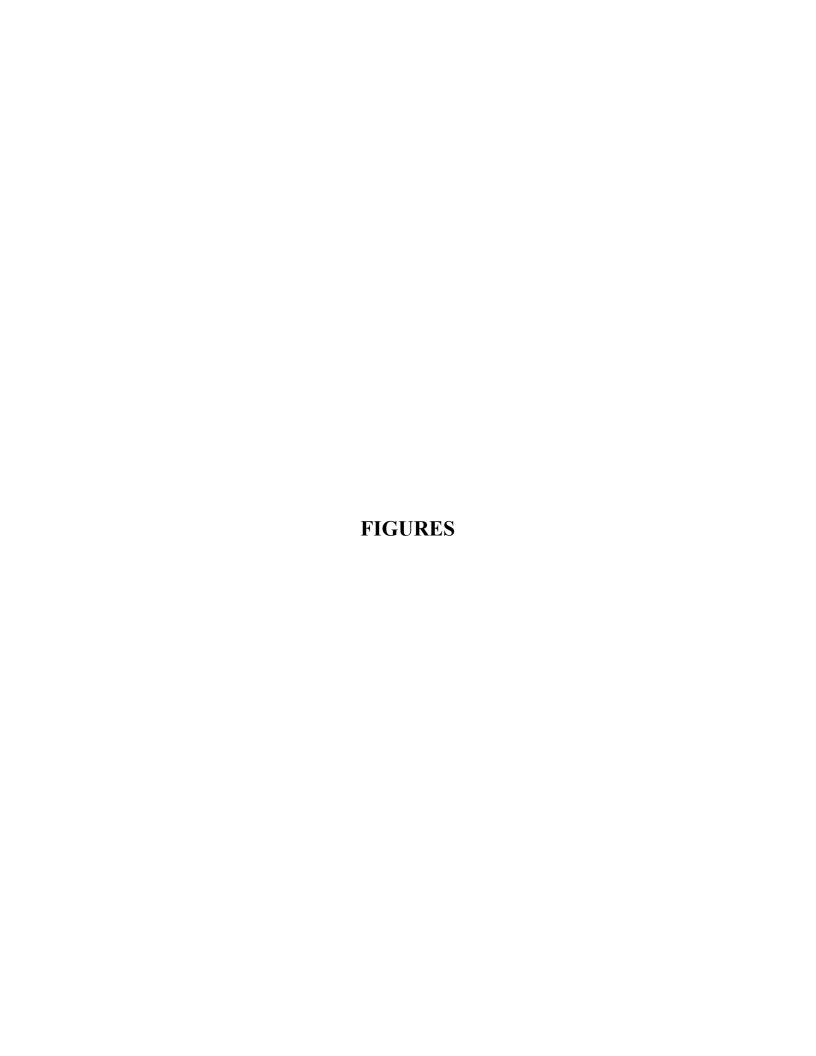
Assume one injection per 50 ft of open borehole
 Assume 2,000 gallons of amendment per injection μg/L – micrograms per liter

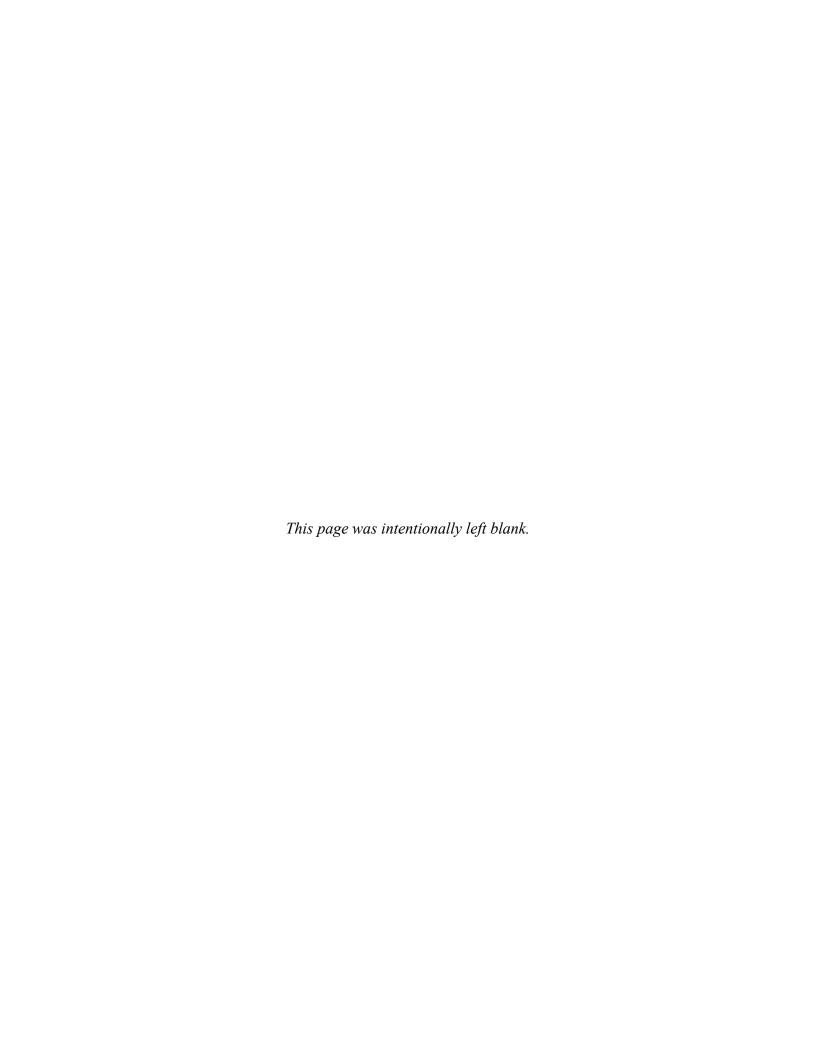
Table 5.1
ISCO and ISBR Remedial Action
Cost Estimate
AIW Frank/Mid-County Mustang Site

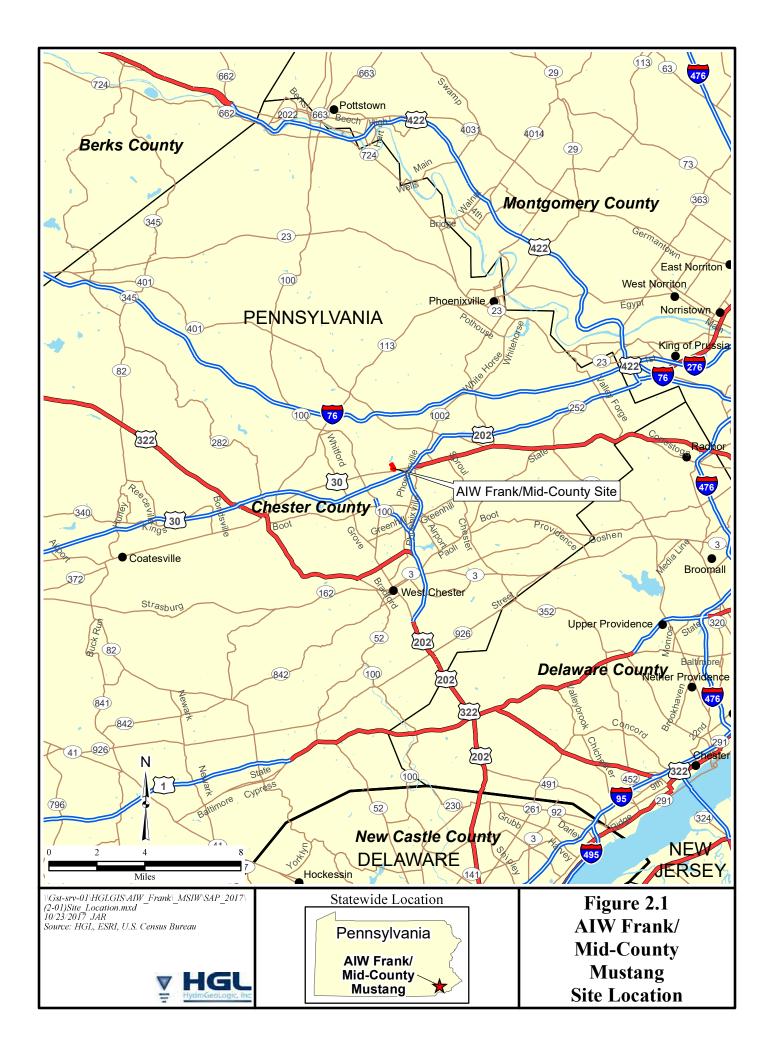
Phase Name	Year 2018	Year 2019	Year 2020	Year 2021	Year 2022	Years 2023- 2027	Years 2028- 2032	Years 2033- 2037	Years 2033- Years 2038- Years 2043- 2037 2042 2048	Years 2043- 2048	Total
Remedial Action (RA)											
Site Preparation	\$									3.	\$
Well Installation Event	\$										\$
Geophysics and Packer Testing		\$									\$
1st Round Persulfate Injections		\$									\$
Performance Sampling		\$	\$								\$
2nd Round Persulfate Injections			\$								\$
Performance Sampling				\$						- *	\$
Background Sampling					\$						
1st Round ABC Injections						\$					\$
Performance Sampling ABC						\$					\$
2nd Round ABC Injections						\$				- *	\$
Performance Sampling ABC						\$					\$
Post RA Implementation											
Long-term monitoring sampling event						\$	\$				\$
RACR Report							\$			- *	\$
Five-Year Review			\$			\$					\$
Subtotal \$	\$		\$	\$	\$	\$	\$				\$
Escalated for Inflation* \$	\$		\$	\$	\$	\$	\$				\$
Present Value Estimate* \$	\$		\$	\$	\$	\$	\$				\$

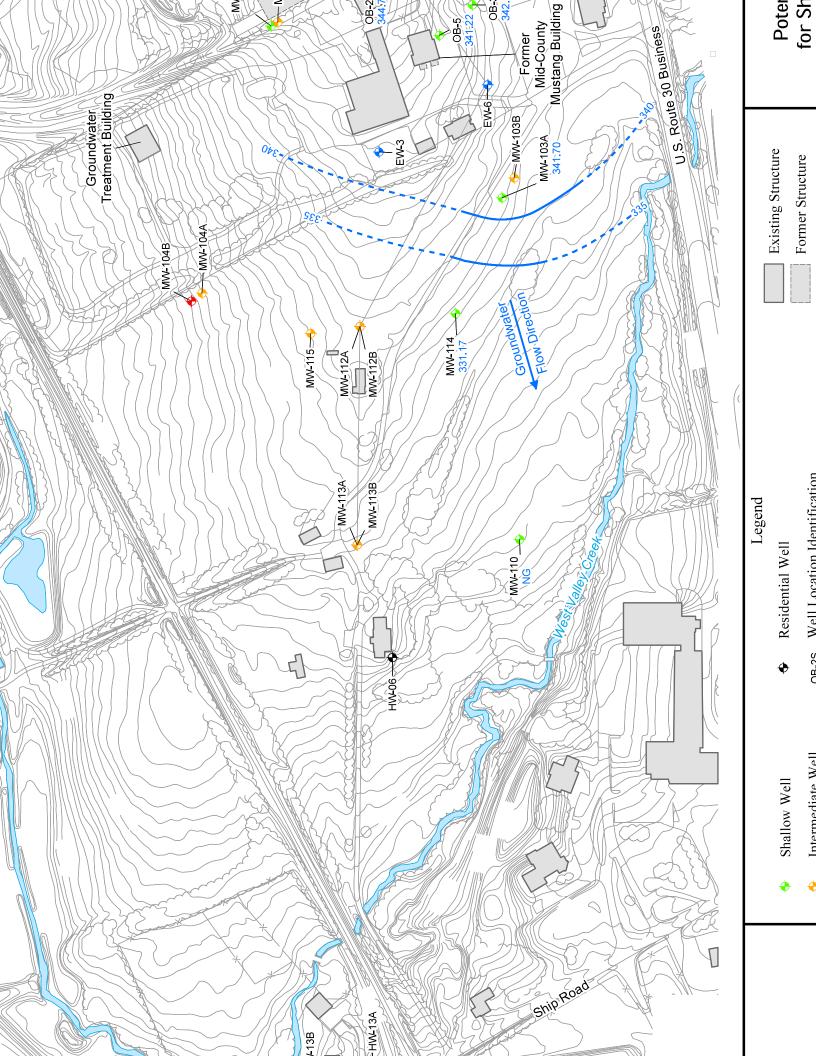
 st A yearly inflation rate of 1.50% is u

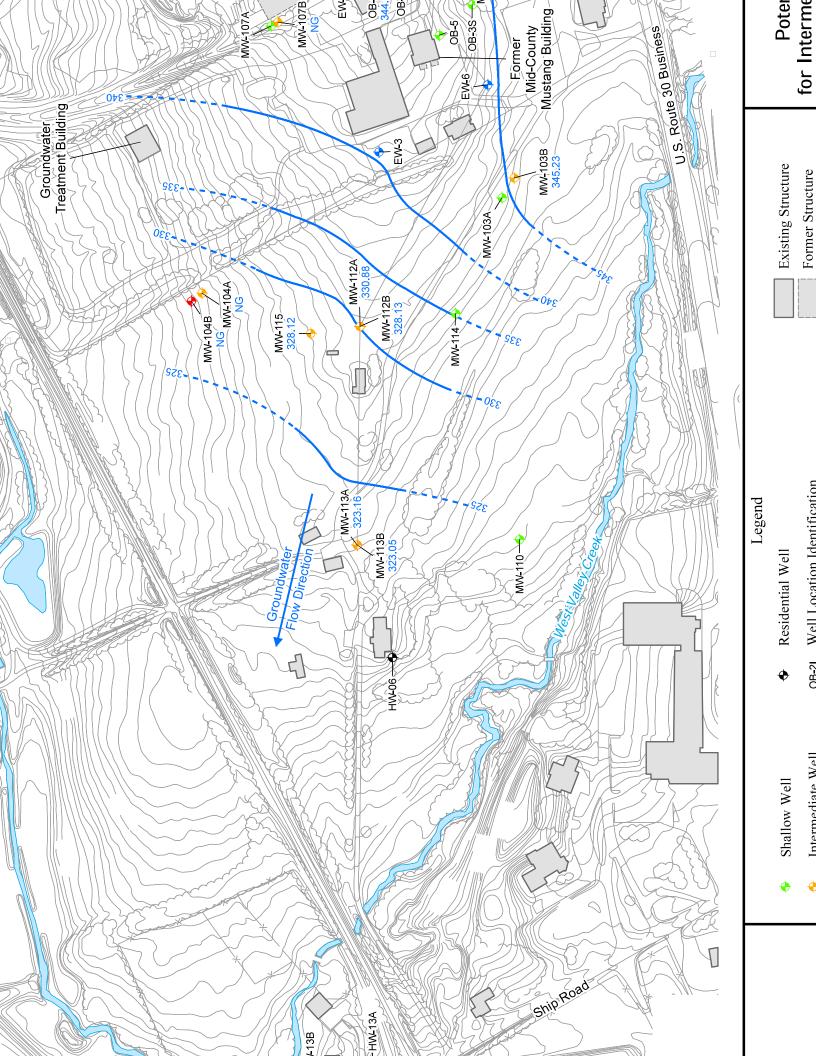
1.50% is used along with a 7% discount rate.

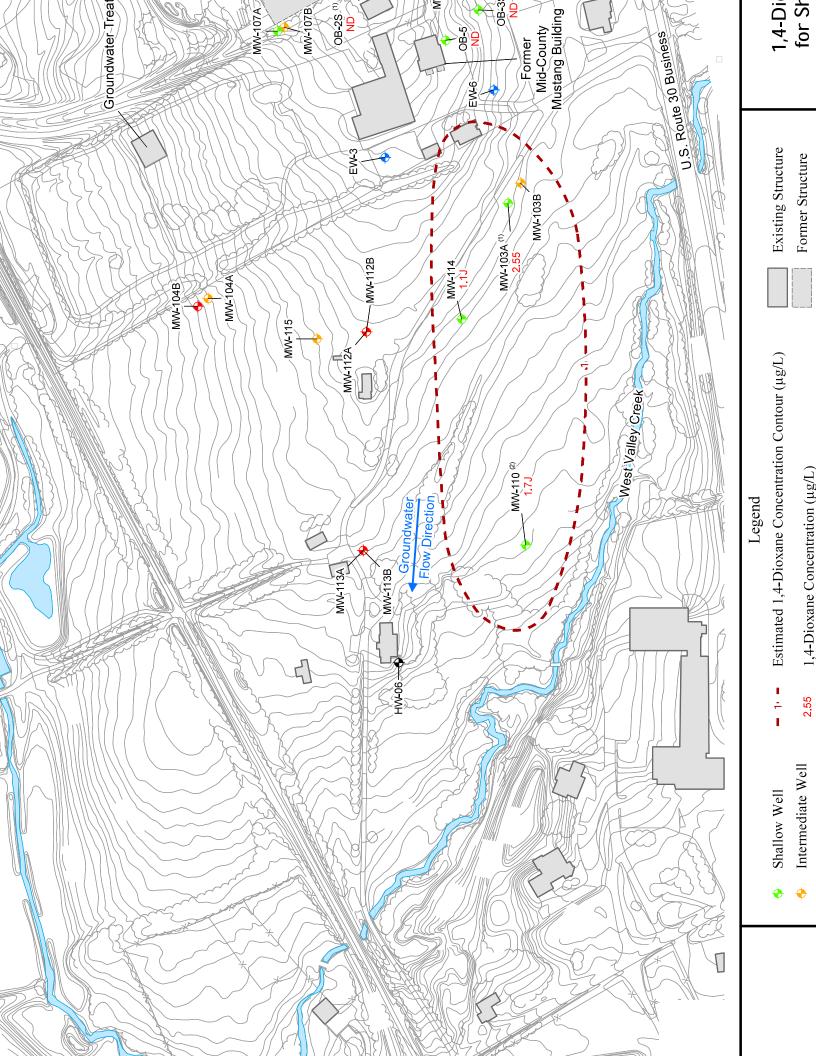


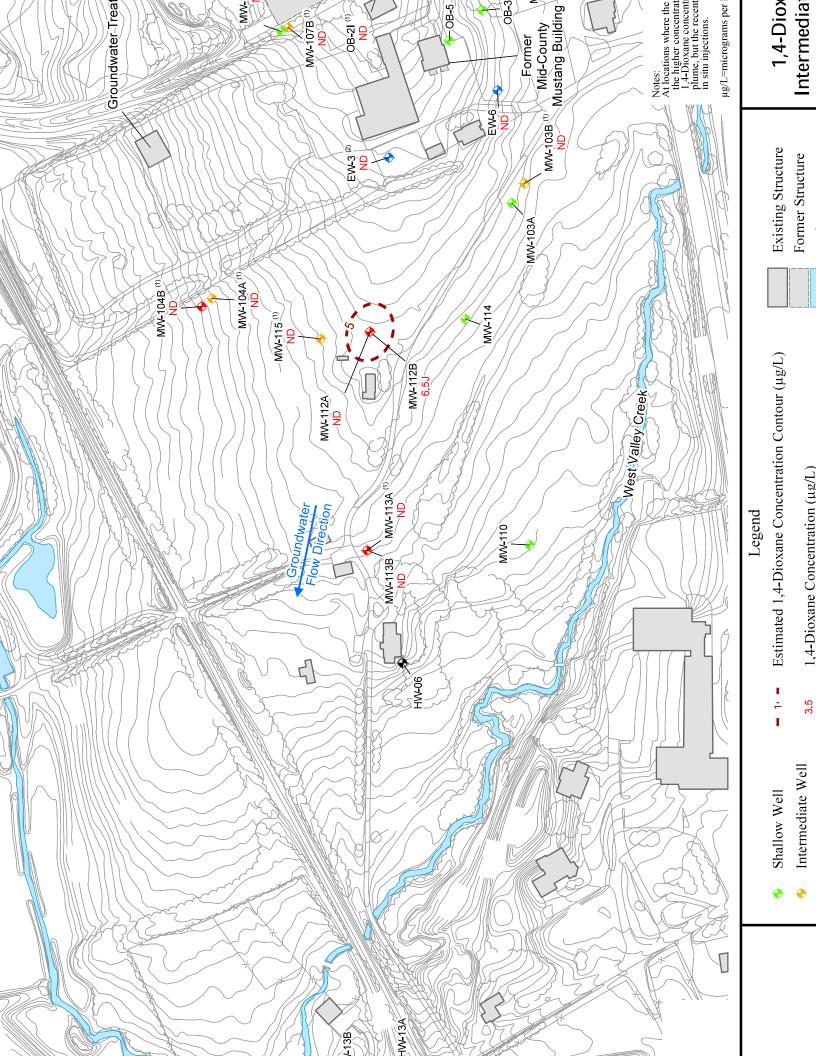


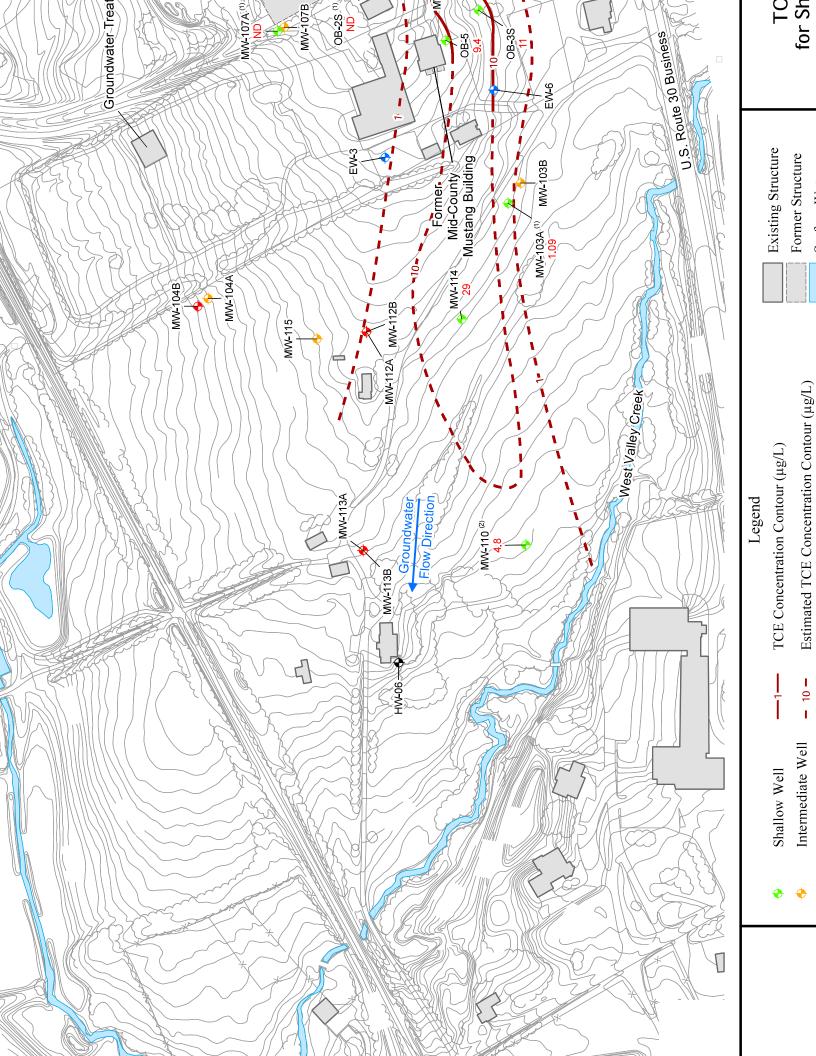


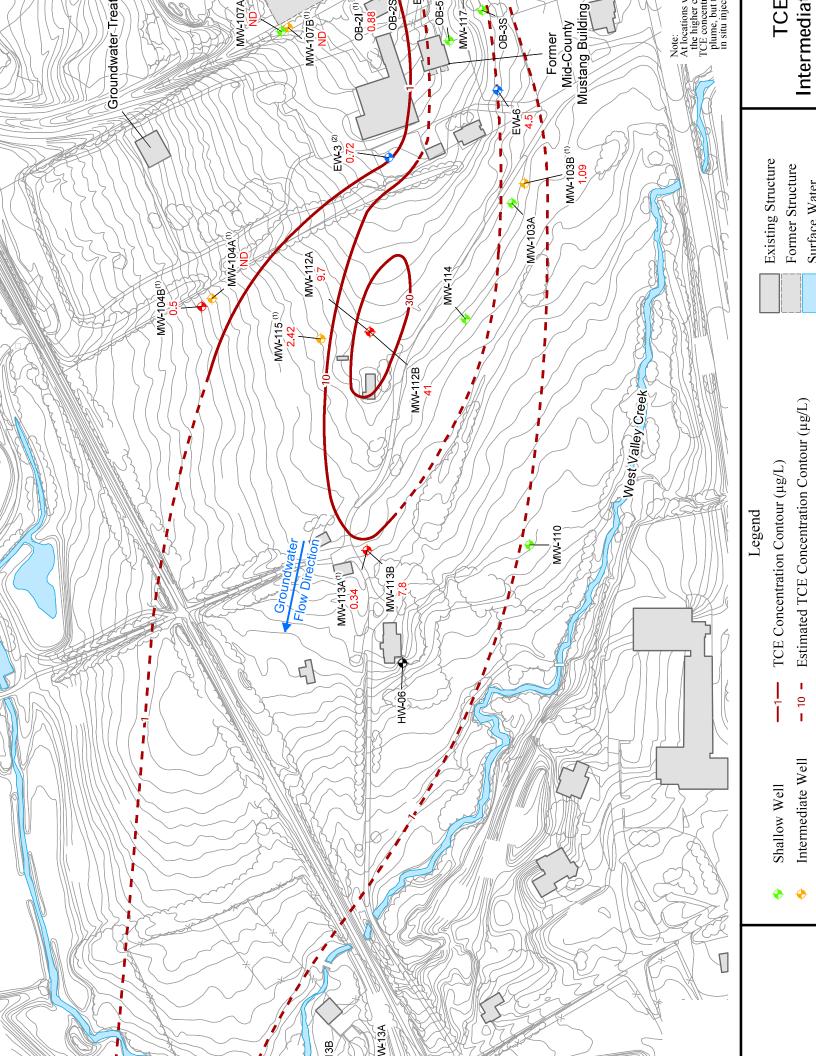


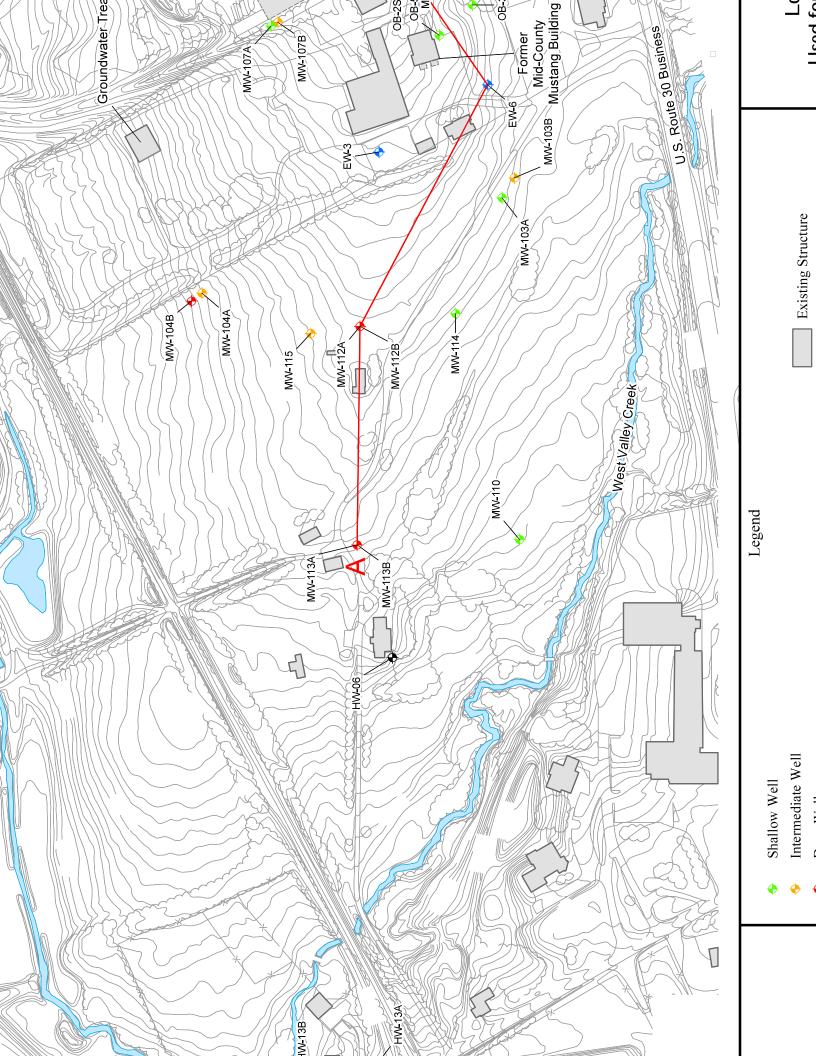


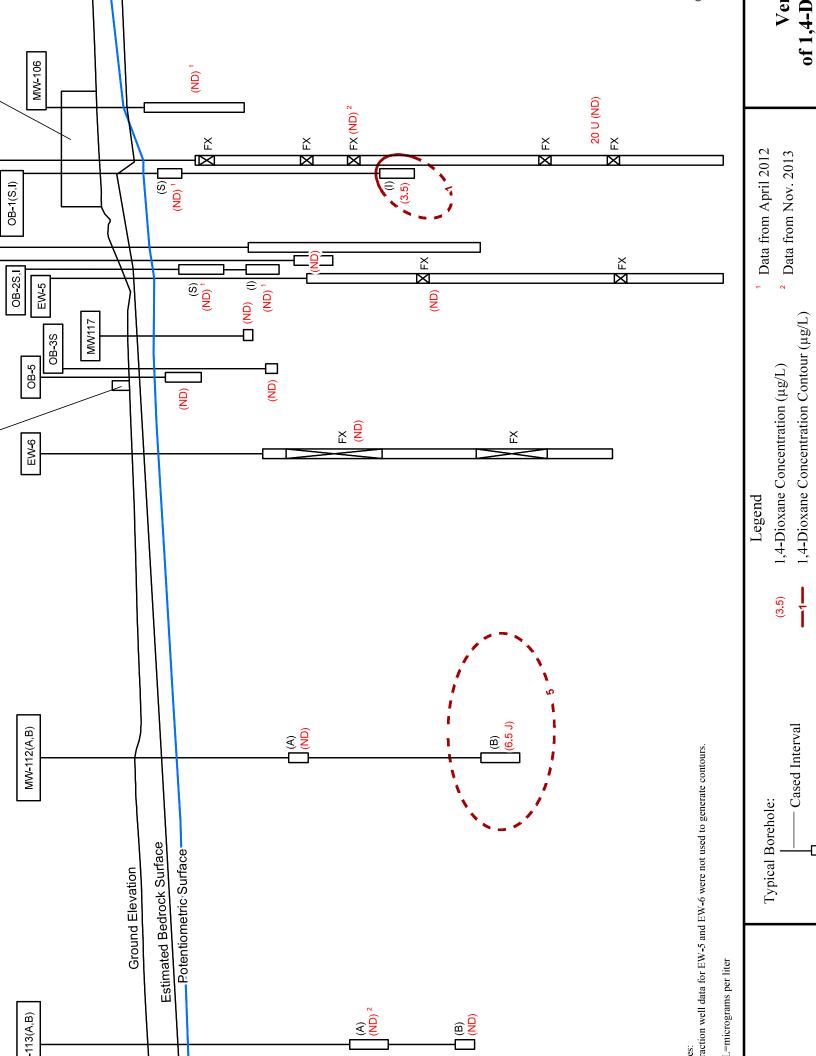


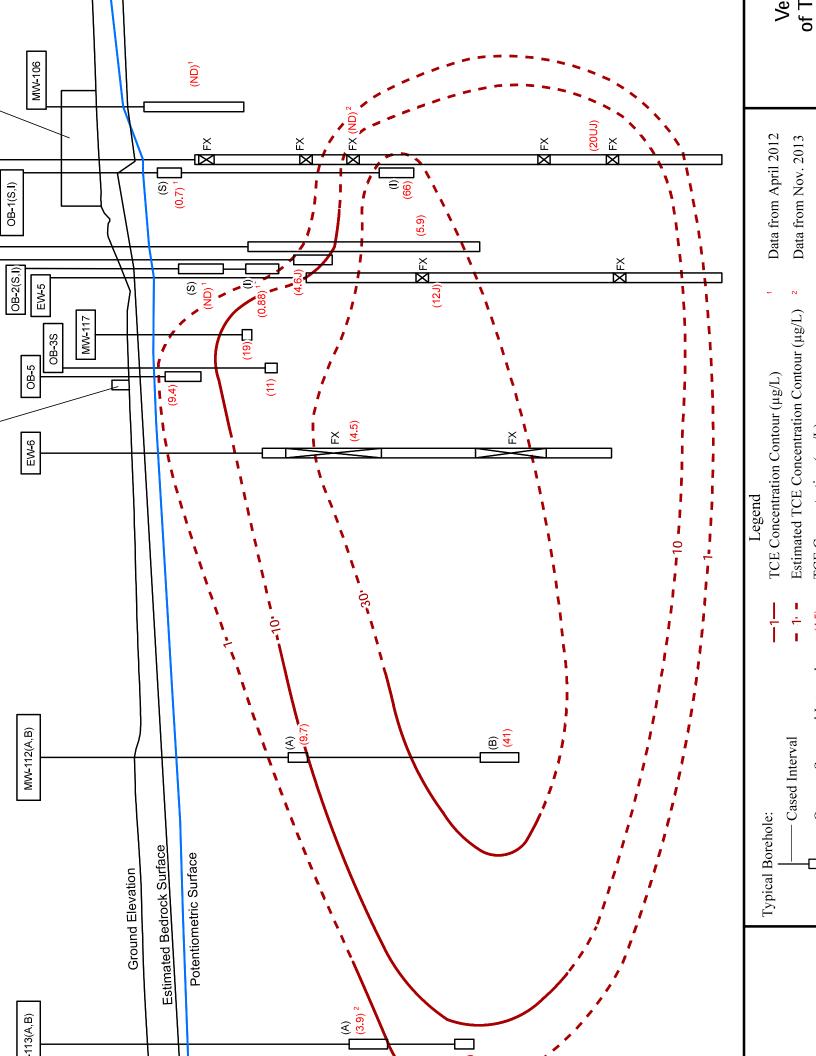


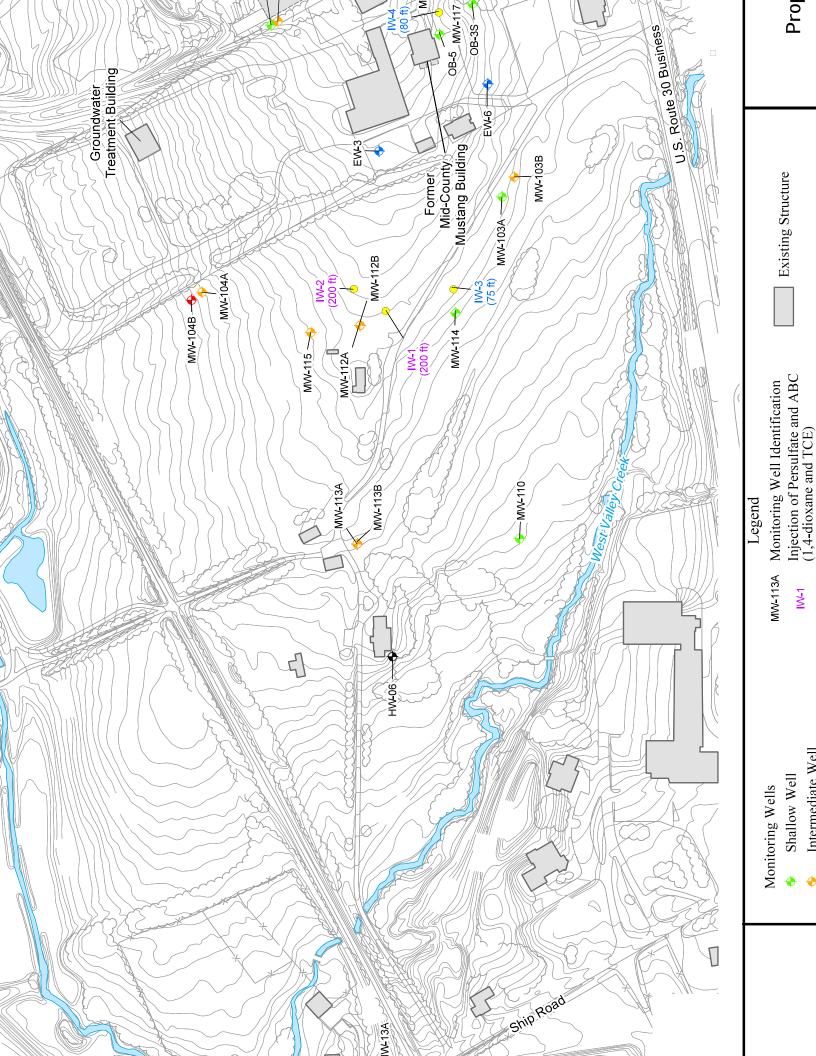




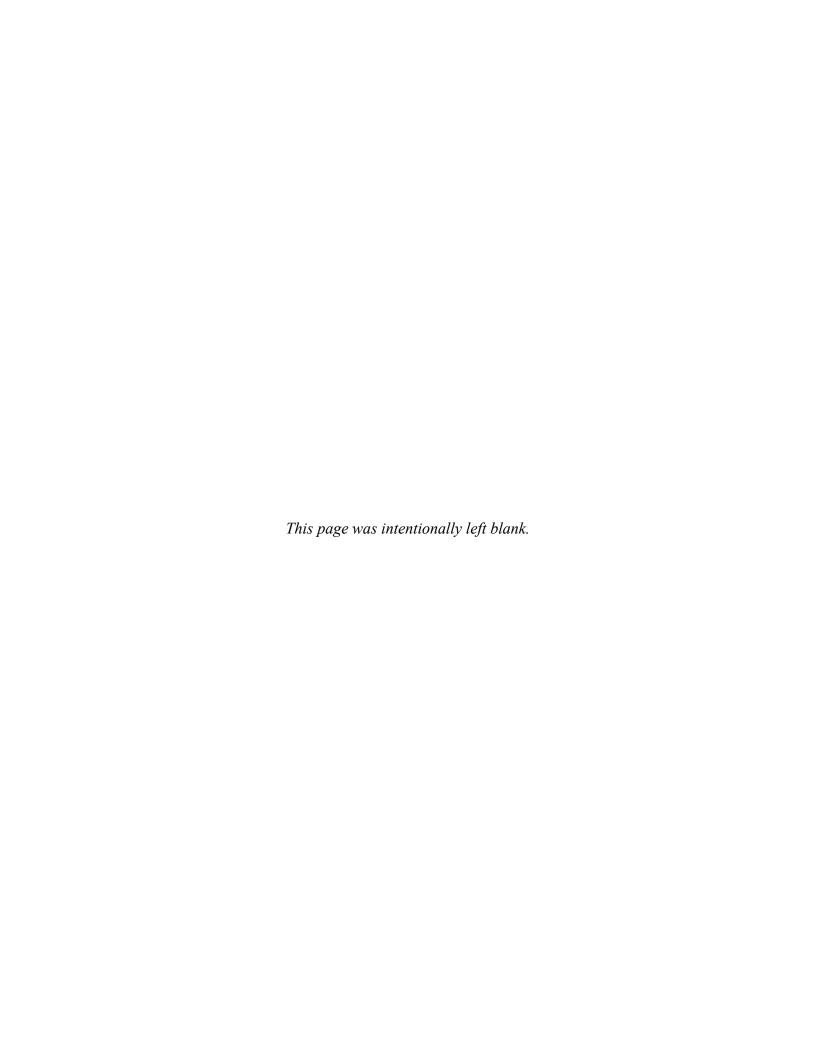


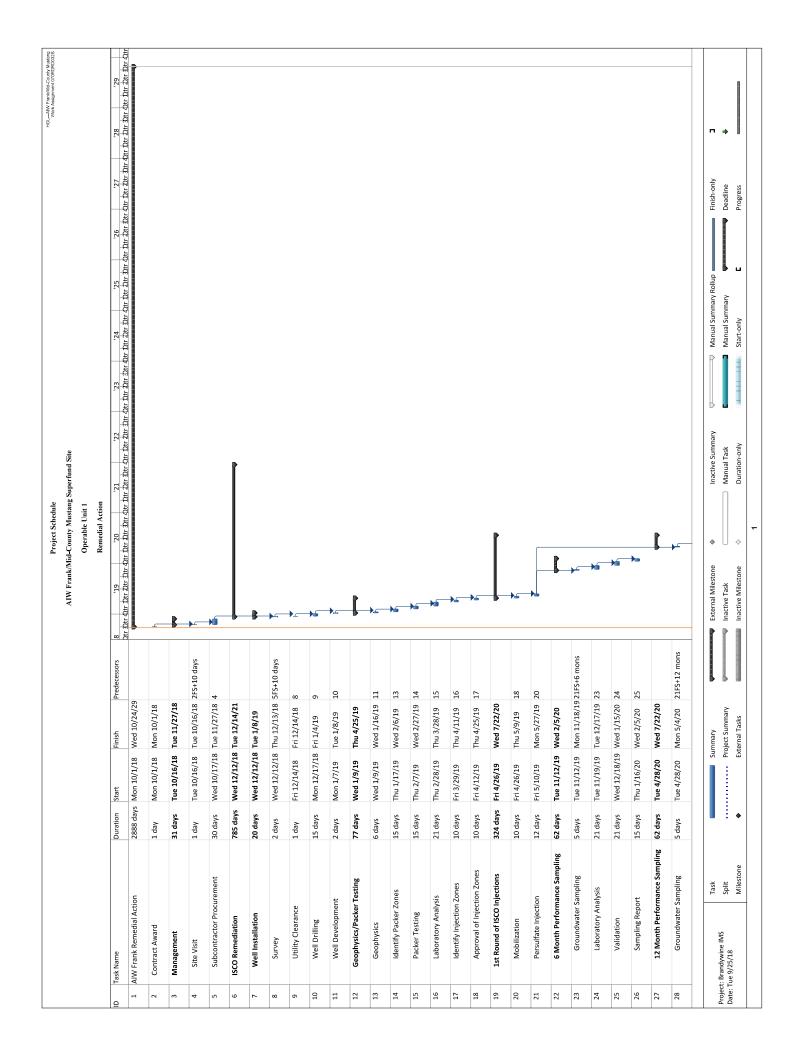


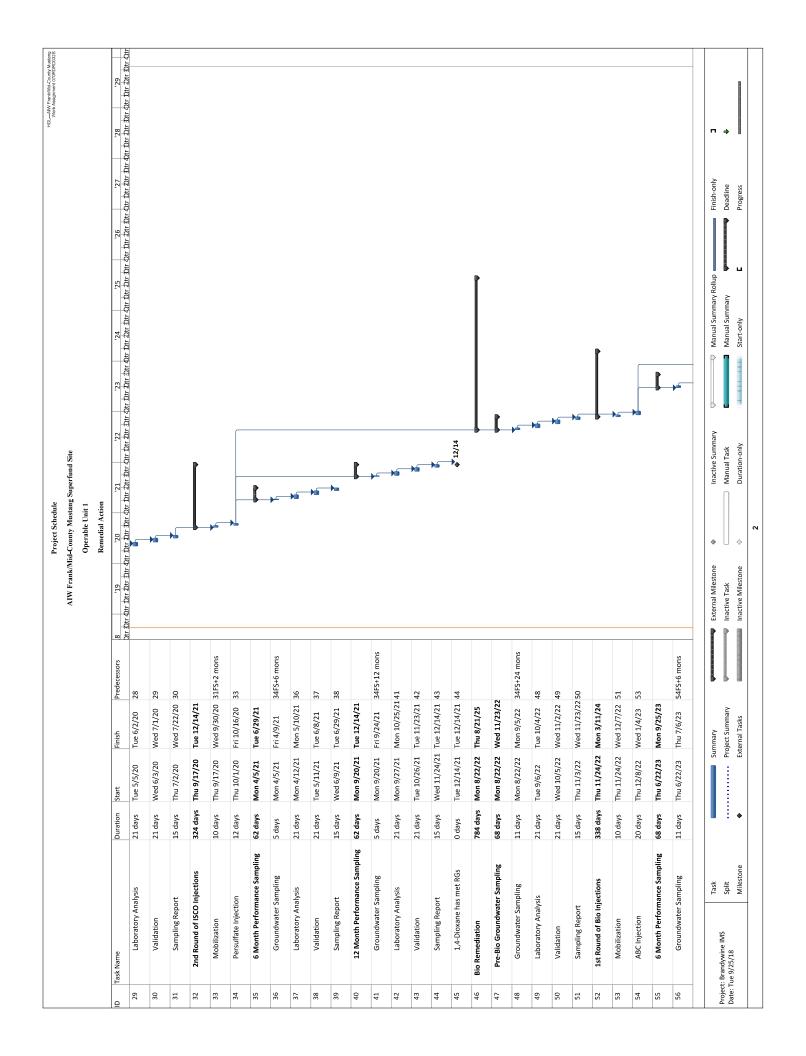


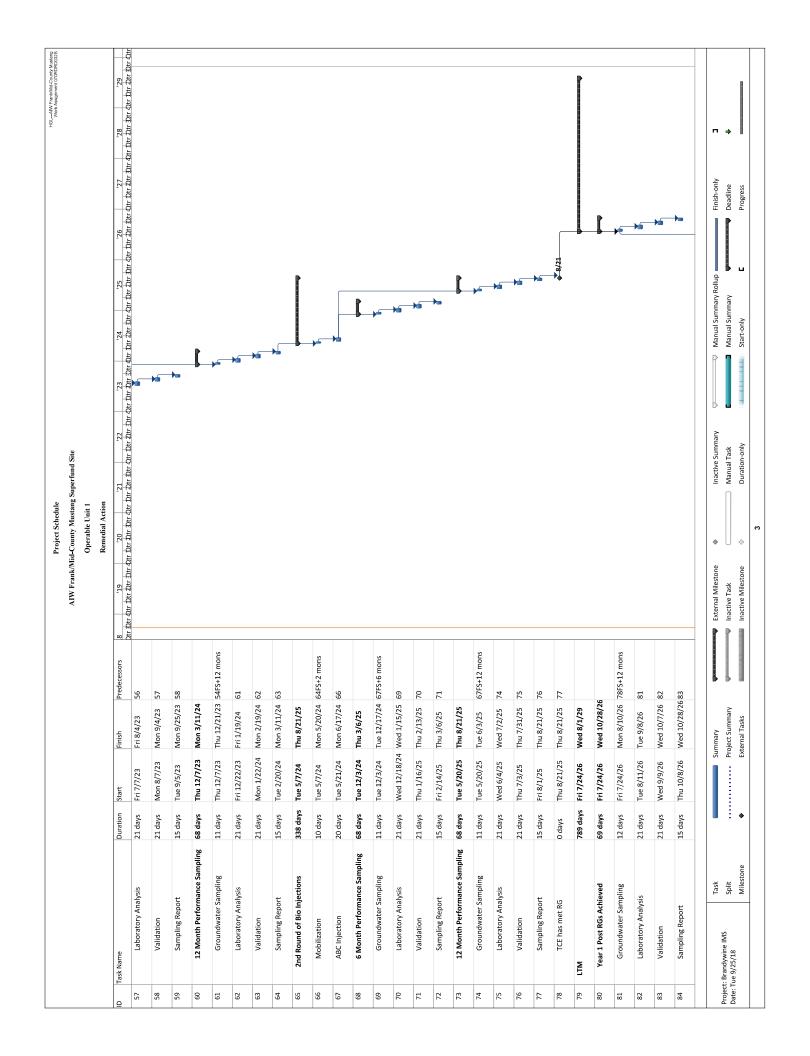


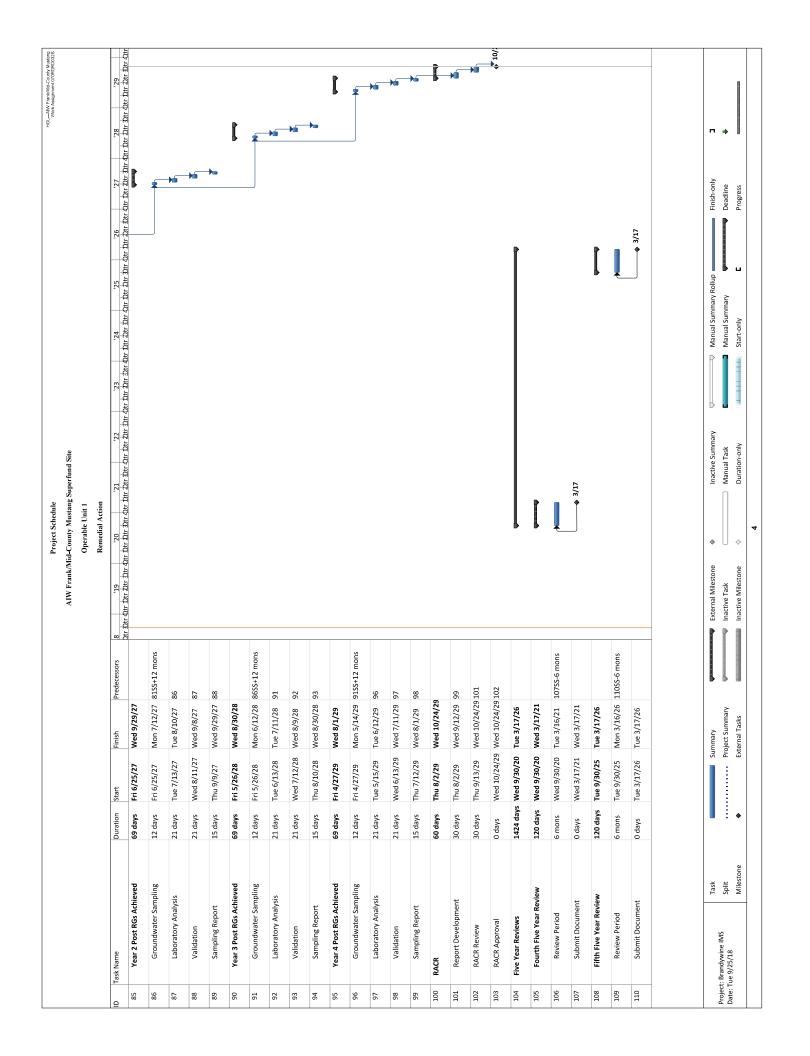
APPENDIX A PROJECT SCHEDULE



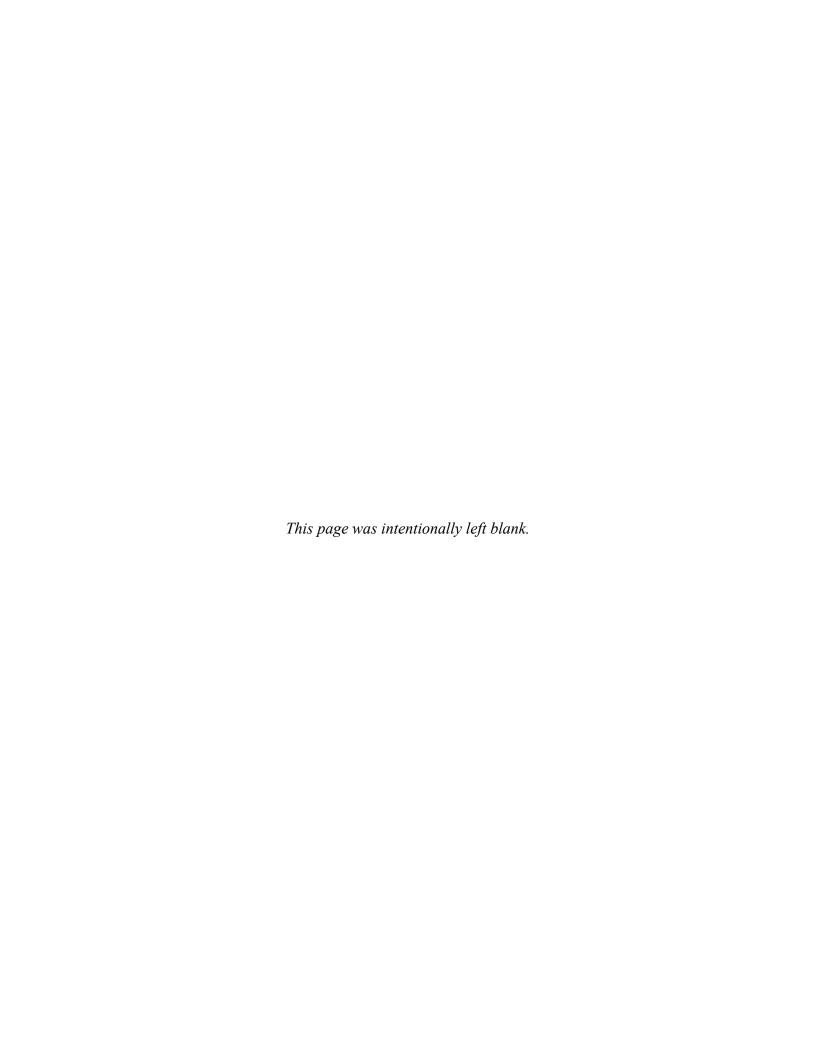








APPENDIX B SUBSTRATE INJECTION CALCULATIONS



NOTE: Shaded boxes are user input.

	Values	Range	Units
Length (Perpendicular to predominant groundwater flow direction)	1300	1-10,000	feet
Width (Parallel to predominant groundwater flow)	150	1-1,000	feet
Average Injection Interval	60	1-100	feet
Treatment Zone Cross Sectional Area	78000		ft ²
Treatment Zone Volume	11,700,000		ft ³
Treatment Zone Total Pore Volume (total volume x total porosity)	21,884,850		gallons
Treatment Zone Effective Groundwater Volume (total volume x effective porosity)	4,376,970		gallons
Design Period of Performance	3	.5 to 5	year
Total Porosity	0.25	.05-50	
Effective Porosity	0.05	.05-50	
Average Aquifer Hydraulic Conductivity	10	.01-1000	ft/day
Average Hydraulic Gradient	0.01	0.1-0.0001	ft/ft
Average Groundwater Seepage Velocity through the Treatment Zone	2.00		ft/day
Average Groundwater Seepage Velocity through the Treatment Zone	730.0		ft/yr
Average Groundwater Flux through the Treatment Zone	21,301,254		gallons/year
Soil Bulk Density	1.8	1.4-2.0	gm/cm ³

A. Aqueous-Phase Native Electron Acceptors

Soil Fraction Organic Carbon (foc)

Oxygen Nitrate Sulfate

Carbon Dioxide (estimated as the amount of Methane produced)

B. Solid-Phase Native Electron Acceptors

Manganese (IV) (estimated as the amount of Mn (II) produced) Iron (III) (estimated as the amount of Fe (II) produced)

C. Soluble Contaminant Electron Acceptors

Tetrachloroethene 1,1,2-Trichloroethane Trichloroethene cis-1,2-Dichloroethene Vinyl Chloride 1,2-Dichloropropane Toluene 1,1,1-Trichloroethane 1,1-Dichloroethane 1.1-Dichloroethene

D. Sorbed Contaminant Electron Acceptors

(Soil Concentration = Koc x foc x Cgw) Tetrachloroethene Trichloroethene

Vinyl Chloride

1,2-Dichloropropane

cis-1,2-Dichloroethene

Toluene

1,1,1-Trichloroethane

1,1-Dichloroethane

1,1-Dichloroethene

	Concentration (mg/L)	Mass (lb)	Stoichiometric demand (wt/wt h ₂)	Hydrogen Demand (lb)	Electron Equivalents per Mole
	4.2	764.26	7.9	96.74	4
	1.8	320.82	10.2	31.45	5
	89.8	16392.34	10.6	1552.30	8
	28.6	5227.47	5.5	957.41	8
Solu	ble Competing	Electron Acce	eptor Demand (lb.)	2637.9	

0.005 0.0001-0.1

					•
	Concentration	Mass	Stoichiometric demand	Hydrogen Demand	Electron Equivalents per Mole
	(mg/L)	(lb)	(wt/wt h ₂)	(lb)	iviole
	0.1633625	29.83	27.5	1.08	1
	0.03625	6.62	55.9	0.12	1
Solid-Pha	ase Competing	Electron Acce	eptor Demand (lb.)	1.20	

				•
Concentration	Mass	Stoichiometric demand	Hydrogen Demand	Electron Equivalents per
(mg/L)	(lb)	(wt/wt h ₂)	(lb)	Mole
0.050	9.13	20.6	0.44	8
0.050	9.13	20.0	0.46	8
0.050	9.13	21.7	0.42	6
0.050	9.13	24.0	0.38	4
0.050	9.13	31.0	0.29	2
0.050	9.13	25.4	0.36	8
0.050	9.13	12.3	0.74	6
0.050	9.13	22.0	0.42	6
0.050	9.13	25.0	0.37	4
0.050	9.13	24.0	0.38	4

Total Soluble Contaminant Electron Acceptor Demand (lb.)

Soil Conc. (mg/kg)	Mass (lb)	Stoichiometric demand (wt/wt h ₂)	Hydrogen Demand (lb)	Electron Equivalents per Mole
0.07	86.46	20.6	4.20	8
0.03	35.18	21.7	1.62	6
0.01	14.79	24.0	0.62	4
0.00	0.99	31.0	0.03	2
0.06	73.64	25.4	2.90	8
0.02	20.71	12.3	1.68	6
0.03	34.52	22.0	1.57	6
0.01	9.86	25.0	0.39	4
0.02	21.37	24.0	0.89	4
	(mg/kg) 0.07 0.03 0.01 0.00 0.06 0.02 0.03 0.01	(mg/kg) (lb) 0.07 86.46 0.03 35.18 0.01 14.79 0.00 0.99 0.06 73.64 0.02 20.71 0.03 34.52 0.01 9.86	Soil Conc. (mg/kg) Mass (lb) demand (wt/wt h₂) 0.07 86.46 20.6 0.03 35.18 21.7 0.01 14.79 24.0 0.00 0.99 31.0 0.06 73.64 25.4 0.02 20.71 12.3 0.03 34.52 22.0 0.01 9.86 25.0	Soil Conc. (mg/kg) Mass (lb) demand (wt/wt h ₂) Demand (lb) 0.07 86.46 20.6 4.20 0.03 35.18 21.7 1.62 0.01 14.79 24.0 0.62 0.00 0.99 31.0 0.03 0.06 73.64 25.4 2.90 0.02 20.71 12.3 1.68 0.03 34.52 22.0 1.57 0.01 9.86 25.0 0.39

Total Sorbed Contaminant Electron Acceptor Demand (lb.) 13.90

(continued)

A. Soluble Native Electron Acceptors

Oxygen Nitrate Sulfate

Carbon Dioxide (estimated as the amount of Methane produced)

Concentration (mg/L)	Mass (lb)	Stoichiometric demand (wt/wt h ₂)	Hydrogen Demand (lb)	Electron Equivalents per Mole
4.2	743.88	7.9	94.16	4
1.8	312.26	10.2	30.61	5
89.7625	15955.21	10.6	1510.91	8
28.625	5088.07	5.5	931.88	8

Total Competing Electron Acceptor Demand Flux (lb/yr) 2567.6

B. Soluble Contaminant Electron Acceptors

Tetrachloroethene
Trichloroethene
cis-1,2-Dichloroethene
Vinyl Chloride
1,2-Dichloropropane
Toluene
1,1,1-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethene

	•	, , ,		_
Concentration (mg/L)	Mass (lb)	Stoichiometric demand (wt/wt h ₂)	Hydrogen Demand (lb)	Electron Equivalents per Mole
0.010	1.78	20.6	0.09	8
0.010	1.78	21.7	0.08	6
0.010	1.78	24.0	0.07	4
0.010	1.78	31.0	0.06	2
0.010	1.78	25.4	0.07	8
0.010	1.78	12.3	0.14	6
0.010	1.78	22.0	0.08	6
0.010	1.78	25.0	0.07	4
0.010	1.78	24.0	0.07	4
	A		0.74	1

Total Soluble Contaminant Electron Acceptor Demand Flux (lb/yr) 0.74

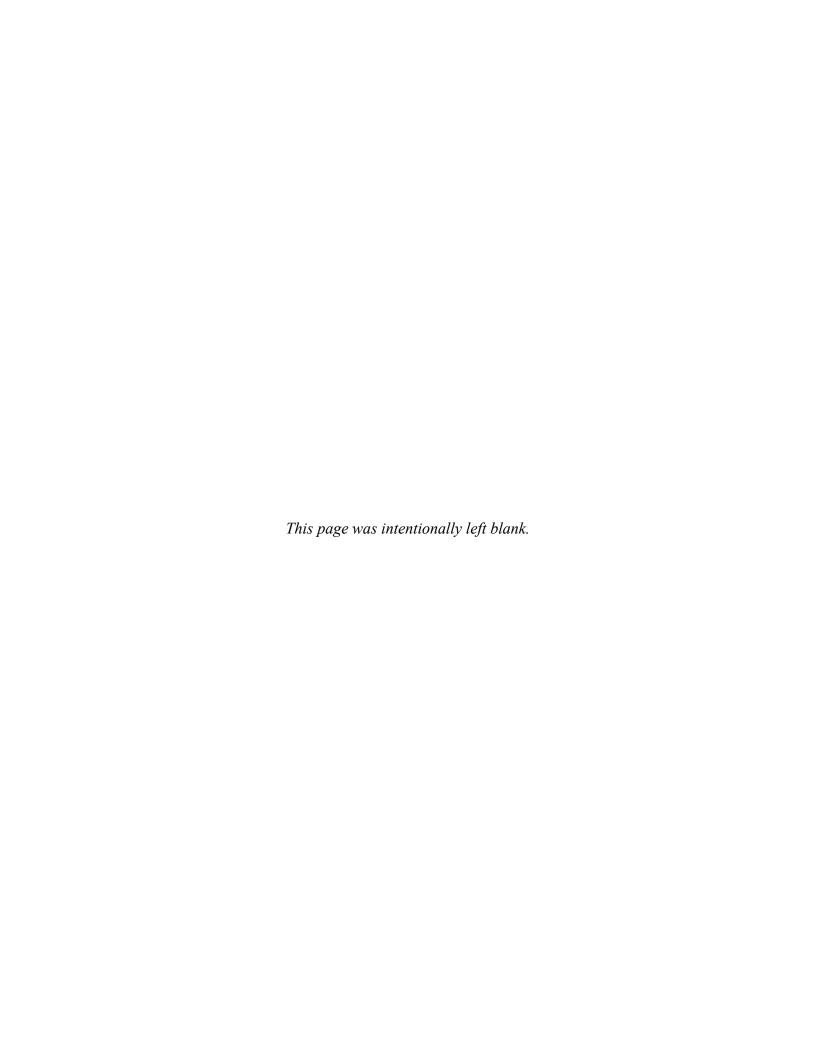
Total Hydrogen Demand (lb) 10,362.2

Total Hydrogen Demand (lb. of H₂): 10,362

ABC provides 0.079 lb H2/lb substrate

Total ABC Requirement (lbs): 131,167

APPENDIX C PROJECT SPECIFICATIONS



SECTION 33 29 10

WELL INSTALLATION

PART 1 – GENERAL

1.1 SCOPE OF WORK

- 1.1.1 Provide all necessary labor, associated materials and equipment, and other facilities and incidentals to locate, drill, install, complete, and develop each monitoring well installed at the site.
- 1.1.2 Construct eight wells in accordance with all applicable State of Pennsylvania and EPA Region 3 guidelines, the requirements herein, and Figure 3.1 and Table 3.1 of the Remedial Design Report.
- 1.1.3 Locations and anticipated dimensions of the nine wells are shown on Figure 3.1 and Table 3.1 of the Remedial Design Report, respectively.

1.1.4 ANTICIPATED SUBSURFACE CONDITIONS

Based on previous geological investigations, top of bedrock is estimated to range between 10 to 50 feet below ground surface (bgs). The water table in depicted in Figures 2.2 and 2.3 of the Remedial Design Report.

1.1.5 PERFORMANCE REQUIREMENTS

Install each well in a manner to prevent aquifer contamination by the drilling operation and equipment, prevent intra- and inter-aquifer contamination, and prevent vertical seepage of surface water adjacent to the well into the subsurface, especially the well intake zone. Wells shall be installed in accordance with Pennsylvania Department of Conservation and Natural Resources, Drilling Water Wells, 17 Pa. Code §§47.

1.2 RELATED WORK (NOT USED)

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The RA Contractor shall submit the following items in accordance with the contract and the Performance Work Statement.

1.3.1 Decontamination Pad Design [FIO]

Design of the decontamination pad that will be installed and used under Paragraph 3.2 herein.

1.3.2 Boring Logs [FIO]

Borehole logs as described in Paragraph 1.9.1 herein.

1.3.3 Well Installation Diagrams [FIO]

Well installation diagrams as described in Paragraph 1.9.2 herein.

1.3.4 Well Development Records [FIO]

Well development records as described in Paragraph 1.9.3 herein.

1.3.5 Field Notebooks [FIO]

Field notebooks as described in Paragraph 1.9.4 herein.

1.3.6 Catalog Data [FIO]

Submit catalog data for permanent casing, bentonite/cement grout, surface protective covers, locking caps, and storage containers. Catalog data shall include any information, written or otherwise, supplied by the manufacturers or suppliers of the above listed items.

1.3.7 Qualifications [FIO]

Qualification documentation in accordance with Paragraph 1.5 herein.

1.3.8 Drilling Rig Inspection [FIO]

Supply rig inspection certificates prior to the start of onsite activities. The certificates shall indicate that the rigs are in acceptable working order and are capable of performing the work identified in this specification.

1.3.9 Permits and Licenses [FIO]

Copy of all permits, licenses, or other requirements necessary for execution of the work. Copies of all permits shall be furnished no later than 2 working days prior to mobilization.

1.3.10 Well Registration Permits [FIO]

Copy of the permits for the completed monitoring wells submitted to the State of Pennsylvania.

1.4 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Where reference is made to one of following references, the revision in effect at the time of bid opening shall apply.

ASTM INTERNATIONAL (ASTM)

ASTM C 150	Portland Cement Standards
ASTM D 420	Guide to Site Characterization for Engineering, Design, and Construction Purposes
ASTM D 1452	Practice for Soil Investigation and Sampling by Auger Borings
ASTM D 1889	Turbidity of Water
ASTM D 2487	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2488	Description and Identification of Soils (Visual-Manual Procedure)
ASTM D 5088	Decontamination of Field Equipment Used at Nonradioactive Waste Sites
ASTM D 5092	Standard Practice for Design and Installation of Ground Water Monitoring Wells in
	Aquifers

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 570/9-75-001	Manual of Water Well Construction Practices
EPA 600/4-79/020	Methods for Chemical Analysis of Water and Wastes

PENNSYLVANIA DEPARTMENT OF CONCERVATION AND NATURAL RESOURCES

32 P.S. §645.1 et. seq.	Water Well Driller License Act
17 Pa. Code §§47	Drilling Water Wells

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

1 LINING	TEVANIA DEI AKTMENT OF ENVIRONMENTALTROTECTION
25 Pa. Code §262.a	Standards Applicable to Generators of Hazardous Waste
25 Pa. Code §264.a	Owners and Operators of Hazardous Waste Treatment, Storage and Disposal
	Facilities
25 Pa. Code, VIII	Municipal Waste Handling
25 Pa. Code, IX	Residual Waste Handling

CHESTER COUNTY HEALTH DEPARTMENT

500 Code §501 Water Well Construction, Monitoring Wells, and Individual, Semi-Public and Public

Water Supplies, and Geothermal Boreholes

500 Code §504 Solid and Liquid Waste Management

1.5 OUALIFICATIONS

A geologist or engineer with the appropriate baccalaureate degree from an accredited university with at least 2 years of experience in hazardous waste projects, soil and rock logging, and groundwater monitoring well installation and testing shall be onsite and perform all borehole logging, drilling, well installation, well development activities, and testing activities.

1.6 REGULATORY REQUIREMENTS

1.6.1 Permits and Licenses

Local, state, or federal permits or licenses required to perform the work included in this Contract shall be obtained prior to commencing drilling and well installation operations.

1.6.2 Prepare and submit well registration permits to Chester County Health Department.

1.6.3 Statutes and Regulations

Conduct work required by this specification in strict compliance with applicable local, state, and federal regulations, statutes, and codes. Compliance shall be the responsibility of the RA Contractor and drilling subcontractor.

1.6.4 Groundwater and Drill Cuttings

Groundwater removed from the subsurface during drilling, development, and testing shall be disposed of in accordance with Paragraph 3.5 herein. Drill cuttings shall be disposed of in accordance with Paragraph 3.5 herein.

1.7 DELIVERY, STORAGE, AND HANDLING

Store and maintain well materials in a clean, uncontaminated condition throughout the course of the project.

1.8 SITE CONDITIONS, PROTECTION OF EXISTING FACILITIES, AND ENVIRONMENTAL PROTECTION

- 1.8.1 Access to the well installation sites, including any utility clearance, shall be the responsibility of the RA Contractor. The RA Contractor shall visit the proposed well locations to observe any condition that may hamper transporting equipment or personnel to the site. If clearing or relocation is necessary, the RA Contractor and the EPA shall agree on a suitable clearing or relocation plan and the location of any required access road.
- 1.8.2 Protect all surface and subsurface structures and surrounding areas from damage that may result from the methods employed in performing the work. The drilling subcontractor shall be responsible for any damages to such structures resulting from his operations. Damage to property shall be repaired or replaced to the existing condition at no additional cost to the Government. The RA Contractor and EPA shall have the right to approve these restoration measures.
- 1.8.3 Take all precautions as may be required to prevent contaminated water or water having undesirable physical or chemical characteristics from entering the water supply stratum through the well bore or by seepage from the ground surface. The drilling subcontractor shall also take all precautions necessary to

prevent contamination of the ground surface or of surface waters resulting from drilling of the test-hole or well.

1.9 DOCUMENTATION AND QUALITY CONTROL REPORTS

Establish and maintain documentation and quality control reports for well construction and development to record the required information and to assure compliance with contract requirements. In addition, all forms required by the State of Pennsylvania for installation of wells shall be completed by the drilling subcontractor and returned to the appropriate agency, as well as a copy provided to the RA Contractor and EPA. The well will not be accepted before the geologic logs and well installation diagrams are received and approved by EPA.

1.9.1 Borehole Logs

A borehole log shall be prepared and submitted for each boring drilled (test borings and well). A geologist or engineer meeting the qualifications listed in Paragraph 1.5 and present at the Site during drilling activities shall prepare borehole logs for all well drilling activities. The vertical scale shall be clearly indicated on the borehole logs. Copies of complete logs shall be kept current in the field at each well site and shall be available at all times for inspection by the EPA. Information provided on the logs shall include, but not be limited to, the following:

- 1.9.1.1 Name of the project and site.
- 1.9.1.2 Boring/well identification number.
- 1.9.1.3 Legal description of the location of the water well or test hole (coordinates, if available).
- 1.9.1.4 Make and manufacturer's model designation of drilling equipment and name of drilling firm.
- 1.9.1.5 Depth and diameter or dimension of constructed water well and test hole.
- 1.9.1.6 Diameter and depth or dimension of excavated hole if applicable.
- 1.9.1.7 Static water level. Provide and maintain at each well under construction a portable water-measuring device of sufficient length to measure the water level to 150-foot depth. The device shall be available at all times, and measuring wire shall be graduated in 0.01 foot. The method of measuring the liquid level shall be noted on the boring log. Water level measurements shall be taken to the nearest 0.01 foot.
- 1.9.1.8 Signature of drilling subcontractor.
- 1.9.1.9 Dates drilling commenced and construction completed.
- 1.9.1.10 Name, address, and signature of the owner.
- 1.9.1.11 Reference data for all depth measurements.
- 1.9.1.12 Name of driller and name and signature of geologist or engineer preparing log.
- 1.9.1.13 Method of drilling, including information such as rod size, bit type, pump type, etc. shall be recorded. Also include a description of any temporary casing used, drill fluids, and fluid additives used, if any, including brand name and amount used.
- 1.9.1.14 Depth of each change of stratum. If location of strata change is approximate, it should be so stated.

- 1.9.1.15 Description and depth of geologic materials encountered, in accordance with ASTM D 2488, and/or standard rock nomenclature, as necessary. Soil parameters for logging shall include, but not be limited to classification, depositional environment and formation, if known, Unified Soil Classification Symbol in accordance with ASTM D 2487, secondary components and estimated percentages, color, plasticity, consistency (cohesive soil), density (non-cohesive soil), moisture content, and grain angularity. Classification shall be prepared in the field at the time of sampling. The results of visual observation of the material encountered and any unusual odor detected shall also be duly noted and recorded.
- 1.9.1.16 Depth and estimated percent of drill fluid loss or lost circulation, if applicable to drilling method. Measures taken to regain drill water circulation. Significant color changes in the drilling fluid return.

1.9.2 Well Construction Diagrams

A well construction diagram shall be prepared and submitted for each installed well. Each diagram shall illustrate the as-built condition of the well and include, but not be limited to, the following items, as may be applicable to the well construction:

- 1.9.2.1 Name of the project and site.
- 1.9.2.2 Legal description of the location of the water well. Well location by coordinates. A plan sheet shall also be included showing the coordinate system used and the location of each well. A plan sheet is not required for each well installation diagram; multiple wells may be shown on the same sheet.
- 1.9.2.3 Make and manufacturer's model designation of drilling equipment and name of drilling firm.
- 1.9.2.4 Name of driller and name and signature of the geologist preparing diagram.
- 1.9.2.5 Well identification number and identification number for the water well issued by the State of Pennsylvania.
- 1.9.2.6 Intended use of water well.
- 1.9.2.7 Dates drilling commenced and construction completed.
- 1.9.2.8 Description and depth of geologic materials encountered including borehole logs prepared in accordance with Paragraph 1.9.1 herein.
- 1.9.2.9 Depth and diameter or dimension of constructed water well and test hole.
- 1.9.2.10 Diameter and depth or dimension of excavated hole, if applicable.
- 1.9.2.11 Description of material from which the well is constructed, including, as applicable, well casing/riser pipe and screen material and schedule; centralizer composition and location(s), if used; inside and outside diameters of casing and screen; screen slot size; brand name, size, and gradation of filter pack; source, processing method, and method of placement of the filter pack; bentonite seal type (pellets, granules, chips, or slurry), grout type (cement or high solids bentonite) and placement method; lithologic description; and type of protective cover.
- 1.9.2.12 Depth to top and bottom of screen and filter pack, method of filter pack placement, and quantity of filter pack material used.

- 1.9.2.13 Depth to top and bottom of any seals installed in the well boring (grout or bentonite), method of placement and quantities used.
- 1.9.2.14 Type of cement and/or bentonite used, mix ratios of grout, method of placement, and quantities used.
- 1.9.2.15 Elevations/depths/heights of key features of the well, such as top of casing/riser pipe, top and bottom of protective casing, ground surface, bottom of well screen, top and bottom of filter pack, and top and bottom of seal.
- 1.9.2.16 Other pertinent construction details, such as percent open area of screen, type of screen, and manufacturer of screen.
- 1.9.2.17 Description of surface completion.
- 1.9.2.18 Static water level upon completion of the well.
- 1.9.2.19 Special problems and their resolutions (e.g., grout in wells, lost casing, or screens, bridging, etc.)
- 1.9.2.20 All sieve analyses and calculations used in gravel pack and screen design.
- 1.9.2.21 Signature of water well installation subcontractor.
- 1.9.2.22 Name, address, and license number of any driller/contractor licensed in accordance with the Pennsylvania Water Well Driller License Act of any person who constructed the water well.
- 1.9.3 Well Development Records

A well development record for each well installed under the supervision of the qualified representative present during well installation operations shall be prepared and submitted. Information provided on the well development record shall include, but not be limited to, the following:

- 1.9.3.1 Date, time, and elevation of water level in the well before development.
- 1.9.3.2 Depth to bottom of well, name of project and site, well identification number, and date of development.
- 1.9.3.3 Method used for development, to include size, type, and make of equipment, bailer, and/or pump used during development.
- 1.9.3.4 Time spent developing the well by each method, to include typical pumping rate, if pump is used in development.
- 1.9.3.5 Volume and physical character of water removed, to include changes during development in clarity, color, particulates, and odor.
- 1.9.3.6 Volume of water added to the well, if any.
- 1.9.3.7 Volume and physical character of sediment removed, to include changes during development in color and odor.
- 1.9.3.8 Source of any water added to the well.

- 1.9.3.9 Total depth of well and the static water level from top of the casing immediately after pumping/development and 24 consecutive hourly readings after development.
- 1.9.3.10 Readings of pH, conductivity, temperature, and turbidity taken before, during, and after development.
- 1.9.3.11 Name and qualifications of individual developing well.
- 1.9.3.12 Name and/or description of the disposal facility/area, for the waters removed during development.

1.9.4 Field Notebook

The qualified representative present shall keep a field notebook. The notebook shall have pre-numbered pages, be permanently bound, and have a waterproof cover. Information shall include, but not be limited to, the following:

- 1.9.4.1 Date and personnel present
- 1.9.4.2 Visitors to the site
- 1.9.4.3 Activities performed
- 1.9.4.4 Quantities of materials used
- 1.9.4.5 Any chemical sampling information
- 1.9.4.6 Weather conditions
- 1.9.4.7 Any problems encountered and their resolution
- 1.9.4.8 Any change in procedure, process, and the material used

PART 2 – PRODUCTS

2.1 WELL CASING

The well casings shall consist of new threaded steel casing. All pipes shall have a minimum ID of 4 inches.

2.2 CENTRALIZERS

Wells will be open in the bedrock and therefore there is no need for centralizers.

2.3 WELL SCREENS

Wells will be open in the bedrock and therefore without screens.

2.4 CEMENT AND BENTONITE GROUT

- 2.4.1 Grout used to fill the annular space of the borehole from bedrock up to the ground surface around the steel casing shall be proportioned of Type II Portland cement mixed with 3 to 4 percent (by volume) of pure bentonite. The following mixture is suggested:
 - One 94-pound bag of Type II Portland cement
 - 2.5 pounds of bentonite
 - 6 gallons potable water

2.4.2 The bentonite shall have a free flowing consistency to facilitate its transport into the borehole. The grout shall be pumped into the borehole through a tremmie pipe or a pressure grouting method will be employed. All necessary provisions shall be made by the drilling subontractor to ensure that the inside of the riser remains free of grout.

The drilling subcontractor may, at his discretion, use ready-made truck mix to seal the annulus providing the approximate component mixture is maintained. The grout shall be allowed to set a minimum of 48 hours prior to development of the well.

2.5 SURFACE COMPLETION

Surface completions shall be as detailed in Paragraph 3.3.6 herein.

2.6 LUBRICANTS

Tool joint lubricants used during drilling operations shall contain no petroleum products.

2.7 WATER

Potable water is available within the Groundwater Extraction and Treatment System (GETS) building located onsite.

PART 3 - EXECUTION

3.1 PROTECTION OF EXISTING CONDITIONS

The RA Contractor shall maintain existing survey monuments, piezometers, and wells and protect them from damage from equipment and vehicular traffic. The RA Contractor shall repair any items damaged by the RA Contractor. The drilling subcontractor shall repair any items damaged by the drilling subcontractor. Prior to starting site preparation work for the construction of the monitoring wells, the RA Contractor shall obtain utility clearances as specified by the Remedial Design Report.

3.2 DECONTAMINATION

- 3.2.1 A decontamination pad shall be constructed at the site where the drill rig, drill rods, drill bits, temporary casing, permanent casing (if required), well developing equipment, tremie pipes, grout pumping lines, and other associated equipment shall be cleaned with high-pressure hot water/steam prior to drilling.
- 3.2.2 All drilling equipment and materials including drill bits, rods, tremmie pipe, casings, screens, and sampling equipment shall be steam-cleaned and void of any external oils or greases prior to use in boring and well installation activities. Flush all contact equipment, including pumps and hoses with water before each use and as directed during the program. Containerize all fluids as details in Paragraph 3.5.
- 3.2.3 All materials and equipment (bits, rods, screens, casings, etc.) that will be inserted in the drilled boreholes shall be steam cleaned prior to use. Casings and screens shall be pre-cleaned and factory-wrapped, as well as steam cleaned, to ensure cleanliness.
- 3.2.4 All sampling equipment shall be either steam-cleaned (large equipment) or cleaned with phosphate-free detergent using the following decontamination procedures (smaller sampling equipment):
 - Wash and scrub with detergent (i.e., Alconox)
 - Tap water rinse
 - Demonstrated analyte-free water rinse
 - Air dry
 - Wrap in clean aluminum foil for transport

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- 3.2.5 All cleaning equipment shall be provided by the drilling subcontractor.
- 3.2.6 All potable water to be used in the drilling operation is available onsite. All decontamination fluids generated shall be containerized in drums provided by the drilling subcontractor. Transport of all water to and from the decontamination pad and well sites shall be the responsibility of the drilling subcontractor.
- 3.2.7 The equipment shall also be cleaned after the last hole/well is drilled. Decontamination shall be conducted in accordance with ASTM D 5088. Decontamination shall be performed at a central decontamination station. Screen and well casing shall be cleaned with high-pressure hot water/steam immediately prior to installation in the well. The water used for cleaning shall be in accordance with Paragraph 2.7 herein.
- 3.2.8 Decontaminate all sampling devices (e.g., split-spoons, split-barrel samplers, etc.) before being used at each sample interval. Decontaminate the samplers using high-pressure hot water/steam at the decontamination pad or with a nonphosphate detergent wash and a potable water rinse at the drilling location.

3.3 WELL INSTALLATION

- 3.3.1 Install wells utilizing air rotary drilling techniques. Proposed well locations are identified on Figure 3.1 of the Remedial Design Report.
- 3.3.2 A 6-inch boring shall be drilled and keyed into bedrock, which is estimated to range between 10 to 50 ft bgs.
- 3.3.3 Four-inch steel casing shall be installed 10 ft into competent bedrock and will extend approximately 3 ft above ground surface.
- 3.3.4 Seal the annulus casing bottom to grade with cement/bentonite grout installed by the tremmie method in a continuous motion. The casing will be grouted in place and allowed to cure for a minimum of 12 hours.
- 3.3.5 After the grout has cured, a 4-inch borehole shall be advanced to depths specified in Table 3.1 of the Remedial Design Report.
- 3.3.6 The surface of the well shall be completed utilizing the 4-inch steel casing as the monument, rising 3 ft above ground surface. A 4-inch Royer's 2-piece aluminum locking well cap will be installed on the top of the casing. The RA Contractor will provide the locks. A 2-foot by 2-foot by 6-inch thick square concrete pad (Sakrete concrete mix or similar) shall be constructed around the well. The concrete pads shall extend approximately 2 to 3 inches below grade. The concrete pads shall slope away from the outside of the manhole cover to facilitate runoff away from the well.
- 3.3.7 Should a well be located in an area that a flush mount is required, the 4-inch steel casing shall be cut approximately 3 to 4 inches below the ground surface and an 8-inch diameter flush mount monument with a 12-inch skirt shall be installed over the casing. The monument shall meet AASHTO H-20 roadway loading requirements. The monument shall be set into concrete around the top of the riser and a 2-ft diameter concrete pad placed around the cover. Each well casing shall be fitted with an expandable rubber seal locking cap (J-plug). The RA Contractor shall provide weather-resistant locks and provide extra keys to the EPA. All locks shall be keyed alike.

3.4 WELL DEVELOPMENT

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- 3.4.1 Newly installed wells shall be developed within 1 week of the well being constructed but no sooner than 48 hours after annular space grouting is complete. The drilling subcontractor shall be responsible for carrying out well development. All surge blocks, pumps, discharge lines, and equipment shall be properly decontaminated in accordance with Paragraph 3.2 before being used at each well location.
- 3.4.2 All wells shall be developed by alternately surging and pumping the well. Surging will be accomplished with a surge block attached to a ¾-inch polyvinyl chloride (PVC) or equivalent pipe. Submersible pumps shall be used to pump or purge the wells. Purging shall continue until all formation cuttings have been removed from the well and water quality parameters have stabilized.
- 3.4.3 Periodic measurements of pH, conductivity, temperature, and turbidity shall be taken during development. Parameters are considered stable when three consecutive readings, taken 3 to 5 minutes apart, have stabilized within plus or minus (±) 10%, as follows:
- less than ± 1 degree Celsius (°C) for temperature,
- 0.10 pH units,
- ±5 percent (%) for specific conductance,
- less than or equal to 50 nephelometric turbidity units.
- no visual sediment in development water.

The main purpose of well development is to develop the well until the water is clear and free of fines. It is assumed a maximum of six well casing volumes will be purged from the well, but pumping shall not exceed 6 hours. Upon completion of well development, water shall be collected in a clear glass jar and photographed for documentation.

3.4.4 Purge water generated during development may be temporarily containerized in tanks on site. At each well, the development water shall be containerized in a portable tank (typical 250 gallon pickup truck-mounted polyethylene tank) and/or drums. The water will then be transported and pumped into a larger tank (typical 5,000 gallon tank) next to GETS building for decanting. The drilling subcontractor shall be responsible for transporting all water from the well site to the GETS area. The drilling subcontractor shall be responsible for pumping the development water from the portable tank and/or drums into the larger storage tank. The drilling subcontractor shall provide all equipment and supplies necessary to transfer the development water to the larger tanks. This includes, but is not limited to, pumps, hoses, fittings, and fuel.

3.5 INVESTIGATION-DERIVED WASTE

- 3.5.1 Investigation-derived waste (IDW) will consist of drill cuttings, development groundwater, decontamination liquids, and disposable protective clothing. The drilling subcontractor shall properly containerize and store all IDW onsite in accordance with the SAP (Appendix D of the Remedial Design).
- 3.5.2 The Contractor shall be responsible for transporting the drill cuttings from the drill site to the temporary storage location, as directed by the project geologist. The Contractor shall be responsible for providing 55-gallon drums for transport. In the event that grossly contaminated material is encountered, based upon appearance and PID readings, this material shall be containerized in separate 55-gallon drums.
- 3.5.3 Drilling fluids, decontamination and development water shall be containerized in portable polyethylene tanks (provided by the drilling subcontractor) or 55-gallon drums and transferred to larger polyethylene tanks at next to GETS building to allow for settling and subsequent decanting. The drilling subcontractor shall provide all equipment necessary to transport and transfer waste to the GETS building. Contents of the tank will be transferred to the equalization tank in the GETS building and then treated by the GETS.

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3.5.4 Nonhazardous trash such as used paper towels, cement sacks, and papers may be disposed of as municipal solid waste.

3.6 SURVEYS

The RA Contractor will be responsible for surveying in all newly installed wells. The northing and easting coordinates will be surveyed in Pennsylvania State Plane north (North American Datum 1983) coordinate system to an accuracy of plus or minus 0.10 ft. The elevation of the well will be surveyed using National Geodetic Vertical Datum (NGVD) 1929 to an accuracy of plus or minus 0.01 ft. Two elevation measurements will be surveyed, one representative of ground level immediately north of the well's concrete pad and one at the top of the steel casing.

3.7 WELL ACCEPTANCE

It is the responsibility of the drilling subcontractor to properly construct, install, and develop the well according to the requirements of this specification so that it is suitable for the intended purpose. If the drilling subcontractor installs a well that is not functional or not in accordance with these specifications, the RA Contractor will disapprove the well and direct the drilling subcontractor to repair or replace it at no additional cost and to abandon the disapproved well.

Remedial Design references include:

- 1. Table 3.1, Injection Well Construction Specifications
- 2. Figure 2.2, Potentiometric Contours for Shallow Bedrock Wells, April 2018
- 3. Figure 2.3, Potentiometric Contours for Intermediate and Deep Bedrock Wells, April 2018
- 4. Figure 3.1, Proposed Locations for New Monitoring/Injection Wells and Amendments
- 5. Appendix D, Sampling and Analysis Plan

END OF SECTION

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SECTION 02 52 20

CHEMICAL OXIDANT AND BIOREMEDIATION APPLICATIONS

PART 1 – GENERAL

1.1 SCOPE OF WORK

Furnish all labor, materials, equipment and other facilities and incidentals required to implement in situ chemical oxidation (ISCO) and in situ bioremediation (ISBR) to the subsurface by the methods specified herein at the AIW Frank/Mid-County Mustang Superfund Site, Chester County, PA (Site).

- 1.1.1 Construct an injection system that is capable of delivering chemical oxidant and bioremediation solution at high pressure, low pressure, and gravity. The injection system shall include, at a minimum: pump(s), mixing tank(s), motorized mechanical mixer(s), flow meters, pressure gauges, control valves, and interconnecting piping and hoses.
- 1.1.2 Apply ISCO and ISBR chemicals to select wells as specified on the Remedial Design figures and tables and as summarized herein. It is anticipated that there will be two ISCO applications followed by two ISBR applications. Well injection locations are subject to change and additional injections may be performed at the discretion of the RA Contractor and EPA based on results from the post-injection sampling events. Costs related to injections beyond the two ISCO and two ISBR injections will be paid for at the same unit rates as scoped injections.
- 1.1.3 Conduct groundwater monitoring at the Site 6 months and 12 months after each ISCO application. Groundwater monitoring results shall be used to verify the proposed injection locations and volumes are performing as designed. Monitoring results also will be used to propose revised injection locations and/or volumes, as needed.
- 1.1.4 Conduct groundwater monitoring at the Site 6 months and 12 months after the each ISBR application. Groundwater monitoring results shall be used to verify the proposed injection locations and volumes are performing as designed. Monitoring results also will be used to propose revised injection locations and/or volumes, if needed.
- 1.1.5 Acquire all necessary approvals, permits, and registrations, and keep appropriate records of all injection activities. The RA Contractor shall supply these records upon request to the EPA.

1.2 RELATED WORK

Groundwater monitoring requirements are specified in the Sampling and Analysis Plan (SAP), (Appendix D of the Remedial Design Document for the Site).

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The RA Contractor shall submit the following items in accordance with the contract and the Performance Work Statement.

- 1.3.1 Chemical Oxidant and Bioremediation Substrate Information [FIO] The Contractor shall submit applicable chemical oxidant and bioremediation substrate manufacturer's information to RA Contractor prior to use.
- 1.3.2 Chemical Oxidant and Bioremediation Application Completion Reports [FIO] The RA Contractor shall prepare an injection completion report after completing each application two ISCO and two ISBR applications. The chemical injection completion reports shall include a discussion of the equipment used, number of injection points completed, figure(s) showing actual surveyed injection locations, injectant solution composition and gallons of injected at each point, injection flow rates, injection pressures, and any design or contract deviations and an explanation for each design or contract deviation.

1.4 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Where reference is made to one of the below standards, the revision in effect at the time of bid opening shall apply.

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910 Occupational Safety and Health Standards

PENNSYLVANIA DEPARTMENT OF CONCERVATION AND NATURAL RESOURCES

32 P.S. §645.1 et. seq. Water Well Driller License Act 17 Pa. Code §§47 Drilling Water Wells

- 1.5 QUALITY ASSURANCE (NOT USED)
- 1.6 DELIVERY, STORAGE, AND HANDLING
- 1.6.1 The chemical oxidant, sodium persulfate (Na2S2O8) (PeroxyChem brand buffered sodium persulfate with a trade name of Klozur®) shall be shipped and delivered directly to the Site as a dry powder in either 55 lb bags or 225-pound drums. The sodium persulfate will be stored at the Site inside the treatment system building to be protected from the elements prior to use. The sodium persulfate shall only be handled by personnel who have had persulfate safety training. The RA Contractor will be responsible for purchasing the sodium persulfate.
- 1.6.2 The bioremediation substrate to be used, Anaerobic BioChemTM (ABCTM), developed by Redox Tech, LLC, shall be shipped and delivered directly to the Site as a liquid (i.e., viscosity of milk) in 300-gallon poly tanks. The ABC shall be stored at the Site inside the treatment system building, or outside within the existing fenced area, at a location where vehicular damage to the tanks is unlikely. The RA Contractor will be responsible for purchasing the ABC.
- 1.7 WARRANTY (NOT USED)
- 1.8 DEFINITIONS (NOT USED)

PART 2 – PRODUCTS

2.1 WATER SUPPLY

- 2.1.1 Any water used in producing the chemical oxidant and bioremediation solutions and used for decontamination of injection equipment shall either be pumped from one or more of the existing wells on Site and/or hauled in from an off-site potable water source. Transport and storage of all water shall be the responsibility of the subcontractor.
- 2.1.2 A flow meter and backflow preventer shall be used to record water use from the off-Site source, if used, and prevent inadvertent addition of foreign material to the off-Site water supply. The subcontractor shall be responsible for providing the flow meter and backflow preventor.

2.2 CHEMICAL OXIDANT AND BIOREMEDIATION SUBSTRATE

- 2.2.1 The chemical oxidant to be used shall be sodium persulfate ($Na_2S_2O_8$) (PeroxyChem brand buffered sodium persulfate with a trade name of Klozur®). The RA Contractor shall be responsible for the purchase of the sodium persulfate.
- 2.2.2 The bioremediation substrate to be used is a proprietary substrate, ABC^T, developed by Redox Tech, LLC. The RA Contractor shall be responsible for the purchase of the ABC.

2.3 EQUIPMENT

2.3.1 CHEMICAL OXIDANT INJECTIONS

- 2.3.1.1 For the low/high-pressure injections, the delivery system shall consist of a poly tank, a transfer pump, distribution hoses, and fittings to connect to each injection point. 4-ft inflatable straddle packers and stainless steel manifold equipped with digital flow meters and pressure gauges at both the manifold and well head connection shall be used. A positive displacement booster pump with persulfate-compatible ethylene propylene diene monomer seals (or equivalent) that has a capacity to inject at up to 50 gpm shall be used. All pressurized lines shall be equipped with pressure gauges, flow meters, associated shut-off valves and safety features.
- 2.3.1.2 An alternative to the low/high pressure injection shall be to gravity feed the sodium persulfate solution into the well(s). In this case, equipment shall include a poly tank, a temporary riser attached to the top of the well, a water-tight Fernco rubber fitting, and distribution hoses.
- 2.3.1.3 All equipment surfaces that come into contact with the sodium persulfate solution shall be constructed of materials compatible with the sodium persulfate solution, as the solution is highly corrosive and will damage common materials like carbon steel.

2.3.2 BIOREMEDIATION INJECTIONS

2.3.2.1 For the low/high-pressure injections, the delivery system shall consist of a poly tank, a transfer pump, distribution hoses, and fittings to connect to each injection point. 4-ft inflatable straddle packers and stainless steel manifold equipped with digital flow meters and pressure gauges at both the manifold and well head connection shall be used. A positive displacement booster pump (or equivalent) that has a capacity to inject at up to 50 gpm shall be used. All pressurized lines shall be equipped with pressure gauges, flow meters, associated shut-off valves and safety features.

- 2.3.2.2 An alternative to the low/high-pressure injection shall be to gravity feed the ABC solution into the well(s). In this case, equipment shall include a poly tank, a temporary riser attached to the top of the well, a water-tight Fernco rubber fitting, and distribution hoses.
- 2.3.2.3 Although the ABC solution injection procedures under both high and low pressures are essentially the same as those described for the sodium persulfate injections, the ABC solution is much safer to handle and will not react with the pumps or well materials.
- 2.3.3 Each delivery line shall have a separate flow meter and pressure gauge so that each injection point can be monitored.
- 2.3.4 Power to operate the injection system shall be supplied by a generator to be supplied by the subcontractor.

2.4 CHEMICAL OXIDANT NEUTRALIZATION SOLUTION

2.4.1 The subcontractor shall provide a neutralization solution for use during all chemical mixing and chemical injection activities. The neutralization solution shall be prepared in accordance with the manufacturer's recommendations for the chemical oxidant being used. This solution shall be used to neutralize chemical oxidant spills.

PART 3 – EXECUTION

3.1 GENERAL

- 3.1.1 Field personnel shall take precautions while working with the chemical oxidant and bioremediation substrate by working upwind of the product and wearing the appropriate personal protective equipment (PPE). PPE will be supplied by the subcontractor for their employees. Safety Data Sheets for the chemical oxidant and bioremediation substrate shall be kept at the Contractor's field office for reference. Personnel operating field equipment used during the application process shall have the appropriate training, supervision, and experience. The field leader from the injection subcontractor shall have a minimum of 5 years' experience with similar injection work.
- 3.1.2 The RAContractor shall measure groundwater elevations and chemical conditions, to establish the baseline conditions prior to injection in accordance with the sampling procedures and schedule outlined in the SAP (Appendix D of the Remedial Design).
- 3.1.3 Upon completion of the system set-up, the system shall be tested for leaks and the instrumentation checked prior to beginning the injection by the subcontractor. The subcontractor shall be responsible for maintaining, testing, and operating all injection equipment.
- 3.1.4 The subcontractor shall provide instrumentation to monitor and measure pressure and flow rates at each injection point. Record totalizer readings from all mechanical flow meters and pressure gauges at 5 minute intervals. Note which meters connect to which injection points, and put temporary labels at all meters that correspond to the injection point identifiers.
- 3.1.5 Subcontractor shall use a motorized mechanical mixer to continuously mix the chemical oxidant solution and bioremediation substrate during preparation and application.

- 3.1.6 All connections shall be leak tight and the minimum number of connections shall be used. Perform inspections of all above ground piping associated with the injection system twice daily at a minimum. Inspections shall be performed by the subcontractor to ensure that the system is functioning correctly and there are no visible leaks. If a problem is found (e.g., hose leak, etc.), the subcontractor shall make repairs as soon as possible. The subcontractor shall have a ready supply of fittings on site to reduce down time during repairs.
- 3.1.7 Prevent spillage or leakage of chemicals by using appropriate operational practices. In the event of a leak, the subcontractor shall implement spill control and countermeasures in accordance with an approved spill prevention and control plan that will be submitted by the subcontractor to the RA Contractor prior to mobilization.
- 3.1.8 Subcontractor may inject clean water after the required volume of solution has been delivered to clear the injection lines and enhance dispersion from the injection line or injection point. The subcontractor shall note volume of clean water injected.

3.2 DECONTAMINATION

- 3.2.1 Subcontractor shall construct a decontamination pad at the Site where the injection equipment shall be cleaned with high-pressure hot water/steam prior to injection activities commencing. The pad shall be lined with polyethylene sheeting and have sides and a bottom to contain generated wash water. All sides of the pad shall be bermed to prevent water from running off the pad. The pad shall also contain a sump to allow the water to pool so it can be pumped out of the containment structure into a polyethylene storage tank.
- 3.2.2 All injection equipment shall be decontaminated before use by the subcontractor. All equipment and materials including accessory and injection tools shall be steam-cleaned and void of any external oils or greases prior to use. All contact equipment including pumps, hoses, and extension rods shall be steam cleaned before each use. The subcontractor shall containerize all fluids.
- 3.2.3 All downhole equipment shall be either steam-cleaned (large equipment) or cleaned with Alconox or Liquinox detergent using the following decontamination procedures (smaller sampling equipment) by the subcontractor:
 - Wash and scrub with detergent (i.e., Alconox or Liquinox)
 - Tap water rinse
 - Demonstrated analyte-free water rinse
 - Air dry
 - Wrap in clean aluminum foil for transport
- 3.2.4 Subcontractor shall clean the equipment after the last injection. The water used for cleaning shall be in accordance with Paragraph 2.1 herein.
- 3.2.5 Subcontractor shall pump, or transfer by other means, water from the decontamination pad into the tank. The subcontractor shall be responsible for removing the decontamination pad and properly disposing of associated materials upon conclusion of chemical oxidant injection activities.
- 3.2.6 Water from the decontamination pad shall be considered investigation-derived waste (IDW). The subcontractor shall properly containerize and store all IDW onsite in accordance with the SAP (Appendix D of the Remedial Design). Nonhazardous trash such as used PPE, paper towels, containers for supplies, and papers may be disposed of as municipal solid waste by the subcontractor.

3.3 CHEMICAL OXIDANT INJECTION

- 3.3.1 The subcontractor shall conduct two rounds of sodium persulfate injections at the wells listed on Table 4.1 of the Remedial Design. The locations of these wells are shown on Figure 3.1 of the Remedial Design. The second round of injections shall be conducted approximately 18 months after the first round and after results from the post-injection sampling events have been evaluated. Should results from the performance sampling indicate that RGs have been achieved the second round of injections may not me required. The Contractor and EPA will make the determination if another injection will be required. Well injection locations are subject to change based on groundwater monitoring as described in Paragraph 1.1.2 herein.
- 3.3.2 The subcontractor shall be responsible for preparing the sodium persulfate solution, installing the injection equipment to the wells, and injecting the solution into the groundwater as specified herein. The sodium persulfate solution shall not be mixed more than 1 hour before injection and should continue to be mixed during the injection. Volume of injection may require mixing more than one batch to meet the requirements of Table 4.1 of the Remedial Design.

Field personnel shall set up a temporary mixing system to produce a solution of sodium persulfate by mixing the sodium persulfate powder with water. The sodium persulfate concentration shall be 20% by weight (200 grams per liter [gr/L]) and shall be activated with sodium hydroxide (NaOH). To ensure that there is sufficient iron to catalyze the reaction iron ethylenediaminetetraacetate (FeEDTA) shall be introduced at 100 milligrams per liter (mg/L).

The concentration of the buffered sodium persulfate solution to be injected shall be 20% by weight (200 gr/L or 0.44 lbs/L), 0.36 lbs of 25 wt% NaOH per lb of sodium persulfate, and FeEDTA at a concentration at 100 mg/L. Each gallon of water shall have the following constituent concentrations:

Sodium persulfate = 1.7 lbs/gal 25 wt% NaOH = 0.61 lbs/gal FeEDTA = 0.0008327 lbs/gal

- 3.3.3 The injection procedure shall involve batch-mixing the sodium persulfate solution in 300-gallon poly tanks. Water for the injection shall either be pumped from one or more of the existing wells on Site and/or hauled from an off-site potable source in accordance with Paragraph 2.1. When thoroughly mixed, the delivery system shall transfer the sodium persulfate solution from the mixing tank and deliver it to the appropriate injection well(s). The delivery system shall consist of a transfer pump, distribution hoses, and fittings to connect to each injection well.
- 3.3.4 Apply the volume of sodium persulfate solution per well according to Table 4.1 of the Remedial Design. The sodium persulfate shall be injected at the downgradient and cross-gradient wells first, thereby establishing a reactive zone around the treatment area. The upgradient injections shall then be conducted. The persulfate solution shall be injected under high pressures into wells that are completed as open boreholes and at low pressures and/or by gravity into wells constructed with screens.
- 3.3.5 The persulfate solution shall be injected under high pressures by the subcontractor into wells that are completed as open boreholes.
- 3.3.5.1 For the low/high-pressure injections, 4-ft inflatable straddle packers shall be installed by the subcontractor inside the borehole to isolate the appropriate injection interval and inflated to a pressure of

approximately 2,000 pounds per square inch (psi). The sodium persulfate solution shall be injected through a stainless steel manifold equipped with digital flow meters and pressure gauges at both the manifold and well head connection. A positive displacement pump (or equivalent) with persulfate-compatible ethylene propylene diene monomer seals that have a capacity to inject at up to 50 gpm shall be used. All pressurized lines shall be equipped with pressure gauges, flow meters, associated shut-off valves and safety features.

- 3.3.5.2 To maintain uniform mixing, the solution shall be recirculated back with a transfer pump to the mixing tanks and then bled off at the required rate to ensure injection pressure limits are not exceeded. The injection pressures are expected to range between 300 to 400 psi and occasionally as high as 1500 psi. The injection rig shall have automatic shutoff capabilities, should there be a leak. Flow rates shall be highly variable between wells and shall likely range between 5 to 50 gpm.
- 3.3.5.3 As injection proceeds, water levels shall be monitored every two hours in nearby monitoring/injection wells to check for increases in water levels.
- 3.3.5.4 Upon injecting the required volume specified in Table 4.1 of the Remedial Design, the pressure created by injection shall be allowed to dissipate and the borehole shall be flushed with water. The amount of chase water shall be the same volume held by the well bore across the injection interval.
- 3.3.5.5 If the open borehole well and associated bedrock does not accept the sodium persulfate solution at the planned injection rate (due to limited permeability), the injection shall be suspended for 10 to 15 minutes and then restarted. If difficulties with the injection continue, the injection shall be attempted under low pressures following the procedures outlined in Paragraph 3.3.6.
- 3.3.6 The sodium persulfate solution shall be injected by gravity into wells.
- 3.3.6.1 A temporary riser shall be attached to the top of the well with a water-tight Fernco rubber fitting by the subcontractor. The riser shall be extended several feet above the liquid level of the mixing tank. A hose shall be connected at the bottom of the poly tank (or larger holding tank) and a siphon will be created prior to placing the other end down the well. The expected gravity feed rate is approximately 1 to 2 gpm. The holding tank shall be filled as needed throughout the work day. Before moving to a new location, the borehole shall be flushed with the same volume held by the total well bore.

3.4 BIOREMEDIATION INJECTION

- 3.4.1 The subcontractor shall conduct two rounds of bioremediation substrate (ABC) injections at the wells listed on Table 4.2 of the Remedial Design. The locations of these wells are shown on Figure 3.1 of the Remedial Design. ABC injections shall be conducted after the sodium persulfate remediation is complete and 1,4,-dioxane meets its RG (6.4 µg/L), which is expected to be approximately 24 months after the second application of sodium persulfate. The bioremediation substrate injections shall promote microbial reductive dechlorination to remediate the remaining COC's. The second round of injections shall be conducted approximately 18 months after the first round of injection and after monitoring results have been evaluated. Should results from the performance sampling indicate that RGs have been achieved the second round of injections may not me required. The Contractor and EPA will make the determination if another injection will be required. Well injection locations are subject to change based on groundwater monitoring as described in Paragraph 1.1.2 herein.
- 3.4.2 The subcontractor shall be responsible for preparing the ABC solution, installing the injection equipment to the wells, and injecting the solution into the groundwater as specified herein. The ABC solution shall not be mixed more than 1 hour before injection and should continue to be mixed during the

injection. Volume of injection may require mixing more than one batch to meet the requirements of Table 4.2 of the Remedial Design.

- 3.4.3 The subcontractor Field personnel shall set up a temporary mixing system to produce the ABC solution by mixing the ABC with water. Each gallon of water shall be mixed with approximately 2 lbs (0.25 gal) of ABC. The injection procedure shall involve batch-mixing with water in 300-gallon poly tanks. Water for the injection shall either be pumped from one or more of the existing wells on Site and/or hauled in from an off-Site source. When thoroughly mixed, a temporary delivery system shall be used to transfer the ABC solution from the holding tank and deliver it to the appropriate injection well(s). The delivery system shall consist of a transfer pump, distribution hoses, and fittings to connect to each injection well(s).
- 3.4.4 The subcontractor shall apply the volume of ABC solution per well according to Table 4.2 of the Remedial Design. The ABC solution shall be injected at the downgradient and cross-gradient wells first, thereby establishing a reactive zone around the treatment area. The upgradient injections shall then be conducted. The ABC solution shall be injected under low/high pressures into wells that are completed as open boreholes.
- 3.4.5 The ABC solution shall be injected under low/high pressures by the subcontractor into wells that are completed as open boreholes.
- 3.4.5.1 For the low/high-pressure injections, 4-ft inflatable straddle packers shall be installed by the subcontractor inside the borehole to isolate the appropriate injection interval and inflated to a pressure of approximately 2,000 pounds per square inch (psi). The ABC solution shall be injected through a stainless steel manifold equipped with digital flow meters and pressure gauges at both the manifold and well head connection. A positive displacement booster pump (or equivalent) shall be attached to the injection rig. All pressurized lines shall be equipped with pressure gauges, flow meters, associated shut-off valves and safety features.
- 3.4.5.2 To maintain constant flow to the injection well, the ABC solution shall be recirculated back to the mixing tanks and then bled off at the required rate to ensure injection pressure limits are not exceeded. The injection pressures are expected to range between 300 to 400 psi and occasionally as high as 1500 psi. Flow rates shall be highly variable between wells and shall likely range between 5 to 50 gpm.
- 3.4.5.3 As injection proceeds, water levels shall be monitored every two hours by the RA contractor in nearby monitoring/injection wells to check for increases in water levels.
- 3.4.5.4 Upon injecting the required volume specified in Table 4.2 of the Remedial Design, the pressure created by injection shall be allowed to dissipate and the borehole shall be flushed with water by the subcontractor. The amount of chase water shall be the same volume held by the well bore across the injection interval.
- 3.4.5.5 If the open borehole well and associated bedrock does not accept the ABC solution at the planned injection rate (due to limited permeability), the injection shall be suspended for 10 to 15 minutes and then restarted. If difficulties with the injection continue, the injection shall be attempted under low pressures following the procedures outlined in Paragraph 3.4.6.
- 3.4.6 The ABC solution shall be injected by gravity into wells.
- 3.4.6.1 A temporary riser shall be attached to the top of the well with a water-tight Fernco rubber fitting by the subcontractor. The riser shall be extended several feet above the liquid level of the mixing tank. A

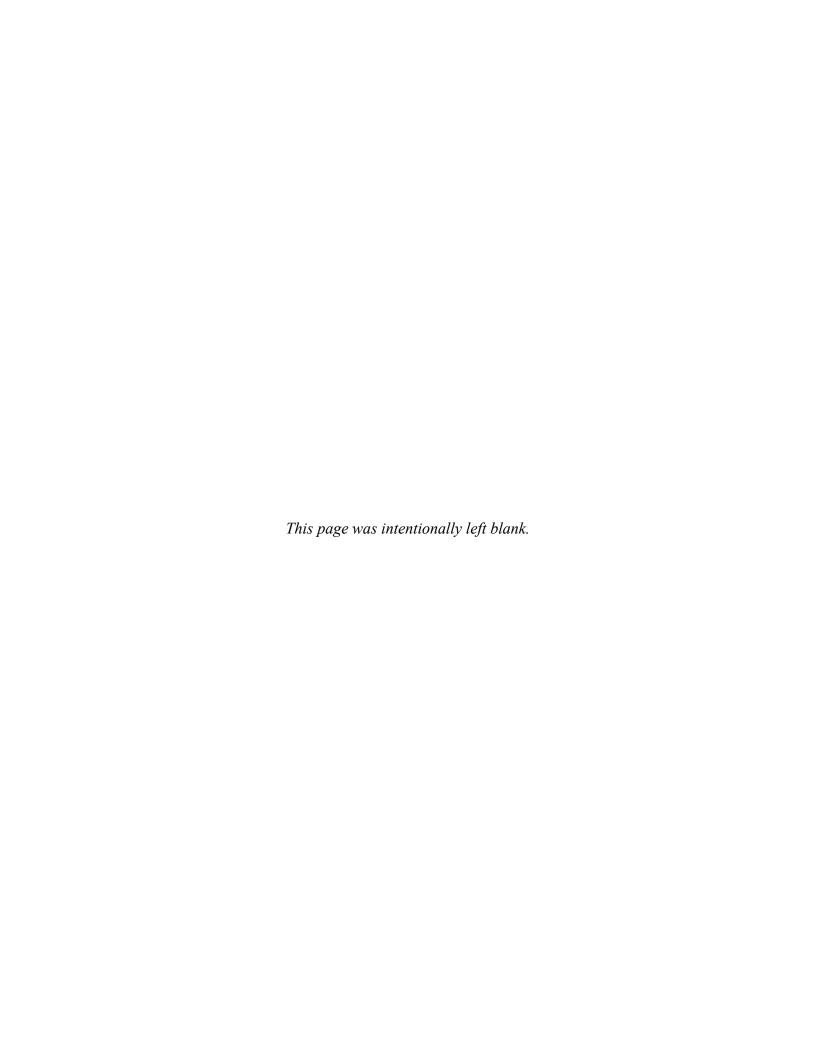
hose shall be connected at the bottom of the poly tank (or larger holding tank) and a siphon will be created prior to placing the other end down the well. The expected gravity feed rate is approximately 1 to 2 gpm. The holding tank shall be filled as needed throughout the work day. Before moving to a new location, the borehole shall be flushed with the same volume held by the total well bore.

Remedial Design references include:

- 1. Remedial Design Report
- 2. Table 3.1, Injection Well Construction Specifications
- 3. Table 4.1, Sodium Persulfate Injection Specifications
- 4. Table 4.2, ABC Injection Specifications
- 5. Figure 3.1, Proposed Locations for New Monitoring/Injection Wells and Amendments
- 6. Appendix D, Sampling and Analysis Plan

END OF SECTION

APPENDIX D SAMPLING AND ANALYSIS PLAN



REMEDIAL ACTION SAMPLING AND ANALYSIS PLAN AIW FRANK/MID-COUNTY MUSTANG SUPERFUND SITE OPERABLE UNIT 1 CHESTER COUNTY, PENNSYLVANIA

Prepared for:



U.S. Environmental Protection Agency Region 3 1650 Arch Street Philadelphia, PA 19103

> EPA Contract EP-S3-07-05 Work Assignment 070RDRD032S

> > September 2018



REMEDIAL ACTION SAMPLING AND ANALYSIS PLAN AIW FRANK/MID-COUNTY MUSTANG SUPERFUND SITE OPERABLE UNIT 1 CHESTER COUNTY, PENNSYLVANIA

Prepared for:

U.S. Environmental Protection Agency Region 3 1650 Arch Street Philadelphia, PA 19103

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September 2018

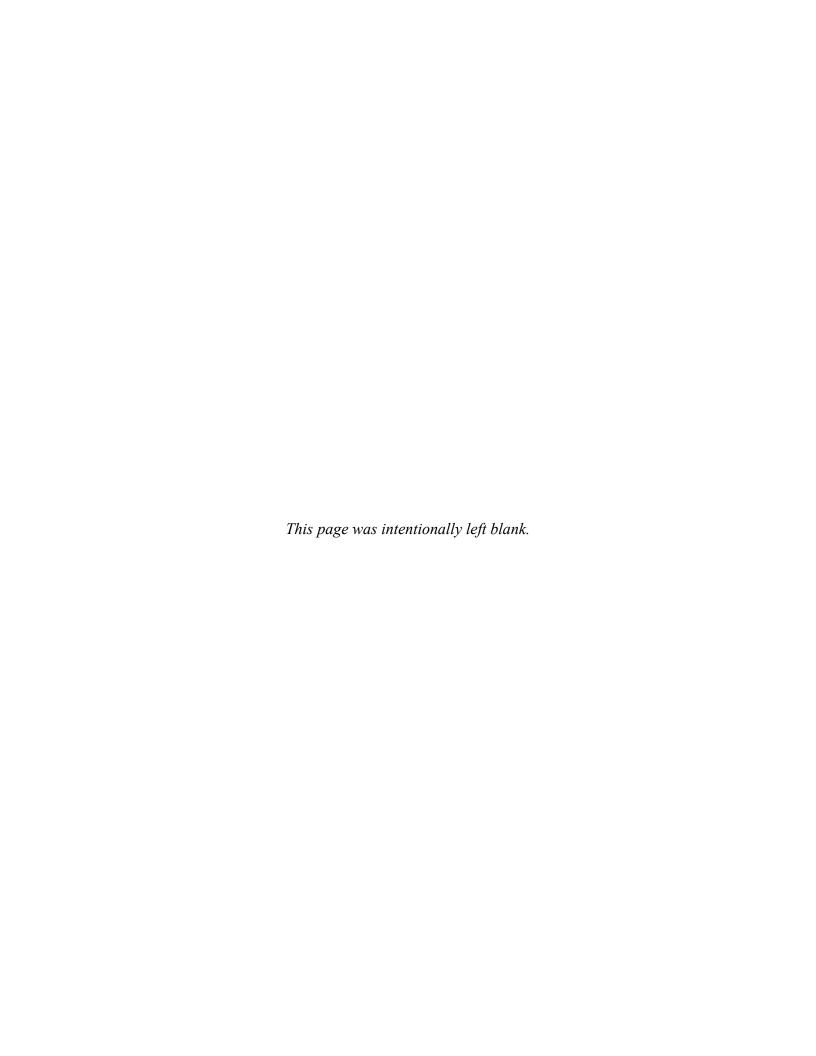


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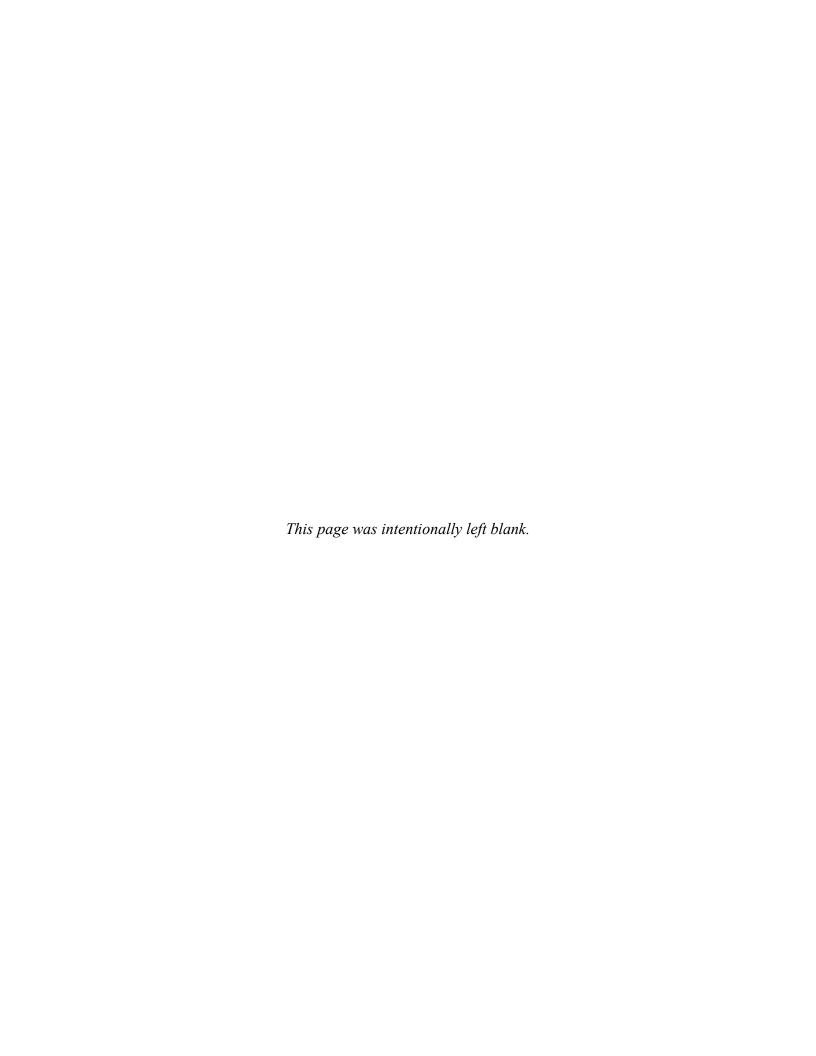
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LIST OF ACRONYMS AND ABBREVIATIONS

μg/L micrograms per liter 1,1,1-TCA 1,1,1-trichloroethane

APHA American Public Health Association

bgs below ground surface

CAS Chemical Abstracts Service
CFR Code of Federal Regulations
CLP Contract Laboratory Program
COC contaminant of concern
COD chemical oxygen demand

CRQL contract required quantitation limit

DBA database administrator

DCE dichloroethene

DMP Data Management Plan

DOT (U.S.) Department of Transportation

DQO data quality objective

EDD electronic data deliverable

EPA (U.S.) Environmental Protection Agency ESAT Environmental Services Assistance Team

EW extraction well

FFS Focused Feasibility Study

FS Feasibility Study FSP Field Sampling Plan

ft foot/feet

FTL field team leader

G glass with TeflonTM

GETS groundwater extraction and treatment system

gpm gallon per minute

H₂SO₄ sulfuric acid HCl hydrochloric acid HGL HydroGeoLogic, Inc.

HI hazard index HNO₃ nitric acid

HNUS Halliburton NUS Corporation

HSP Health and Safety Plan

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

IDW investigation-derived waste

IW injection well

LCS laboratory control sample

LCSD laboratory control sample duplicate

LTM long-term monitoring

MCL maximum contaminant level MDL method detection limit

mL milliliter MS matrix spike

MSD matrix spike duplicate MW monitoring well

N/A not available/applicable

O&M operation and maintenance

OASQA Office of Analytical Services and Quality Assurance

ORP oxidation reduction potential

OSWER Office of Solid Waste and Emergency Response

OU operable unit

P polyethylene with TeflonTM

PADEP Pennsylvania Department of Environmental Protection

PARCCS precision, accuracy, representativeness, completeness, comparability, and

sensitivity

PCE tetrachloroethene

percent R percent recovery
PgM Program Manager
PID photoionization detector

PM Project Manager

PPE personal protective equipment PQL Practical Quantitation Limit

PVC polyvinyl chloride

QA quality assurance

QAPP Quality Assurance Project Plan

QC quality control

RA Remedial Action

RCRA Resource Conservation and Recovery Act

RD Remedial Design

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

RG remedial goal ROD Record of Decision

RPD relative percent difference RSL Regional Screening Level

SAP Sampling and Analysis Plan

Site AIW Frank/Mid-County Mustang Superfund Site

SOP standard operating procedure

SOW statement of work

SSC Superfund State Contract

SVOC semivolatile organic compound

TAL target analyte list TBD to be determined TCE trichloroethene

TCLP total characteristic leaching procedure

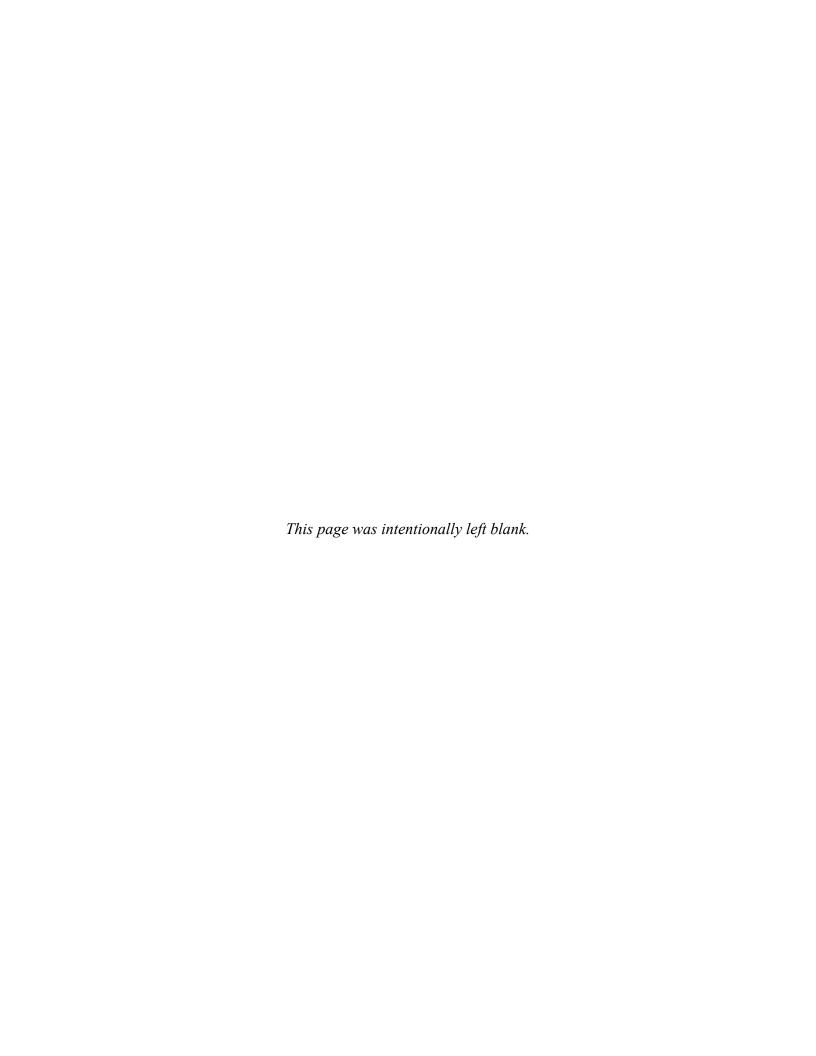
TOC total organic carbon

TR/COC traffic report/chain of custody

UFP Uniform Federal Policy

VOC volatile organic compound

WAM Work Assignment Manager



REMEDIAL ACTION SAMPLING AND ANALYSIS PLAN AIW FRANK/MID-COUNTY MUSTANG SUPERFUND SITE OPERABLE UNIT 1 CHESTER COUNTY, PENNSYLVANIA

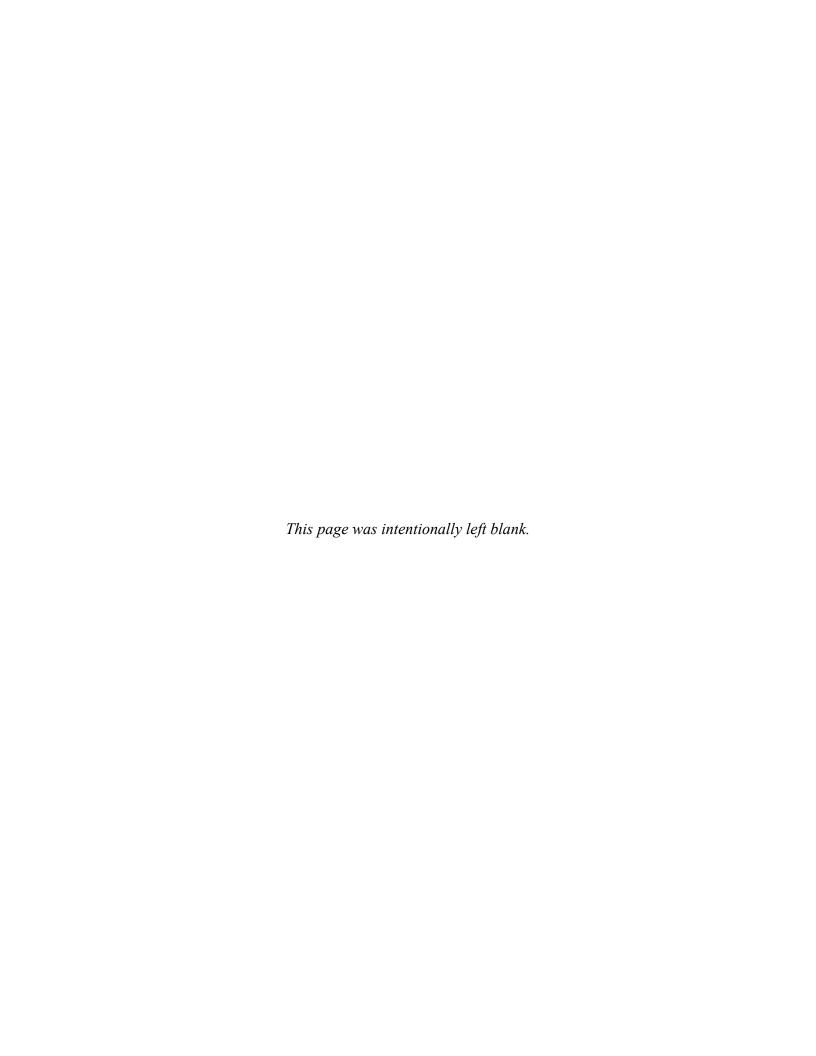
1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) describes investigation activities to be performed by the Remedial Action (RA) Contractor during RA activities at the AIW Frank/Mid-County Mustang Superfund Site (herein referred to as "the Site") located in Chester County, Pennsylvania.

This SAP is presented in the three parts. Part 1 is the Field Sampling Plan (FSP), Part 2 is the Quality Assurance Project Plan (QAPP), and Part 3 is the Data Management Plan (DMP).

The 2017 Record of Decision (ROD) Amendment selected chemical oxidation followed by enhanced biological remediation as the remedial technologies. Injection wells (IWs) will be installed as part of the RA and will need to be sampled to establish baseline conditions. After injections, performance sampling will be completed to monitor the effectiveness of the injections. Long-term monitoring (LTM) sampling will also be completed until the Site groundwater poses no more unacceptable risk to human health. The overall objective of the RA sampling is to evaluate the effectiveness of the chemical oxidation and enhanced biological remediation of volatile organic compound (VOC) and 1,4-dioxane groundwater contamination over time. To achieve this objective, the following activities are to be performed:

- Conduct baseline sampling to determine the concentrations of VOCs and 1,4-dioxane.
- After injections are conducted, sample existing monitoring wells (MWs) to determine the effectiveness of the injections.



2.0 SITE BACKGROUND

2.1 SITE LOCATION AND DESCRIPTION

The Site is located approximately one mile east of Exton on Lincoln Highway, U.S. Business Route 30 in West Whiteland Township, Chester County, Pennsylvania (Figure 2.1). The Site consists of two adjoining properties: the AIW Frank property covers roughly 15 acres, and the Mid-County Mustang property covers less than 1 acre.

West Valley Creek flows east to west through the northernmost portion of the Site, just south of the Chester Valley Trail walking path. Before the U.S. Environmental Protection Agency's (EPA's) involvement at the Site, the creek was impounded on the property to form a pond measuring approximately 310 feet (ft) by 60 ft (0.4 acres).

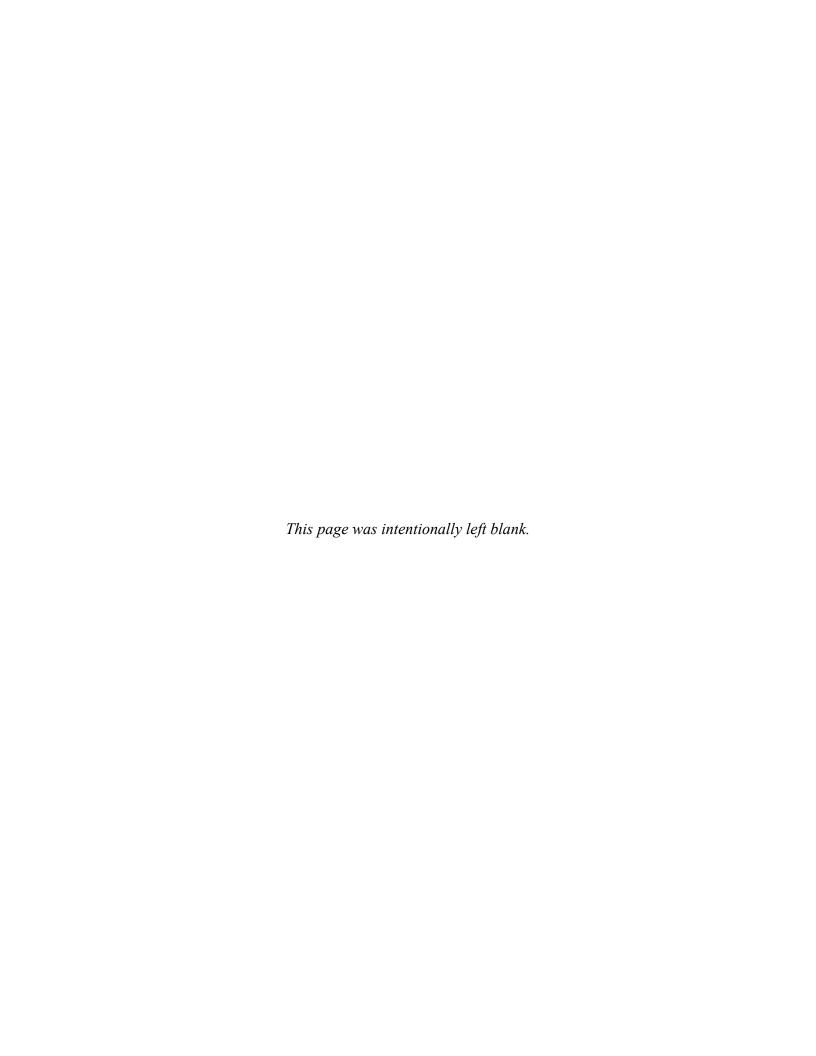
The National Superfund Database Identification Number for the Site is PAD004351003. EPA is the lead agency for the Site, and the Pennsylvania Department of Environmental Protection (PADEP) is the support agency. Pursuant to a July 22, 1997, Superfund State Contract (SSC) for the Site, PADEP assumed responsibility for operation and maintenance (O&M) activities at the Site on December 31, 2011. The SSC was modified on June 12, 2018 and provides clarification regarding EPA's and DEP's individual responsibilities regarding implementation of the Selected Remedy specified in EPA's 2017 ROD Amendment.

2.2 SITE HISTORY

A detailed Site history is presented in the 2017 ROD Amendment (EPA, 2017c).

2.3 GEOLOGY AND HYDROGEOLOGY SUMMARY

A detailed description of the Site geology and hydrogeology is presented the 2017 ROD Amendment (EPA, 2017c).



PART 1: FIELD SAMPLING PLAN

3.0 GROUNDWATER SAMPLING PROGRAM, RATIONALE, AND LOCATIONS

This FSP, in association with the project QAPP (Sections 6.0 through 9.0), describes the sampling program for the RA. The following subsections detail the field investigation activities that will be conducted and the samples to be collected for laboratory analysis. Section 7.4 discusses collection and submittal of quality assurance (QA)/quality control (QC) samples, including blind duplicates, trip blanks, equipment blanks, field blanks, and matrix spike (MS)/matrix spike duplicate (MSD).

This task is designed to obtain groundwater and geochemical data to be used to assess the progress of the RA. Multiple rounds of groundwater sampling will be required over the course of the RA.

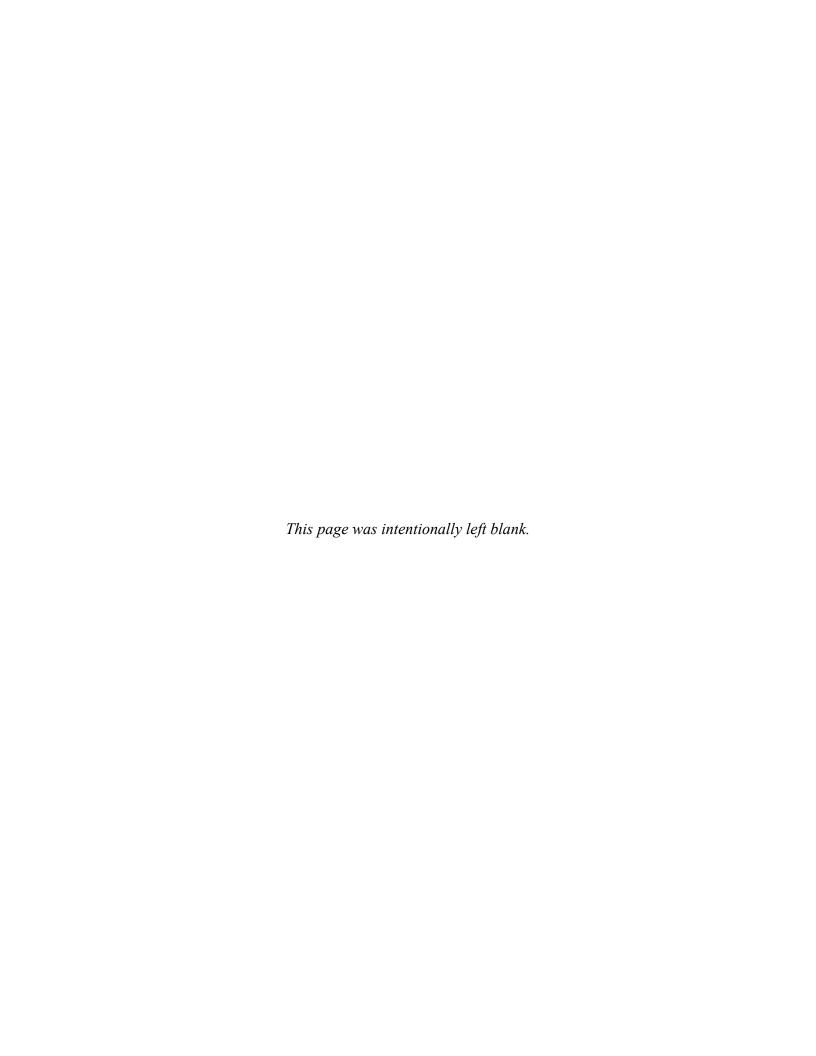
RA sampling will be completed as follows:

- Two rounds of persulfate injections, with a total of four rounds of performance sampling conducted 6 and 12 months after each injection. If remedial goals (RGs) are met after first round of persulfate injections, the second round of injections and performance monitoring may not be required.
- One round of baseline sampling of wells before ABC® injections commence.
- Two rounds of ABC® injections, with a total of four rounds of performance sampling conducted 6 and 12 months after each injection. If RGs are met after first round of ABC® injections, the second round of injections and performance monitoring may not be required. If RGs are not met after second round of ABC® injections, additional injections and performance monitoring may be required.
- After injections and associated performance monitoring, annual LTM sampling will commence.

Prior to initiating groundwater sampling activities, synoptic groundwater levels will be gauged at all Site wells. Groundwater purging and sampling activities will be conducted utilizing a submersible pump, volumetric purging techniques, and an in-line water quality meter and separate turbidity meter. MWs that will be sampled are shown on Figures 3.1 through 3.4.

Tables 3.1 through 3.3 summarizes the groundwater wells to be sampled and the parameters that to be analyzed for each sampling event.

Groundwater and decontamination water will be generated as investigation-derived waste (IDW) during groundwater sampling activities. IDW management activities will be conducted in accordance with Section 5.0 of this document.



4.0 FIELD ACTIVITY METHODS AND PROCEDURES

This section describes the field activities that will be performed:

- Site mobilization;
- Procurement of equipment, supplies, and containers;
- Water Level Measurements;
- Groundwater well purging and sampling;
- Field logbook documentation;
- Sample collection, handling, packing, and shipping;
- Equipment decontamination;
- IDW management; and
- Site demobilization.

Sampling activities will be conducted in accordance with the Office of Solid Waste and Emergency Response (OSWER) *Contract Laboratory Program Guidance for Field Samplers*, EPA 540-R-014-013 (EPA, 2014). Field data sheets to be used during this investigation are included in Appendix A.

4.1 MOBILIZATION

The RA Contractor will identify and provide all necessary personnel, equipment, and materials for mobilization and demobilization to and from the Site for the purpose of conducting RA sampling activities. Prior to mobilizing, a readiness review meeting will be held with the Project Manager (PM), the Field Team Leader (FTL), and the rest of the sampling team to discuss the activities that will be conducted during the sampling event. Equipment and supplies will be stored within the groundwater extraction and treatment system (GETS) building for the duration of the field events. A general list of field supplies and equipment is included as Table 4.1.

4.2 PROCUREMENT OF EQUIPMENT, SUPPLIES, AND CONTAINERS

Equipment and supplies needed for the RA field event includes monitoring and sampling equipment, health and safety supplies, decontamination materials, and field operation supplies (such as, coolers, bottleware, and sample preservatives). All equipment to be used for this project will be rented. Supplies required to implement sampling activities will be purchased and are expected to be expended over the course of the investigation.

4.3 WATER LEVEL MEASUREMENTS

Synoptic water level measurements will be collected from all the Site wells prior to each sampling event. All water levels will be obtained within an 8-hour period of consistent weather conditions to minimize the effects of any short-term water level changes due to background trends. Water levels will be obtained using an electric water level indicator or similar device. Water level measurements will be collected to the nearest 0.01 ft. The top of the well casing or other designated, surveyed point will be used as the point of reference for each measurement. Water level measurements will be recorded on water level monitoring forms and in the Site logbooks.

Several of the Site MWs have not been located recently due to increased vegetation at the Site and current tenant operations that may have covered some of the wells with equipment and/or material. Should the RA Contractor be unable to locate a MW, this well will not be included in the water level round and the EPA Work Assignment Manager (WAM) will be notified.

4.4 GROUNDWATER WELL PURGING AND SAMPLING

4.4.1 Permanent Monitoring Wells

Prior to sampling, the Site MWs will be purged using volumetric purging techniques using a submersible pump. The volume of water to be purged will be between 3 and 5 well volumes. A well volume is defined as the volume of standing water in the well prior to emplacement of the pump. Water quality parameters including water level, temperature, pH, specific conductance, dissolved oxygen, oxidation reduction potential (ORP), and turbidity will be measured using an in-line water quality meter every 3 to 5 minutes during the purging process. If the in-line water quality meter does not have the capability to measure turbidity, a separate turbidity meter will be utilized. The submersible pump will be placed in the center of the screened interval, or the center of the saturated zone, if well is completed as an open hole. Purging will be considered achieved after a minimum of 3 well volumes have been purged and when stabilization of the water quality parameters is obtained, or the well has been purged dry. Water quality parameter stabilization is considered achieved when the parameter readings vary less than ± 1 °C for temperature, ± 0.1 pH units for pH, ±3 percent for specific conductance, and ±10 percent for dissolved oxygen and ORP for three consecutive readings. In addition, turbidity measurements should be less than 10 nephelometric turbidity units or have varied by less than 10 percent for three consecutive readings. Following stabilization, groundwater samples will be collected and submitted to EPAselected laboratories for laboratory analysis in accordance with Tables 3.1, 3.2, and 3.3.

If during the purging process the water level continues to drop close to the inlet of the pump, the pump will be lowered to the bottom of the well (approximately 1 ft off the bottom). If the water level continues to drop and the well goes dry prior to 3 well volumes being removed, the purging will be stopped. The water level within the well will be allowed to recover and a sample will be collected within 24 hours after the purging has stopped and there is adequate water for sample collection.

If alternative sampling methods (e.g., low flow, hydro sleeves, passive diffusion bags) are to be considered, they must first be proven to obtain similar results to the volumetric method. EPA will be consulted prior to proposing a new sampling method to assist in developing a sampling program that will provide sufficient evidence that results from the new method are comparable to the results from the volumetric purging.

4.4.2 EW-3 and EW-6 Extraction Wells

The two currently operating extraction wells (EWs), EW-3 and EW-6, will be sampled directly from the sampling port installed on the discharge line. The EWs will be turned on prior to sampling to allow for adequate water to be removed to obtain a representative sample. The purge rate of EW-6 is around 100 gallons per minute (gpm); therefore, 20 minutes is adequate time for 3 well volumes to be purged. The purge rate of EW-3 is around 1 gpm, and therefore requires 24

hours for adequate time for 3 well volumes to be purged. After adequate water has been purged, water quality parameters will be collected and recorded and the sample will be collected. If at any time amendment is showing up in the equalization tank during purging of the EWs, the wells will be turned off. It will be at the determination of the project team to decide if a sample is worth collecting, as the EW pump and associated piping and wiring would need to be removed to allow for a submersible pump to be used to collect a sample. Sampling would be conducted in accordance with procedures outlined in Section 4.4.1.

4.5 FIELD LOGBOOK DOCUMENTATION

All field activities will be documented in a field logbook and on separate field data sheets. All documentation activities will be performed in accordance Section 6.7 of this document.

4.6 SAMPLE COLLECTION, HANDLING, PACKAGING, AND SHIPPING

All sample collection, handling, packaging, and shipping activities for the EPA Contract Laboratory Program (CLP) laboratories will be conducted in accordance with the OSWER *Contract Laboratory Program Guidance for Field Samplers*, 540-R-014-013 (EPA, 2014).

4.7 EQUIPMENT DECONTAMINATION

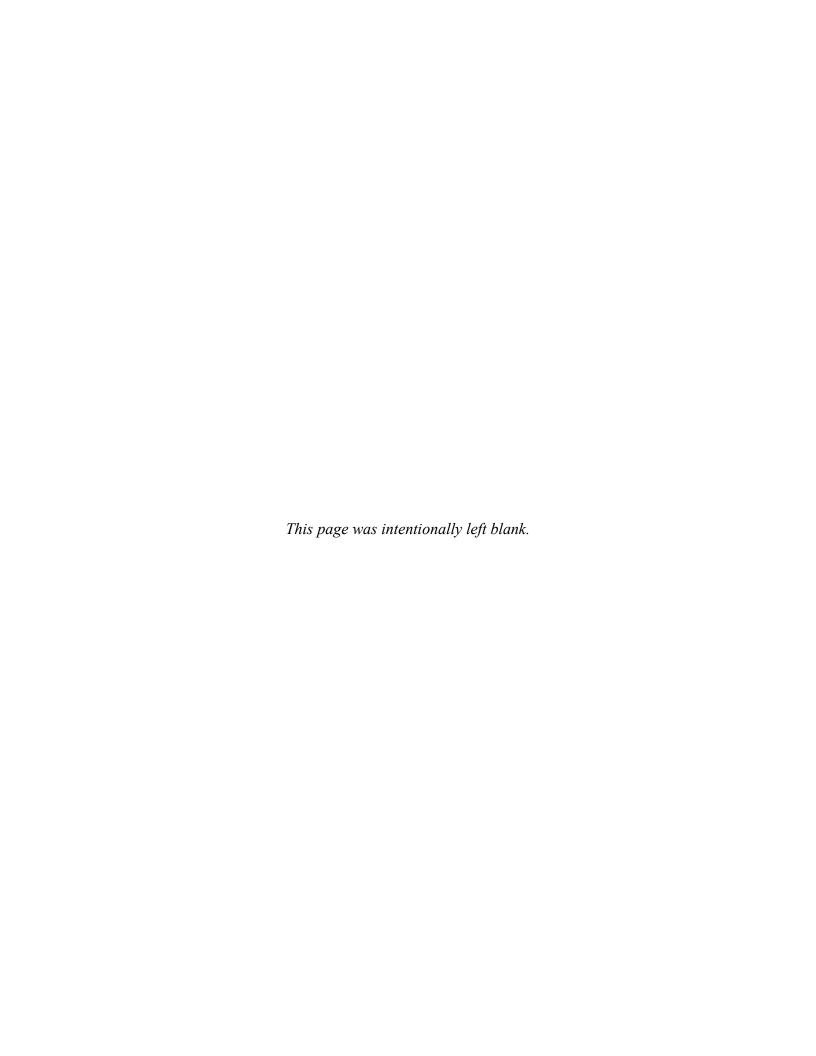
Sampling equipment that is exposed to contaminated media will require decontamination. Water level meters will be washed with detergent such as Alconox and tap water and then rinsed with tap water followed by deionized water. Submersible pumps will be decontaminated after collecting samples. The pump and associated electrical cord that has come into contact with groundwater will be placed into a container with tap water and detergent. The pump will be turned on to circulate the detergent solution through the pump. The pump and electrical cord will then be placed into a second container that contains tap water. The pump will be turned on to recirculate the tap water through the pump. The final step will be to place the pump and electrical cord into a third container that contains deionized water. The pump will be turned on to recirculate the deionized water. Wind the electrical cable back onto the pump reel and place in clean plastic bag. Equipment blanks will be required at the frequency discussed in section 7.4.2. The decontaminated pump will be placed into a clean container filled with deionized water. A clean piece of tubing will be attached to the pump and the pump will be turned on. The equipment blank sample will be collected from the water being discharged from the pump tubing.

4.8 IDW MANAGEMENT

IDW management activities will be conducted in accordance with Section 5.0 of this document.

4.9 **DEMOBILIZATION**

Upon completion of all field activities, all used personal protective equipment (PPE) and trash associated with the investigations will be removed. The removed materials will be disposed of at a local municipal landfill.



5.0 INVESTIGATION-DERIVED WASTE MANAGEMENT

RA field sampling activities to be conducted include groundwater sampling and decontamination. These field activities will result in the generation of IDW including used PPE, decontamination water, and purge groundwater. The purpose of this section is to outline the procedures that will be taken to ensure that contaminants are not released off Site during RA sampling activities and to ensure proper storage, treatment, and disposal of IDW generated during fieldwork. Every effort will be made to minimize the amount of IDW generated.

5.1 INTRODUCTION

RA field activities to be conducted that will generate IDW include the installation of groundwater IWs and groundwater sampling. Details of the IWs installation are provided in the remedial design (RD) (HGL, 2018). These field activities will result in the generation of IDW including used PPE, soil cuttings, decontamination water, and purge groundwater. IDW from the RA fieldwork will be disposed of in accordance with all applicable Resource Conservation and Recovery Act (RCRA) regulations by a waste removal/disposal firm under subcontract with the RA Contractor. All activities will follow the EPA guidance document, *Guide to Management of Investigation-Derived Wastes*, 9345-03FS, January 1992.

5.2 IDW CONTAINERIZATION

5.2.1 Used Personal Protective Equipment

Used PPE will be collected in plastic trash bags. Any soils or sediment on the bulk materials or PPE will be scraped off before being bagged. The bagged used PPE will be stored in the GETS building until the end the field event. At the end the field event, the used PPE will be disposed of at the local county municipal landfill.

5.2.2 Soil Cuttings and Generated Water from Drilling

Soil cuttings and water will be containerized in 55-gallon, U.S. Department of Transportation (DOT) approved steel drums. The drums will be stored within the temporary IDW storage unit until removed by an IDW removal/disposal firm under contract with the RA Contractor. The filled IDW drums will be stacked in rows of two and segregated by media if possible. Immediately upon placing generated IDW into a drum, a wax pen will be utilized to mark the drum with the appropriate EPA contact information.

All empty drums stored on site will be stored upside down to help minimize the potential accumulation of rainwater and marked "Empty."

During well installation and development activities, the volume of soil cutting and water IDW may be large enough to warrant storage in larger containment vessels. Soil cuttings will be transferred to a plastic-lined rolloff container that will be located in the IDW Storage unit. Drilling fluids and development water may be contained in a larger poly tank or frac tank for storage. These containers will also be located within the IDW Storage unit.

The drilling and development water will be allowed to decant, as long as necessary based on best professional judgment to limit potential overloading of the GETS filters, prior to being pumped into the equalization tank within the GETS building. The sediment remaining in the containers can be combined and containerized with the soil cuttings.

5.2.3 Generated Sampling Water

Water IDW generated during sampling will be containerized in 5-gallon buckets and/or poly tanks during purging of the wells. If the well that is being purged is outside of the injection areas, the water will be transported to the GETS building and pumped into the equalization tank. Decontamination water will also be transported to the GETS building and pumped into the equalization tank. If the well that is being purged is within the injection areas and may contain amendment, the water will be containerized during sampling in poly tanks or bladder tanks and pumped back down the well after sampling. Should the purge water not be able to be pumped back into the well within a reasonable amount of time, a gravity feed system will be set up to allow the purge water to flow back into the well over a longer period of time.

5.3 IDW STORAGE UNIT

A temporary IDW storage unit will be constructed for the duration of the drilling event. The temporary IDW storage unit will be constructed of poly sheeting and a wood frame to store the drums of IDW. At the end of each day, the IDW storage unit will be covered with poly sheeting and weighted down to eliminate the potential collection of rainwater during storm events. If rolloff containers and frac tanks are required, a field decision will be made to determine if they can be located within the IDW storage unit.

The IDW storage unit will be located within the fenced area outside the GETS. If it is determined that rolloff containers and frac tanks will not fit in the designated IDW storage unit, they will be placed in a location that is agreed upon with EPA and property owners.

5.4 IDW SAMPLING

IDW in the form of soil cuttings is anticipated during the well installations. Water IDW will be generated during all sampling events with the highest volumes generated during the well installation and development events. No IDW will be allowed to remain on the Site longer than 90 days.

All soil cutting IDW generated during the well installations will be sampled and analyzed by an EPA-approved laboratory through the CLP for total characteristic leaching procedure (TCLP) VOCs, TCLP semivolatile organic compounds (SVOCs), TCLP pesticides, TCLP metals including cyanide, corrosivity and ignitability. Soil IDW samples will be composited from up to 10 drums of soil (or one rolloff container) per sample.

Provided there is sufficient storage capacity in the two 21,000 gallon frac tanks that will be brought onto the Site, the water IDW from well installation and development activities will be sampled for VOCs, SVOCs, and metals with 24-hour turn around to determine whether treatment via the GETS is necessary prior to discharge. The total amount of storage capacity needed at any

given time is not expected to exceed 42,000 gallons, however if storage capacity within the two frac tanks is exceeded during well drilling and/or development, water IDW sampling may be temporarily suspended and unsampled water IDW may be sent to the GETS until additional storage capacity becomes available in the frac tanks.

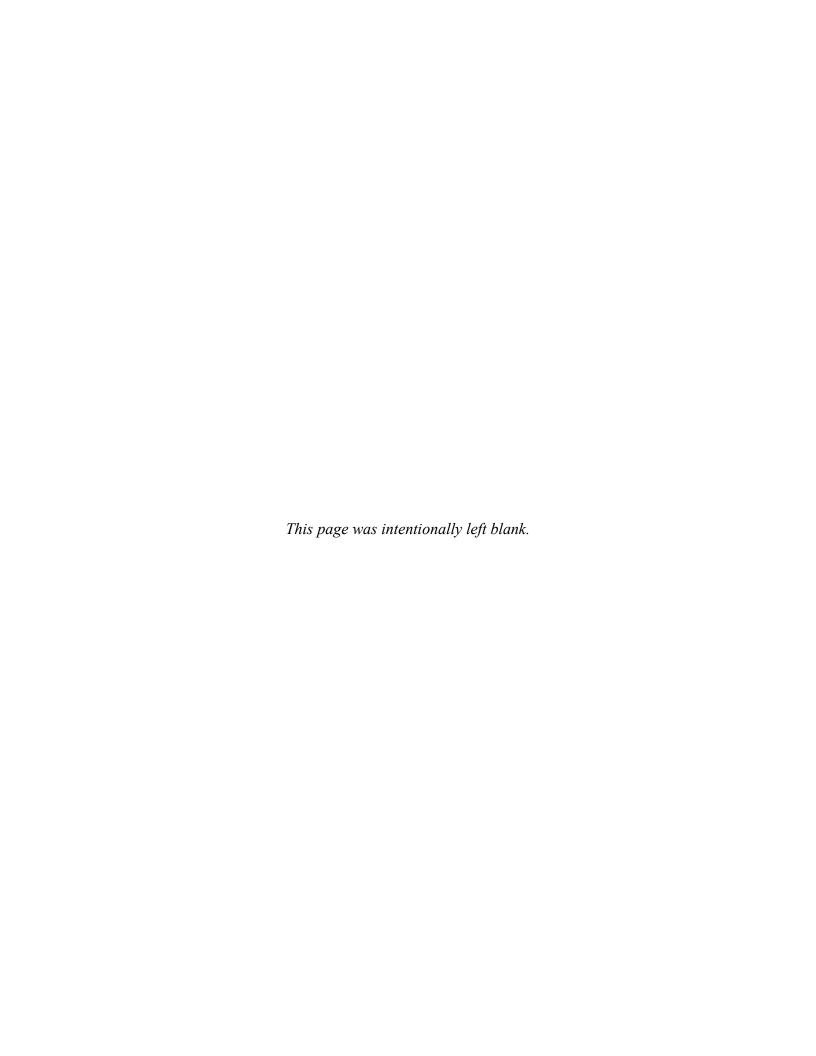
5.5 IDW SOIL REMOVAL

All soil generated IDW will be removed from the Site. Soil cuttings will be picked up and transported off Site to an EPA-approved landfill or disposal facility by an IDW removal/disposal firm under contract with the RA Contractor. To minimize costs, IDW removal events will be kept at a minimum; however, no containerized IDW will be allowed to remain on the Site for longer than 90 days.

All required paperwork (manifests, waste tickets, bills-of-lading, etc.) will be signed by the RA Contractor on behalf of the EPA. Copies of the signed IDW paperwork will be filed in a project file, as well as included as an attachment in the appropriate project reports.

5.6 IDW WATER TREATMENT/DISPOSAL

After water IDW has been transferred to the equalization tank, the GETS will be utilized to treat the water IDW if waste characterization results indicate the water does not meet NPDES discharge levels or it is needed to keep up with the amount of IDW being generated. The GETS will be operated in accordance with the 2018 Revised Operations Memo prepared by Baker O'Brien & Gere for PADEP, and for issues where the 2018 memo is silent, the 2001 O&M Plan will be applied (Tetra Tech NUS, 2001). After the water IDW has been treated, the GETS will be turned off. If waste characterization results indicate the water does meet NPDES discharge levels, the IDW water will be pumped directly to the onsite pond.



PART 2: QUALITY ASSURANCE PROJECT PLAN

6.0 PROJECT MANAGEMENT

A QAPP provides QA/QC guidance for the proposed RA activities to be conducted at the Site. This plan addresses data needs and data quality objectives (DQOs) for the RA sampling addressed under this SAP and provides site-specific QA procedures and protocols. The RD, which describes RA tasks to be performed and the schedule and budget, combined with the SAP forms an integrated management system against which RA progress can be measured. The baseline plans are a precise description of how the RA will be executed in terms of scope, schedule, and budget.

Part 2 (Sections 6.0 through 9.0) of the SAP comprises the project-specific QAPP. Section 6.0 covers the general areas of project management, project definition and objectives, and roles and responsibilities of the project team. The elements of project management ensure that the project's goals are clearly stated, that all participants understand the goals and the approach to be used, and that project planning is documented. Section 7.0 describes data acquisition processes. Section 8.0 addresses activities for assessing the effectiveness of project implementation and the associated QA/QC activities. Section 9.0 presents the QA/QC activities that will occur after completion of data collection.

6.1 PROJECT ORGANIZATION

The RA Contractor will provide the technical staff necessary to perform the sampling and reporting components of this project. Analytical services will be provided by EPA-designated laboratories through the CLP. Responsibility for data validation services will be assigned by the EPA. The RA Contractor will not perform or procure these services. Uniform Federal Policy (UFP) Worksheet #7 identifies the personnel responsibilities specific to this RA. UFP Worksheet #6 describes project-specific communication pathways.

6.2 BACKGROUND AND PURPOSE

Site background information for the Site is provided in Section 2.0. The purpose and objectives of this RA sampling are identified in Section 1.0. The purpose of this QAPP is to provide guidance to ensure that all data collection procedures and measurements are scientifically sound, are of known, acceptable, and documented quality, and are conducted in accordance with the requirements of the project.

6.3 PROBLEM DEFINITION

UFP Worksheet #10 outlines the Problem Definition. The overall objective of the RA sampling activities is to collect data to analyze the effectiveness of the RA and to ultimately determine if the Site contaminants of concern (COCs) have met RGs. To achieve this objective, the following activities will be conducted:

- Determine the effectiveness of the persulfate at reducing 1,4-dioxane and VOC concentrations.
- Determine the effectiveness of the ABC® at reducing VOC concentrations.
- Determine if the injections have pushed contamination to areas of the Site that previously did not have contamination.
- Determine that the Site COCs have met their RGs.
- Characterize soil IDW generated during well installation for disposal.

6.4 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT

6.4.1 End Uses of the Data

The end use of the field and analytical data is to determine the effectiveness of the RA and ultimately determining the Site COCs have met their RGs.

6.4.2 Data Types

Quality of analytical data is defined as either "definitive data" or "screening data with definitive confirmation" in *Data Quality Objectives Process for Superfund, Interim Final Guidance*, EPA540-R-93-071, September 1993 (EPA, 1993). For this project, the analytical data generated by the EPA Region 3 selected laboratories will constitute definitive data.

Some data for this project will be screening data that will not receive definitive confirmation. Types of data that are included in the other category include photoionization detector (PID) field screening measurements, water quality measurements taken with a field meter, and water level measurements. Some analytical data will be produced by methods that are considered to be screening level methods by definition. These data include titrimetric methods (alkalinity and chemical oxygen demand [COD]).

6.4.3 Data Quality Objectives

The following subsections describe the development of DQOs for this RA. The DQO process described below is to support a data end use of definitive as defined in Section 0.9 of *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA, 2006a).

6.4.3.1 Step 1: State the Problem

The problems to be addressed by the analytical data are identified in Section 6.3 and are presented on UFP Worksheet #10.

6.4.3.2 Step 2: Identify the Goals of the Study

This step identifies the questions that the study will attempt to resolve and the actions that may result. The principal study components and related questions are presented on UFP Worksheet #10.

6.4.3.3 Step 3: Identify Information Inputs

The sampling program, briefly described in Section 6.3 and described in greater detail in Section 3.0, is designed to provide the inputs to address the questions presented on UFP Worksheet #10. Based on the principal study question, the following information is required:

• Analytical results of groundwater samples collected from Site wells.

6.4.3.4 Step 4: Define the Boundaries of the Study

The spatial boundary of the study is the extent of the groundwater contamination that exceeds remediation goals. The temporal boundary for this study is the duration of the RA.

6.4.3.5 Step 5: Develop the Analytic Approach

The data collected in the field investigations will be used to assist in planning of the injections and determining when sampling can be ended. The data will be used in accordance with the following decision rules developed for the project questions presented in UFP Worksheet #10.

6.4.3.6 Step 6: Specify Performance or Acceptance Criteria

The five project questions are presented in Worksheet #10. All five questions describe decision problems. For decision problems, decision errors for projects involving environmental sampling generally fall into two categories: false rejection of the null hypothesis (Type I) and false acceptance of the null hypothesis (Type II). The null hypotheses associated with the project questions associated with decision problems are:

- Question 1 Has the persulfate lowered 1,4-dioxane and VOC concentrations within the Site monitoring wells?

 The null hypothesis is that 1,4-dioxane and VOC concentrations are lower after the injections.
- Question 2 Has the ABC® lowered VOC concentrations within the Site monitoring wells? The null hypothesis is that VOC concentrations are lower after the injections.
- Question 3 Have concentrations of 1,4-dioxane or VOCs increased in wells after injection? The null hypothesis is that the injections may have moved contamination to areas that previously did not have contamination.
- Question 4 Are the Site COCs at concentrations less than their RGs?

 The null hypothesis is that concentrations are less than their RGs.
- Question 5 Does IDW constitute a RCRA hazardous waste?

 The null hypothesis is that IDW constitutes a RCRA hazardous waste.

For this project, a Type I decision error would result in deciding that a contaminant is less than the RG and does not need remediated, when it actually does. A Type II decision error would

result in deciding that a contaminant is greater than RG and needs remediated, when it actually does not. The null hypotheses have been framed in such a way that Type I errors are more serious than Type II errors because they could possibly mask contaminant levels that may pose a risk or lead to a non-compliant situation.

One of the most important tools for preventing error is the establishment of sensitivity limits. The project laboratories are required to establish a method detection limit (MDL) for each analyte and matrix for each analytical method. The MDL is the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99 percent level of confidence; at the MDL, the false positive rate is 1 percent. The MDL lies below the calibrated range for each analyte. The CLP statement of work (SOW) establishes a Contract Required Quantitation Limit (CRQL) for each analyte. For non-CLP methods, the corresponding limit is referred to as the Practical Quantitation Limit (PQL). The CLP SOW requires laboratories to report all results at or above the MDL but below the CRQL or PQL as estimated detections; results at or above the CRQL or PQL can be reported without qualification and have quantitative significance. The requirements for CRQL or PQL are presented in Table 6.1.

The answers to the project questions require definitive data in order to verify that the data were generated in accordance with the QC requirements of the analytical methods. Data validation will be performed in accordance with the EPA validation guidelines described in Section 9.0. Data that are validated will be subject to the data evaluation activities described in Worksheet #37 in order to evaluate potential errors associated with using the project dataset. The probability of false positive or false negative results is controlled for each data point by establishing sensitivity limits and by evaluating the impact of batch and instrument QC discrepancies identified in the data validation process. The number of data points that will be evaluated in decision-making will limit the impact of incorrect decisions made for individual data points, including data points with quantification that that lies near or within the "gray region" described in *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA, 2006a).

6.4.3.7 Step 7: Develop the Plan for Obtaining Data

The data collection plan (sampling program) is described in detail in FSP Sections 3.0 and 4.0.

6.5 DATA MEASUREMENT OBJECTIVES

Data measurement requirements will be met by the following:

- Following standard QA guidance documents,
- Using indicators of data quality,
- Collecting reliable field measurements, and
- Using approved laboratories and standard analytical and validation methods.

6.5.1 Quality Assurance Guidance

The field QA program has been designed in accordance with EPA Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA, 2006a), and EPA Requirements for Quality Assurance Project Plans (EPA, 2001). Laboratory analyses will be performed in

accordance with the EPA organic and inorganic SOWs for CLP analyses (EPA, 2006b and 2006c); analytical methods not covered in the CLP SOWs will be performed in accordance with published analytical methodologies, including the EPA's *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846 (EPA, 2015) and *Standard Methods for the Examination of Water and Wastewater* (APHA, 2011).

The EPA or an EPA-subcontractor will provide data validation services. The data validation shall be conducted in accordance with the EPA National Functional Guidelines for organic and inorganic methods (EPA, 2017a and 2017b).

6.5.2 Data Quality Indicators

Precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) parameters are indicators of data quality. The following PARCCS goals have been established for this project to aid in assessing data quality.

6.5.2.1 Precision

The acceptable relative percent difference (RPD) limit for field duplicates is less than or equal to 20 percent for aqueous samples and 35 percent for soil samples.

6.5.2.2 Accuracy

Accuracy will be measured by percent recovery (percent R), which will be evaluated during data validation in accordance with the CLP SOW and other analytical methodologies.

6.5.2.3 Representativeness

The representativeness of sample results will be assessed qualitatively by reviewing the sampling and analytical procedures and quantitatively by reviewing the results of blank samples. If an analyte is detected in a method, preparation, trip, or rinsate blank, any associated positive result may be considered a false positive result and qualified as a potential artifact of the sampling and analysis process.

6.5.2.4 Completeness

The completeness goal for this project is 90 percent, calculated for the entire project dataset. Data rejected during the validation process will not be considered usable. If the completeness goal is not met, the effect of not meeting this goal and potential corrective action will be discussed by the RA Contractor and the EPA Region 3 Remedial PM. Data gaps caused by rejected results or by planned samples that could not be collected will also be evaluated, even if overall completeness goals are met.

6.5.2.5 Comparability

To ensure comparability of results with those collected during previous sampling efforts performed to support the RD, data developed under this RA will be from samples collected and analyzed using standard EPA analytical methods and QC procedures.

6.5.2.6 Sensitivity

Analytical data will be compared to the RG values established in the 2017 ROD Amendment, regulatory levels, and Regional Screening Levels (RSLs). These will include the federal maximum contaminant levels (MCLs) established by the Clean Water Act, and the EPA RSLs established for residential tap water.

6.5.3 Field Measurements

Field measurements from several sources will be collected during the planned field activities:

- Water quality parameters including pH, specific conductance, temperature, ORP, and dissolved oxygen will be measured during groundwater sampling activities.
- Turbidity measurements will also be collected for the groundwater sampling event.
- A depth to water level meter will be utilized to obtain groundwater elevation measurements.
- A PID will be utilized to monitor organic vapors in the air around each MW during sampling.

Manufacturer recommendations for calibration, handling, maintenance, and use will be followed for the instruments used to make field measurements. Detailed descriptions of the required field measurements per sampling event are provided in Section 4.0.

6.5.4 Laboratory Analysis

The data uses established for the Site require varying levels of QC requirements and analytical methodology. The specific analyses that will be performed for each component of the sampling are presented in Table 6.1 (groundwater).

Analyses for samples will be requesting through the CLP program by submission of an Analytical Request Form. Analytical services procured under the CLP program will require complete CLP-formatted data packages, where applicable, as well as complete QC documentation in accordance with the associated method, where applicable. The analytical methods provide details of sample preparation, extraction, analyses, and detection limits.

6.6 SPECIAL TRAINING REQUIREMENTS AND CERTIFICATION

All personnel involved in sample collection and tracking will be trained in (or be able to document experience in) the use of the Scribe sample collection and documentation process.

As required under Occupational Safety and Health Administration Standard 29 Code of Federal Regulations (CFR) 1910.120, The RA Contractor employees and their subcontractors are required to obtain the appropriate level of training prior to working at Comprehensive Environmental Response, Compensation, and Liability Act sites or at certain RCRA sites. The RA Contractor will keep records of employee training certificates and certifications on-site.

Subcontractors must also provide documentation of their compliance with 29 CFR 1910.120 training requirements.

6.7 DOCUMENTATION AND RECORDS

Documents used or generated during the course of the project will be tracked and will become a part of the project files upon completion of the task. Complete project file records will be maintained in the RA Contractor's office and will be updated by a project administrator under the PM's direction. Project records included in the file may include, but are not limited to, the following:

- Sample identification documents and field logbooks;
- Traffic report/chain of custody records (TR/COC);
- Project deliverables;
- Copies of laboratory data packages, which may include analytical logbooks, laboratory data, calculations, graphs, control charts, field logs (to include instrument identification numbers, calibration, and measurements), and software;
- Reports, responses to comments, and associated document transmittal letters;
- Communication logs;
- Records of deviation from the SAP and RD; and
- Photographs.

6.7.1 Field Logbook and Documentation

Logbooks must be bound and the entries recorded in waterproof ink. The logbook must contain sufficient information to distinguish samples from one another and describe all site activities and conditions relevant to the sample collection process. Logbooks can be supplemented by other documentation and checklists, such as well stabilization forms, field sampling forms, boring logs, and daily QC forms. Logbook entries will be reviewed on a daily basis by the FTL to ensure that entries are complete and properly formatted. The FTL will also use Site documentation to verify sampling completeness on an ongoing basis to ensure that all projected samples and analytical fractions, including all required associated field QC samples, are collected and submitted for analysis.

At a minimum, the following information will be recorded in the site logbook:

- The name of the person to whom the logbook is assigned;
- The logbook number;
- The project name;
- The project start date;

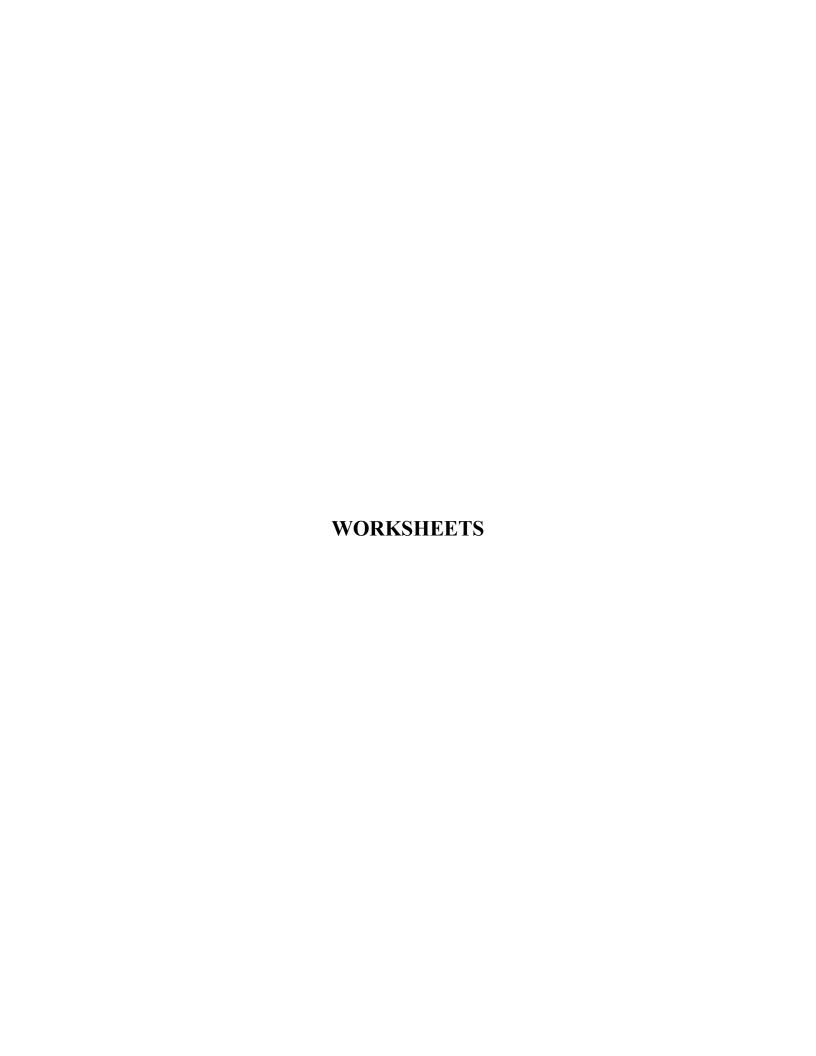
- The names and responsibilities of on-site project personnel, including subcontractor personnel;
- The arrival/departure of Site visitors;
- The arrival/departure of equipment;
- Sampling activities and sample log sheet references;
- A description of Contractor activities;
- Sample pickup information including TR/COC numbers, airbill numbers, carrier, time, and date:
- A description of borehole or MW installation activities and operations;
- Health and safety issues; and
- A description of photographs including the date, time, photographer, roll and picture number, location, and compass direction of the photograph.

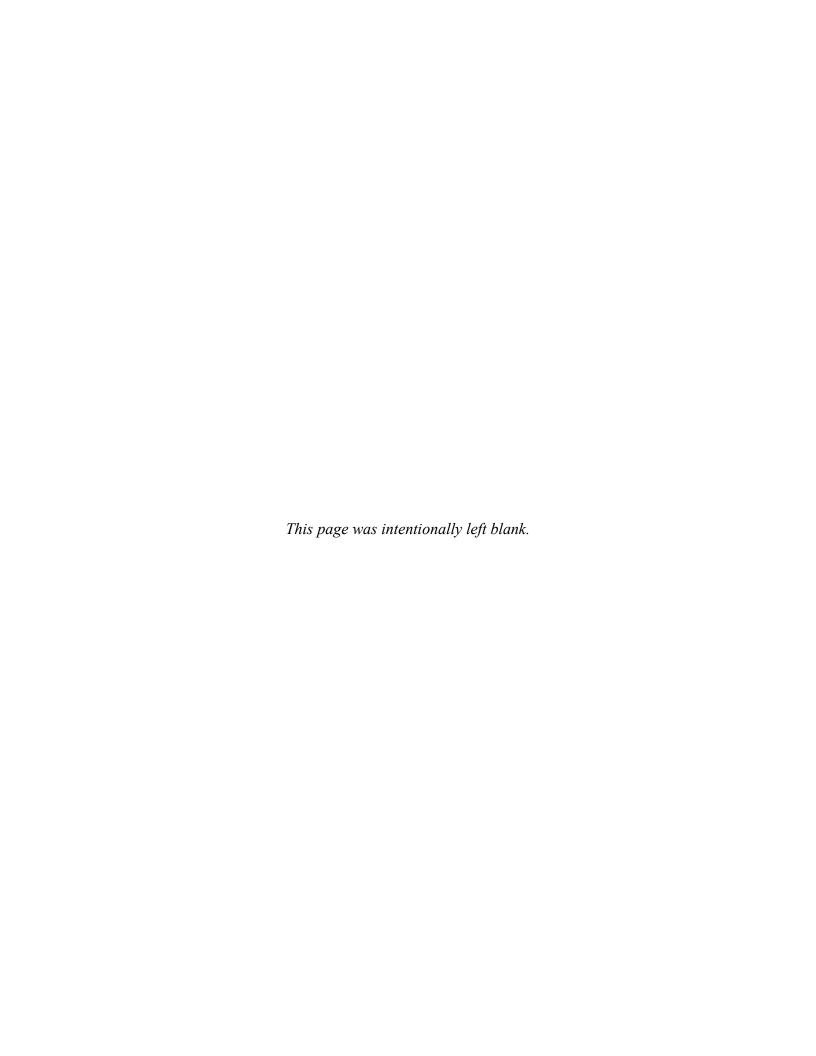
The equipment used to collect the sample will be noted in the logbook, along with date and time of sampling, sampler's name, sample description, sample location, and the volume and number of containers collected. QC sample information will be appropriately recorded to allow for the association of QC samples with field samples.

All entries will be written in ink, and no erasures will be made. If an incorrect entry is made, the incorrect information will be indicated with a single strike line; the person making the correction will initial and date the change. The correct information will be entered close to the incorrect entry and in such a fashion that it is clear that this information replaces the crossed-out entry.

6.7.2 Laboratory Data

Laboratory data will be submitted to the RA Contractor from EPA. Each report will contain a case narrative that briefly describes the number of samples, the analyses performed, and any analytical issues or QA/QC issues associated with submitted samples. Each laboratory data report will also include signed TR/COC forms, cooler receipt/sample log-in forms, analytical data, a QC package, and raw data. An electronic version of the data (in the form of a .xls file or similar format) will also be provided by the laboratories.





Project-Specific OR Generic QAPP – Project Specific Site Name/Project Name: AIW Frank/Mid-County Mustang Superfund Site **Revision Number: 1**

Site Location: Exton, PA Revision Date: 7/2018

QAPP Worksheet #6 Communication Pathways

Communication	Responsible	N	Di N	Procedure
Drivers	Entity	Name	Phone Number	(Timing, pathways, etc.)
QAPP and SAP Amendments	RA Contractor	TBD	TBD	The RA Contractor's PM will send QAPP/SAP amendments to EPA WAM for approval.
Notifications of Project Delays	RA Contractor	TBD	TBD	If RA Contractor encounters or anticipates delays, the EPA WAM will be notified by verbal communication immediately with email or memo follow-up
Changes in Site Conditions or Field Plan	RA Contractor	TBD	TBD	If any changes or modifications are necessary during implementation of the field work, the FTL will contact the RA Contractor's PM who will then contact the EPA WAM. Initial communications will be verbal with email or memo follow-up.
Issues of Analytical Data Quality	OASQA	Brandon McDonald	410-305-2607	If issues with data quality, field data collection or reporting limits are encountered, the EPA OASQA will notify the RA Contractor's PM. The EPA OASQA and the RA Contractor's PM will develop a plan to address the quality issues; however, any modifications that could potentially impact the approved WA scope of work must be approved by the EPA WAM/EPA Contract Officer prior to implementation.
Analytical Services	RA Contractor	TBD	TBD	The RA Contractor's PM will coordinate analytical service requests with EPA's OSAQA and/or laboratories.
Analytical Validation Services	EPA	TBD, ESAT	TBD	The EPA ESAT will conduct data validation and provide the results to the RA Contractor once data packages are complete.

Notes:

EPA = (U.S.) Environmental Protection Agency Environmental Services Assistance Team ESAT

FTL Field Team Leader. PM Project Manager

OASQA = EPA Office of Analytical Services and Quality Assurance

QAPP Quality Assurance Project Plan SAP Sampling and Analysis Plan TBD To Be Determined = Work Assignment Manager WAM

Title: SAP

Project-Specific OR Generic QAPP – Project Specific Site Name/Project Name: AIW Frank/Mid-County Mustang Superfund Site Title: SAP **Revision Number: 1** Site Location: Exton, PA Revision Date: 7/2018

QAPP Worksheet #7 Personnel Responsibilities and Qualifications Table

Name	Title	Organizational Affiliation
Gregory Voigt	EPA RPM	EPA Region 3
		1650 Arch Street
		Philadelphia, PA 19103
		(215) 814-5737
TBD	PgM	TBD
TBD	EPA Contracting Officer	EPA Region 3
		1650 Arch Street
		Philadelphia, PA 19103
TBD	PM	TBD
TBD	Corporate Health and Safety	TBD
	Manager	
TBD	FTL	TBD
TBD	Project Chemist	TBD
TBD	Database Manager	TBD

Notes:

EPA = U.S. Environmental Protection Agency

FTL = Field Team Leader PgM = Program Manager PM = Project Manager

WAM = Work Assignment Manager

Project-Specific OR Generic QAPP - Project Specific Site Name/Project Name: AIW Frank/Mid-County Mustang Superfund Site

Revision Number: 1 Site Location: Exton, PA Revision Date: 7/2018

QAPP Worksheet #10 Problem Definition

The problem to be addressed by the project:

The overall objective of the RA sampling activities to be conducted under this WA is to collect data to analyze the effectiveness of the RA and to ultimately determine if the Site COCs have met RGs.

The environmental questions being asked:

- 1. Has the persulfate lowered 1,4-dioxane and VOC concentrations within the Site MWs?
- 2. Has the ABC® lowered VOC concentrations within the Site MWs?
- 3. Have concentrations of 1,4-dioxane or VOCs increased in wells after injections?
- Are the Site COCs at concentrations less than their RGs?
- Does IDW constitute a RCRA hazardous waste?

Project decision conditions:

If the 1,4-dioxane concentrations still exceed the RG after 1 year past the initial persulfate injection, additional persulfate injections will be completed until the 1,4-dioxane concentrations are less than the RG. If data indicates that the amendment is working, but the concentrations have not met the RG, the timing of additional injections can be changed with EPA concurrence.

If the 1,4-dioxane concentrations are less than the RG and there are VOCs present at concentrations higher than their RGs, than the well will be remediated with ABC®.

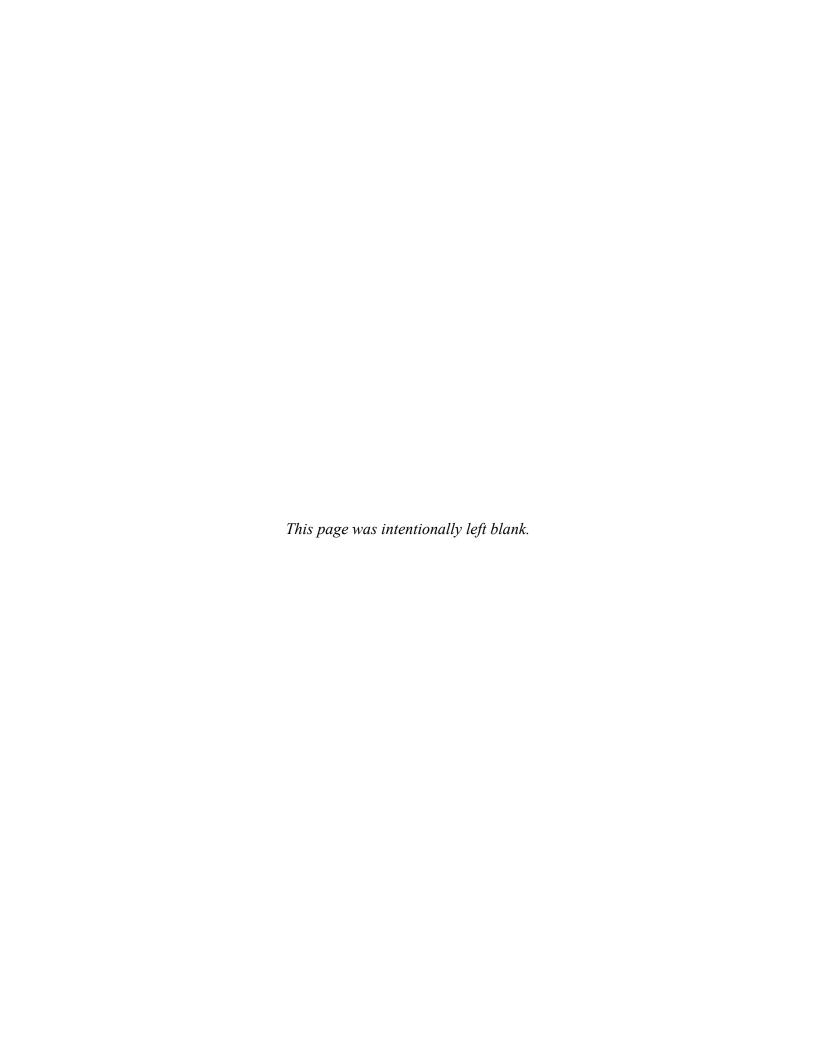
If the VOC concentrations still exceed their RGs after 1 year past the initial ABC® injection, additional ABC® injections will be completed until the VOC concentrations are less than their RGs. If data indicates that the amendment is working, but the concentrations have not met the RG, the timing of additional injections can be changed with EPA concurrence.

If the 1,4-dioxane concentrations are less than the RG and VOCs are also less than their RGs, no additional remediation will be necessary. Annual LTM sampling will be initiated.

If LTM data indicate that the exposure to groundwater would result in a cumulative excess carcinogenic risk less than or equal to 10-4 and a cumulative excess non-carcinogenic hazard index (HI) of less than or equal to 1 throughout the groundwater plume, the sampling can be ended.

If the solid IDW meets the definition of a RCRA hazardous waste, then it will be disposed of as hazardous waste.

Title: SAP



7.0 MEASUREMENT AND DATA ACQUISITION

7.1 SAMPLE PROCESS DESIGN

The sampling process design presented in the FSP was developed to meet the DQOs discussed in Section 6.4. Information in this section provides details related to the sample collection to ensure the split sample data are of known and acceptable quality. The number, types, locations, and analysis of samples are presented in Section 3.0.

7.2 SAMPLING METHOD REQUIREMENTS

All sampling activities will be conducted in accordance with the procedures outlined in Section 4. Information in this section discusses the sample container and collection requirements specific to each analytical laboratory where sample analysis will be performed.

7.2.1 Sampling Equipment and Preparation

Sampling equipment required for the field program for acceptance and submittal of samples, health and safety monitoring, and general field operations are listed in Table 4.1.

Field preparatory activities will include review of this FSP and QAPP by all RA Contractor field personnel; a field planning meeting with field personnel to discuss the content of the FSP, QAPP, and the Health and Safety Plan (HSP); general logistics related to implementation of the field program; and procurement of field equipment and supplies.

7.2.2 Sample Containers

The RA Contractor will provide certified clean sample containers that are pre-cleaned and traceable to the facility that performed the cleaning. Sampling containers will not be cleaned or rinsed in the field. Table 7.1 specifies the analytical methods, sample containers, preservation requirements, and holding times for the analyses that will be conducted by the EPA-approved laboratory and/or CLP laboratory(ies).

7.2.3 Sample Collection

Sample collection procedures outlined in Section 4 of the FSP will be used to collect these samples in the containers with appropriate preservatives as specified in Table 7.1. Documentation that will be delivered with samples includes sample labels and TR/COC forms as specified in Section 7.3. Samples will be shipped to the EPA Region 3 laboratory and/or to one or more CLP laboratories daily Monday through Thursday for overnight delivery via Federal Express.

7.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Custody and documentation for field and laboratory work are described below, followed by a discussion of corrections to documentation. All sample handling issues will be conducted in accordance with EPA-540-R-014-013, *Contract Laboratory Program Guidance for Field*

Samplers. Attached UFP Worksheet #26 summarizes the Sample Handling System and personnel responsible for each task.

7.3.1 Field Sample Custody and Documentation

The purpose and description of the sample label and the TR/COC record are discussed in the following sections. All identification and tracking procedures for samples will be conducted in accordance with EPA-540-R-014-013, *Contract Laboratory Program Guidance for Field Samplers*.

The location of each sample, as well as time and date of sample collections and requested analyses, will be recorded on a field sheet completed for each sample. An example field sheet is provided in Appendix B.

7.3.1.1 Chain of Custody Requirements

Scribe is the mandatory electronic format for the TR/COC for all CLP requests. The TR/COC record is employed as physical evidence of sample custody and control. This record system provides the means to identify, track, and monitor each individual sample from the point of collection through final data reporting. An example TR/COC record is included with the field forms in Appendix B.

A copy of the TR/COC, included in Appendix B, will be completed for each accepted sample that will be submitted to the EPA Region 3 laboratory for analysis. The TR/COC will be completed by the field sampling team. The field sampler will sign off on the TR/COC when the samples are relinquished to the sample coordinator for packaging and shipping of the samples to the EPA-approved laboratory.

The sample coordinator will sign the TR/COC when accepting custody of these samples, and shall relinquish custody to FedEx for shipment by noting "FedEx" and the FedEx air bill number on the TR/COC form. The TR/COC shall be shipped to the EPA-approved laboratory with the samples, and a copy of the TR/COC shall be maintained by the RA Contractor.

7.3.1.2 Sample Packaging and Shipping

Samples will be packaged and shipped promptly after collection. When sent by common carrier, packaging, labeling, and shipping of hazardous materials are regulated by DOT under CFR Title 49, Part 172. Sample bottles will be sealed in a zip-top bag prior to emplacement in cooler. The shipping cooler will be lined with a garbage bag and packed with ice. The samples will be placed within the cooler with care, to ensure that there is sufficient room for the samples and adequate ice. The garbage bag liner will be taped closed and the TR/COC will be taped to the underside of the lid of the cooler. The cooler lid will be taped down and custody seals will be signed and attached across the openings of the cooler lid.

All samples will be shipped by an overnight delivery service (i.e., FedEx) to the designated laboratory. A copy of each air bill will be retained by the RA Subcontractor and the air bill number will be recorded in the field logbook so the cooler can be easily tracked if mishandled.

7.3.1.3 Field Logbook(s) and Records

Field Logbooks

An important element of field documentation is the proper maintenance by field personnel of the site-specific field logbooks. The logbook is an accounting of the accomplishment of scheduled activities, and will duly note problems or deviations from the governing plans and observations relating to the field program. Logbooks will be kept in the field team member's possession or in a secure place when not being used. The FTL will periodically check logbook entries to make sure the required information is present.

Field Forms

In addition to the field logbooks, field forms will be used to record sampling activities and measurements taken in the field. Field forms to be used during this project are included in Appendix A Information included on the field sheets will be repeated in the field logbook. Each completed field sheet will be referenced in the field logbook, as appropriate. Field forms include the following:

- Boring Log;
- Well Construction Details and Abandonment Form;
- Well Development Record;
- Waste Inventory Tracking Form;
- MW Static Water Level Form,
- MW Purging Form,
- Groundwater Field Sampling Data Sheet,
- TR/COC,
- Change Request Form (if needed), and
- Nonconformance report (if needed).

At the conclusion of Site activities or when the logbook is filled, the logbook and field forms will be incorporated into the project file.

Photographs

Field activities and sampling events will be documented using a digital camera. For each photograph, the following items will be noted in a photographic record recorded in the applicable field logbook:

- Date of photograph,
- Time of photograph,
- Signature of the photographer,
- Identification of the Site or sample by sample number,
- General direction the photograph is oriented, and
- Sequential number of the photograph recorded on the disk.

7.3.2 Laboratory Custody Procedures and Documentation

Laboratory custody procedures are provided in the laboratory's QA Manual. Upon receipt at the laboratory, each sample shipment will be inspected to assess the condition of the shipping cooler and the individual samples. This inspection will include measuring the temperature of the cooler (if cooling is required) to document that the temperature of the samples is within the acceptable criteria (≤6 °C without freezing) and verifying sample integrity. The pH of the samples will be measured, if preserved. The enclosed TR/COC record(s) will be cross-referenced with all of the samples in the shipment. Laboratory personnel will then sign these TR/COC records and copies provided to HGL will be placed in the project file. The sample custodian may continue the TR/COC record process by assigning a unique laboratory number to each sample on receipt. This number, if assigned, will identify the sample through all further handling. It is the laboratory's responsibility to maintain internal logbooks and records throughout sample preparation, analysis, data reporting, and disposal.

7.3.3 Corrections to and Deviations from Documentation

If required, a single strikeout initialed and dated is required to document changes for correcting erroneous field entries. The correct information should be entered in close proximity to the erroneous entry. The same procedure will be used on field logbooks, field sheets and TR/COC records.

Any deviations from the project plans (RD, FSP, QAPP, HSP) will be recorded in the appropriate field logbook. A field change request form included in Appendix B will be completed prior to implementing the deviation from the project plans. The field change request form will be signed by the FTL and PM. Significant deviations will require signature by the EPA WAM before the change is implemented. Completed field change request forms will be included and discussed in the field investigation report.

7.4 FIELD QUALITY CONTROL REQUIREMENTS

The following types of QC samples will be collected in the field and shipped to the laboratories for analysis:

- Field duplicates,
- Equipment rinse blanks,
- Field blanks,
- MS/MSD,
- Temperature blanks, and
- Trip blanks.

7.4.1 Field Duplicates

Field duplicates are samples that are divided into two portions at the time of sampling. Field duplication sampling provides information regarding sample matrix homogeneity, handling, shipping, storage, preparation, and analysis. Field duplicates will be submitted per matrix at a frequency of one per every ten samples or one per sampling trip if fewer than ten samples are

collected. Duplicate samples will be submitted for the same analyses as the duplicated sample. No duplicate samples will be collected for waste characterization samples.

7.4.2 Equipment Rinse Blanks

Equipment rinse blanks are obtained under representative field conditions by running analyte-free deionized/distilled water through sample collection equipment (e.g., bailer, split-spoon, corer, pump) after decontamination and collecting the rinse water in the appropriate sample containers for each analytical method. Rinse blanks will be used to assess the effectiveness of decontamination procedures. Rinse blanks will be collected for each type of non-dedicated sampling equipment used and will be submitted at a frequency of 1 per every 20 samples per matrix per type of sampling equipment.

Based on the proposed field activities, rinsate samples are anticipated for submersible pumps. Rinse blanks will be submitted for the same analyses as the sample collected prior to the rinse blank.

7.4.3 Field Blanks

Field blanks are aliquots of analyte-free deionized/distilled water poured into laboratory-provided sample bottles and handled as an environmental sample in the field under representative field conditions. A field blank is used to determine whether contamination has been introduced during sample collection, storage, and shipment, as well as sample handling in the analytical laboratory. Field blanks will only be collected during the collection of aqueous samples and will be collected at a frequency of one per sampling event. Field blanks will be submitted for the same analyses as the samples collected during the sampling event.

7.4.4 Matrix Spike/Matrix Spike Duplicate

MS/MSD samples are required by the laboratory's CLP contract to check organic and inorganic analysis. MS/MSD samples will be collected for every 20 samples submitted. MS/MSD samples will not be collected for target analyte list (TAL) VOCs and TAL SVOCs analyses. For aqueous samples, a triple-volume sample aliquot is collected in the field.

The MS and MSD sample aliquots are identified with the same sample ID number as the associated environmental samples, and the samples to be used for laboratory QC will be noted on the TR/COC form. Note that the CLP inorganic methods require an MS and a laboratory duplicate instead of an MS/MSD. For these analyses, the laboratory will perform an MS and a laboratory duplicate analysis on the same sample designated for organic MS/MSD analyses.

7.4.5 Temperature Blanks

A temperature blank measures the temperature of the shipment upon arrival at the laboratory. It is used to determine whether sufficient temperature control was maintained during the shipping process. A temperature blank is prepared in the field from analyte-free water in a container used to ship samples (a 40-milliliter [mL] vial is suggested) and marked "Temperature Blank–Do Not Analyze." One temperature blank will be shipped per cooler containing samples.

7.4.6 Trip Blanks

Trip blanks are analyzed only for VOCs. They are prepared in a clean area in the laboratory or in the field prior to sampling events. Once prepared, trip blanks must not be opened. Trip blanks are transported over the Site with the sampling teams to evaluate field-derived contamination and accompany samples through the entire shipping process. They are submitted at a frequency of one per shipping cooler containing VOC samples.

7.5 LABORATORY QUALITY CONTROL SAMPLES

Samples accepted during this project will be analyzed in accordance with standard EPA and/or nationally accepted analytical procedures. The laboratory will adhere to all applicable QA/QC requirements stated in the applicable method and its laboratory QA Plan.

Laboratory QC samples will include continuing calibration checks, method blanks, laboratory control samples (LCSs), laboratory duplicates, surrogate spikes, and MSs as required by the analytical method. The EPA-approved laboratory will analyze laboratory QC samples in accordance with its in-house QA plan and method requirements.

7.6 INTERNAL QUALITY CONTROL CHECKS

All project deliverables will receive technical and QA review prior to being issued to the EPA.

7.7 FIELD INSTRUMENT CALIBRATION AND FREQUENCY

Field instruments will be used to monitor aqueous water quality and well stabilization parameters and monitor organic vapor concentrations in the air. It is the FTL's responsibility to ensure that each member of the field team is trained in the calibration, use, and maintenance of all applicable field equipment.

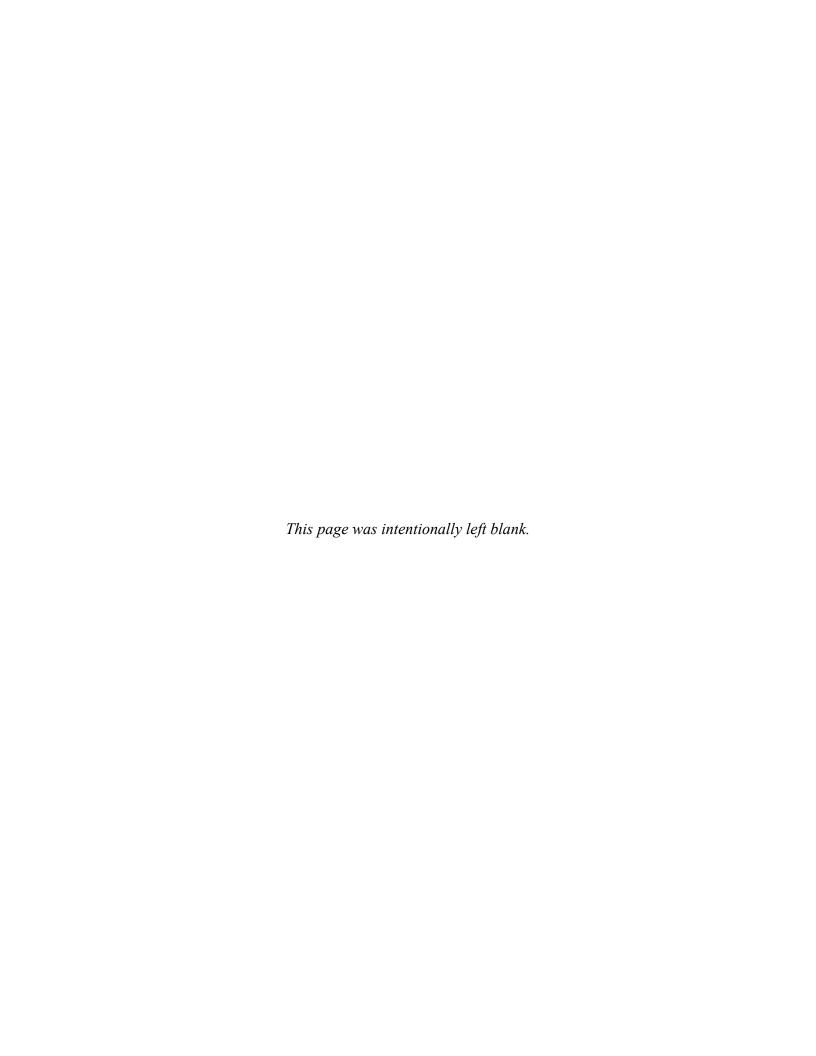
Instruments will be calibrated at the beginning and end of each day in accordance with the instrument manufacturer's instructions. Calibration will be documented on an equipment calibration log or within the project's field logbook. During calibration, an appropriate maintenance check will be performed on each piece of equipment. If damaged or defective parts are identified during the maintenance check and it is determined that the damage could have impact on the instrument's performance, the instrument will be removed from service and clearly marked to ensure against further use until the defective parts are repaired or replaced. It is the equipment operator's responsibility to verify that the instrument is operating properly and holding calibration at all times. If the field instrument does not hold calibration, it will be removed from service. The field logbook will clearly identify the specific instruments used for each task.

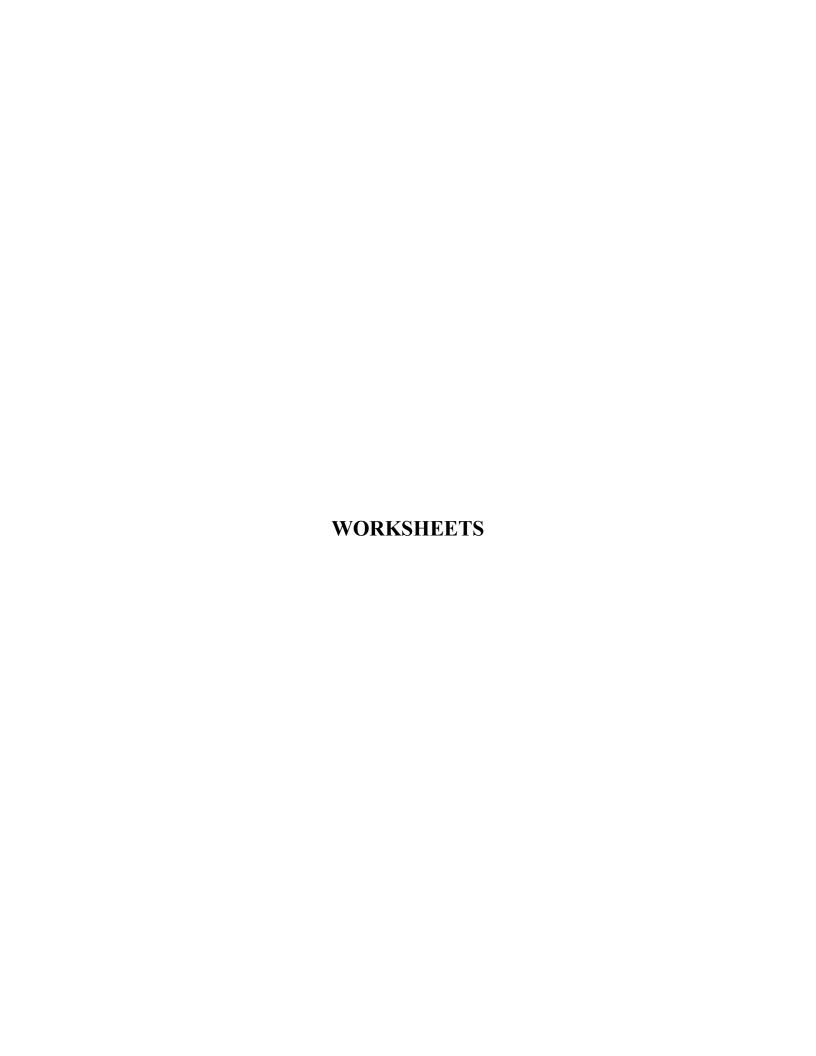
7.8 ACCEPTANCE REQUIREMENTS FOR SUPPLIES

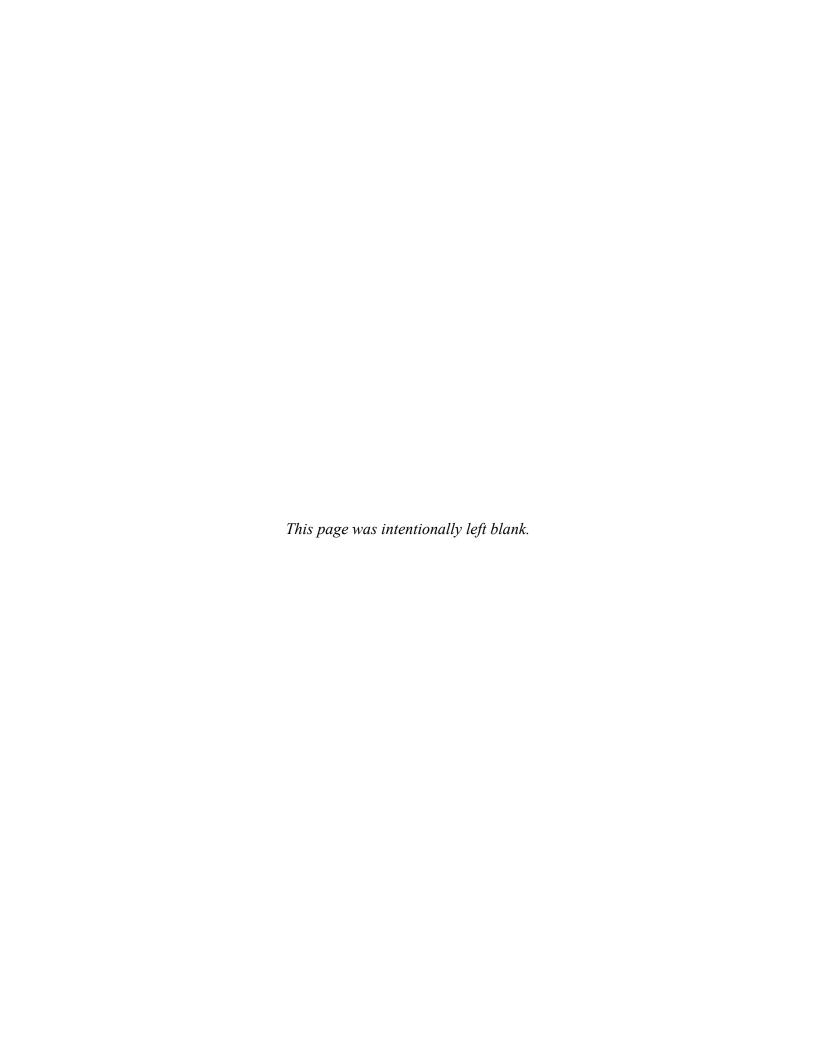
Prior to acceptance, all supplies and consumables will be inspected to ensure that they are in satisfactory condition and free of defects.

7.9 NONDIRECT MEASUREMENT DATA ACQUISITION REQUIREMENTS

Nonmeasurement sources include site reconnaissance, historical databases, and literature searches. The acceptance criteria for such data include a review by someone other than the author. Any measurement data obtained from non-direct measurement sources will be utilized only to the extent that those data can be verified. Non-direct measurement data requirements are presented in UFP Worksheet #13.







Title: SAP Revision Number: 1 Revision Date: 7/2018

Project-Specific OR Generic QAPP – Project Specific Site Name/Project Name: AIW Frank/Mid-County Mustang Superfund Site Site Location: Exton, PA

Secondary Data Criteria and Limitations Table QAPP Worksheet #13

	,	Data (1 11 11 11 11 11	
Secondary Data	Data Source	Generator(s)	How Data Will Be Used	Limitations on Data Use
Groundwater	HGL, 2015, Final FFS Report for OU1	HGL, Weston	Background information,	No restrictions for use, as all
contamination			determination of	activities were overseen by
distribution	HGL, 2012, Pilot Study In Situ		contaminant trends, RD	EPA or PADEP
MW construction information	Enhanced Bioremediation Application Summary Report		evaluation	
Historical sampling information	HGL, 2012, Semiannual Groundwater Monitoring Report October 2011 for OU1			
	Weston, 2012, Groundwater Sampling and Monitoring Report			

Notes:

U.S. Environmental Protection Agency Focused Feasibility Study

HydroGeoLogic, Inc.

EPA FFS HGL MW OUI PADEP RD

monitoring well
Operable Unit 1
Pennsylvania Department of Environmental Protection remedial design

U.S. EPA Region 3

Revision Date: 7/2018 Title: SAP Revision Number: 1

Project-Specific OR Generic QAPP – Project Specific Site Name/Project Name: AIW Frank/Mid-County Mustang Superfund Site Site Location: Exton, PA

Sample Handling System QAPP Worksheet #26

MENT	
CKAGING, AND SHIP	
SAMPLE COLLECTION, PACKAGING, AND SHIPMENT	
SAM	

Sample Collection (Personnel/Organization): RA Contractor FTL Sample Packaging (Personnel/Organization): RA Contractor FTL

Coordination of Shipment (Personnel/Organization): RA Contractor FTL

Type of Shipment/Carrier: Cooler/FedEx

SAMPLE RECEIPT AND ANALYSIS

Sample Receipt (Personnel/Organization): CLP Laboratory or Office of Analytical Services and QA Laboratory

Sample Custody and Storage (Personnel/Organization): RA Contractor and assigned laboratory

Sample Preparation (Personnel/Organization): RA Contractor FTL

Sample Determinative Analysis (Personnel/Organization): Assigned Laboratory

SAMPLE ARCHIVING

U.S. EPA Region 3

Field Sample Storage (No. of days from sample collection): RA Contractor FTL (must be less than the maximum hold time)

Sample Extract/Digestate Storage (No. of days from extraction/digestion): Assigned Laboratory (laboratory specific)

Biological Sample Storage (No. of days from sample collection): N/A

SAMPLE DISPOSAL

Personnel/Organization: Assigned Laboratory

Number of Days from Analysis: Assigned Laboratory (laboratory specific)

Notes:

Contract Laboratory Program CLP

U.S. Environmental Protection Agency

Field Team Leader 11 11

EPA FTL N/A QA

Not Applicable Quality Assurance

HGL 9/25/18

U.S. EPA Region 3

HGL 9/25/18

8.0 ASSESSMENT AND OVERSIGHT

8.1 ASSESSMENTS AND RESPONSE ACTIONS

The success of any individual project will be monitored by the performance of assessment activities at predetermined intervals. Assessment activities can be associated with project planning, sample collection, analysis, data manipulation, and data reporting phases. These activities include routine QA/QC surveillance, management system reviews, and readiness reviews. These assessment activities will be ongoing and will often produce routine documentation such as hand corrected printouts, editorial comments, and e-mailed memoranda. These ongoing assessment activities can be supplemented by audits of one or more of the data collection phases. These audits can be internal, performed by a team of the RA Contractor's management and QA/QC personnel, or can be external, performed by the EPA team or a subcontractor. The Division QA Manager, PM, and PgM all have the authority and the responsibility to issue a "stop work" notice if critical QA/QC deficiencies are observed at any time. Assessment activities are outlined in UFP Worksheet #31, and procedures for handling project deviations are outlined in UFP Worksheet #32.

8.2 SAMPLE COLLECTION/FIELD ACTIVITY ASSESSMENT

The FTL will report to the PM on a daily basis regarding progress of the fieldwork and QC issues associated with the field activities. The FTL will review all field team logbooks. Any deficiencies identified by the FTL during the logbook review process will be communicated to the individual field teams. If these deficiencies are severe (e.g., sample condition was compromised, information not properly recorded), the FTL will communicate these deficiencies to the PM for follow-up. These follow-up activities can include retraining or institution of procedural modifications. If, during field assessment activities, site subcontractor (e.g., an excavation or drilling firm) performance deficiencies are identified, these deficiencies will be addressed with the subcontractor before allowing any further site work to be performed and a discrepancy report will be transmitted to the PM.

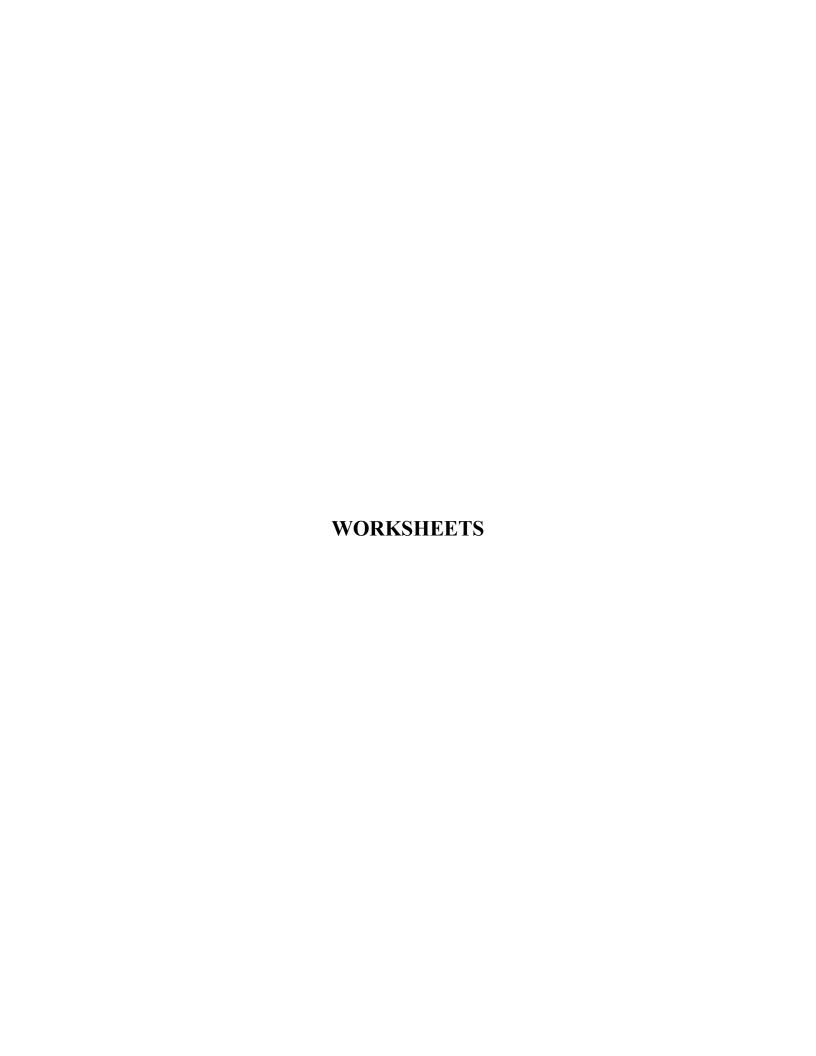
8.3 AUDITS

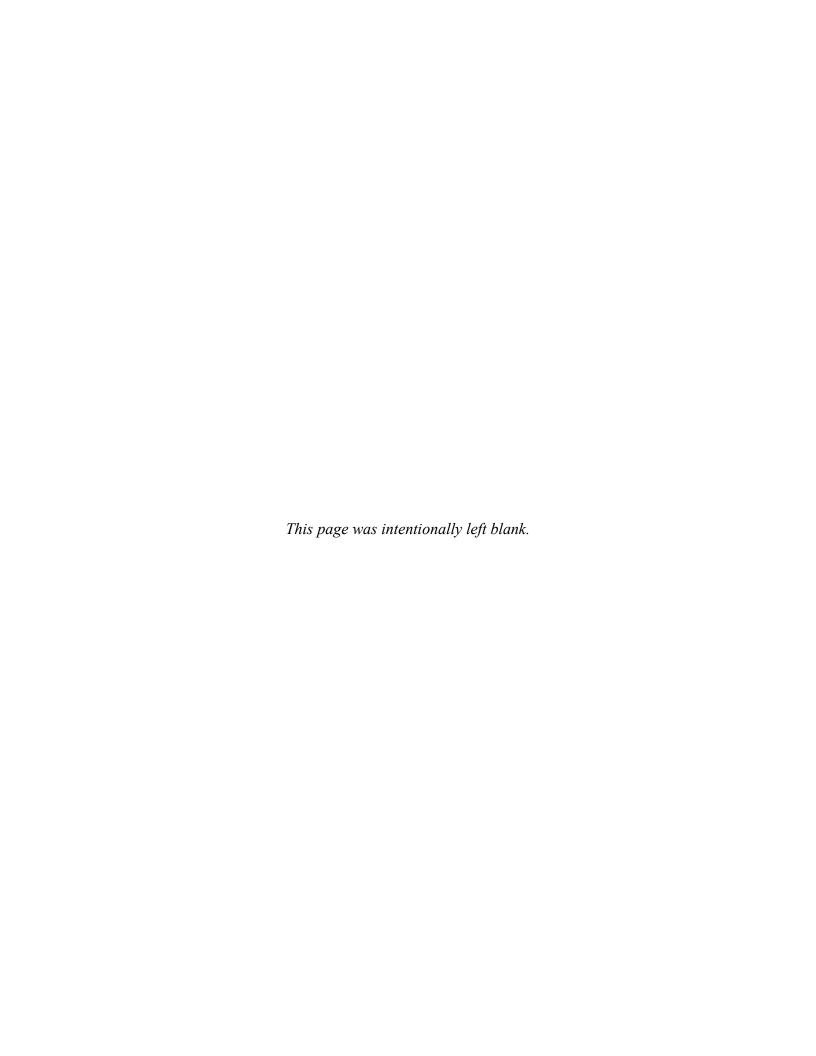
At the discretion of the Division QA Manager, any stage of the data collection process can undergo an audit. These audits can be in response to a specific incident or can be part of the overall corporate QA/QC program. The PM or PgM may also request that an audit be initiated if concerns over quality arise. Examples of audits that can be performed include sample collection or health and safety audits performed in the field; audits of project management and scheduling; audits of laboratory or field analytical systems; and audits of data tracking and manipulation processes. All audits will be documented, and the audit findings and resulting corrective actions will be entered into the project file. If the audit was initiated in response to EPA concerns, a report will be provided to the EPA for review, comment, and corrective action.

8.4 REPORTS TO MANAGEMENT

Reports will be generated for all QA audits that are conducted and provided to the QA Manager. Reports will include deficiencies that were noted during the audit and corrective actions that were planned or implemented.

The EPA WAM will receive QA reports whenever major quality problems cannot be immediately corrected.





Title: SAP Revision Number: 1 Revision Date: 7/2018

Planned Project Assessments Table QAPP Worksheet #31

Project-Specific OR Generic QAPP – Project Specific Site Name/Project Name: AIW Frank/Mid-County Mustang Superfund Site Site Location: Exton, PA

Possible Assessment Types	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing Corrective Actions	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions
Field Audit	As Required	Internal	RA Contractor	RA Contractor's QA Officer	RA Contractor's PM	RA Contractor's FTL and PM	RA Contractor's QA Officer
Technical Reviews	Each Report	Internal	RA Contractor	RA Contractor's Technical Reviewer	RA Contractor's PM	RA Contractor's PM	RA Contractor's Technical Reviewer
Data Validation	Each Sampling Event	External	ESAT	ESAT Data Validator	CLP Laboratory or RA Contractor's PM	CLP Laboratory Manager or RA Contractor's PM	EPA's OASQA

Notes:

CLP EPA ESAT OASQA QA

Contract Laboratory Program U.S. Environmental Protection Agency EPA Environmental Services Assistance Team Office of Analytical Services and Quality Assurance Quality Assurance

U.S. EPA Region 3

Title: SAP Revision Number: 1 Revision Date: 7/2018

Project-Specific OR Generic QAPP – Project Specific Site Name/Project Name: AIW Frank/Mid-County Mustang Superfund Site Site Location: Exton, PA

Assessment Findings and Corrective Action Responses **QAPP Worksheet #32**

Possible Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response	Timeframe for Response
Field Audit	Written audit report	RA Contractor's PM	5 days after audit	Corrective actions implemented by field team	QA Officer	Field actions immediately implemented, two weeks to address other concerns in report
Technical Reviews	Written comments and/or track changes	RA Contractor's PM	Immediately upon review	Document Tracking and Review Form	Technical Reviewer	Five days to address written comments
Data Validation	Memo	RA Contractor's PM	Determined by Laboratory	Memo-to-File	EPA OASQA McDonald.Brandon@epa.gov	One day

Notes:

U.S. Environmental Protection Agency Office of Analytical Services and Quality Assurance Project Manager Quality Assurance EPA OASQA PM QA

11 11 11

9.0 DATA VALIDATION AND USABILITY

Laboratory results will be reviewed for compliance with project objectives. Data validation and evaluation are discussed below.

9.1 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

Responsibility for data validation will be assigned by EPA Region 3. The actual content and format of the validation report are based on the level of review performed. The levels of validation available range from stringent QA/QC review of a complete data package to less rigorous protocols. The EPA WAM is responsible for coordinating the level of data validation required.

Because the analytical data obtained during the remedial investigation will be utilized to determine the nature and extent of contamination, these data must be of definitive data quality and be legally defensible; because of this requirement, the highest level of data validation is proposed.

Data validation for data obtained using CLP analytical methods will be performed in accordance with the following data validation guidance:

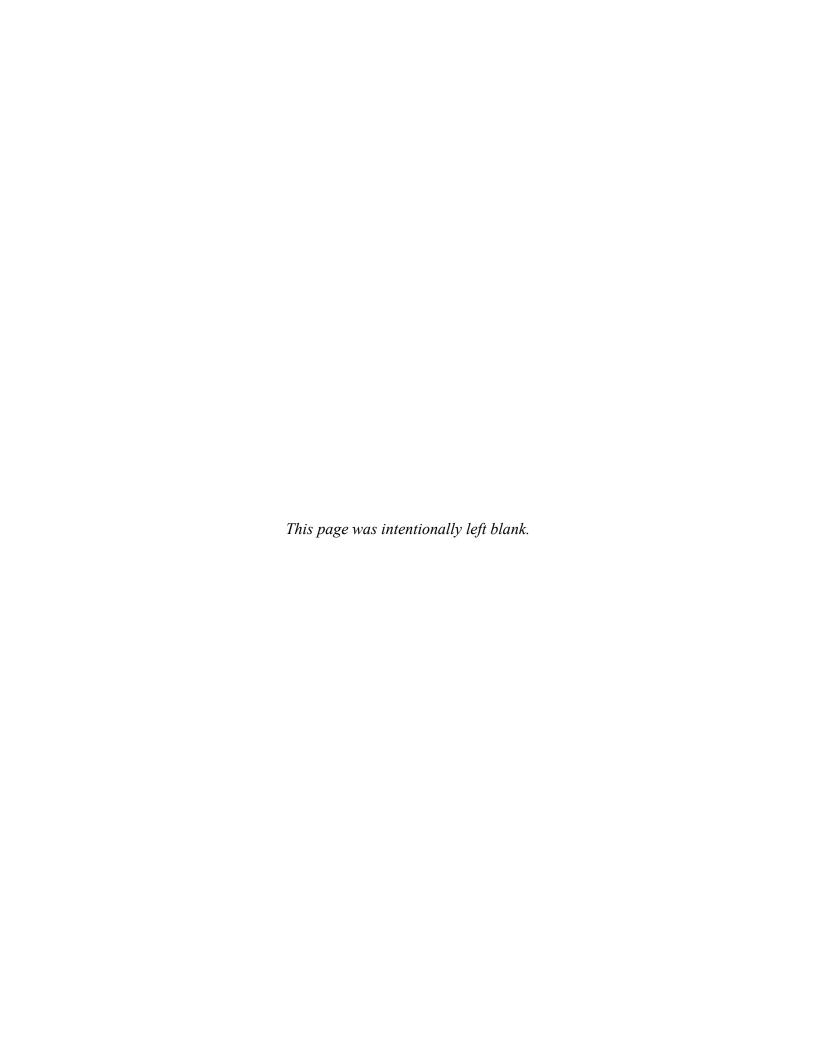
- EPA CLP National Functional Guidelines for Organic Superfund Methods Data Review (EPA, 2017a)
- EPA CLP National Functional Guidelines for Inorganic Superfund Data Review (EPA, 2017b)

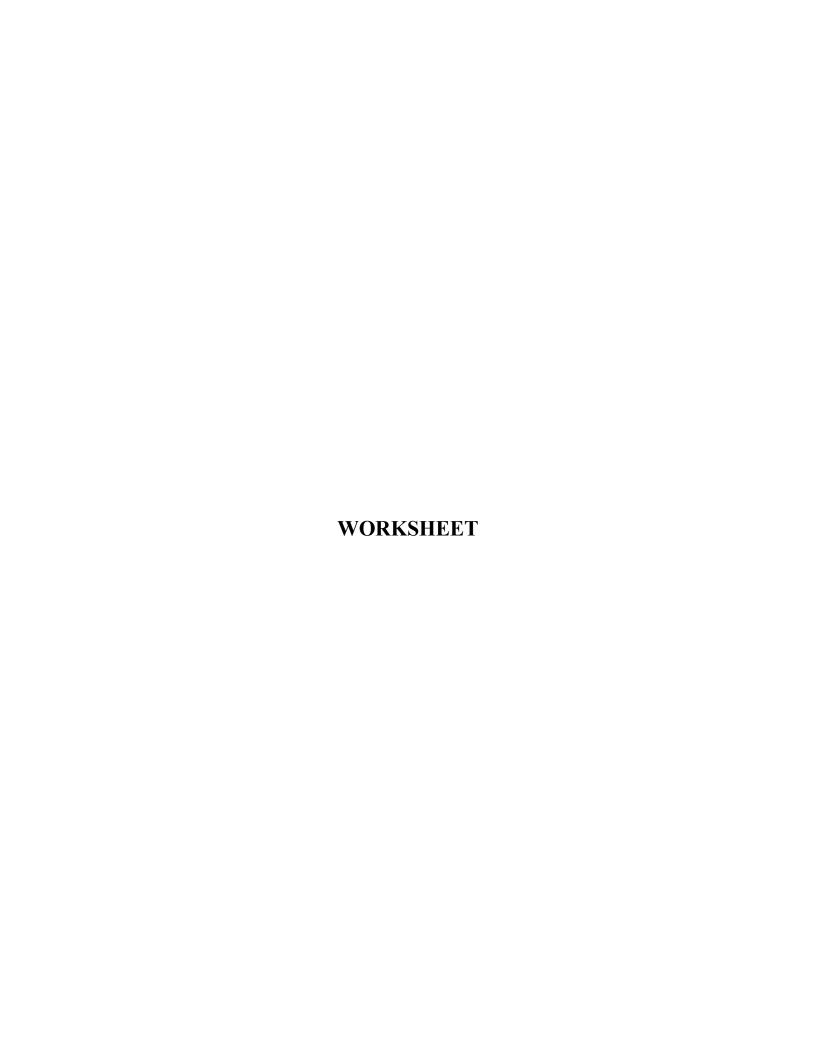
Data obtained from non-CLP analytical methods will be validated in accordance with the most similar CLP validation protocol, with method-specific adjustments for performance acceptance criteria.

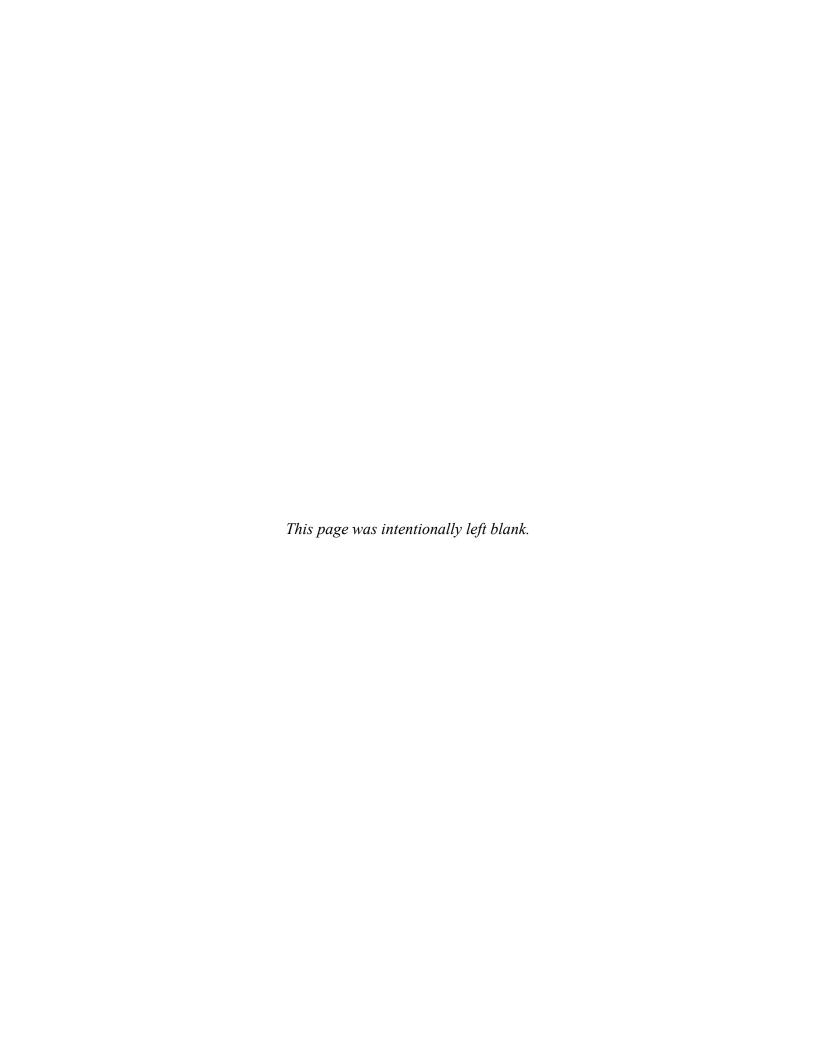
Data generated during the study will be reduced to a concise form for presentation in data evaluation summary reports. The analytical results will be managed using an electronic Access database. QA procedures will be implemented to prevent errors from occurring during data entry. The data entered into the program are checked by the computer operator, and the printouts are checked against the original laboratory sheets by a chemist.

9.2 DATA EVALUATION

The development of DQOs focuses on the end use of the collected data and on determining the degree of certainty with respect to PARCCS necessary to satisfy the end use. One hundred percent of the analytical data will be evaluated against PARCCS criteria as described in Section 6.0. After validation and evaluation, The RA Contractor will determine if data are usable for the intended purposes and if any limitations or gaps affect the overall usability of the dataset or a data subset. The Usability Assessment is provided in UFP Worksheet #37.







Title: SAP Revision Number: 1 Revision Date: 7/2018

Project-Specific OR Generic QAPP – Project Specific
Site Name/Project Name: AIW Frank/Mid-County Mustang Superfund Site
Site Location: Exton, PA

QAPP Worksheet #37

Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used: The usability assessment will include a measure or determination of precision, accuracy, completeness, representativeness, comparability and sensitivity. Precision is quantitative and most often expressed in terms of RPD. The RPD can be calculated from the following equation:

RPD =
$$[|(x_1-x_2)|/((x_1+x_2)/2)] \times 100$$

e $x_1 = \text{regular sample result}$ $x_2 = \text{duplicate sample result}$ The acceptable RPD limits for duplicate samples submitted to the EPA Region 3 laboratory or to a CLP laboratory are less than 20 percent for aqueous samples. Chemical analytical data will be evaluated for precision using field duplicates, laboratory duplicates, MS/MSDs, and LCS/laboratory control sample duplicates (LCSDs), as applicable.

matrix-specific are defined in the CLP SOW. For non-CLP methods, percent R requirements for LCS/ LCSDs, surrogates, and MS/MSDs will be as specified in the analytical method; if the method does not specify percent R for acceptance, the laboratory's internally derived limits will be is quantitative and usually expressed as the percent R of a sample result. Acceptable QC limits for CLP analytical methods are method- and Accuracy is the degree of agreement of a measurement with an accepted reference or true value, and is a measure of the bias in a system. Accuracy

as estimated data are considered usable. Rejected data are not considered. Completeness will be calculated after the data have been through quality review. For this work, a completeness goal of 90 percent is projected for all analytical data. If this goal is not met, additional sampling may be Completeness is a measure of the amount of usable data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Data will assess usability of the results. Those data that are validated and need no qualification, or are qualified necessary to adequately achieve project objectives. Title: SAP Revision Number: 1 Revision Date: 7/2018

Project-Specific OR Generic QAPP – Project Specific Site Name/Project Name: AIW Frank/Mid-County Mustang Superfund Site Site Location: Exton, PA

QAPP Worksheet #37 - (continued) Usability Assessment

selection of sampling sites; (b) selection of testing parameters and methods that adequately define and characterize the extent of possible Representativeness expresses the degree to which sample data accurately and precisely represent (a) a characteristic of a population, (b) parameter variations at a sampling point, and/or (c) an environmental condition. Good representativeness will be achieved through: (a) careful, informed contamination and meet the required parameter reporting limits; (c) proper gathering and handling of samples to avoid interference and prevent contamination and loss; (d) collection of a sufficient number of samples to allow characterization; and (e) evaluation of each detected result against associated blank results to determine if the detected analyte is potentially not indicative of actual site conditions.

Consistency in the acquisition, handling, and analysis of samples is necessary for comparing results. Where appropriate, the results of analyses obtained will be compared with the results obtained in previous studies. Standard EPA analytical methods and QC will be used to ensure comparability of results with other analyses performed in a similar manner.

Analytical quantitation limits for the various sample analytes should be below the level of interest to allow an effective comparison. For this 6.2 of this QAPP are the minimum levels that the laboratory will report analytical results without a qualifier when an analyte is detected. The laboratory can typically detect analytes at concentrations of up to an order of magnitude lower than the reporting limits shown in these tables. In Sensitivity is related to the ability to compare analytical results with project-specific levels of interest, such as delineation levels or action levels. project, sample quantitation limits should be lower than the Federal MCLs and RSLs. The analytical reporting limits provided in Tables 6.1 and this case, when a positive detection is less than the reporting limit but at or above the MDL, the value will be reported and qualified as an estimated concentration (J).

Describe the evaluative procedures used to assess overall measurement error associated with the project:

analytical data will be reviewed for accuracy using surrogates, MS/MSDs, and LCS/LCSDs, as applicable. The overall accuracy of laboratory data Field duplicate samples will be collected to provide a measure of the contribution to overall variability of field-related sources. Chemical also will be assessed using a review of equipment calibration and method-specific QC elements. Representativeness is a consideration that will be employed during all sample location and collection efforts and will be assessed qualitatively by reviewing field procedures and reviewing actual sample locations versus planned locations. Title: SAP Revision Number: 1
Revision Date: 7/2018

Project-Specific OR Generic QAPP – Project Specific Site Name/Project Name: AIW Frank/Mid-County Mustang Superfund Site Site Location: Exton, PA

QAPP Worksheet #37 - (continued)

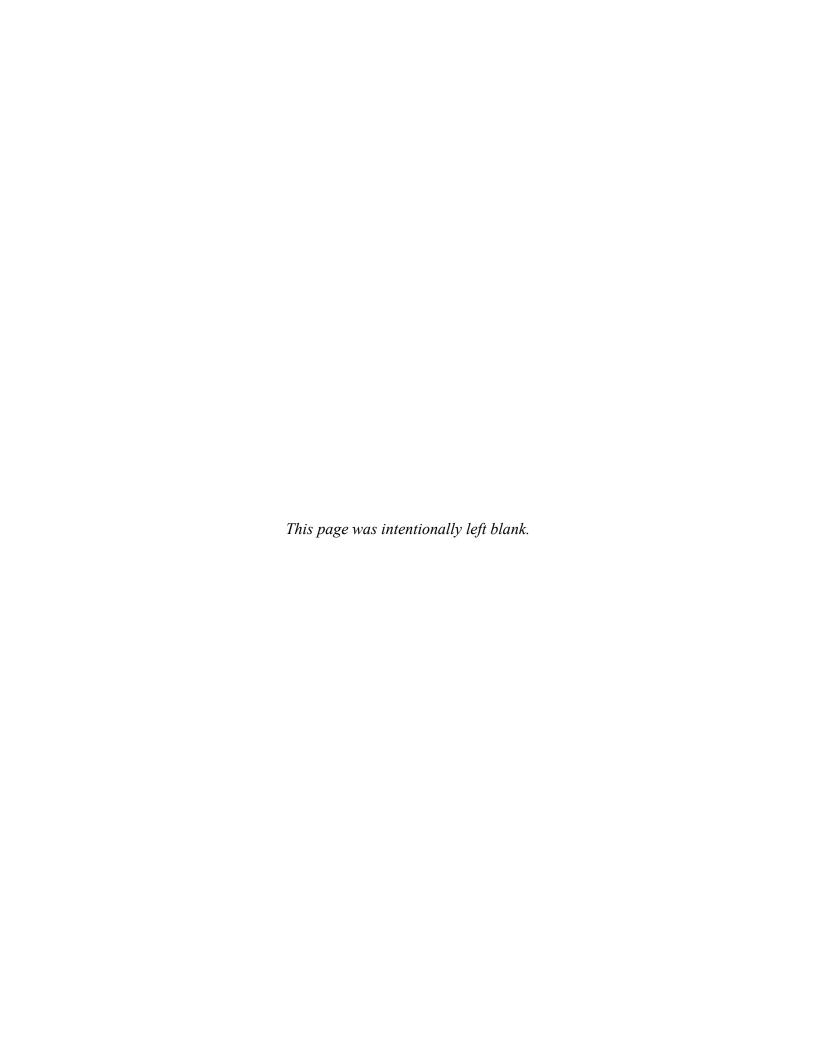
Usability Assessment

Identify the personnel responsible for performing the usability assessment:

Data Manager: TBD Chemist: TBD Project Manager: TBD

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

organic and inorganic data review (EPA 20017a and 2017b, respectively). The project chemist or designee will perform a quality check of the added by the EPA validator to determine usability of the results, and reviewing results of field QC samples such as field duplicates, trip blanks, or Analytical data packages will be received from the EPA laboratory in electronic data deliverable (EDD) format for uploading into the project database. EPA will validate the data prior to providing it to the RA Contractor, in accordance with EPA National Functional Guidelines for EPA results by reviewing sample numbers versus TR/COCs and EPA field sheets for consistency and completeness, reviewing any qualifiers rinsate blanks that are submitted to the EPA laboratory for analysis. The additional data will be added to the existing site database. The Access database will be utilized to manage the data. Tables summarizing the results of sample analysis will be generated from the database after the sampling effort is completed and validated analytical results have been received. Reconciliation with the DQOs and overall project objectives will be discussed in the data reports.



PART 3: DATA MANAGEMENT PLAN

10.0 DATA MANAGEMENT

10.1 INTRODUCTION

This DMP addresses the procedures to be followed for the assembly and manipulation of laboratory and field data generated during sampling and analysis activities. RA sample collection activities to be conducted at this Site will generate field and fixed laboratory data from the analysis of groundwater samples, survey data, field measurements, and other site-derived information. The resulting data will be entered into a single data management system for consistency in tracking samples, storing and retrieving data, evaluating analytical results, visualizing data, and generating data tables and reports. The DMP presented in this section was prepared to assist in implementing a successful data management strategy. The DMP is augmented by the requirements and procedures for field sample collection detailed in the FSP, and the sampling and analytical methodologies detailed in the QAPP.

10.1.1 Objectives of Data Management Plan

Successful data management results from coordinating data collection, control, storage, access, reduction, evaluation, and reporting. This DMP documents the methodology that will be employed during project execution to link the various data management tools, including software packages, to assure that the various data and information types to be collected are systematically collected and managed. The specific objectives of this DMP are:

- Standardize and facilitate the collection, formatting, and transfer of project data into the data management system and components;
- Provide a structured data system that will support the end uses of the data, including planning, decision making, and reporting;
- Minimize the uncertainties associated with the data, data-derived products, and interpretation of results through defined QC measures and documented processes, assumptions and practices; and
- Provide data of know quality that are adequately documented with descriptive information for technical defensibility and legal admissibility of the data.

10.1.2 Data Management Team Organization

A data management team will be established for the Site. The team will work together to properly execute the DMP and ensure that the project objectives and scope are realized. The team will be composed of specialists in each related discipline and technical resource. The RA Contractor's PM is an integral part of the data management team and has overall responsibility for assuring the data are collected in accordance with the EPA-approved SAP. The members of the data management team are as follows:

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- PM;
- Data Manager;
- FTL;
- Project Chemist;
- Sample Manager; and
- Database Administrator (DBA).

The functional responsibilities of the data management team are described in Section 10.1.3. One person may perform multiple roles on a project depending on the level of data to be managed and analyzed.

10.1.3 Roles and Responsibilities of Data Management Team

The responsibilities of the members of the data management team are summarized in Table 10.1. If the scope of the data requires a division of labor, the PM, in consultation with the Data Manager, will make assignments as appropriate to assure the best work flow.

10.1.4 Data Management Process

The data management process begins at the planning stages of the project as presented within this DMP. QC steps are implemented at each step of the data flow in which data undergoes a transformation. Transformations include conversion from hardcopy to electronic form, uploads to the database, output queries from the database, etc. After each process step, a 10 percent QC check is performed of the transformed data against the original dataset to ensure that no data were corrupted or lost.

The following are core concepts of the data management process:

- The Data Manager oversees the transfer of data from one member of the data management team to another and serves as the link between each step in the process.
- All data passes through a single repository to minimize the chance that data are duplicated or lost.

The post-processing (analysis) and reporting phases of the DMP create the majority of deliverables. The Data Manager and PM are responsible for providing to the staff the information needed to generate the required outputs. The Data Manager is not, in most cases, involved in the creation of the deliverables.

10.2 ACCESS DATABASE

The project data will be stored in the existing Site Microsoft Access database using the EPA Region 3 format. The database will be stored locally on a server that will undergo periodic backups to prevent loss of information.

10.2.1 Data Collection

All analytical sample data will be received from the ESAT following sample analysis as an EDD for inclusion in the database. EDDs will be received as an Extensible Markup Language (.xml) file as required by the EPA's ESAT. Only validated data, provided by the EPA, will be loaded into the project database.

10.2.1.1 Data Tracking Sheets

Once data have been collected, sample result packages will be checked by the Data Manager for completion and entered onto a sample tracking sheet by the Sample Manager. A sample tracking sheet will inventory samples collected and determine which results have not been received from the laboratory. Sample tracking sheets will be developed by exporting TR/COC forms generated through Scribe into an Excel spreadsheet. Scribe is the field sample documentation program that will be used at the Site to track samples from collection to the laboratory. If data are missing, the Data Manager will notify the PM, who will contact the ESAT coordinator to obtain electronic/hard copies of the missing data.

10.2.1.2 Database Log

During the data manipulation process, the Data Manager will maintain a database log updated with project-specific assumptions and changes made.

10.2.2 Pre-Processing Non-Staged Electronic Data Deliverable Data

All data not received as an EDD may be entered into a separate Excel spreadsheet for loading into the Site database, rather than directly keyed into the database through the user interface. This is done so that the loading quality checks are uniformly applied, and to ensure that all data pass through the same QC process. Data included in this step are sample collection information and field parameters. All hand-entered data will receive a 100 percent QC check before being loaded into the database.

10.2.3 Processing Electronic Data Deliverables

Each EDD will be loaded into the Access database by the DBA using the data loading tools provided in the software. Analytical data will be provided by EPA's data validation subcontractor in staged EDD format and will not require revision to perform the automated data review. All data in each EDD will be validated by the EPA's ESAT prior to receipt by HGL.

The electronically available data will be transferred into the project database and will be considered 100 percent accurate. Per the EPA, no QA/QC checks of the imported EDD data will be conducted. If a discrepancy between the ESAT's validation report and the EDD is encountered during any step of the process, the EDD data will be revised to reflect the ESAT's validation report.

10.2.4 Post-Processing

Data will be exported from the database for analysis and visualization. Database queries will be conducted only when analytical data has been validated and entered into the database.

10.2.5 Reporting

Tables summarizing the results of sample analysis will be generated from the database after the sampling effort is completed and validated analytical results have been received. These tables will include results for all constituents analyzed and found in at least one sample along with relevant sample collection information.

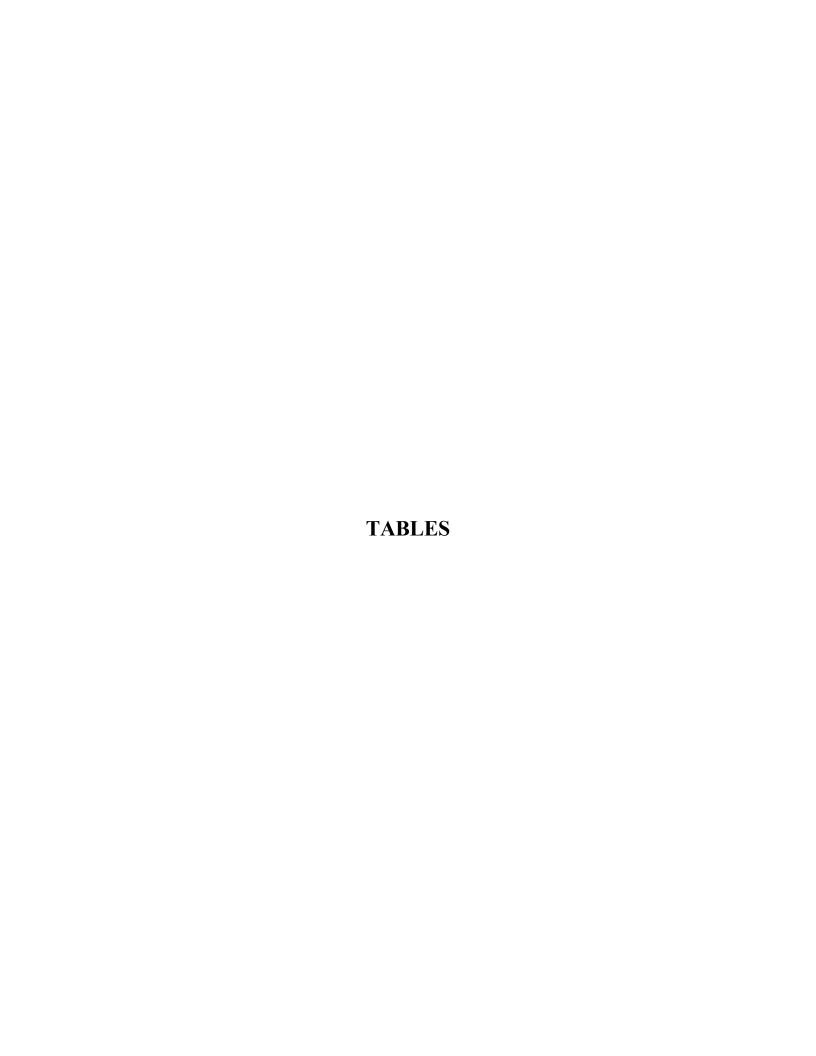
10.3 GRAPHICS

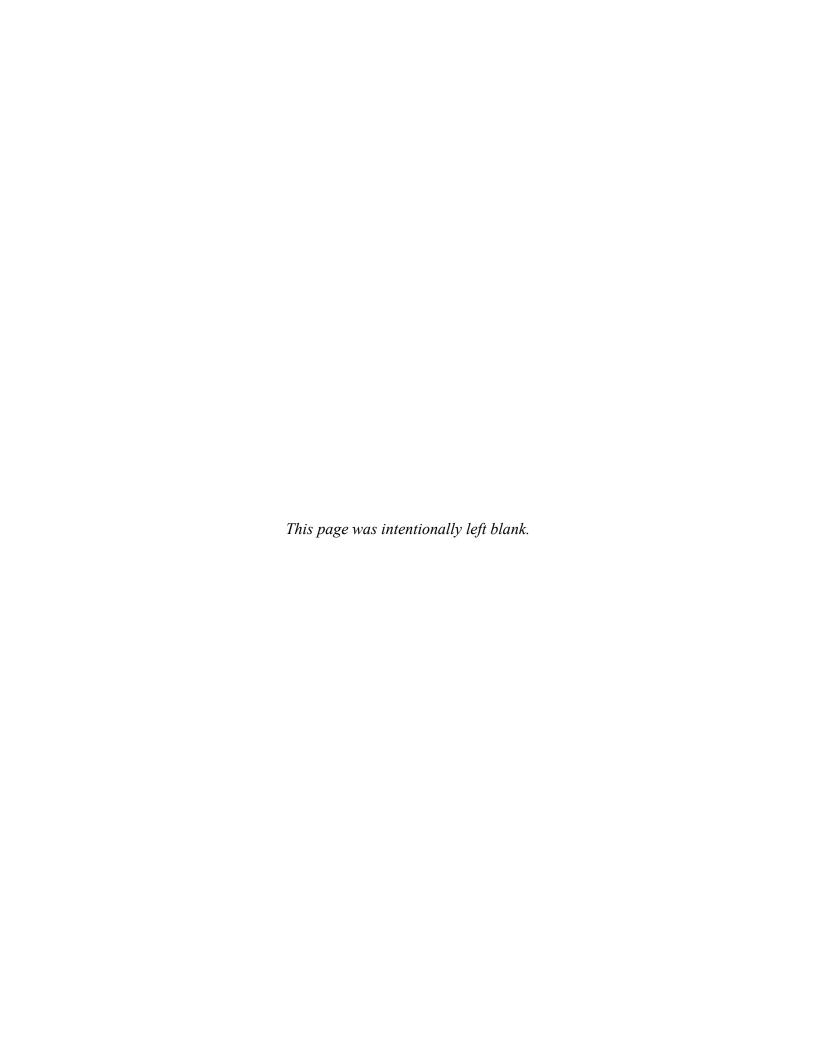
Upon completion of the project, all final versions of figures generated for the RA will be submitted in a format compatible with the EPA's ESRI geographical information systems software.

11.0 REFERENCES

- American Public Health Association (APHA), 1995. Standard Methods for the Examination of Water and Wastewater. 19th Edition.
- Halliburton NUS Corporation (HNUS), 1995. Remedial Investigation Report, AIW Frank/Mid-County Mustang Site, Chester County, Pennsylvania. April.
- HydroGeoLogic, Inc. (HGL), 2009. Corporate Quality Assurance Manual. August.
- HGL, 2012a. "Semiannual Groundwater Monitoring Report, October 2011, for Operable Unit 1 (OU-1), Long-Term Response Action, AIW Frank/Mid-County Mustang Site, Chester County, PA". January.
- HGL, 2012b. Contract Quality Management Plan, U.S. EPA Contract EP-S3-07-05. June.
- HGL, 2015. Final Focused Feasibility Study Report for Operable Unit 1 (OU-1) AIW Frank/Mid-County Mustang Site, Chester County, Pennsylvania. June.
- HGL, 2017. Work Assignment Work Plan Remedial Design Chem-Fab Site. September.
- HGL, 2018. Remedial Design AIW Frank/Mid-County Mustang Superfund Site Operable Unit 1, Chester County, Pennsylvania. July.
- U.S. Environmental Protection Agency (EPA), 1993. Data Quality Objectives Process for Superfund, EPA540-R-93-071. September.
- EPA, 2001. EPA Requirements for Quality Assurance Project Plans. EPA/240/B-01/003. March.
- EPA, 2006a. *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G4, EPA/240/B-06/001. February.
- EPA, 2006b. EPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration, SOM01.1/SOM01.2.
- EPA, 2006c. EPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration, ILM05.3/ILM05.4.
- EPA, 2014. Contract Laboratory Program Guidance for Field Samplers, EPA-540-R-014-013. October.
- EPA, 2015. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA publication SW-846, Third Edition through Final Update V. August.
- EPA, 2017a. USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (OLEM 9355.0-136; EPA-540-R-2017-002). January.

- EPA, 2017b. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (OLEM 9355.0-135; EPA-540-R-2017-001). January.
- EPA, 2017c. Record of Decision Amendment AIW Frank/Mid-County Mustang Superfund Site West Whitefield Township, Chester County, Pennsylvania. June.
- Tetra Tech NUS, Inc., 2001. AIW Frank/Mid-County Mustang Site Groundwater Remediation Operation and Maintenance Plan. March.





Persulfate Performance Sampling Scheme

	TOC	X	X	X	X	X	X	X	X	X
cheme	COD	X	X	X	X	X	X	X	X	X
ytical S	Sulfate	X	X	X	X	X	X	X	X	X
ng Anal	V)İnileAlA	X	X	X	X	X	X	X	X	X
Sampli	Total Iron	X	X	X	X	X	X	X	X	X
Groundwater Sampling Analytical Scheme	Dissolved Iron	X	X	X	X	X	X	X	X	X
Groun	9nsxoi U- 4,1	X	X	X	X	X	X	X	X	X
	AOC8	X	X	X	X	X	X	X	X	X
	Type of Screen	Open	Open	PVC	PVC	PVC	PVC	Open	PVC	PVC
	Screened Interval (ft bgs)	79-298	64-197	96-116	06-08	180-200	55-95	NA	150-160	33-43
	Well Depth (ft bgs)	867	161	911	06	200	56	52	160	43
	Well Diameter (inches)	8	9	2	2	2	2	9	2	2
	Well ID	EW-5	MW-108A	MW-111	MW-112A	MW-112B	MW-115	MW-116	OB-1I	OB-1S

below ground surface chemical oxygen demand

feet total organic carbon volatile organic compounds volatile organic compounds

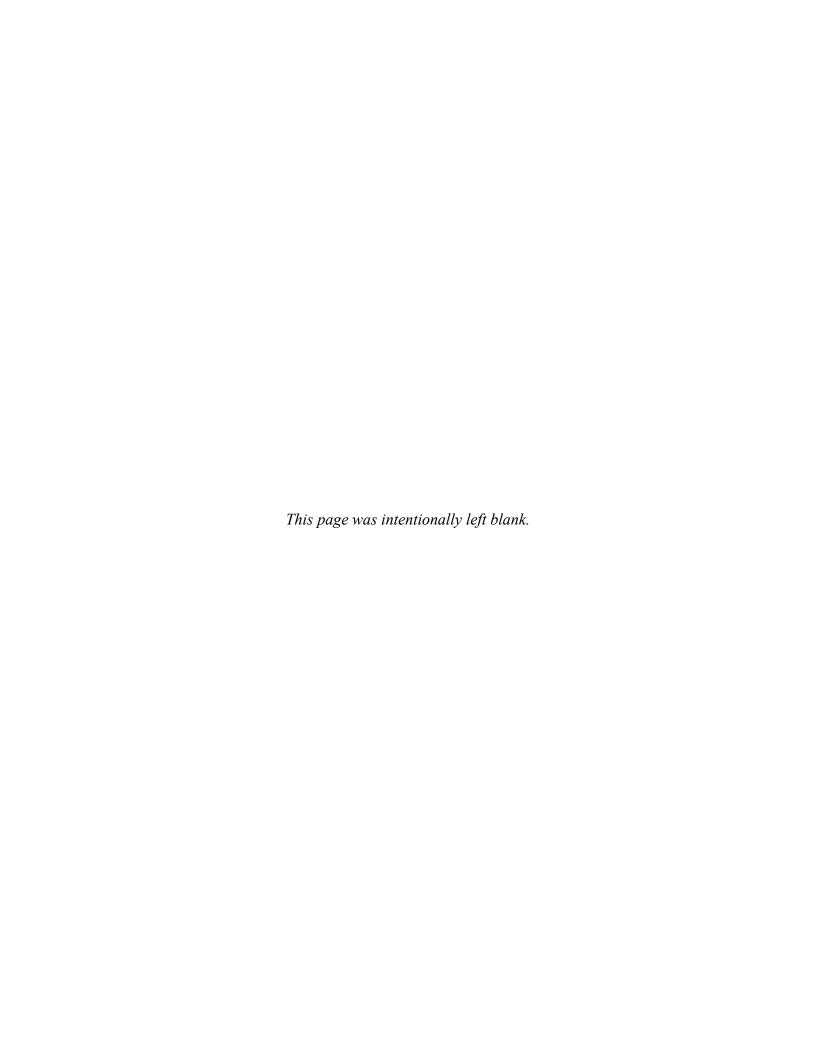


Table 3.2 ABC $^{\tiny \oplus}$ Pre and Post Performance Sampling Scheme

	Biomass		×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
	Dehalococcoides bacteria	1	×	×	×	×	×	×	×	×	×	×	×	×	X	×	×	X	×	×
me	SQT	×	×	×	×	X	×	×	×	×	×	X	×	×	X	×	×	×	×	×
al Sche	Chloride	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Analytic	Methane, ethene, ethane	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
npling A	Arsenic, Potassium, and Manganese	×	X	×	×	×	×	×	X	×	×	×	×	×	×	X	×	X	×	X
ter San	Sulfate	×	X	×	X	X	×	X	X	X	X	X	×	X	X	X	X	X	X	X
Groundwater Sampling Analytical Scheme	Vitrate	×	X	X	X	X	X	×	X	×	X	X	X	×	X	X	×	X	X	×
Gre	¹sbioA ɔilodstəM	×	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	TOC	×	X	X	X	X	X	×	X	X	X	X	X	×	X	X	X	X	X	X
	VOC.s	×	X	X	X	X	×	×	X	X	X	X	×	×	X	X	X	X	X	X
	Type of Screen	Open	Open	PVC	PVC	PVC	PVC	PVC	Open	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	Open
	Screened Interval (ft bgs)	67-250	64-197	96-116	06-08	180-200	59-55	55-95	NA	52-62	162.5-167.5	105-125	160-170	150-160	33-43	73-83	40-55	71-76	100-150	NA
	Well Depth (ft bgs)	250	197	116	06	200	99	95	52	62	195	125	170	160	43	83	55	92	150	39
	Well Diameter (inches)	8	9	2	2	2	2	2	9	2	1	2	2	2	2	2	2	2	4	9
	Well ID	EW-6	MW-108A	MW-111	MW-112A	MW-112B	MW-114	MW-115	MW-116	MW-117	MW-118C	MW-113A	MW-113B	OB-11	OB-1S	OB-2I	OB-2S	OB-3S	OB-4	OB-5

Notes:

¹Lactic, pyruvic, acetic, propionic, and butyric bgs = below ground surface

COD = chemical oxygen demand ft = feet

TOC = total organic carbon VOCs = volatile organic compounds

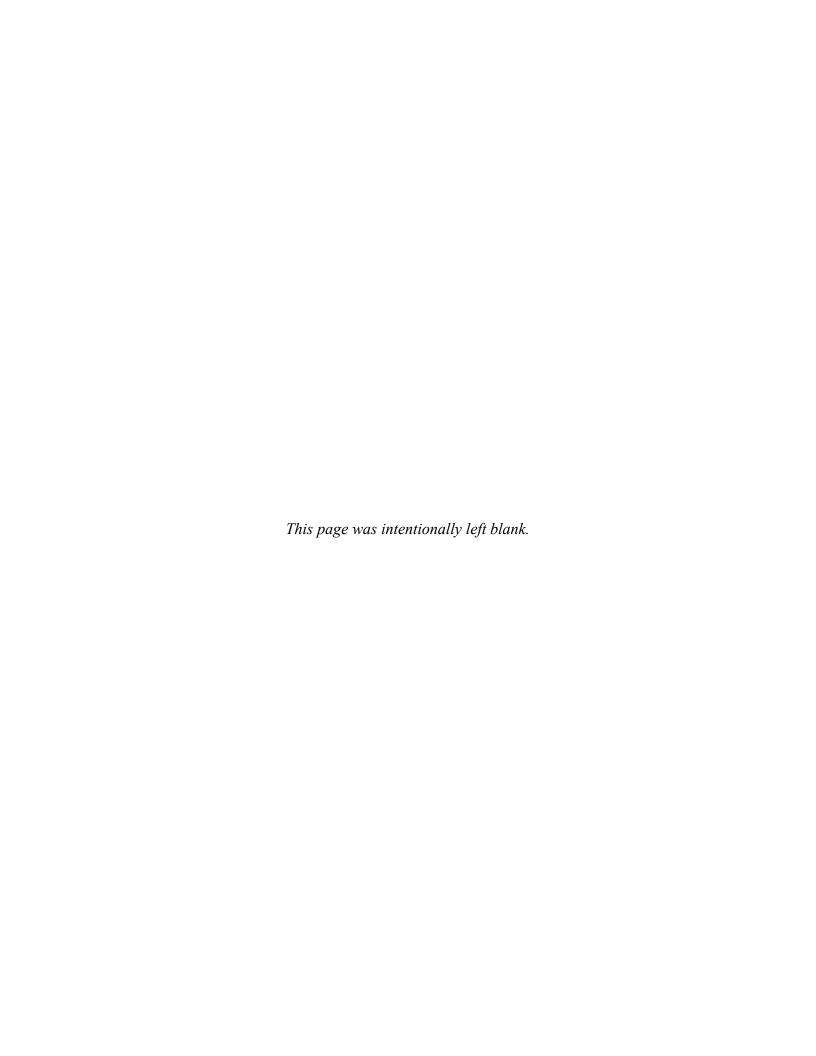


Table 3.3 LTM Sampling Scheme

						dwater Sa lytical Sch	
Well ID	Well Diameter (inches)	Well Depth (ft bgs)	Screened Interval (ft bgs)	Type of Screen	VOCs	1,4-Dioxane	Arsenic and Manganese
EW-31	8	200	72-200	Open	X	X	X
EW-6	8	250	67-250	Open	X	X	X
HW-13A ²	NA	NA	NA	NA	X	X	X
HW-13B ³	NA	NA	NA	NA	X	X	X
HW-6	6	75.5	NA	Open	X	X	X
MW-103A	4	40	20-40	PVC	X	X	X
MW-103B	6	132	68-132	Open	X	X	X
MW-104A	6	95	25-95	Open	X	X	X
MW-104B	6	140	105-140	Open	X	X	X
MW-105A	6	100	20-100	Open	X	X	X
MW-105B	6	175	110-175	Open	X	X	X
MW-106	6	78	26-78	Open	X	X	X
MW-107A	6	55	28-55	Open	X	X	X
MW-107B	6	80	65-80	Open	X	X	X
MW-108A	6	197	64-197	Open	X	X	X
MW-110	2	55	45-55	PVC	X	X	X
MW-111	2	116	96-116	PVC	X	X	X
MW-112A	2	90	80-90	PVC	X	X	X
MW-112B	2	200	180-200	PVC	X	X	X
MW-113A	2	125	105-125	PVC	X	X	X
MW-113B	2	170	160-170	PVC	X	X	X
MW-114	2	65	55-65	PVC	X	X	X
MW-115	2	95	55-95	PVC	X	X	X
MW-116	6	52	NA	Open	X	X	X
MW-117	2	62	52-62	PVC	X	X	X
MW-118A	1	195	137-142	PVC	X	X	X
MW-118B	1	195	148-158	PVC	X	X	X
MW-118C	1	195	162.5-167.5	PVC	X	X	X
OB-1I	2	160	150-160	PVC	X	X	X
OB-1S	2	43	33-43	PVC	X	X	X

Table 3.3 (Continued) LTM Sampling Scheme

						dwater Sa lytical Sch	
Well ID	Well Diameter (inches)	Well Depth (ft bgs)	Screened Interval (ft bgs)	Type of Screen	VOCs	1,4-Dioxane	Arsenic and Manganese
OB-2I	2	83	73-83	PVC	X	X	X
OB-2S	2	55	40-55	PVC	X	X	X
OB-3S	2	76	71-76	PVC	X	X	X
OB-4	4	150	100-150	PVC	X	X	X
OB-5	6	39	NA	Open	X	X	X
OB-6	8	200	NA	Open	X	X	X

Notes:

below ground surface chemical oxygen demand COD =

= feet

TOC = total organic carbon VOCs = volatile organic compounds

¹Sample collected from sampling port while EW is running ²Sample collected from barn sink

³Sample collected from sump in basement of house

Table 4.1 Field Equipment and Supplies

Sampli	ng Supplies
Sample containers	Deionized water
Preservatives (HCl, HNO ₃ , H ₂ SO ₄ , sodium hydroxide)	Shipping material (packaging tape, bubble wrap)
Baggies	Sampling field forms
Ice	Sample labels
Sample shipping coolers	Chain of custody forms
Alconox	Custody seals
Iron reagent	Plastic spray bottles
Poly tanks	5-gallon buckets
Sampling	g Equipment
Water quality meter	Laptop computer
Turbidity meter	Calibration solutions
Water level indicator	Converter Box
Grundfos Redi-Flo 2 submersible pump	3/8"-inch inner diameter polyethylene tubing
Grundfos 3" submersible pump	1"- inch inner diameter polyethylene tubing
Portable generator	Global Positioning System
HACH Kit	Flow thru cell
Health	and Safety
Nitrile gloves	PID
Rubber gloves	First aid kits
Eye wash station	Fire extinguishers
Tyvek suits	Cotton glove liners
Rubber overboots or booties	Hearing protection
Hard hat	Safety glasses
Safety vest	Drinking water
General Fi	eld Operations
Logbooks	Indelible ink pens
Digital camera	Paper towels
Kimwipes	Trash bags
Plastic sheeting	5-gallon buckets for decontamination
Measuring tape	Utility knives
Brushes	Clear/duct tape

Notes:

 $\begin{array}{lll} H_2SO_4 & = & sulfuric\ acid \\ HCl & = & hydrochloric\ acid \\ HNO_3 & = & nitric\ acid \\ PID & = & photoionization\ detector \end{array}$

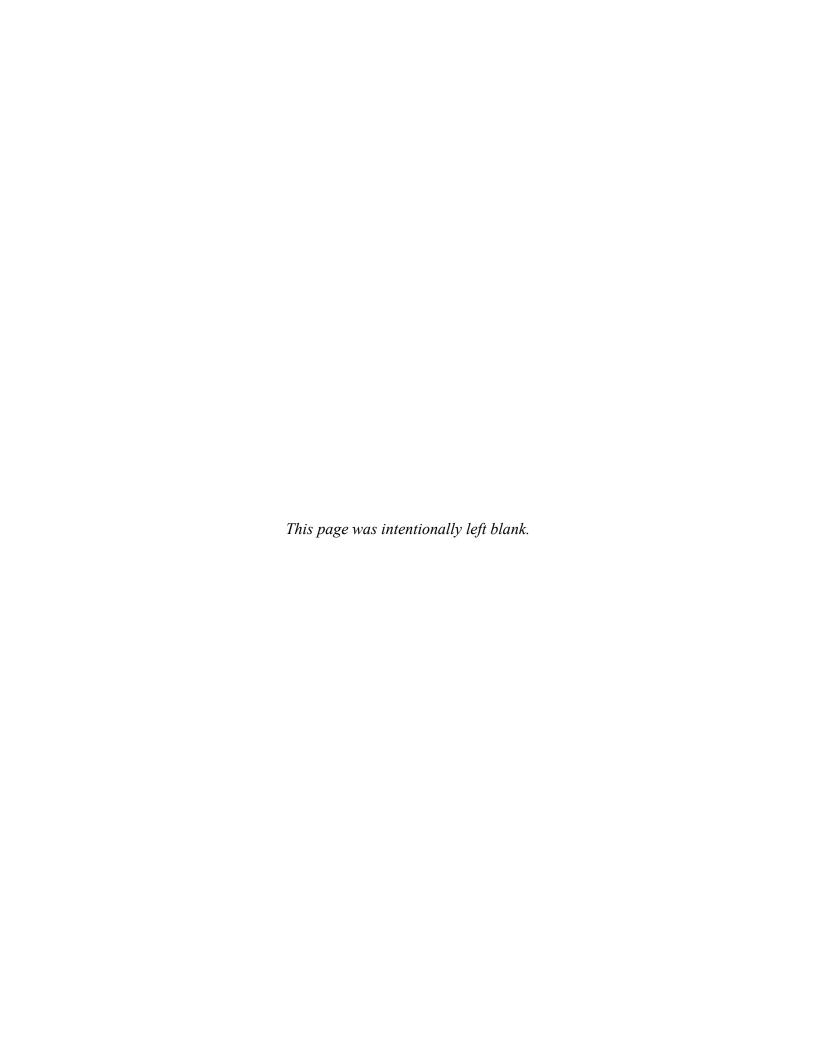


Table 6.1 Groundwater Sampling Analytical Parameters and Screening Values

Analyte	CAS Number	CRQL (µg/L)	EPA Tap Water RSL ⁽¹⁾ (μg/L)	RG ⁽²⁾ (μg/L)
TAL VOCs by SOM02.2 (Trace Level)				
1,1,1-TCA	71-55-6	0.5	800 (n)	200
1,1,2,2-Tetrachloroethane	79-34-5	0.5	0.076 (c)	N/A
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	0.5	1,000 (n)	N/A
1,1,2-Trichloroethane	79-00-5	0.5	0.041 (n)	5
1,1-DCE	75-35-4	0.5	28 (n)	7
1,1-Dichloroethane	75-34-3	0.5	2.8 (c)	31
1,2,3-Trichlorobenzene	87-61-6	0.5	0.7 (n)	N/A
1,2,4-Trichlorobenzene	120-82-1	0.5	0.4 (n)	N/A
1,2-Dibromo-3-chloropropane	96-12-8	0.5	0.00033 (c)	N/A
1,2-Dibromoethane	106-93-4	0.5	0.0075 (c)	N/A
1,2-Dichlorobenzene	95-50-1	0.5	30 (n)	N/A
1,2-Dichloroethane	107-06-2	0.5	0.17 (c)	N/A
1,2-Dichloropropane	78-87-5	0.5	0.14 (c)	5
1,3-Dichlorobenzene	541-73-1	0.5	N/A	N/A
1,4-Dichlorobenzene	106-46-7	0.5	0.48 (c)	N/A
2-Butanone	78-93-3	5	560 (n)	N/A
2-Hexanone	591-78-6	5	3.8 (n)	N/A
4-Methyl-2-pentanone	108-10-1	5	630 (n)	N/A
Acetone	67-64-1	5	1,400 (n)	N/A
Benzene	71-43-2	0.5	0.46 (c)	N/A
Bromochloromethane	74-97-5	0.5	8.3 (n)	N/A
Bromodichloromethane	75-27-4	0.5	0.13 (c)	N/A
Bromoform	75-25-2	0.5	3.3 (c)	N/A
Bromomethane	74-83-9	0.5	0.75 (n)	N/A
Carbon disulfide	75-15-0	0.5	81 (n)	N/A
Carbon tetrachloride	56-23-5	0.5	0.46 (c)	N/A
Chlorobenzene	108-90-7	0.5	7.8 (n)	N/A
Chloroethane	75-00-3	0.5	2,100 (n)	N/A
Chloroform	67-66-3	0.5	0.22 (c)	N/A
Chloromethane	74-87-3	0.5	19 (n)	N/A
cis-1,2-DCE	156-59-2	0.5	3.6 (n)	70
cis-1,3-Dichloropropene	10061-01-5	0.5	0.47 (n)	N/A
Cyclohexane	110-82-7	0.5	1,300 (n)	N/A
Dibromochloromethane	124-48-1	0.5	0.87 (c)	N/A
Dichlorodifluoromethane	75-71-8	0.5	20 (n)	N/A

Table 6.1 (continued)
Groundwater Sampling Analytical Parameters and Screening Values

Analyte	CAS Number	CRQL (µg/L)	EPA Tap Water RSL¹ (μg/L)	RG ² (µg/L)
Ethylbenzene	100-41-4	0.5	1.5 (c)	N/A
Isopropylbenzene	98-82-8	0.5	45 (n)	N/A
<i>m,p</i> -Xylene	179601-23-1	0.5	19 (n) (as <i>m</i> -xylene)	N/A
Methyl acetate	79-20-9	0.5	2,000 (n)	N/A
Methyl tert-butyl ether	1634-04-4	0.5	14 (c)	N/A
Methylcyclohexane	108-87-2	0.5	N/A	N/A
Methylene chloride	75-09-2	0.5	11 (n)	N/A
o-Xylene	95-47-6	0.5	19 (n)	N/A
Styrene	100-42-5	0.5	120 (n)	N/A
PCE	127-18-4	0.5	4.1 (n)	5
Toluene	108-88-3	0.5	110 (n)	1,000
trans-1,2-DCE	156-60-5	0.5	36 (n)	N/A
trans-1,3-Dichloropropene	10061-02-6	0.5	0.47 (c)	N/A
TCE	79-01-6	0.5	0.28 (n)	5
Trichlorofluoromethane	75-69-4	0.5	520 (n)	N/A
Vinyl Chloride	75-01-4	0.5	0.019 (c)	2
TAL SVOCs by SOM02.2 (Low Level)			
1,4-Dioxane	123-91-1	2.5	0.46 (c)	6.4
TAL Metals by ISM02.2 (ICP-MS)				
Iron (total and dissolved)	7439-89-6	100	1,400 (n)	N/A
Potassium	7440-09-7	10	40 (n)	N/A
Manganese	7439-96-5	1	180 (n)	N/A
Arsenic	7440-38-2	1	0.052 (c)	N/A
Metabolic Acids by HPLC/UV				
Acetic acid	64-19-7	1000	N/A	N/A
Butyric acid	107-92-6	1000	N/A	N/A
Lactic acid	50-21-5	1000	N/A	N/A
Propionic acid	79-09-4	1000	N/A	N/A
Pyruvic acid	127-17-3	100	N/A	N/A
Anions by EPA 353.1 or EPA 9056				
Nitrate	N/A	1000	13,000 (n)	N/A
Chloride	16887-00-6	1000	N/A	
Sulfate	N/A	1000	N/A	N/A

Table 6.1 (continued) Groundwater Sampling Analytical Parameters and Screening Values

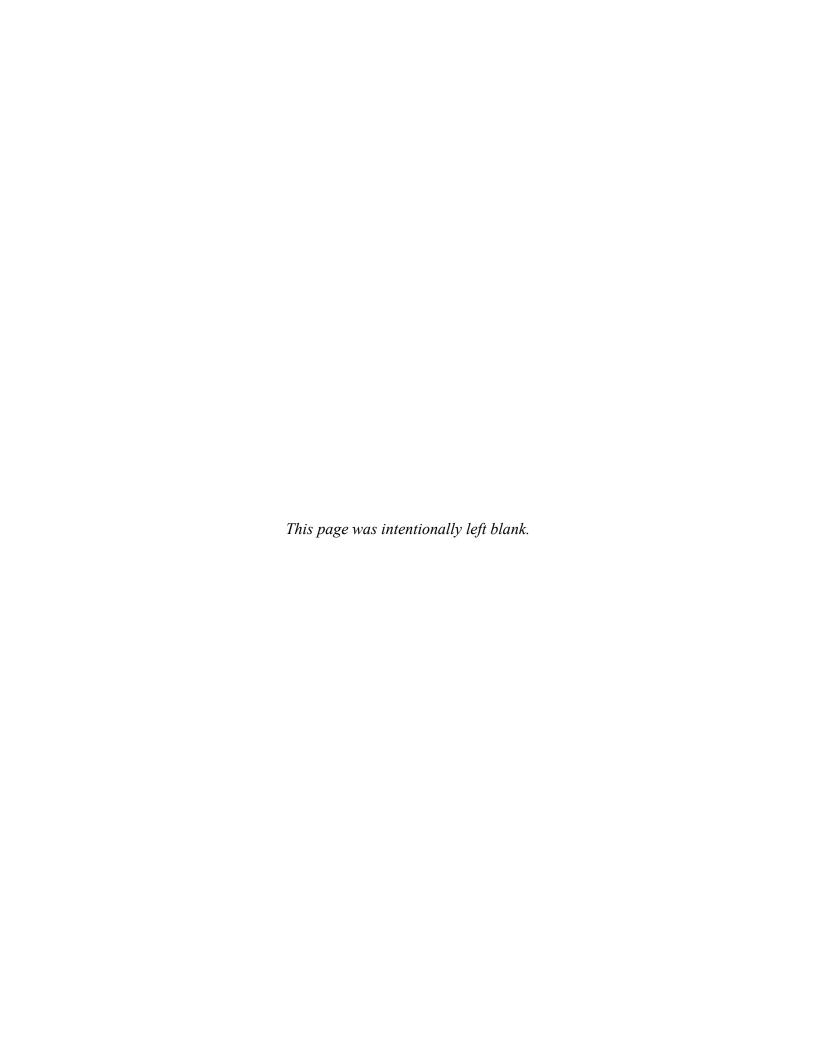
Analyte	CAS Number	CRQL (µg/L)	EPA Tap Water RSL ¹ (μg/L)	RG ² (μg/L)
Dissolved Gases by EPA 8015B				_
Methane	74-82-8	5	N/A	N/A
Ethane	74-84-0	5	N/A	N/A
Ethene	74-85-1	5	N/A	N/A
Other Analysis				<u>, </u>
Alkalinity (SM2320B)	ALK	10,000	N/A	N/A
COD (410.1)	COD	50	N/A	N/A
Sulfate (SW9056A)	14808-79-8	2,000	N/A	N/A
Biomass (PLFA)	N/A	1E+06 cells/sample	N/A	N/A
Dehalococcoides bacteria (QPRC)	N/A	100 cells/sample	N/A	N/A
TDS (SM2540)	N/A	10,000	N/A	N/A
TOC (SM5310)	7440-44-0	1,000	N/A	N/A

Notes:

² RG value established in the 2017 ROD Amendment

μg/L	=	micrograms per liter	PLFA	=	Phospholipid Fatty Acid Analysis
1,1,1-TCA	_	1,1,1-trichloroethane	QPRC	=	Quantitative Polymerase Chain Reaction
			RG	=	Remedial Goal
CAS	=	Chemical Abstracts Service	ROD	=	Record of Decision
COD	=	Chemical Oxidant Demand	RSL	=	Regional Screening Level
CRDL	=	Contract Required Detection Limit	SVOC	=	Semivolatile Organic Compound
CRQL	=	Contract Required Quantitation Limit	TAL	=	Target Analyte List
DCE	=	Dichloroethene	TCE	=	Trichloroethene
EPA	=	U. S. Environmental Protection Agency	TDS	=	Total Dissolved Solids
ICP	=	Inductively Coupled Plasma	TOC	=	Total Organic Carbon
N/A	=	Not Applicable	VOC	=	Volatile Organic Compound
PCE	=	Tetrachloroethene			

 $^{^{1}}$ EPA Region 3 Tap Water RSLs presented in the June 2017 RSL table. Noncarcinogenic (n) RSLs based on HI of 0.1; carcinogenic RSLs (c) based on a carcinogenic risk of 1 x 10^{-6} .



Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times

	Analytical			Minimum Sample Volume	
Name	Methods	Container ¹	Preservation	or Weight ²	Maximum Holding Time
Aqueous Samples					
ORP	ASTM D1498	P, G	None required	N/A	Analyze immediately (field measurement)
Temperature	E170.1	P, G	None required	N/A	Analyze immediately (field measurement)
Turbidity	E180.1	P, G	None required	N/A	Analyze immediately (field measurement)
Dissolved oxygen	E360.1	Ð	None required	N/A	Analyze immediately (field measurement)
Hydrogen ion (pH)	SW9040C	P, G	None required	N/A	Analyze immediately (field measurement
Conductance	SW9050A	P, G	None required	N/A	Analyze immediately (field measurement)
Iron (total and ferrous)	N/A	P, G	None required	N/A	Analyze immediately (field measurement)
TAL VOCs	SOM02.2	G (Teflon TM -lined septum)	<6°C; HCl to pH<2	3 x 40 mL	14 days; 7 days if unpreserved by acid
TAL SVOCs (1,4-dioxane)	SOM02.2	Ð	J ₀ 9>	2 x 1 liter	7 days until extraction and 40 days after extraction
Total Iron	ISM02.2	d	HNO_3 to pH<2, <6°C	500 mL	180 days
Dissolved Iron	ISM02.2	d	Field filter, HNO ₃ to pH<2, <6°C	500 mL	180 days
Manganese	ISM02.2	d	HNO_3 to pH<2, <6°C	500 mL	180 days
Potassium	ISM02.2	d	HNO_3 to $pH<2$, <6 °C	500 mL	180 days
Arsenic	ISM02.2	Ь	HNO_3 to $pH<2$, <6 °C	500 mL	180 days
Alkalinity	SM 2320 B	d	2∘9>	250 mL	14 days
Sulfate	SW846 9056A	d	J ₀ 9>	250 mL	28 days
COD	SM 5220	Ð	H_2SO_4 to pH<2, <6°C	50 mL	28 days
TOC	SM 5310	d	H_2SO_4 to pH<2, <6°C	125 mL	28 days
Metabolic Acids	HPLC/UV	d	J ₀ 9>	500 mL	14 days
Dissolved Gases	EPA 8015 B	G (Teflon TM -lined septum)	<6°C; HCl to pH<2	3 x 40 mL	14 days: 7 days if unpreserved by acid
Anions	EPA 9056	J	2∘9>	200 mL	28 days: 48 hours for nitrate
TDS	SM 2540	P,G	J ₀ 9>	500 mL	7 days
Biomass (PLFA)	PLFA	Ь	3∘9>	2 x 1 liter	24 - 48 hours
Dehalococcoides bacteria	QPRC	d	3°9>	1 liter	24 - 48 hours
Air Monitoring					
Organic vapors in air	None	None	N/A	N/A	Real-time field measurement

Notes:

¹Container composed of the specified material.

²Samples for methods with compatible container and preservation requirements may be able to combine in a single container. The contractor should coordinate with the laboratory prior to sampling to determine what combinations are possible that still meet minimum sample size requirements.

Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times Table 7.1 (Continued)

P = Polyethylene with Teflon TM - lined cap, unless otherwise noted.	PLFA = Phospholipid Fatty Acid Analysis	QPRC =		. = TCL	TDS = Total Dissolved Solids		VOC = Volatile Organic Compound	
= degrees Celsius	П	 Glass with TeflonTM- lined cap (amber glass for water samples), unless otherwise noted. 	П	П	П	П	= Not Applicable	0
ွ	ASTM	Ü	$\mathrm{H}_2\mathrm{SO}_4$	HCI	HNO ₃	m	N/A	ORP

Table 10.1 Data Management Member Roles and Responsibilities

Team Member	Roles and Responsibilities					
PM	Responsible for preparing the work plan, schedule, and milestones.					
	Coordinates efforts with the EPA WAM.					
	Determines the needs and objectives for tasks.					
	Assigns appropriate personnel to complete the project.					
	Ultimately responsible for the completion of the project.					
Data Manager	Coordinates documents and reports on all data management activities.					
	Acts as a liaison between the data users and the data holders, making certain that data are provided to those who need it in the appropriate format.					
	Ensures that the EDD provided by ESAT meets the project requirements.					
	Loads staged EDD into Access.					
FTL	Responsible for the collection and documentation of all field generated data.					
	Reports collection efforts and information to the Sample Manager.					
	Works with PM to develop request/delivery of analytical services' requests.					
	Assists the PM in communicating with the ESAT.					
Project Chemist	Assists in the definition of regulatory criteria and threshold values, and maintains the regulatory criteria in the database.					
	Provides assistance to the PM and technical staff in interpreting analytical results.					
Sample Manager	Responsible for tracking samples from collection through analysis to their inclusion in the project database.					
	• Conducts QC checks between anticipated collection and actual collection; the accuracy of documentation; submission to and receipt from laboratories; and submission to the DBA.					
	Has overall responsibility for the maintenance of the project database.					
DBA	Responsible for the implementation, and evaluation of SOPs to ensure integrity of the database system.					

Notes:

DBA Database Administrator Electronic Data Deliverable EDD

EPA

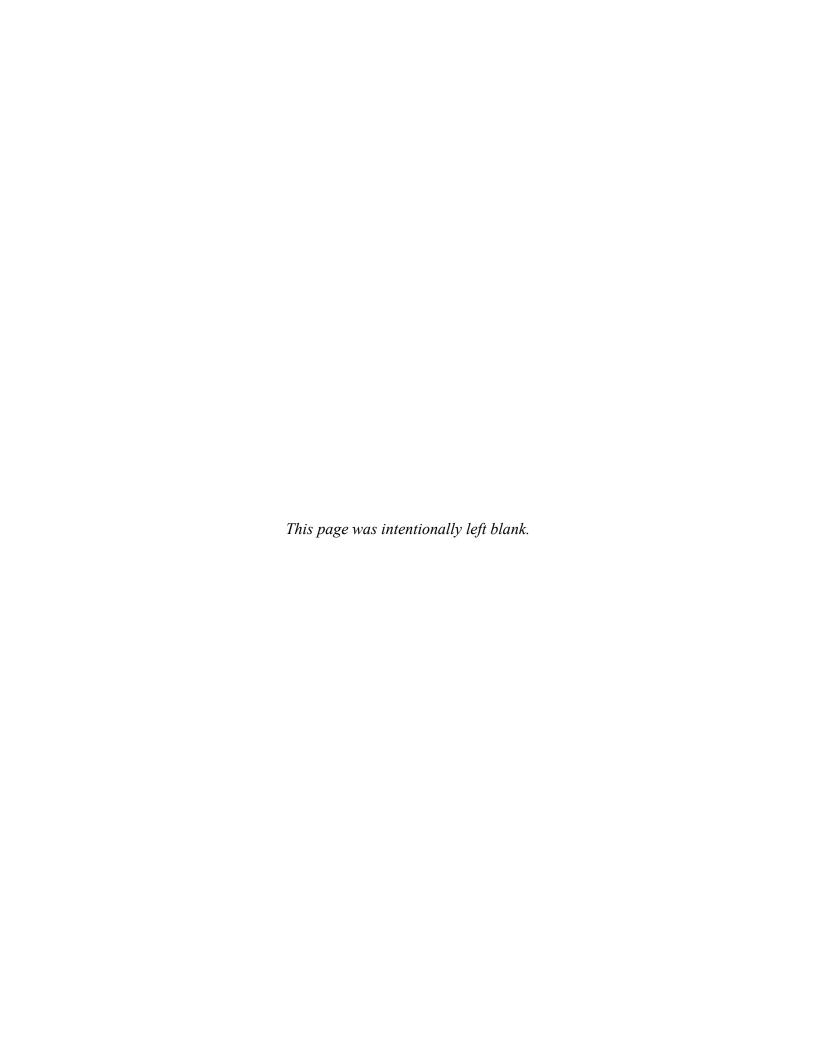
U.S. Environmental Protection Agency EPA's Environmental Services Assistance Team ESAT =

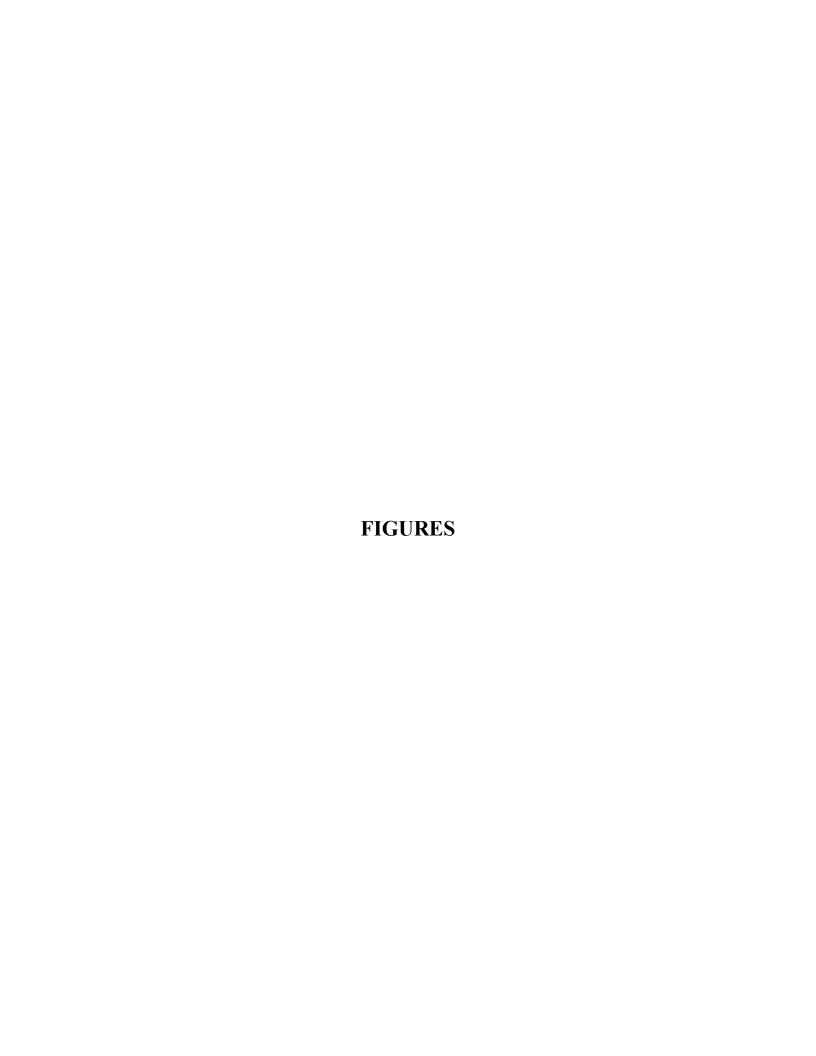
FTL Field Team Leader

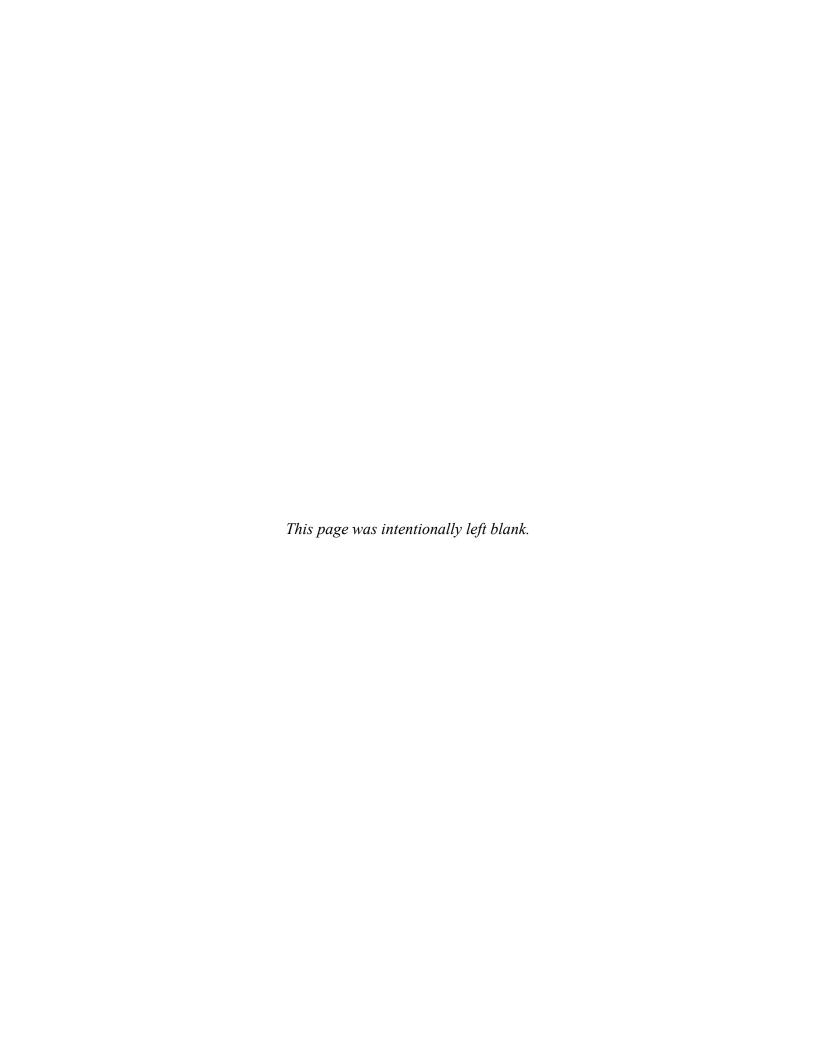
O&M Operation and Maintenance

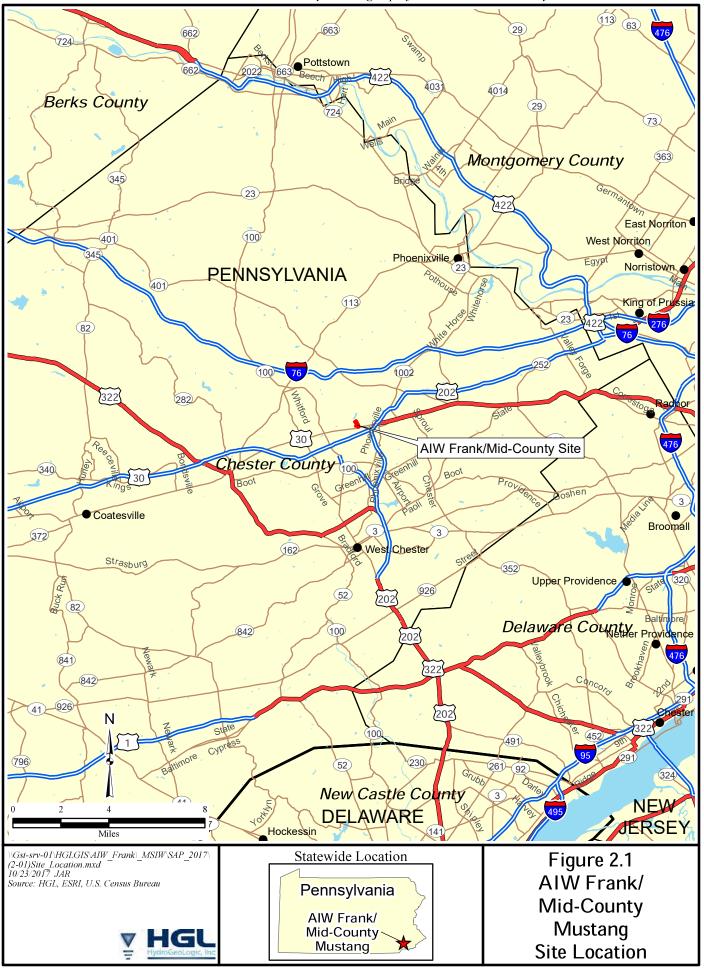
Project Manager Quality Control PM QC

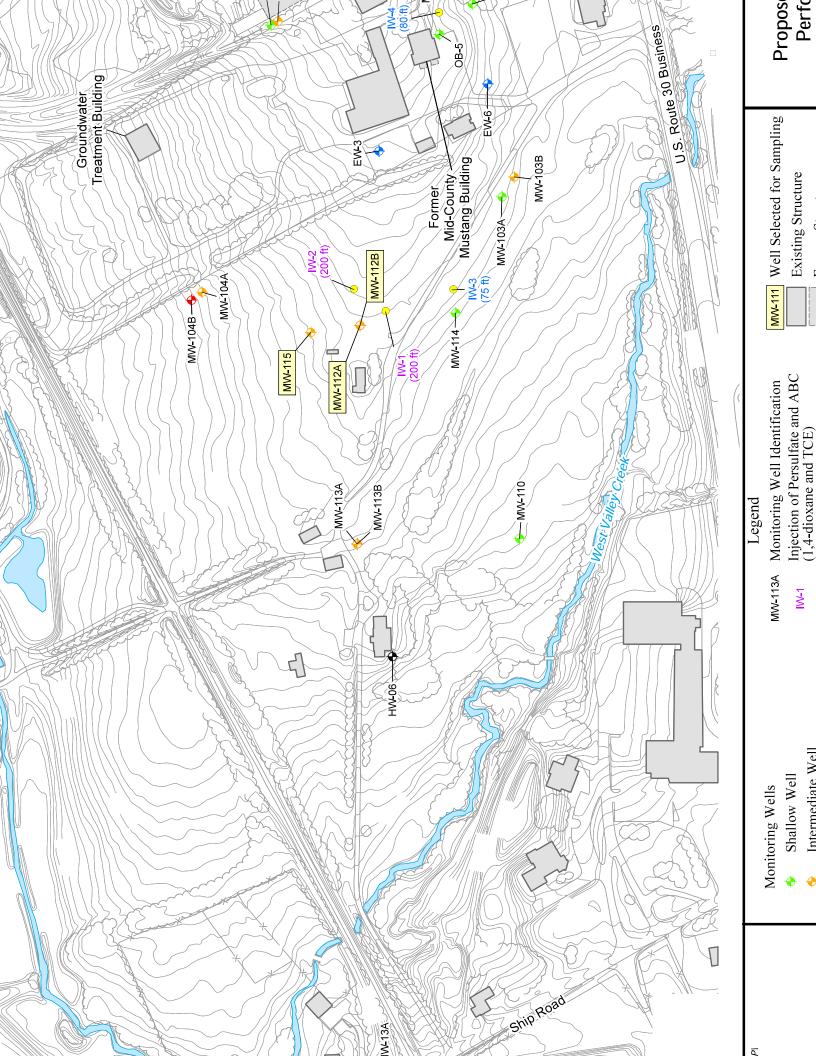
SOP Standard Operating Procedure WAM Work Assignment Manager

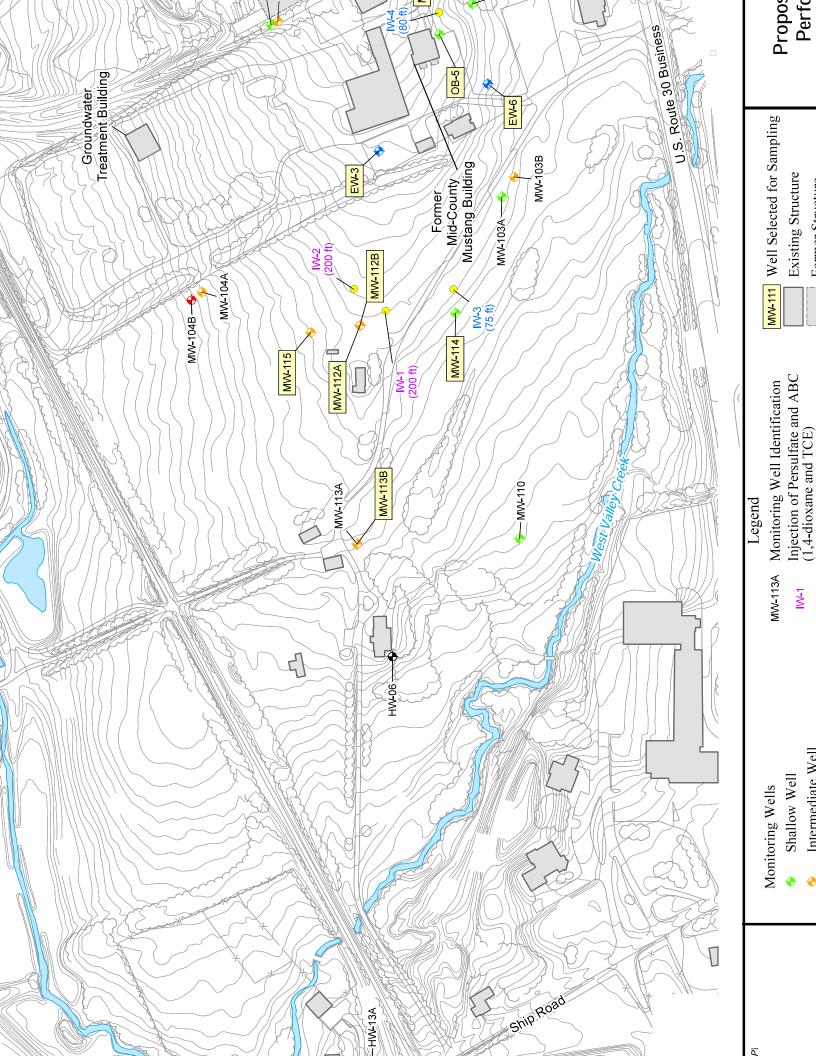


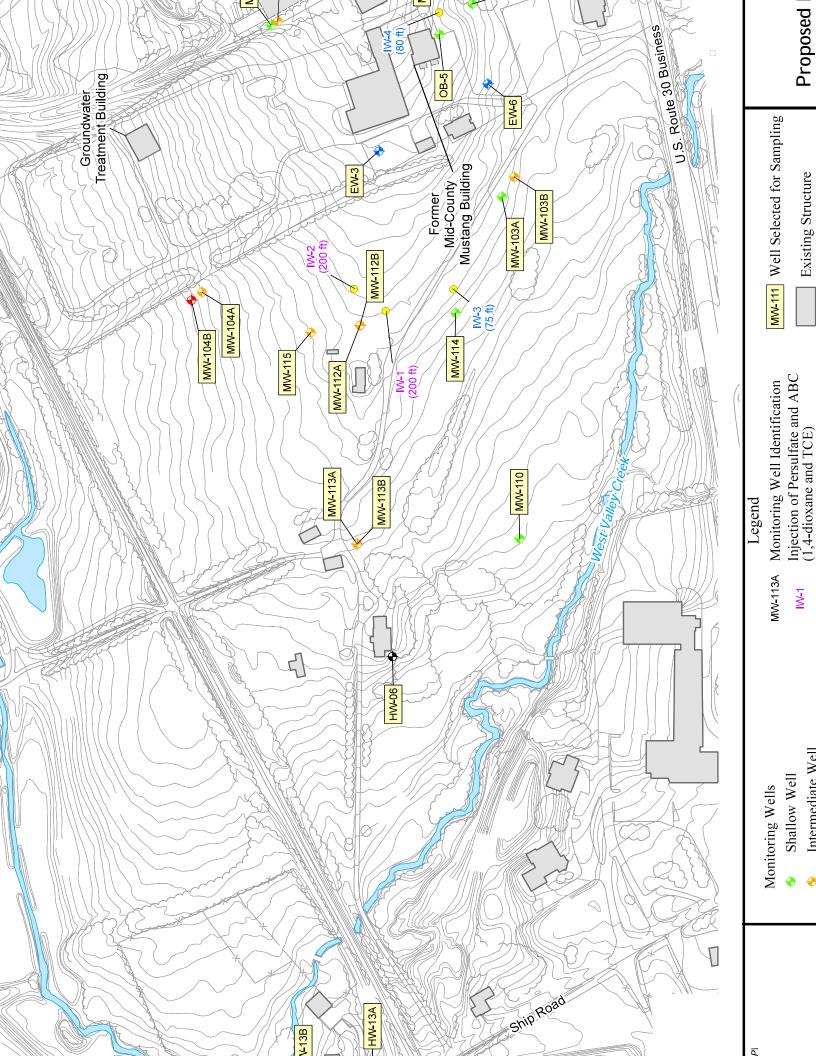




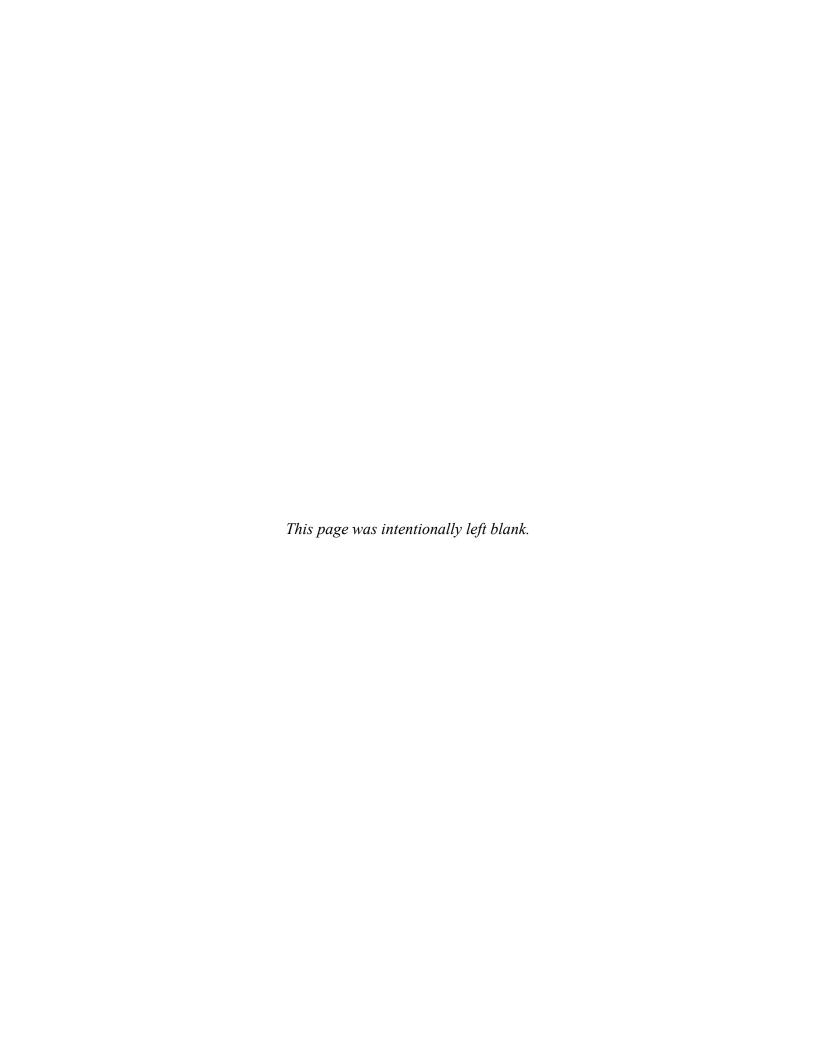








APPENDIX A FIELD FORMS





BORING LOG

Sheet _____ of ____

Вс	reho	le ID	•			Pro	ect Na	ame AIW Frank RA
Investigation				Project Number		Co-	locate	d Location:
Drilling Company		Driller		Ground Elevation		Tota	ıl Drill	led Depth
Drilling Equipment	Drilling 1	Method	Borehole Diameter	Date/Time Drilling Started		Date	e/Time	Total Depth Reached
Type of Sampling Device	•		•	Water Level (bgs) First		Fir	ıal	
Sample Hammer Type	Driving	. Wt.	Drop	Hydrogeologist				Checked by/Date
Location Description (include								
Depth Interval Recovery Blow Counts	(Include li	thology, gra minerology,	Description in size, sorting, angular bedding, plasticity, der applicable)	ity, Munsell color name & nsity, consistency, etc., as	USCS Symbol	Lithology	Water Content	Remarks (Include all sample types & depth, odor, organic vapor measurements, etc.)



BORING LOG (cont'd)

Borehole ID: Sheet of

Investigation		Project Number				Project Name AIW Frank RA		
Location Descrip	otion (include sketch in field logbook)							
Depth Interval Recovery	Description (Include lithology, grain size, sorting, angularity, Muns notation, minerology, bedding, plasticity, density, consupplicable)	ell color name & sistency, etc., as	USCS Symbol	Lithology	Water Content	Remarks (Include all sample types & depth, odor, organic vapor measurements, etc.)		



WELL DEVELOPMENT RECORD

SHEET	of
SHELL	O1

PROJECT NAME: AIW Fra	nk RA_PROJE	CT NO. :			DA	ГЕ:					
WELL/PIEZOMETER ID		DATI	E INSTALLE	ED:							
TOTAL DEPTH (FTOC)	SCREI	EN LENGTH	-I	CASIN	G DIAMETER _						
MEASURING POINT HEIGHT	`ABOVE/BELOW	GROUND I	LEVEL								
METHODS OF DEVELOPMEN	<u>NT</u>										
☐ Swabbing Equipment decomtaminated prior to or Describe		☐ Pumpin		Describe Yes	□ NO						
EQUIPMENT NUMBERS: pH Meter	IT NUMBERS: EC Meter Turbidity Meter Thermometer										
CASING VOLUME INFORMA	UME INFORMATION:										
Casing ID (inch)	1.0 1.5	2.0	2.2 3.0	4.0	4.3 5.0	6.0	7.0	8.0			
Unit Casing Volume (A) (gal/ft)	0.04 0.09	0.16	0.2 0.37	7 0.65	0.75 1.0	1.5	2.0	2.6			
PURGING INFORMATION: ft. Measured Well Depth (B)											
Time (FTOC) Ren	olume moved gal) Temp F or C	pH	EC ()	Water Color	Turbidity/ Sand (ppm)	Sedim	ze, and An ents Disch ring Purgin	arged			



PROJE	CT NAMI	E:						
ACTIV	TITIES:							
Date Waste Generated	Activity Generating Waste (borehole # / well #)	Description of Waste	Field Evidence of Contamination	Estimated Volume	Type of Container (storage ID#)	Location of Container	Waste Characterization	Comments
Note:	Describe whet	ther soil or v	vater samples ha	ave been co	llected for wa	ste character	ization, include d	late, if known.



MONITOR WELL STATIC WATER LEVEL FORM

PROJE	CT NA	ME:				_ DA	ГЕ:	
WATER	R LEVE	L INDIC	CATOR ID	#		FIEL	D BOOK #	
INVES	TIGATI	ON:					PAGE #	
Monitor Well Number	Total Well Depth	Well Screen Length	Measuring Point Elev.	Time	Depth to Static Water Level	Sounding	Explosimeter Reading (above background)	PID Reading (above background
Note: To	tal well d	epth to be	measured at	time o	f gauging.			
Commen	ts:							



MONITOR WELL PURGING FORM

PROJEC	T:				DATI	E:			
LOCAT	ION:				EXPL	OSIMETER B	OREHOLE R	READING	
WELL II	D:					GE VOLUME ELLBORE VOI	.UMES):	(L)
Time	Depth to Water (ft)	Flow Meter Reading	Volume Purged (L)	Temp.	рН	Electrical Conductivity (mmho)	Turbidity N.T.U	Comments	
	librate at sta	he well:			oserver				

GROUNDWATER FIELD SAMPLING DATA SHEET

Well No.:		Location:	OU-1						
Sampler(s):		Project Name:	AIW Fr	ank RD					
Well Depth:		Project #: E100	70.03.01		Date	: :	Time:		
DTW (ft):	DTP Top (ft):	Courier:	FedEx _	UPS	_Hand	_Other			
MP Ht. Above/Below	Ground Surface:	Sampling Method:							
Condition of Bottom o	f Well:	Type of Pump:							
Screen Interval FTOC	(ft): (-)	Weather (sun/clear, overcast/rain, wind direction, ambient temperature)							
Well Diameter (in):		•							
Placement of Pump In	let (ft)								
		Field Pa	rametei	·s					

Time	Depth to Water (ft)	Flow Rate (L/m)	Total Volume (L)	рН	Temp. (C)	Cond. (umhos/cm)	ORP (mv)	DO (mg/L)	Turb. (NTU)	Type, Size, and Amount of Sediment Discharged

Observations

Color:	Clear	Other (describe):				
Odor:	None	Low	Medium	High	Very Strong	H2S	Fuel-like
Notes:							
Signed	'Sample	r(s):					



FIELD SAMPLING REPORT

LOCATION:	AIW Frank	/Mid-County Must	ang F	PROJECT NAME:	AIW Frank	RD					
SITE:	OU-1		I	PROJECT NO:	E10070.03	.01					
		S	AMPLE INI	FORMATION							
SAMPLE ID				DATE:		TIME:_					
MATRIX TYPE:				ENTER SAMPLE	NUMBERS	S FOR OC S	SAMPLES/				
SAMPLING MET	HOD:			BLANKS ASSOCI		-					
CASE #:				MATRIX SPIKE	(MS):						
(Ambient Blank # - Eq	uipment Blank #	- Trip Blank # - Cooler	#)	MATRIX SPIKE DUP (SD):							
				FIELD DUP (FD):							
				AMBIENT BLANK (AB):							
SAMPLE BEG. DPE	TH (FT):			EQUIPMENT BL	ANK (EB):		_				
SAMPLE END DPET				TRIP BLANK (TI	3):						
GRAB () COM	IPOSITE ()										
CONTAINER	_	SERVATIVE/	Al	NALYTICAL	AN	ALYSIS	CLP ID				
SIZE/TYPE #	PR	EPARATION		METHOD			+				
							<u>† </u>				
<u> </u>	<u> </u>	NO	TADIE OD	SERVATIONS							
PID READIN	IGS					MIS	SCELLANEOUS				
1st		OLOR:	AWI LL OTIATO	CHARACTERISTICS MISCELLAN							
2nd		DOR:									
-11		THER:	i l	(m. ~ /T) Consider C		(
pH				en(mg/L (ppm) Total			(umhos/cm)				
Tublaity	(IIII) OKI			FORMATION	. I'C	(ppiii)					
WEATHED. CINI	CLEAD				٨	MDIENT TEN	ADED A TUDE				
				WIND DIRECTION _ OTHER TRACE							
				OTHER TRACE		ZK					
				OBSERVER:							
	TRIX TYPE CO					IETHOD COI					
DC=DRILL CUTTIN		SL=SLUDGE		B=BAILER		G=GR					
WG=GROUND WAT		SO=SOIL		BP=BLADDER PUMF)	HA = H	IAND AUGER				
LH=HAZARDOUS L	IQUID WASTE	GS=SOIL GAS		BR=BRASS RING		H=HO	DLLOW STEM AUGER				
SH=HAZRDOUS SO	LID WASTE	WS=SURFACE WA	TER	CS=COMPOSITE SAM			ERISTALTIC PUMP				
SE=SEDIMENT		SW=SWAB/WIPE	VEDTEDD ATT	C=CONTINUOUS FL	IGHT AUGER		PLIT SPOON				

Page 1 of 1

USEPA CLP COC (REGION COPY)

DateShipped: CarrierName: AirbillNo:

CHAIN OF CUSTODY RECORD

CASE # Cooler #:

No: Lab:

Lab Contact: Lab Phone:

Sample Type								
Collection Date/Time								
Location								
Tag/Preservative/Bottles								
Analysis/Turnaround (Days)								
Coll. Method								
Matrix/Sampler								
CLP Sample No.								
Sample Identifier								

	Samples Transferred From Chain of Custody #	Shipment for Case Complete? N	
			Sample(s) to be used for Lab QC: Samples Transferred From Chain of Custody #

Date/Time Sample Condition Upon Receipt		
Date/Time		
Received by (Signature and Organization)		
Date/Time		
Items/Reason Relinquished by (Signature and Organization)		
Items/Reason		

HGL, CHANGE REQUEST FORM

Contract/Project:			Date:	
Requested by:		3444		*
Description of accepted shown		*	10	
Description of requested change:		-		
		'n		
		(*)		•
•				6
· · · · · · · · · · · · · · · · · · ·				
Reason for change:				
recason for enauge.				*
			*	
	# # #	**		
			-	
	5-1			
		·		*
	-		*	
Expected results or impact:				
		* f		
		* "		up.

ubmit this form to the project mana	ager immediately.			
equired before implementation of m	aior chances	+		
7	oyor onongoo.			Ť
pproved by:	(Project M	anager) Date:		
pproved by:	(Title;) Date:		
: QA Staff Member	-			
			- 01	12/2005

Nonconformance Report

No.:	Nonconformance and Corr	ective Action Report
Division/Department:		Location:
Reported	By:	Date:
Date:		
Part 1: Nonconformance		
Representative Notified:		Date Notified:
Date Corrective Action Pla	n Due:	
Nonconformance:		
Potential Harm:		
Part 2: Root Cause		
Tart 2. Root Cause		
Part 3: Corrective Action	Plan	
Corrective Actions:	1 1411	
Actions to Prevent Recurre	ence:	
Estimated Completion Date	e:	
Responsible Manager		
Signature:		Date:
QA Manager		
Signature:		Date:
Part 4: Corrective Action Comments:	Closure	
Comments.		
Responsible Manager		
Signature:		Date:
QA Manager		
Signature:		Date:

APPENDIX E DETAILED COST ESTIMATE

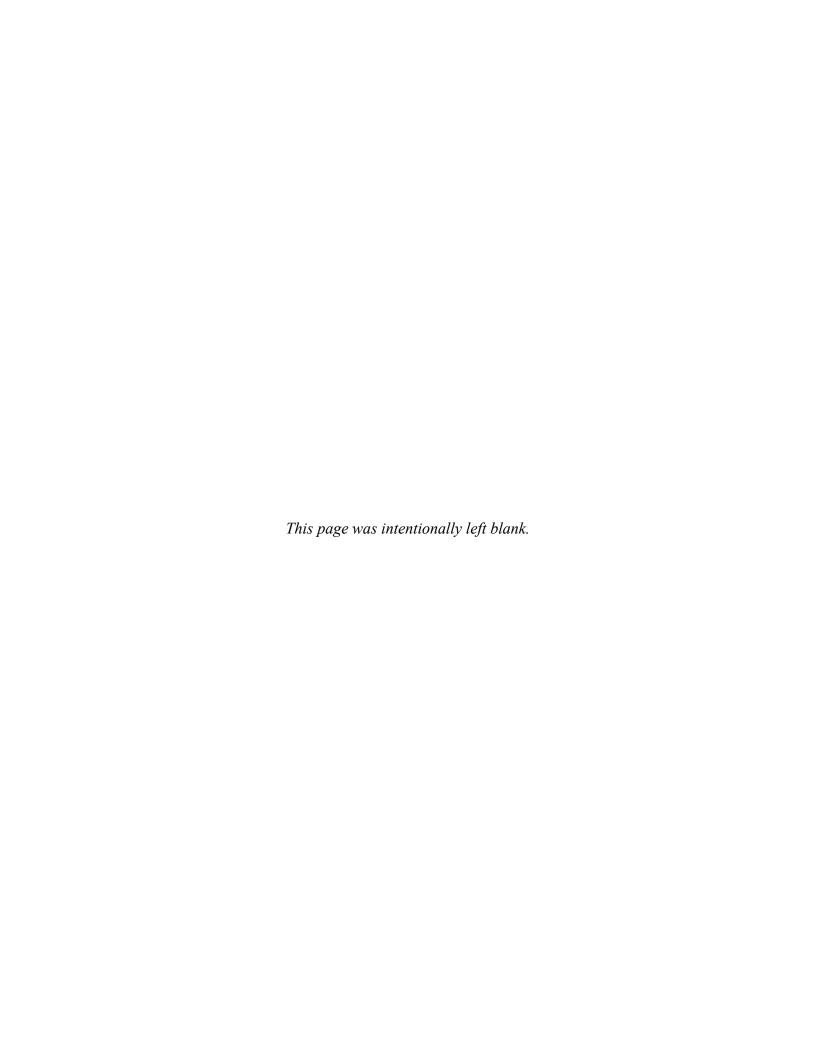


Table E.1 Cost Estimate - Site Preparation Remedial Design

AIW Frank/Mid-County Mustang Superfund Site Operable Unit 1, Chester County, Pennsylvania

<u>General Comments</u>
A Site Visit will be conducted to mark well locations, identify decontamination and storage areas, and to obtain utility clearance.

Description	Qty	MON	Unit Cost	Total	Notes
Utility Clearance				\$	
Field Crew (2 Associate Scientists)				❖	
Project Manager				\$	
Per Diem (per person)				\$	
Automobile Rental (including gas and tolls)				\$	
			Subtotal	\$ [
Markup (G&A and Fee)			10.25%	5% \$	
Project Management			1	10% \$	
Total Site Preparation Component					

Table E.2 Cost Estimate - Well Installation Event Remedial Design AIW Frank/Mid-County Mustang Superfund Site Operable Unit 1, Chester County, Pennsylvania

General Comments							
The following wells (4" diameter) are planned to be installed:	Number	Depth	(feet) 6" drilling	Depth (feet) 6" drilling 4" drilling<100' 4" drilling>100	00 4" drilli	g>100'	
All waste is assumed to be non-hazardous.		7	200	25	75	100	
Liquid IDW will be discharged directly to the onsite pond after sampling.		2	200	25		100	
		3	75	25	20	0	
		4	80			0	
		2	80	25	55	0	
		9	170	25		70	
		1	760	70		09	

		5 80		2	22	0			
		6 170		2	75	2			
		7 160		25 25	75	9 9			
						3			1
	Assembly Description	Qty UOM	Material	Labor		Equipment	Vendor Quote	Total Cost Basis	
	33010101 Mobilize/DeMobilize Drilling Rig & Crew	1 LS	\$	٠٠				\$ Racer Estimate	
	33231132 Air Rotary, 6" Dia Borehole (Consolidated), Depth < 100 ft	200 LF	\$	\$	\$	٠	\$	Vendor Quote V	Vendor
	33231128 Air Rotary, 4" Dia Borehole (Consolidated), Depth <= 100 ft	535 LF	\$	- γ-	\$	٠	• ◊•	Quote Vendor	Quote
	33231131 Air Rotary, 4" Dia Borehole (Consolidated), 100 ft < Depth <= 500 ft	390 LF	\$	\$	\$	٠	φ.		Quote
	33230123 4" Steel, Well Casing	200 LF	\$	φ.	\$	٠	φ.	Vendor	Quote
	33231502 Surface Pad, Concrete, 4' x 4' x 4'	8 EA	\$	\$		\$	1	\$Vendor	Quote
Installation	33231814 4" Well, Portland Cement Grout	200 LF	\$		\$	٠	٠	\$Vendor Quote Vendor Quote	ote
Component	33232105 4" Well, Bentonite Seal	8 EA	\$		\$	φ.	٠	\$	
	33020303 Organic Vapor Analyzer Rental, per Day	15 DAY	\$	\$	\$	•	\$ \$		
	33170808 Decontaminate Rig, Augers, Field Equipment	15 DAY	\$		\$	•	· \$	\$ Racer Estimate	
	33231182 DOT steel drums, 55 gal., open, 17C	15 EA	\$		\$	٠	· \$	\$ Racer Estimate	a
	33240101 Other Direct Costs	1 LS	\$		\$	٠	· s	\$ Racer Estimate	
	33231186 Well Development Equipment Rental (weekly, includes tubing)	1 WK	\$	Ş	Ş	•	\$	Racer Estimate	
			-	-	-		Subtotal	φ,	
	33190815 Bulk Solid Waste Disposal Container, 20 CY Roll-Off (monthly)	9 MO	\$	\$	\$	٠	· \$	\$ Vendor Quote	
	33170904 Delivery/Pickup Roll-Off Containers on Truck	6 EA	\$	\$	10	٠	· \$	\$ Vendor Quote Vendor	ndor
	33170924 Transport Roll-Off Containers (1 per truck)	3 EA	\$	\$	\$	•	\$	Quote Vendor Quote	uote
	33190205 Delivery/Pickup 21,000 Gallon Bulk Frac Tank	4 EA	\$	\$	\$	•	\$	\$ Vendor Quote	
	33190101 21,000 Gallon Bulk Frac Tank Rental (monthly)	5 MO	\$	\$			- \$	<>	
IDW management	33190807 32 Ft. Dump Truck, 6 Mil Liner, disposable	3 EA	\$ 45.73	\$	٠	٠	· \$	\$ Vendor Quote	Vendor
	33190809 Cleaning 21,000 Gallon Bulk Frac Tank	1 EA	\$	ş	\$		•	\$	Quote
	33190317 Solid Waste Stream Evaluation	1 EA	· \$	s	\$ -	٠	\$	Vendor Quote	Vendor
	33190318 Liquid Waste Stream Evaluation	8 EA	\$	\$	\$ -	٠	\$	Quote Vendor	r Quote
	33197270 Landfill Nonhazardous Solid Bulk Waste by CY	55 CY	\$	\$	-	٠	\$	Project Experience	
	Pump, hose, fittings, sediment filter	1 EA	\$		\$	•		\$	
							Subtotal	φ.	
	Development Crew (2 people)	3 DAY	\$	ş	٠,	٠	· \$	\$Vendor Quote	
	Oversight during Drilling (Staff Scientist)	15 DAY	· \$	s	ş	٠	· \$	\$ Project Experience	
	Per Diem during Drilling (per person)	15 DAY	\$	s	\$	٠	\$	GSA Rates	
	Automobile, Rental during Drilling (including gas and tolls)	3 WK	· \$	\$	\$	٠	\$	Project Experience	e
-	Survey (per well)	44 EA	÷	\$		٠	\$	Vendor Quote Pro	Project
Land	Well Development Crew (1 Associate Scientist)	2 DAY	· \$	s	ş	٠	· \$	\$ Experience	
	Per Diem during Well Development (per person)	2 DAY	· \$	\$		٠	\$	GSA Rates	
	Automobile, Rental during Drilling (including gas and tolls)	2 DAY	· \$	s	\$ -	٠	\$	Project Experience	perience
	Project Manager	8 HR	\$	ς.	ş	٠	- \$	\$ Project Experience Project	Project
	Draftsman/CADD	8 HR	\$	\$	ş	٠	- \$	\$	Experience
							Subtotal	\$	

Markup (G&A and Fee) Project Management **Total Well Installation Component**

Table E.3 Cost Estimate - Geophysics and Packer Testing Remedial Design

AIW Frank/Mid-County Mustang Superfund Site Operable Unit 1, Chester County, Pennsylvania

General Comments
Geophysical logging and packer testing will be conducted in all new injection wells prior to any injection event.
An HGL representative will oversee both activities.
During the packer testing, 30 VOC/SVOC samples will be collected

	Assembly Description	Qty	NOM	Material	rial	Labor		quipmen	t Ven	Equipment Vendor Quote		Total Cost Basis	
	Mobilization, Site Preparation, Demobilization	1	1 EA	\$		Ş	\$ -	•	Ş			Vendor Quote	
	Geophysical Logging	1,125 FT	H :	Ş	í	٠,	٠	•	Ş	\$		Vendor Quote	
	Reporting	11	1 LS	\$	í	٠,	\$	•	ş	❖		Vendor Quote	
Geophysical/	Packer Testing	16	16 DAY	\$	í	٠,	\$	•	ş	2	Ş	Vendor Quote	
Packer Testing	Decontamination	11	1 LS	\$	í	٠,	\$	•	ş	❖		Vendor Quote	
	Pump, hose, fittings, sediment filter	11	1 EA	\$		٠,	\$	•			Ş	Project Experience	
	33021618 Testing, purgeable organics (8260C)	30	30 EA	\$	í	٠,	\$	•	ş	\$		Project Experience	Project
	33021619 Testing, semi-volatile organics (1,4-dioxane, 8270D)	30	30 EA	\$		٠,	\$	•	Ş	\$		Experience	
									Subto	tal	s		
	Oversight during geophysics (staff scientist)	7	7 DAY	\$	í	\$		•	\$	•	\$	Project Experience	
	Oversight during packer testing (staff scientist)	16	16 DAY	\$	í	\$		•	ş	•	ş	Project Experience	
Labor	Automobile, Rental during Injections (including gas and tolls		23 DAY	\$,	٠,	\$	•	s	s		Project Experience	GSA
	Per Diem during Injections (per person)	23	23 DAY	\$		٠,	\$	•	Ş	\$		Rates	
	Project Manager	32	32 HR	ş	,	\$		1	Ş	•	s	Project Experience	
									Subtota	tal	\$		

Markup (G&A and Fee) Project Management **Total Background Sampling Component**

Remedial Design AIW Frank/Mid-County Mustang Superfund Site Operable Unit 1, Chester County, Pennsylvania Table E.4 Cost Estimate - Persulfate Injections

7 days for injection
3 days for equipment set up and mixing
2 days for mobilization/demobilization General Comments
For both rounds of injections, the duration will be 40,000 gallons of injectant in each round

	Description	Qty	NOM	Unit Cost	Total	Notes
	Mobilization/Demobilization	2	LS			Vendor Quote
	Health and Safety Submission	1	LS	\$	❖	Vendor Quote
	Decontamination Pad	1	LS	\$	❖	Vendor Quote
20:+00:01	Injection Platforms and Crew	12	days	\$	❖	Vendor Quote
ווווברווחו	Mixer Tank (includes delivery)	0.5	month	\$	❖	Vendor Quote
	Water truck, off highway, 6000 gal	0.5	month	\$	❖	2016 RSMeans, 01 54 33 6950
	Injectant	40,000	gallon	\$	\$	Vendor Quote
	Misc ODC	12	days	❖	❖	Project Experience
	Decontamination	10	per well	❖	❖	Project Experience
	Cleaning Mixer Tank	8	۲	\$-	❖	Vendor Quote
IDW Handling	IDW Handling DOT steel drums, 55 gal., open, 17C	10	each	❖	\$-	Vendor Quote
	Transportation of IDW drums (non-hazardous)	2	LS	\$	\$-	Vendor Quote
	Disposal of IDW drums (non-hazardous)	П	LS	\$	❖	Vendor Quote
	Oversight during 1st Round (Staff Scientist)	12	day	ب	❖	Project Experience
	Oversight during 1st Round (Senior Hydro)	3	day	\$	❖	Project Experience
Labor	Per Diem during Injections (per person)	15	day	\$	❖	GSA Rates
	Automobile, Rental during Injections (including gas and tolls)	8	weeks	\$-	\$	Project Experience
	Project Manager	32	hours	\$	\$	Project Experience
				Subtotal	tal \$	
	Markup (G&A and Fee)				10.25% \$ 10%	
	Project Management				\$	

Total Persulfate Injections Component

ş

Table E.5 Cost Estimate - Performance Sampling Persulfate Remedial Design

AIW Frank/Mid-County Mustang Superfund Site Operable Unit 1, Chester County, Pennsylvania

General Comments

Nine locations are scheduled for sampling during each sampling event. Costs are for one sampling event.

Field crew can sample 3 wells per day.

QA/QC samples will be collected in 1:10 ratio for field duplicate, one EB and FB per event, and one trip blank for VOCS.

	Assembly Description	Qty UOM	Material	le.	Labor	Equip	Equipment	Vendor Quote	uote	Total Cost	Basis	ı
	33020401 Disposable Materials per Sample	9 EA	\$	\$		ş		\$,		Racer E	Racer Estimate
	33020402 Decontamination Materials per Sample	9 EA	\$	\$	•	ş	ı	\$,		Racer	Racer Estimate
	33020561 Lysimeter accessories, nylon tubing, 1/4" OD	2,000 LF	\$	\$	•	ş	,	\$,	Racer	Racer Estimate	Racer
	33021509 Monitor well sampling equipment, rental, water quality testing parameter device rental	1 WK	\$	\$ -	1	s	ı	\$		Estimate	a)	
	33021618 Testing, purgeable organics (8260C)	16 EA	\$	\$ -	•	s		\$	٠,	Project E	Project Experience	
	33021619 Testing, semi-volatile organics (1,4-dioxane, 8270D)	13 EA	\$	\$ -	•	\$,	\$	ş	P	Project Experience	rience
	33021620 Testing, TAL metals (dissolved iron, 6010C)	13 EA	\$	٠ -	•	ş		\$	ş	Project	+	Experience
2	33021621 Testing, Alkalinity (SM 2320B)	13 EA	\$	\$ -	•	s		\$	٠,	Project	+	Experience
Sample	33021622 Testing, Anions (Sulfate, SM 2320B)	13 EA	\$	·	•	ş	,	\$	\$	Project	+	Experience
Collection	33021623 Testing, COD (410.4)	13 EA	\$	\$ -	1	ş	ı	\$	٠,	Project	+	Experience
	33021624 Testing, TOC (5310C)	13 EA	\$	٠	•	s	ı	\$	\$	Project	Project Experience	e ce
	33021625 Testing, Iron Field Kit	1 LS	\$	·	•	ş	,	\$	÷		Project	Project Experience
	33022043 Overnight delivery service, 51 to 70 lb packages	7 EA	\$	\$ -	1	ş	ı	\$	\$	Projec	Project Experience	ice
	33240101 Other Direct Costs	1 LS	\$		•	s		\$,	Project F	Project Experience	Project
	Well Sampling Crew (2 Associate Scientists)	3 DAY	\$	\$ -	\$		·	\$,	Experience		GSA Rates
	Per Diem during Sampling (per person)	6 DAY	\$	\$ -	•	ş	ı	\$				
	Automobile, Rental during Sampling (including gas and tolls)	2 WK	\$	\$ -	1	ς.	,	\$	\$	Proje	Project Experience	nce
								Subtotal	•	0		
	Project Manager	12 HR	\$	\$ -	\$,	\$	1	Pr	Project Experience	rience
	Staff Engineer	12 HR	\$	\$ -	\$		1	Ş	1	Proje	Project Experience	nce
	Staff Scientist	32 HR	\$	٠ -	\$,	Ş	,	Proje	Project Experience	nce
Report	QA/QC Officer	8 HR	\$	٠ -	\$			\$,	Proje	Project Experience	nce
	Word Processing/Clerical	8 HR	\$	٠ -	\$,	\$,	Proje	Project Experience	nce
	Draftsman/CADD	8 HR	\$	٠ -	\$,	Ş	,	Proje	Project Experience	nce
	Data Base Manager	24 HR	\$	٠	\$			Ş	,	Proje	Project Experience	nce
							-	Subtotal	•			

10.25% \$ 10% \$ \$

Markup (G&A and Fee) Project Management **Total Background Sampling Component**

Remedial Design AIW Frank/Mid-County Mustang Superfund Site Operable Unit 1, Chester County, Pennsylvania Table E.6 Cost Estimate - ABC Injections

13 days for injection
3 days for equipment set up and mixing
2 days for mobilization/demobilization General Comments
For each ABC injection event, the duration will be 66,000 gallons of injectant in each round

	Description	Qty	MON	Unit Cost	Total	Notes
	Mobilization/Demobilization	2	LS	\$	\$.	Vendor Quote
	Health and Safety Submission	1	LS	\$	\$	Vendor Quote
	Decontamination Pad	1	LS	❖	\$	Vendor Quote
Per Injection	Per Injection Injection Platforms and Crew	18	days	\$.	\$	Vendor Quote
Round	Mixer Tank (includes delivery)	1	month	\$	\$	Vendor Quote
	Water truck, off highway, 6000 gal	1	month	\$	\$	2016 RSMeans, 01 54 33 6950
	Injectant	132,000	q	\$	\$	2 lbs per gallon
	Misc ODC	18	days	\$	\$	Project Experience
	Decontamination	8	per well	❖	\$	Project Experience
0 1 MO	DOT steel drums, 55 gal., open, 17C	18	each	❖	❖	Vendor Quote
אַנווואַנואַנואַנואַנואַנואַנוואַנואַנוא	DW nationing Transportation of IDW drums (non-hazardous)	1	LS	❖	\$	Vendor Quote
	Disposal of IDW drums (non-hazardous)	П	LS	<∧	\$	Vendor Quote
	Ovareight during Injection Dound (Geoff Sciantist)	2	2	v	v	Droiort Experience
	יייייייייייייייייייייייייייייייייייייי	2	, ,	٠,	·	יין פורי באליבורים
	Oversight during Injection Round (Senior Hydro)	2	day	S	s	Project Experience
Labor	Per Diem during Injections (per person)	18	day	\$	\$	GSA Rates
	Automobile, Rental during Injections (including gas and tolls)	4	weeks	❖	❖	Project Experience
	Project Manager	32	hours	\$	\$	Project Experience
				Subtotal	Ş	

⋄ ⋄ ⋄

Project Management

Total ABC Injections Component

Markup (G&A and Fee)

10.25% 10%

Table E.7 Cost Estimate - Performance Sampling ABC Remedial Design
AIW Frank/Mid-County Mustang Superfund Site
Operable Unit 1, Chester County, Pennsylvania

<u>General Comments</u>

Nineteen locations are scheduled for sampling after each ABC injection. Costs are for one sampling event.

Field crew can samples 3 wells per day.

QA/QC samples will be collected in 1:10 ratio for field duplicate, one EB and FB per event, and one trip blank for VOCS.

Metaboloc acids include the following: lactic, pyruvic, acetic, propionic, and butyric.

	Assembly Description	Qty NOM	Material	_	Labor	Equip	Equipment	Vendor Quote	note	Total Cost	Basis	ı
	33020401 Disposable Materials per Sample	19 EA	\$ \$,	\$,	٠,	·	Race	Racer Estimate	Racer
	33020402 Decontamination Materials per Sample	19 EA	\$	\$	•	\$,	10	۰,	Estin	Estimate	
	33020561 Lysimeter accessories, nylon tubing, 1/4" OD	4000 LF	\$	\$	٠	\$,	٠,	۰,	Race	Racer Estimate	
	33021509 Monitor well sampling equipment, rental, water quality testing parameter device rental	1.5 WK	\$	٠ -	•	\$,	\$		Race	Racer Estimate	Project
	33021618 Testing, purgeable organics (8260C)	28 EA	\$	٠	•	\$,	٠Λ.	\$	Experi	Experience Project	ect
	33021619 Testing, semi-volatile organics (1,4-dioxane, 8270D)	23 EA	\$	\$ -	•	\$,	٠,	10	Experience	ence	
	33021620 Testing, TAL metals (arsenic, potassium, manganese, and dissolved iron, 6010C)	23 EA	\$	·	,	\$	1	10	Ş	Projec	Project Experience	Project
	33021621 Testing, Alkalinity (SM 2320B)	23 EA	\$	\$	•	\$	1	10	\$	ă	Experience	Project
	33021622 Testing, Anions (Chloride, Nitrate, and Sulfate, SM 2320B)	23 EA	\$	٠	•	\$	1	10		ш	Experience F	Project
	33021623 Testing, COD (410.4)	23 EA	\$	·	•	\$,	10	\$	Ä	Experience	Project
Sample	33021624 Testing, TOC (5310C)	23 EA	\$	\$	•	\$,	٠,	\$	Ë	Experience	Project
Collection	33021625 Testing, Iron Field Kit	1 LS	\$	\$ -	•	\$,	٠,	\$	ă	Experience	Project
	33021626 Testing, Metabolic acids (8015D)	23 EA	\$	٠	•	\$,	10	\$	ă	Experience	Project
	33021627 Testing, Dehalococcoides bacteria (qPCR)	23 EA	\$	\$	•	\$,	10	\$	Ã	Experience	Project
	33021628 Testing, Biomass (PLFA)	23 EA	\$	٠ -	•	\$,	٠Λ.	\$	ã	Experience	Project
	33021629 Testing, Methane, ethane, ethene (RSK-175)	23 EA	\$	·	•	\$,	10	\$	Ш	Experience F	Project
	33021630 Testing, TDS (PLFA)	23 EA	\$	\$	•	\$,	٠,	\$	Δ	Experience	Project
	33022043 Overnight delivery service, 51 to 70 lb packages	9.5 EA	\$	٠ -	•	\$,	٠,	10	Ã	Experience	Project
	33240101 Other Direct Costs	1 LS	\$		•	\$,	٠,	,		Experience	9.
	Well Sampling Crew (2 Associate Scientists)	7 DAY	\$	\$	s		,	٠Λ.	٠,	Project	Project Experience	
	Per Diem during Sampling (per person)	14 DAY	\$	٠ -	•	\$,	٠Λ.	\$	GSA	GSA Rates Project	ject
	Automobile, Rental during Sampling (including gas and tolls)	4 WK	\$	\$ -	•	\$	1	٠,	\$	Experience	ence	
							SΙ	Subtotal	••	4		
	Project Manager	12 HR	\$	٠ -	\$,	٠Λ.	٠,		Project Experience	rience
	Staff Engineer	12 HR	\$	٠ -	\$,	٠,	,	Pro	Project Experience	nce
	Staff Scientist	32 HR	\$	\$\$,	٠Λ.	٠,	Pro	Project Experience	nce
Report	QA/QC Officer	8 HR	\$	- \$\$,	٠,	,	Pro	Project Experience	nce
	Word Processing/Clerical	8 HR	\$	\$	\$,	٠,	·	Pro	Project Experience	nce
	Draftsman/CADD	8 HR	\$	- \$\$,	٠Λ.	۰,	Pro	Project Experience	nce
	Data Base Manager	24 HR	\$	٠ -	\$,	٠,	۰,	Pro	Project Experience	nce
								104044.	•	,		

Markup (G&A and Fee) Project Management **Total Performance Sampling Component**

Table E.8 Cost Estimate - LTM Sampling Remedial Design

AIW Frank/Mid-County Mustang Superfund Site Operable Unit 1, Chester County, Pennsylvania

General Comments

Thirty six locations are scheduled for sampling once all injections and associated performance monitoring are completed. Field crew can samples 3 wells per day.

QA/QC samples will be collected in 1:10 ratio for field duplicate, one EB and FB per event, and one trip blank for VOCS. An annual report will document the resutls of the LTM sampling.

	Assembly Description	Qty UOM		Material	La	Labor	Equipment	ent	Vendor Quote	ote	Total Cost	Basis
	33020401 Disposable Materials per Sample	36 EA	\$	\$			\$	\$ -		-	\$ Racer	Racer Estimate
	33020402 Decontamination Materials per Sample	36 EA	\$-	ş		,	\$	\$ -		1	\$ Racer	Estimate
	33020561 Lysimeter accessories, nylon tubing, 1/4" OD	5000 LF	s	\$		ı	\$	\$ -		1	\$ Racer Estimate	nate
	33021509 Monitor well sampling equipment, rental, water quality testing parameter device rental	2 WK	\$	٠	ş	٠	\$	٠	Ş		Racer Estimate	nate Project
5	33021618 Testing, purgeable organics (8260C)	50 EA	÷	•	ş	•	\$	\$		\$	Experience	Project
Sample	33021619 Testing, semi-volatile organics (1,4-dioxane, 8270D)	43 EA	\$-	•	ş	ı	\$	\$ -		\$	Experience	Project
רסווברווסוו	33022043 Overnight delivery service, 51 to 70 lb packages	21.5 EA	\$	•	ş	٠	\$	٠		\$	Experience	Project
	33240101 Other Direct Costs	1 LS	\$	ş			\$	٠		1	\$ Experience	
	Well Sampling Crew (2 Associate Scientists)	12 DAY	\$-	•	ş	\$		\$ -		1	\$ Project Experience	ence
	Per Diem during Sampling (per person)	24 DAY	\$	•	ş	٠	\$	\$		\$	GSA Rates	Project
	Automobile, Rental during Sampling (including gas and tolls)	4 WK	\$.	ı	٠	ı	ş	\$ -		\$	Experience	
								S	btotal			
	Project Manager	48 HR	s	٠	\$			\$ -		1	\$ Project Experience	perience
	Staff Engineer	48 HR	s	•	\$			\$ -		1	\$Project	Experience
	Staff Scientist	64 HR	\$	•	\$			\$ -		1	\$Project	Experience
Report	QA/QC Officer	24 HR	s	٠	\$ \$			\$ -		1	\$1 Project	Experience
	Word Processing/Clerical	24 HR	÷	•	\$\$			\$		1	\$Project	Experience
	Draftsman/CADD	24 HR	\$	•	\$			\$ -		1	\$Project	Experience
	Data Base Manager	24 HR	❖	•	\$\$			\$ -		1	\$Project Experience	a)
								S	ubtotal		\$	

Markup (G&A and Fee) Project Management **Total LTM Sampling Component**

AIW Frank/Mid-County Mustang Superfund Site Operable Unit 1, Chester County, Pennsylvania Table E.9 Cost Estimate - FYR Cost Remedial Design

General Comments

Tasks included are: document review, site inspection, travel, and reporting.

FYRs would be required until the cleanup goals for the Site are achieved

Assume FYR site visit/inspection require 1 person for 1/2 day plus reporting

	Assembly	Description	Q t	NOM	Material	ia	Labor	Equip	Equipment	Vendor Quote	ө	Total Cost	Basis	
	Ч	Inspection Crew (1 Associate Scientist)		1 DAY	\$		\$ \$			٠,	\$ -	Project Ex	Project Experience	GSA
	Ě	Per Diem during LUC inspections (per person)		1 DAY	❖	,	· \$	❖	1			Rates		
	Ā	Automobile, Rental during LUC Inspections (including gas and tolls)		1 DAY	❖	,	· \$	❖	1	\$		Proj	roject Experience	nce
	ā	Project Manager		32 HR	❖	,	\$		1	τΛ.	\$ -	Project Experience	erience	Project
Labor	St	Staff Engineer		32 HR	❖	,	\$			τΛ.	·	Experience		Project
	St	Staff Scientist		40 HR	\$		\$			10	\$ -	Experience		Project
	ď	2A/QC Officer		16 HR	\$		\$ \$		1	10	\$	Experience		Project
	<i>\$</i>	Word Processing/Clerical		16 HR	\$,	\$,	40	٠	Experience		Project
	۵	Draftsman/CADD		24 HR	❖		\$		1	τ^.	٠	Experience		
	1								,	ubtotal	•			

Markup (G&A and Fee) Project Management **Total FYR Component**

AIW Frank/Mid-County Mustang Superfund Site Operable Unit 1, Chester County, Pennsylvania Table E.10 Cost Estimate - RACR report Remedial Design

General Comments
Report development at the end of the project.

	Assembly	Description Q	ty	NON	Material	Lal	Labor	Equipment	Vendor Quote	0	Total Cost	Basis	
	Pr	Project Manager	4	48 HR	- \$	\$	\$		\$	\$ -	Proje	Project Experience	e e
	St	taff Engineer	4	8 HR	- \$	ς,	٠,	ı	\$	\$	Project Ex	roject Experience	Project
1	Sta	Staff Scientist	9	4 HR	- \$	\$	\$	1	\$	\$	Experience	ь	Project
Keport	<i>₹</i>	2A/QC Officer	7	24 HR	- \$	ş	ς,		\$	\$	Experience	e	Project
	×	Vord Processing/Clerical	7	24 HR	- \$	\$	\$	ı	\$	\$ -	Experience	e	Project
	D	Draftsman/CADD	7	24 HR	- \$	\$	\$	1	\$	\$ -	Experience	ь	
	1							٠,,	Subtotal	❖			

Markup (G&A and Fee) Project Management **Total LTM Sampling Component**

APPENDIX E

Well ID Specifications

Well ID	Well Diameter (inches)	Well Depth (ft bgs)	Screened Interval (ft bgs)	Type of Screen
MW-114	2	65	55-65	PVC
MW-103A	4	40	20-40	PVC
MW-103B	6	132	68-132	Open
MW-113A	2	125	105-125	PVC
MW-113B	2	170	160-170	PVC
MW-104A	6	95	25-95	Open
MW-104B	6	140	105-140	Open
MW-112A	2	90	80-90	PVC
MW-112B	2	200	180-200	PVC
MW-110	2	55	45-55	PVC
HW-6	6	75.5	NA	Open
MW-115	2	95	55-95	PVC