RECORD OF DECISION AMENDMENT

AIW FRANK / MID-COUNTY MUSTANG SUPERFUND SITE
WEST WHITELAND TOWNSHIP, CHESTER COUNTY, PENNSYLVANIA

UNITED STATES ENVIRONMENTAL
PROTECTION AGENCY

REGION 3
PHILADELPHIA, PENNSYLVANIA
June 2017

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LIST OF ACRONYMS

1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene
1,1,1-TCA	1,1,1-trichloroethane
Act 2	Pennsylvania's Land Recycling and Remediation Standards Act
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
CCHD	Chester County Health Department
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cis-1,2-DCE	cis-1,2-dichloroethene
COC	contaminant of concern
COPC	contaminant of potential concern
EPA	U.S. Environmental Protection Agency
ERA	Ecological Risk Assessment
ESD	Explanation of Significant Differences
FFS	Focused Feasibility Study
FS	Feasibility Study
FYR	five-year review
GETS	groundwater extraction and treatment system
HHRA	Human Health Risk Assessment
HI	Hazard Index
HSCD	Hazardous Site Cleanup Division
IC	institutional control
ISBR	in situ bioremediation
ISCO	in situ chemical oxidation
LTM	long-term monitoring
MCL	Maximum Contaminant Level
MNA	monitored natural attenuation
MSC	medium specific concentration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OU	Operable Unit
O&M	operation and maintenance
PADEP	Pennsylvania Department of Environmental Protection
PADER	Pennsylvania Department of Environmental Resources
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
PCOR	Preliminary Close-out Report
POTW	publicly owned treatment works
PPE	personal protective equipment
PRG	preliminary remediation goal
PRP	potentially responsible party

PSWC	Philadelphia Suburban Water Company
RA	Remedial Action
RAO	Remedial Action Objective
RD	Remedial Design
RG	remediation goal
RI	Remedial Investigation
ROD	Record of Decision
RSL	regional screening level
SDWA	Save Drinking Water Act
SERA	Supplemental Ecological Risk Assessment
SSC	Superfund State Contract
SVOC	semi-volatile organic compound
TBC	to be considered
TCE	trichloroethylene
µg/L	micrograms per liter
UIC	underground injection control
U.S.C.	U.S. Code
UV	ultraviolet
VOC	volatile organic compound

PART I – THE DECLARATION

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I. THE DECLARATION

A. Site Name and Location

The AIW Frank / Mid-County Mustang Superfund Site (the Site) is located in West Whiteland Township, Chester County, Pennsylvania and consists of two adjoining properties that cover approximately 16-acres. The AIW Frank property historically operated as a manufacturing facility for Styrofoam products and commercial refrigeration units, while the adjacent Mid-County Mustang property historically operated as an auto repair facility. The National Superfund Database Identification Number for the Site is PAD004351003. A Site Location Map is included as Figure 1 and the Site Layout is included as Figure 2.

B. Statement of Basis and Purpose

This Record of Decision (ROD) Amendment selects a modification (Remedy Modification) to the remedy selected for the Site by the U.S. Environmental Protection Agency (EPA) in the September 29, 1995 ROD (Selected Remedy). This Remedy Modification was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), 42 U.S.C. § 9601 et seq, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300, as amended.

This ROD Amendment is based on the Administrative Record for the Site, which was developed in accordance with Section 113 (k) of CERCLA, 42 U.S. Code (U.S.C.) § 9613(k). The Administrative Record file is available for review online at http://www.epa.gov/arweb, at the EPA Region III Records Center in Philadelphia, Pennsylvania, and at the West Whiteland Township Building in Exton, Pennsylvania. The Administrative Record Index (Appendix A) identifies each document contained in the Administrative Record upon which the Remedy Modification is based.

The Commonwealth of Pennsylvania concurs with this Remedy Modification (Appendix C).

C. Assessment of the Site

As a result of the historic operations on the AIW Frank and Mid-County Mustang properties, soil and groundwater were impacted at the Site, primarily by volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticide/polychlorinated biphenyl (PCB) compounds, and heavy metals.

The Remedy Modification selected in this ROD Amendment is necessary to protect human health from actual or threatened releases of hazardous substances into the environment.

D. Description of the Remedy Modification

The Remedy Modification described in this ROD Amendment modifies the Selected Remedy to more effectively address groundwater contamination at the Site. The Selected Remedy as set forth in the 1995 ROD consists of the following components:

1. Provision of point-of-use carbon filtration units (for residents at risk until the waterline is extended);

2. Installation of a waterline and service connections;
3. Performance of a Phase I archeological survey prior to any intrusive remedial activities;
4. Excavation and off-site disposal of contaminated soils, following pre-remedial design soil investigations;
5. Removal, decontamination, and off-site disposal of drums and sump;
6. Structure demolition/restoration;
7. Institutional controls (ICs) (to prevent the consumption of contaminated groundwater and creation of any hydraulically adverse influence on the extraction system operation, including deed restrictions until cleanup levels are met);
8. Performance of an additional Ecological Assessment;
9. Extraction and treatment via air stripping of groundwater until Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) are met with vapor phase carbon adsorption and subsequent discharge to either: (i) West Valley Creek, (ii) the on-site pond, or (iii) the West Whiteland spray irrigation publicly owned treatment works (POTW), following a pre-design hydrogeologic investigation; and
10. Long-term groundwater monitoring.

The Remedy Modification described in this ROD Amendment includes the following changes to the Selected Remedy in the 1995 ROD to address groundwater contamination:

1. Replacement of extraction and treatment via air stripping of groundwater with in situ chemical oxidation (ISCO) and in situ bioremediation (ISBR); and
2. Modification of groundwater contaminants of concern (COCs) and remediation goals (RGs).

All other components of the Selected Remedy as described above have been completed or implemented.

D.1 ISCO and ISBR

The 1995 ROD required the use of a groundwater extraction and treatment system (GETS) to remediate contaminated groundwater at the Site. The construction of the GETS was completed in November 2000. During operation and monitoring of the system, 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 MCLs, or the wells were being used for pilot study activities and the extraction pumps were removed. Further, use of the GETS' tray aerator system was discontinued in August 2005 because the groundwater influent concentrations only warranted treatment with the liquid phase carbon. The GETS was therefore turned off by EPA on April 24, 2008, but has been maintained in operational condition. Pursuant to a Superfund State Contract (SSC) for the Site, PADEP assumed responsibility for Operation and Maintenance (O&M) of the Selected Remedy on December 31, 2011.

In order to optimize the groundwater remedy, EPA conducted a series of pilot studies between 2005 and 2011 to determine if ISCO and ISBR would be effective in degrading Site COCs. Post-injection sampling confirmed that both ISCO and ISBR were able to reduce groundwater contamination and could be used as viable options for future treatment. Based on the positive results of the ISCO and ISBR pilot studies, a Focused Feasibility Study (FFS) was completed by EPA in June 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 RGs in a shorter time frame and at a lower cost than extraction and treatment.

Therefore, this ROD Amendment removes the GETS as a component of the Selected Remedy. In place of the GETS, this 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 additional biological degradation of Site COCs. The existing GETS will remain shut down, but will continue to 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 shall continue until contaminant levels in groundwater reach the RGs specified in the 1995 ROD, as modified by Table 2 of this ROD Amendment.

D.2 Modification of Groundwater Chemicals of Concern and Remediation Goals

Though not included in the original list of COCs for the Site, recent monitoring data indicates that 1,4-dioxane concentrations exceed EPA's tap water regional screening level (RSL) of 0.46 micrograms per liter (µg/L) (May 2016). The highest concentration of 1,4-dioxane (250 µg/L) was observed in wells EW-4 and MW-108A in October 2003. Since these concentrations exceed EPA's acceptable risk range, 1,4-dioxane and will be added as a COC that requires remediation. There is no MCL for 1,4-dioxane under the SDWA, therefore, EPA will use the groundwater medium specific concentration (MSC) for 1,4-dioxane set forth in Pennsylvania's Land Recycling and Remediation Standards Act (Act 2) as the RG for this COC. The Act 2 state-wide health standard groundwater MSC for 1,4-dioxane in residential used aquifers with total dissolved solids (TDS) less than or equal 2500 µg/L is 6.4 µg/L, which has an associated excess carcinogenic risk level of approximately 1.39×10^{-5} and non-carcinogenic hazard indices (HIs) of 1.21×10^{-1} (child) and 1.14×10^{-1} (adult). These risk levels are within EPA's acceptable risk range and the new RG is therefore protective of human health.

Like 1,4-dioxane, 1,1-Dichloroethane (1,1-DCA) also does not have an MCL under the SDWA. In the 1995 ROD, EPA's tap water RSL (81 µg/L) was used as the RG for 1,1-DCA. Since the 1995 ROD, the RSL for 1,1-DCA has changed from 81 µg/L to 2.7 µg/L. Therefore, as part of EPA's 2015 FFS, an additional risk evaluation was conducted for 1,1-DCA using data from 2011. The risk evaluation concluded that 1,1-DCA does not pose a threat to human health at the Site. However, there are still two monitoring wells at the Site that have had recent detections of 1,1-DCA that exceed the new RSL. For this reason, 1,1-DCA will remain on the list of Site COCs. EPA will use the Pennsylvania Act 2 MSC for 1,1-DCA as the RG for this COC. The Act 2 state-

wide health standard groundwater MSC for 1,1-DCA in residential used aquifers with TDS less than or equal 2500 µg/L is 31 µg/L, which has an associated excess carcinogenic risk level of approximately 1.13×10^{-5} and non-carcinogenic HIs of 8.26×10^{-3} (child) and 5.00×10^{-3} (adult). These risk levels are within EPA's acceptable risk range and the new RG is therefore protective of human health.

As part of the 2015 FFS, additional risk evaluations were also conducted for chloroform, arsenic, and manganese using 2011 data due to the changes in screening levels since the 1995 ROD. These risk evaluations concluded that chloroform, arsenic, and manganese do not pose a threat to human health at the Site and therefore will be removed from the list of Site COCs.

E. Statutory Determinations

As discussed in EPA's Third Five-Year Review for the Site, the Selected Remedy, as implemented, remains protective of human health and the environment. The Selected Remedy, as modified by this Remedy Modification, meets the mandates of CERCLA § 121 and the regulatory requirements of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The Selected Remedy, as modified by the Remedy Modification, is protective of human health and the environment, complies with Federal and State requirements that are Applicable or Relevant and Appropriate Requirements (ARARs) to the RA, is cost effective, and utilizes a permanent solution to the maximum extent practicable.

The Remedy Modification also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduction of the toxicity, mobility, or volume of hazardous substances).

Statutory Five-Year Reviews (FYRs) will be conducted at least every five years to ensure that the remedy continues to provide adequate protection of human health and the environment and will continue until hazardous substances are no longer present above levels that allow for unlimited use and unrestricted exposure. Since RA has already been initiated at the Site, this ROD Amendment does not alter the FYR schedule. The next FYR for the Site is due March 15, 2021.

F. ROD Amendment Certification Checklist

The following information is included in the Decision Summary (Part II) of this ROD Amendment, while additional information can be found in the Administrative Record file for the Site:

- COCs;
- Baseline risk represented by the COCs;
- How source materials constituting principal threats have been addressed;
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used considered in the baseline risk assessment and ROD Amendment;
- Potential land and groundwater use that will be available at the Site as a result of the Remedy Modification;

- Estimated capital, annual O&M, and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected; and
- Key factors that led to selecting the remedy modifications.

G. Authorizing Signature

This ROD Amendment documents a Remedy Modification to the Selected Remedy for the AIW Frank / Mid-County Mustang Superfund Site, and is based on the Administrative Record for the Site. EPA selected the Remedy Modification with the concurrence of PADEP. The Director of the Hazardous Site Cleanup Division (HSCD) for EPA Region III has approved and signed this ROD Amendment.

Approved by: Date:

JUN 16 2017

Karen Melvin, Director
Hazardous Site Cleanup Division

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PART II – THE DECISION SUMMARY

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II. THE DECISION SUMMARY

A. Site Name, 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 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. The Site also includes the areal extent of the contaminated groundwater plume, the municipal waterline, and the GETS that have been constructed as part of the RA (Figure 2).

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 by 60 feet (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 SSC for the Site, PADEP assumed responsibility for O&M activities at the Site on December 31, 2011.

B. Site History and Enforcement Activities

This section of the ROD Amendment provides the history of the Site and a discussion of EPA and PADEP investigations and response activities. The "Final Rule" adding the Site to the Superfund National Priorities List (NPL) was published in the *Federal Register* on October 24, 1989.

B.1. History of Activities Leading to Contamination

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 also contributed to the groundwater contaminant plume.

EPA suspects that previous operators of the auto garage on the Mid-County Mustang property utilized solvents to clean auto engines and disposed of used solvents in a floor drain. A 1984 environmental study commissioned by former owner CDS Investment Company revealed the presence of trichloroethene (TCE) in a floor drain in the garage building. This drain lead to an on-Site tile field, consisting of a stone filter bed. It is believed that the historic disposal of solvents in the tile field area led to additional soil contamination and contributed to the groundwater contaminant plume.

B.2. History of Previous Environmental Investigations and Response Actions

Based on sampling of local private water supply wells in 1982, the Pennsylvania Department of Environmental Resources (PADER), now known as PADEP, identified elevated VOCs including TCE in the groundwater in the vicinity of the AIW Frank / Mid-County Mustang properties. PADER and contractors retained by the owners of both the Mid-County Mustang and AIW Frank portions of the Site collected subsequent samples from groundwater wells and soils at the Site from 1982 through 1984 and identified elevated concentrations of TCE, tetrachloroethene (PCE) and 1,1,1-trichloroethane (1,1,1-TCA).

As a result of the investigation conducted by the owner of the Mid-County Mustang property, in 1984 the contaminated stone filter bed and associated contaminated soils were excavated to a depth of 3 feet and disposed of off-Site under PADER oversight. Also, the floor drains in the garage areas were abandoned to prevent future disposal. In 1990, Continental Refrigeration Corporation, the owner of the AIW Frank property at that time, removed and disposed of approximately 30 drums containing mostly methylene chloride from the rear building under PADER oversight.

EPA conducted a multimedia investigation of the Site property and some surrounding industrial properties in 1985. This study also found elevated levels of TCE, PCE and 1,1,1-TCA in groundwater and soils at the Site. The Site was subsequently proposed for listing on the NPL on June 24, 1988. The Site was officially listed on the NPL on October 24, 1989.

On August 15, 1991 a fire destroyed one of the buildings on the AIW Frank property. As a result, the remaining portions of the building that were standing were demolished and the demolition debris was removed and disposed of at a demolition waste landfill by EPA. EPA conducted a remedial investigation and feasibility study (RI/FS) of the Site to characterize the nature and extent of contamination at the Site and to develop remedial alternatives to address the contamination. Field work for the RI/FS was conducted between January 1991 and February 1995 and the final RI/FS report was approved in April 1995.

C. Community Participation

Community interest and concern about the Site has been steady throughout EPA's involvement. EPA issued fact sheets in October 1990, July 1992, and October 1993 to keep the public informed of progress on the RI/FS. Additionally, EPA held a public meeting to present the initial Proposed Plan on June 29, 1995 and met with a local civic association on July 20, 1995.

For this ROD Amendment, in addition to historic documents already contained in the Administrative Record, EPA's June 2016 Proposed Plan and June 2015 FFS for the Site were made available for public comment from June 1, 2016 until June 30, 2016. These documents, as well as the 1995 ROD, can be found in the Administrative Record file located in the EPA Region III Office, the West Whiteland Township Building in Exton, PA and online at www.epa.gov/arweb. The notice of the availability of these documents was published in the *West Chester Daily Local News* on June 1, 2016. In addition, a fact sheet was posted to the West Whiteland Township website, and was distributed at a public meeting held on June 14, 2016 to present EPA's Proposed Plan to the community and solicit comments. Approximately 10 people attended the meeting,

including township officials and local residents. Documentation of the public meeting and public comment period is provided in the Responsiveness Summary (Part III) of this ROD Amendment.

These community participation activities meet the public participation requirements in CERCLA § 121 and the NCP at 40 Code of Federal Regulations (CFR) § 300.430 (f)(3).

D. Scope and Role of Response Action

EPA documented the Selected Remedy for the Site in a ROD signed on September 29, 1995. Although Operable Units (OUs) were not defined in the 1995 ROD, OUs were subsequently defined as follows:

- OU1 – Groundwater
- OU2 – Public Water Line
- OU3 – Soil

The components of the Selected Remedy in 1995 ROD are described in detail in Section E.3.

The Remedy Modification described in this ROD Amendment modifies the Selected Remedy for OU1 Groundwater only. The Selected Remedy, as modified by the Remedy Modification, will restore contaminated groundwater to beneficial use in a more effective manner than the Selected Remedy in the 1995 ROD through the use of treatment technologies which are designed to permanently reduce the toxicity, mobility, and volume of contaminants in groundwater. The Selected Remedy, as modified by the Remedy Modification, will also ensure the protection of human health by eliminating current and potential future exposure to contaminated groundwater. The OU2 and OU3 RAs were completed in 2000 and 1998, respectively, as described in detail in Sections E.5 and E.6, and will not be modified.

E. Site Characteristics

This section of the ROD Amendment provides a brief overview of the Site's geology and hydrogeology, the sampling strategy used during Site investigations, and the nature and extent of contamination. Additional information can be found in the RI/FS and FFS documents in the Administrative Record.

E.1. Geology and Hydrogeology

The Site geology consists of unconsolidated silty clay-rich soils, also called Conestoga silty loams, overlying the bluish-gray limestone and dolomite of the Conestoga Limestone, the Ledger Dolomite, and the Elbrook Formation. The soils are derived from the weathering (erosion) of the Conestoga Limestone and the Ledger Dolomite and are well drained. Based on borehole logs from the RI, the thickness of the soil layer (called overburden) ranges from 6 feet to 75 feet throughout the Site. The surface of the bedrock beneath the soil layer sometimes changes abruptly; this may be the result of faulting, erosion that occurred before the soil overburden layer was deposited, or when groundwater dissolves the limestone and forms cavities called solution channels.

The Conestoga Limestone and Ledger Dolomite formations are the major source of groundwater in the Chester Valley. Studies by the U.S. Geological Survey indicate that the two formations, plus

the Elbrook (where present) act as a single hydrologic unit as static water levels do not significantly change where the overburden and bedrock meet, or when groundwater flows through faults. Groundwater migrates through these formations through fractures and solution channels within the rock mass.

Groundwater monitoring wells have been installed at the Site to monitor the groundwater contamination in the shallow, intermediate, and deep zones. Shallow wells are generally less than 75 feet deep, intermediate wells are between 75 feet and 150 feet deep, and deep wells are more than 150 feet deep. Most of the wells at the Site are installed within the Ledger Dolomite. Some wells on the eastern portion of the site are installed within the Conestoga Limestone. Groundwater is generally encountered from 3 feet below ground surface (bgs) to 25 feet bgs. The general direction of groundwater flow at the Site is to the west/northwest.

E.2 Remedial Investigation and Feasibility Study

EPA conducted a RI/FS from January 1991 to January 1993. The RI/FS identified in greater detail the types, quantities, and location of contaminants, as well as to develop ways of addressing the contamination. The RI field investigation at the Site included the following tasks:

- Aerial photography analysis;
- Tank, drum, and building sampling;
- Asbestos survey and associated testing;
- Geophysical survey;
- Soil gas survey;
- Monitoring well installation;
- Groundwater sampling;
- Monitoring well location and evaluation survey;
- Aquifer testing;
- Test pit excavation and soil sampling;
- Surface water and sediment sampling; and
- Ecological assessment.

The RI investigations identified three types of contamination at the Site:

1. Groundwater contamination by VOCs;
2. Subsurface soil contamination by VOCs, SVOCs, pesticide/PCB compounds, and heavy metals;
3. Wastes contained in abandoned debris, underground tanks, drums, and a sump.

E.3 September 29, 1995 Record of Decision

Following completion of the RI/FS, EPA documented the Selected Remedy for the Site in a ROD signed on September 29, 1995. The Selected Remedy in the 1995 ROD consists of the following components:

1. Provision of point-of-use carbon filtration units (for residents at risk until the waterline is extended);
2. Installation of a waterline and service connections;
3. Performance of a Phase I archeological survey prior to any intrusive remedial activities;
4. Excavation and off-site disposal of contaminated soils, following pre-remedial design soil investigations;
5. Removal, decontamination, and off-site disposal of drums and sump;
6. Structure demolition/restoration;
7. ICs (to prevent the consumption of contaminated groundwater and creation of any hydraulically adverse influence on the extraction system operation, including deed restrictions until cleanup levels are met);
8. Performance of an additional Ecological Assessment;
9. Extraction and treatment via air stripping of groundwater until SDWA MCLs are met with vapor phase carbon adsorption and subsequent discharge to either: (i) West Valley Creek, (ii) the on-site pond, or (iii) the West Whiteland spray POTW, following a pre-design hydrogeologic investigation; and
10. Long-term groundwater monitoring.

As discussed above, the 1995 ROD for the Site did not refer to OUs. Since the 1995 ROD was issued, for administrative purposes, EPA has identified OUs for the Site as follows:

OU1: Groundwater

- GETS
- Long-Term Monitoring (LTM)

OU2: Water Line

- Installation of the public waterline

OU3: Soil

- Soil excavation and off-site disposal
- Drum and sump removal and off-site disposal
- Structure demolition/restoration
- Point-of use carbon filtration units
- Ecological assessment
- Archeological assessment
- ICs

E.4 Operable Unit 1 - Groundwater

Remedial design (RD) of the GETS was completed from August 1996 through June 1999. Construction of the GETS was completed from September 1999 through November 2000. The GETS consists of a tray aerator designed for 90 percent VOC removal with vapor phase carbon

treatment of the off-gas followed by liquid phase carbon polishing prior to discharge. The GETS began operation on November 1, 2000, and is capable of treating up to 200 gallons of water per minute. The GETS was designed to operate 24 hours a day, 7 days per week unattended with autodialing capabilities to notify maintenance personnel if GETS alarms occur or GETS components shut down. The ROD also required construction of a spray irrigation discharge system for the adjoining Township and County park property, which was designed and built as an option for utilizing the water discharged from the GETS into the on-site pond. West Whiteland Township assumed all responsibility for the O&M of the spray irrigation system on December 11, 2000. EPA conducted a final inspection on November 3, 2000 and verified that the GETS was treating contaminated groundwater as designed. Completion of the construction was documented in the Preliminary Close-out Report (PCOR) for the Site dated November 10, 2000.

After eight years of operation and monitoring, 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 MCLs, or the wells were being used for pilot study activities and the extraction pumps were removed. Further, use of the GETS' tray aerator system was discontinued in August 2005 because the groundwater influent concentrations only warranted treatment with the liquid phase carbon. The GETS was therefore turned off by EPA on April 24, 2008, but has been maintained in operational condition. EPA performed a series of pilot studies from 2005 through 2011 to evaluate alternative remedial technologies to treat contaminated groundwater at the Site, as discussed in detail in Section E.7. Pursuant to a July 22, 1997 SSC for the Site, PADEP assumed responsibility for O&M of the OU1 Selected Remedy on December 31, 2011.

E.5 Operable Unit 2 – Water Line

The design and construction of the waterline was completed in two stages. The first stage consisted of the water main extension while the second stage addressed the service connections. Philadelphia Suburban Water Company (PSWC), through a contract with U.S. Army Corps of Engineers (USACE), designed and installed the water main extension. The water main extension included 5,483 feet of ductile iron water pipeline, 13 service taps and 4 fire hydrants. It also included either the disconnection of the existing supply wells or the conversion of the wells to strictly non-consumptive outside use in compliance with Chester County Health Department regulations. In all cases, the existing supply wells were disconnected from the in-home distribution system.

The water main extension work was completed in June 2000. Ownership and future O&M of the extended water supply pipelines was assumed by PSWC under an agreement between PSWC and USACE dated July 6, 1998. PSWC was subsequently acquired by Aqua America, Inc.

E.6 Operable Unit 3 - Soil

On December 12, 1997, EPA and Lewis and Ruth Frame, owners of the AIW Frank parcel, signed an Administrative Order on Consent (AOC) whereby the Frames agreed to prepare a RD/RA work plan for OU3. On August 5, 1998, the U.S. District Court for the Eastern District of Pennsylvania entered a Consent Decree between EPA and the Frames requiring the Frames to perform the RA selected in the ROD for OU3 and to pay the United States $1.1 million as reimbursement for the

Agency's response costs at the Site. On September 4, 1998, EPA, in consultation with PADEP, approved the RD/RA work plan.

The Frame's contractor began work on site on October 31, 1998. The work included soil excavation in the former above ground storage tank area of the AIW Frank parcel until the soil RGs, which are protective of future residential use at the Site, were achieved. The contaminated soils were placed in lined roll-off containers and disposed off-site in accordance with the 1995 ROD. Drums that remained in the rear building were over-packed and sent off-site for disposal. Contaminated sediments were removed from the sump adjacent to the foundation of the front building, and the sump was then cleaned. The OU-3 work also included an ecological assessment and an archeological assessment before the soil excavation. No ecological risk or archeological artifacts were identified at the Site as a result of these assessments. Completion of this work allowed for unrestricted use of the AIW Frank parcel, except for the ICs related to the groundwater portion of the remedy.

The 1995 ROD requires ICs to prevent consumption of contaminated groundwater and to prevent adverse impacts on the operation of the GETS. This IC is currently being implemented by regulations promulgated and enforced by the Chester County Health Department (CCHD). According to CCHD Rules and Regulations, Section 501.15 (Groundwater Areas of Concern), installation of a new well in the vicinity of an NPL site requires CCHD to contact and receive prior approval of EPA. Areas of Concern also require initial sampling of the well water to demonstrate that it meets drinking water standards before permission from the CCHD is granted to use the new supply well for drinking purposes. EPA has provided CCHD with base maps of the Site and supplies groundwater contaminant plume information on a biannual basis to assist CCHD in implementing their regulations. The CCHD Area of Concern for the Site is shown in Figure 7. In addition, acknowledgements under Pennsylvania law have been placed on the deeds for both properties at the Site to inform the public of historical soil and groundwater contamination at the Site. EPA will work with the owners of real property at the Site to further implement groundwater use restrictions through the recording of environmental covenants under the Pennsylvania Uniform Environmental Covenants Act, Act No. 68 of 2007, 27 Pa. C.S. §§ 6501-6517.

E.7 Post-ROD Pilot Studies

Groundwater sampling was conducted semiannually at the Site after the GETS began operation in 2000. These sampling results indicated that the effectiveness of the GETS decreased as contaminant concentrations in Site groundwater were reduced over time. The GETS was designed to treat groundwater from five extraction wells, but by 2008, only one well (EW-3) was still operating. The other four wells were taken offline because influent concentrations were either below MCLs, or the wells were being used for pilot study activities and the extraction pumps were removed. Further, use of the GETS' tray aerator system was discontinued in August 2005 because the groundwater influent concentrations only warranted treatment with the liquid phase carbon. After evaluation of the February/March 2008 semiannual groundwater sampling results, EPA determined that operation of the GETS was not generating a hydraulic capture zone and was having minimal impact on the groundwater contaminant plume. The GETS was therefore turned off by EPA on April 24, 2008, but has been maintained in operational condition. EPA performed a series of pilot studies from 2005 through 2011 to evaluate alternative remedial technologies to treat contaminated groundwater at the Site, as discussed in detail in Sections E.8 and E.9, below.

E.8 In-Situ Chemical Oxidation Pilot Studies

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 ($KMnO_4$) in oxidizing VOCs in the most contaminated portions of the Site groundwater plume. The study included injection of 3,480 gallons of 26% $KMnO_4$ solution over two days into EW-4. Monitoring was conducted in EW-4 and 15 surrounding wells for a period of twelve 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 small magnitude of average rebound in VOC concentrations (30% over three months) in the study area. Concentrations of 1,4-dioxane also decreased due to the injections. 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.

Due to the success of the initial injections, a second ISCO pilot study was conducted from August 2007 through November 2007. In this study, 14,281 gallons of 20% $KMnO_4$ 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 $KMnO_4$ 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 polyvinyl chloride (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 ($NaMnO_4$) was used as the oxidant because it has a greater solubility than $KMnO_4$ and can be delivered at greater concentrations. Beginning on September 2, 2009 and ending on September 10, 2009, 1,740 gallons of 11% $NaMnO_4$ solution was injected into OB-1I. In addition to the injection at OB-1I, 1,260 gallons of $NaMnO_4$ was gravity fed into EW-4 to expedite the completion of injection work. Post-injection monitoring indicated that $NaMnO_4$ was equally effective at reducing VOC and 1,4-dioxane concentrations.

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 broke down Site COCs into chemicals and compounds at levels that do not pose a threat to human health, such as manganese dioxide, and carbon dioxide. The estimated TCE mass removed by the three ISCO pilot studies is 4,500 pounds, compared to the removal of approximately 71 pounds of TCE from groundwater via the GETS between November 2000 and April 2008.

E.9 In-Situ Bioremediation Pilot Studies

EPA conducted two additional pilot studies in 2010 and 2011 to determine if Site groundwater could be treated using ISBR, a process in which sub-surface 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 dichloroethene (DCE) to vinyl chloride (VC) to ethene with the removal of one chlorine atom with each step. DCE and VC are the 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, thirty gallons of a substrate solution consisting of 25 gallons of purge water, five gallons of ABC® and 30 grams of sodium bromide tracer was injected into MW-112B, followed by 30 gallons of unamended ground water. ABC® is a patented mixture that contains soluble lactic acid as well as components that slowly release volatile fatty acids. The 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 inability of MW-112B to accept fluids limited the effectiveness of the injection. Positive results included a 50% reduction in TCE concentration and a temporary fivefold 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. Increases in biomass were also observed. Decreases in pH in the injection well during the pilot study to levels detrimental to biologic activity limited the success of the test. Lower pH levels are likely due to 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 the 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 gallons of LactOil® solution made with 770 gallons of LactOil® and 14,630 gallons of treated Site water 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.

E.10 Current Nature and Extent of Groundwater Contamination

Site groundwater is contaminated by VOCs, with the primary contaminant being TCE. Figure 6 illustrates TCE concentrations from October 2005, prior to the implementation of the pilot studies discussed above. In October 2005, the highest TCE concentrations were in wells OB1-I and EW-4, at concentrations of 470 µg/L and 340 µg/L, respectively. Since the pilot studies have been completed, the TCE concentrations have been significantly reduced and in November 2013 TCE was detected at concentrations of 28.5 µg/L and 13 µg/L in wells OB1-I and EW-4, respectively. Figures 3 and 4 show TCE concentrations observed in the shallow wells and intermediate/deep wells, respectively, from data collected in November 2013. The highest levels of contamination are to the south/southwest of the Former AIW Frank rear building. The highest TCE concentrations were detected in the shallow bedrock wells MW-114 and OB-3S at concentrations of 43 µg/L and 34 µg/L, respectively. The contaminant plume has migrated downgradient in a west/northwest direction, which is consistent with groundwater flow at the Site. TCE has been detected on the west side of West Valley Creek, but at lower concentrations than what are seen closer to the Site. November 2013 TCE concentrations are also illustrated on a hydrogeologic cross section on Figure 5. The November 2013 groundwater data indicates that ISCO and ISBR have been effective in reducing groundwater contaminant concentrations and would be viable groundwater treatment technologies at the Site.

F. Current and Future Potential Land Use and Water Use

The Site is located on approximately 16 acres and situated approximately one mile east of Exton, Pennsylvania. Exton covers approximately 3.2 square miles and contains approximately 4,842 residents. All the buildings on the AIW Frank parcel have been demolished. The property is currently an open area overgrown with vegetation and a large pile of crushed stone/concrete remaining from the building demolition. The Mid-County Mustang parcel (currently Corbo Automotive Services) consists of an auto garage, a parking lot, and a small lawn area and adjoins the AIW Frank property to the east. The GETS building is north of the Mid-County Mustang property (Figure 2).

At the time of the 1995 ROD, the Site was zoned for O/L – Office/Laboratory use. However, the site was rezoned for O/R – Office/Residential use on September 9, 2015 by West Whiteland Township. Therefore, the reasonably anticipated future use of the Site would be for commercial and/or residential purposes.

Groundwater in the vicinity of the groundwater contaminant plume is not used for drinking because the area is serviced by public water supplied by Aqua America, Inc. (formerly PSWC). The 1995 ROD requires ICs to prevent consumption of contaminated groundwater and to prevent adverse impacts on the operation of the GETS, which have been implemented by the CCHD as described in Section E.6. Groundwater extraction is not allowed, and is not anticipated in the CCHD Area of Concern until Site groundwater meets the RGs specified in the 1995 ROD and

modified herein. In addition, acknowledgements under Pennsylvania law have been placed on the deeds for both properties at the Site to inform the public of historical soil and groundwater contamination at the Site. EPA will work with the owners of real property at the Site to further implement groundwater use restrictions through the recording of environmental covenants under the Pennsylvania Uniform Environmental Covenants Act, Act No. 68 of 2007, 27 Pa. C.S. §§ 6501-6517.

G. Summary of Site Risks

This section summarizes the results of the Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA) that were performed during the 1995 RI, 1996 Supplemental Ecological Risk Assessment (SERA) Report, and 2015 FFS. These baseline risk assessments (before any cleanup) provide the basis for taking a response action and indicate the exposure pathway(s) that need to be addressed by the Selected Remedy, as modified by the Remedy Modification. For more detailed human health and ecological risk information, please refer to the 1995 ROD and 1995 RI Report, 1996 SERA Report, and 2015 FFS in the Administrative Record.

HOW IS HUMAN HEALTH RISK CALCULATED?

A Superfund HHRA estimates the baseline risk. The baseline risk is an estimate of the likelihood of developing cancer or non-cancer health effects if no cleanup action were taken at a site. To estimate baseline risk at a Superfund site, EPA undertakes a four-step process:

Step 1: Analyze Contamination
Step 2: Estimate Exposure
Step 3: Assess Potential Health Dangers
Step 4: Characterize Site Risk

In Step 1, EPA looks at the concentrations of contaminants found at a site as well as past scientific studies on the effects these contaminants have had on people (or animals, when human studies are unavailable). Comparison between site-specific concentrations and concentrations reported in past studies helps EPA to determine which concentrations are most likely to pose the greatest threat to human health.

In Step 2, EPA considers the different ways that people might be exposed to contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of exposure. Using this information, EPA calculates a "reasonable maximum exposure" scenario, which portrays the highest level of exposure that could reasonably be expected to occur.

In Step 3, EPA uses the information from Step 2 combined with information on the toxicity of each chemical to assess potential risks. EPA considers two types of risk: cancer and non-cancer risk. The likelihood of any kind of cancer resulting from a Superfund site is generally expressed as an upper bound probability; for example, a "1 in 10,000 chance." In other words, for every 10,000 people that could be exposed, one extra cancer may occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than would normally be expected to from all other causes. For non-cancer health effects, EPA calculates a "hazard index" (HI). The key concept here is that a "threshold level" (measured usually as a HI of less than 1) exists below which non-cancer health effects are no longer predicted.

In Step 4, EPA determines whether site risks are great enough to cause health problems for people at or near the Superfund site. The results of the three previous steps are combined, evaluated, and summarized. EPA adds up the potential risks from the individual contaminants and exposure pathways and calculates a total site risk. Generally, cancer risks between 10^{-4} and 10^{-6}, and a non-cancer HI of 1 or less are considered acceptable for Superfund sites.

G.1 Human Health Risk Assessment

The HHRA was conducted during the RI/FS in April 1995to characterize and quantify the current and potential future human health risks associated with the Site. The HHRA identifies the potential exposure pathways in which people may be exposed to Site contaminants, the toxicity of the contaminants present, and the potential for carcinogenic and non-carcinogenic effects to occur from exposure to the contaminants. Chemical contaminants that are ingested (consumed), inhaled (breathed), or dermally absorbed (via skin contact) may present carcinogenic or non-carcinogenic risk to different organs of the human body. EPA has set a target risk range of 10^{-4} to 10^{-6} for a lifetime excess carcinogenic risk. For non-carcinogenic risk, EPA has set a target HI range of no greater than 1.

The HHRA identified the following unacceptable risks:

- Future consumption of the groundwater:
    - Future onsite adult resident: $8.1x10^{-4}$, HI=37
    - Future onsite child resident: $1.2x10^{-4}$, HI=82

The HHRA did not identify unacceptable lifetime carcinogenic risk or non-carcinogenic risk for on-site employees.

The COCs in groundwater identified in the 1995 ROD included:

- TCE
- 1,1,1-TCA
- 1,1-DCE
- 1,1-DCA
- 1,1,2-TCA
- cis-1,2-DCE
- 1,2-Dichloropropane
- Tetrachloroethene
- VC
- Toluene
- Chloroform
- Arsenic
- Manganese

Additional risk assessments were conducted during the 2015 FFS for 1,1-DCA, chloroform, arsenic and manganese due to the changes in screening levels or toxicity data for these compounds since the 1995 ROD. The risk evaluations were performed using groundwater monitoring data from 2011. The 2015 FFS considered the same residential exposure pathways for groundwater as the 1995 HHRA (ingestion, dermal contact, and/or inhalation (only volatile chemicals) of contaminants in groundwater by a resident).

In the 2015 FFS risk assessment, arsenic was not detected or was below its respective MCL of 10 μg/L at all sampling locations in 2011 and was eliminated as a contaminant of potential concern

(COPC) from the risk assessment (see 2015 FFS Table 1.10 and 1.11). Manganese presented a total HI=1 for the lifetime child resident (see 2015 FFS Table 1.18 provided in Appendix D) and an HI=0.6 for the adult lifetime resident (see 2015 FFS Table 1.19 provided in Appendix D). Chloroform was non-detect in the 2011 monitoring data used for the risk assessment. Therefore, based on the updated risk assessment in the 2015 FFS (refer to Tables 1.10, 1.11, 1.23, 1.24 and 1.25 provided in Appendix D), chloroform, arsenic, and manganese do not pose a threat to human health, and therefore will be eliminated as COCs at the Site.

Additionally, the 2015 FFS indicated that the RSL for 1,1-DCA has decreased since the 1995 ROD was issued and the RG for 1,1-DCA should be modified. Finally, 1,4-dioxane has been detected at the Site at concentrations exceeding the RPA tap water RSL since 2003. Therefore, 1,4-dioxane will be added as a Site COC and an RG will be established. Changes to Site COCs and RGs are presented in detail in Section L.2.

Once RGs have been attained throughout the groundwater contaminant plume, EPA will evaluate all groundwater monitoring data and perform a cumulative risk assessment to confirm that exposure to groundwater would result in a cumulative excess carcinogenic risk of less than or equal to 10^{-4} and a cumulative excess non-carcinogenic HI of less than or equal to 1.

G.2 Ecological Risk Assessment

An Ecological Risk Assessment (ERA) was completed in 1996 in accordance with the 1995 ROD and presented in the ERA Report, dated May 30, 1996. The ERA was conducted to determine whether Site COCs posed an unacceptable risk to ecological receptors. The ERA considered exposure of terrestrial plants, soil-dwelling invertebrates, terrestrial wildlife, aquatic plants, benthic invertebrates, fish, and amphibians to each of the contaminants detected in one or more of the surface soil, surface water, or sediment samples collected during the RI. The ERA found that the ecological COCs are primarily PCBs in surface soils, defined as soils from the ground surface to six inches bgs, and that ecological risk is due to bio accumulative toxicity to piscivorous (fish-eating) birds and other species. Because the Remedy Modification selected in this ROD Amendment only addresses the OU-1 groundwater portion of the Selected Remedy, no additional ERA was performed.

G.3 Basis for Remedial Action

In summary, the HHRA and ERA for the Site demonstrated the presence of unacceptable risks to human health and the environment. EPA therefore determined that RAs are necessary to reduce the risks to within or below EPA's acceptable risk range. Therefore, it is EPA's determination that implementation of the Selected Remedy, as modified by the Remedy Modification, is necessary to protect human health and the environment from actual or threatened releases of hazardous substances.

H. Remedial Action Objectives

The 1995 ROD identified the following RAOs to protect human health and the environment from potential current and future risks:

1. Prevent current or future human exposure to contaminants in the groundwater, soils, and sub-surface soils;
2. Minimize migration of contaminated groundwater;
3. Restore groundwater to RGs;
4. Protect uncontaminated groundwater and surface water for current and future use; and
5. Protect environmental receptors.

The Remedy Modification will meet the requirements of these RAOs. The RAOs will not be altered by the Remedy Modification. The Remedy Modification will restore groundwater to RGs more efficiently than the Selected Remedy and will prevent future human exposure to contaminants in the groundwater by accelerating achievement of the groundwater RGs.

I. Description of Alternatives

CERCLA requires that any RA selected under CERCLA Section 121, to address contamination at a Superfund site, be protective of human health and the environment, cost-effective, compliant with regulatory and statutory provisions that are ARARs, and compliant with the NCP, to the extent practicable. The Remedial Alternatives presented in this section will modify the OU-1 Groundwater portion Selected Remedy presented in the 1995 ROD. The components of the Selected Remedy in the 1995 ROD that are not discussed below will not be modified by the Remedial Alternatives presented herein.

As discussed in Section E.3, EPA believes the Remedy Modification is necessary because the Selected Remedy for OU1 was no longer effective at addressing contaminated groundwater. EPA therefore evaluated several remedial alternatives to more effectively address contaminated groundwater in the June 2015 FFS. Specifically, EPA identified and screened a range of technologies with the potential to address the groundwater contamination, then assembled the technologies that passed the screening into a series of remedial alternatives that were subjected to a more detailed evaluation. The three alternatives selected for detailed evaluation were:

Alternative 1: No Action

Alternative 4: Groundwater Extraction, Treatment with Ultraviolet (UV) Oxidation, LTM, and ICs

Alternative 7: ISCO, Enhanced Bioremediation, LTM, and ICs

There are several common elements shared by all three alternatives. First, all of the alternatives will need to achieve the updated COCs and RGs discussed in Section G.1. Additionally, FYRs are required under all three alternatives until groundwater contamination is remediated to RGs. Finally, all three alternatives require ICs consisting of groundwater use limitations that have been implemented per the 1995 ROD through a local ordinance restricting groundwater use for consumption. Each of the alternatives is presented in more detail below.

Alternative 1: No Action – The No Action alternative is included as a baseline for comparison of other alternatives. No remedial activities or additional ICs would be implemented under this alternative. The GETS would remain offline. Some level of natural attenuation of contaminants

might occur in groundwater that would reduce the contaminant mass over time due to naturally occurring processes, such as; biodegradation, dispersion, dilution, adsorption, and volatilization.

Estimated Capital Cost: $0
Estimated Annual Cost: $73,000
Estimated 30-Year Present Value Cost: $1,308,000
Estimated Time to Completion: >30 years

Alternative 4: Groundwater Extraction Treatment with UV Oxidation, LTM, and ICs – The GETS would be brought back online to treat the remaining contaminants in the groundwater. Additional extraction wells may be needed to effectively treat remaining groundwater contamination. It is anticipated that the GETS could accommodate a total flow rate of 200 gallons per minute. A UV Oxidation system would be installed and connected to the existing extraction system to treat 1,4-dioxane. It is estimated that the average influent 1,4-dioxane concentration would be 50 µg/L and the effluent concentration would be less than 1 µg/L. LTM would be required until acceptable cumulative risk levels are achieved.

Estimated Capital Cost: $529,000
Estimated Annual Cost: $482,000
Estimated 30-Year Present Value Cost: $4,732,000
Estimated Time to Completion: >30 years

Alternative 7: ISCO, Enhanced Bioremediation, LTM, and ICs – Given the success of both ISCO and ISBR in their respective pilot studies, both treatment technologies will be utilized at the Site to maximize flexibility during implementation. ISCO will involve the injection of an oxidant (such as $NaMnO_4$ or $KMnO_4$ and possibly other amendments such as iron catalysts, caustic, or acid) into Site monitoring wells with identified groundwater contamination. ISBR will be achieved by injecting nutrients and/or other amendments into Site monitoring wells with identified groundwater contamination. Additional injection and/or monitoring wells will be needed to adequately distribute the oxidants/amendments and monitor their effectiveness. ISCO and ISBR injections will be conducted until contaminant concentrations in groundwater throughout the plume meet the RGs specified in the 1995 ROD, as modified by Table 2 of this ROD Amendment. Details regarding the specific oxidants and amendments to be used, as well as anticipated outcomes of the ISCO and ISBR injections, will be finalized during the RD, and will be shared with the public prior to implementation. Once the RGs are achieved throughout the plume, a risk assessment shall be performed to confirm that exposure to groundwater would result in a cumulative excess carcinogenic risk of less than or equal to 10^{-4} and a cumulative excess non-carcinogenic HI of less than or equal to 1 throughout the groundwater contaminant plume (Figure 3 and Figure 4). LTM will be required for all COCs until acceptable cumulative risk levels are achieved. ICs will include groundwater use limitations that have been implemented per the 1995 ROD through a local ordinance restricting groundwater use for consumption. FYRs of the Site will also be required under CERCLA until the contamination is remediated to acceptable risk levels. The existing GETS will remain shut down, but will continue to be maintained in operable condition. The GETS will be used on a limited basis to treat water generated from well installation and sampling activities. The GETS will also be utilized to pump Site groundwater to be used for mixing ISCO and ISBR amendments during injection activities. EPA will re-evaluate the need for

the GETS during future FYRs, and any change in its operational status will be documented in a decision document.

Estimated Capital Cost: $794,000
Estimated Annual Cost: $117,000
Estimated 30-Year Present Value Cost: $1,629,000
Estimated Time to Completion: 20 years

J. Comparative Analysis of Alternatives

The alternatives discussed above were compared with the nine criteria set forth in the NCP at 40 CFR § 300.430(e)(9)(iii) in order to select a remedy for the Site. These nine criteria are categorized according to three groups: threshold criteria; primary balancing criteria; and modifying criteria. These evaluation criteria relate directly to the requirements in Section 121 of CERCLA, 42 U.S.C § 9621, which determine the overall feasibility and acceptability of the remedy.

Threshold criteria must be satisfied in order for a remedy to be eligible for selection. Primary balancing criteria are used to weigh major trade-offs among remedies. State and community acceptance are modifying criteria formally taken into consideration after public comment is received on the Proposed Plan. A summary of each of the criteria is presented below, followed by a summary of the relative performance of the alternatives with respect to each of the nine criteria. These summaries provide the basis for determining which alternative provides the "best balance" of trade-offs with respect to the nine criteria.

Threshold Criteria:

1. Overall Protection of Human Health and the Environment determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through ICs, engineering controls, or treatment.
2. Compliance with ARARs evaluates whether the alternative meets Federal and State environmental statutes, regulations, and other requirements that pertain to the Site, or whether a waiver is justified.

Primary Balancing Criteria:

3. Long-Term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.
4. Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
5. Short-Term Effectiveness considers the risks that might be posed to the community during implementation of the alternative; the potential impacts on workers during the RA and the effectiveness and reliability of protective measures; potential environmental impacts of the RA; and the length of time until protection is achieved.

6. Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
7. Cost includes estimated capital and annual O&M costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

Modifying Criteria:

8. State/Support Agency Acceptance considers whether the State agrees with EPA's analyses and recommendations, as described in the Proposed Plan.
9. Community Acceptance considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

DETAILED ANALYSIS OF THE PROPOSED REMEDIAL ALTERNTIVES

1. Overall Protection of Human Health and the Environment

Alternative 1 does not provide protection of human health and the environment because it is not expected to reduce groundwater contaminant concentrations to achieve RGs in a reasonable time frame. Protection of human health and the environment would be achieved by Alternatives 4 and 7 through treatment of contaminated groundwater to meet RGs and ICs. Alternative 7 would achieve RGs and restore the groundwater to RGs in the shortest period of time. Based on the evaluation in the 2015 FFS, Alternative 7 would achieve RGs in approximately 20 years, whereas Alternative 4 would take approximately 30 years to achieve RGs. As described in Sections E.6 and F, ICs required by the 1995 ROD restricting groundwater use will be retained as part of Alternatives 1, 4 and 7.

2. Compliance with ARARs

Alternative 1 does not comply with ARARs because groundwater would not be addressed by any remediation to reduce contaminant concentrations and associated risks to acceptable levels. Since Alternative 1 does not meet EPA's threshold criteria, it was eliminated from further evaluation and evaluation in this section. Alternative 4 would comply with ARARs. Alternative 7 is expected to achieve compliance with all identified ARARs.

Further discussion of the ARARs and other advisories, criteria, or guidance to be considered (TBCs) for this Remedy Modification is provided in Section M.2.

3. Long-Term Effectiveness and Permanence

Alternatives 4 and 7 would reduce the concentrations of contaminants over time. Based on historic operation of the GETS, Alternative 4 would be able to permanently reduce COC concentrations to meet RGs. Reconfiguration of the system would be performed to optimize treatment, with additional extraction wells to capture the full extent of the contaminated groundwater plume. Treatment of contaminated groundwater via airstripping and UV oxidation would permanently reduce contaminant concentrations. Pilot study results indicated that Alternative 7 would be

effective in permanently reducing Site COC concentrations to achieve RGs via treatment by ISCO and ISBR. RGs would be achieved in a shorter period of time than Alternative 4. Existing ICs required by the Selected Remedy in the 1995 ROD would prevent the use of contaminated groundwater and enhance the long-term protectiveness of the remedy under both Alternatives 4 and 7. Additionally, LTM will be performed under both Alternatives 4 and 7 to monitor the effectiveness of the treatment over time.

4. Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives 4 and 7 would reduce the toxicity, mobility, and volume of Site COCs through treatment technologies. In Alternative 4, the GETS would control the mobility of the contaminants by extracting and treating contaminated groundwater via carbon adsorption and UV oxidation, thereby reducing the toxicity and volume of the organic chemicals in groundwater. It is anticipated that the GETS could treat up-to 200 gallons per minute. Alternative 4 also may have a greater effect on reducing the mobility of the groundwater contaminant plume by preventing migration of the plume via extraction and treatment. In Alternative 7, both ISCO and ISBR would reduce toxicity, mobility and volume through the use of chemical oxidants and/or biological amendments that naturally breakdown and/or degrade the COCs found in Site groundwater. ISCO oxidants will chemically react with Site COCs and convert them into chemicals and compounds at levels that do not pose a threat to human health. ISBR creates a sequential change of TCE to Dichloroethene (DCE) to VC to ethene with the removal of one chlorine atom with each step. DCE and VC are the 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. The reduction in volume of Site COCs is expected to occur more rapidly under Alternative 7 than under Alternative 4. LTM performed under both Alternatives 4 and 7 would monitor groundwater contaminant plume migration as well and the effectiveness of treatment.

5. Short-term Effectiveness

Implementation of Alternatives 4 and 7 may result in short-term exposure during construction. However, these exposures would be minimized or eliminated through the use of proper personal protective equipment (PPE), safe work procedures, and site controls. Additionally, construction of both Alternatives 4 and 7 would take place largely within the Site property boundary and in primarily undeveloped portions of the Site, and existing ICs required by the 1995 ROD prevent exposure to contaminated drinking water through a local ordinance restricting groundwater use for consumption. Alternative 4 would increase the potential for remedial workers and area residents to be exposed to Site-related contamination through dermal contact and inhalation of vapors during construction of extraction wells, operation of the GETS, and groundwater sampling. The timeframe to bring the GETS back online and complete the construction of additional extraction wells is estimated to be three to six months. Alternative 7 would have the greatest potential to expose remedial workers and local residents to hazardous materials through dermal contact and inhalation of vapors during construction of injection wells, groundwater sampling, and exposure to ISCO amendments. However, construction of injection wells is estimated to be completed within one month and each injection event would only span one to two weeks.

6. Implementability

Both Alternative 4 and Alternative 7 use technologies that are proven to be effective at treating the type and scale of contamination found at the Site. However, Alternative 4 would be more difficult to implement than Alternative 7, as it would require installation of a UV oxidation system and operation of the GETS. This would require long-term O&M over the course of the remedy and would incur additional costs as GETS components begin to fail and require replacement. Alternative 7 could be implemented using standard injection equipment and commercially available amendments. The fractured nature of the bedrock at the Site could make it difficult to distribute the ISCO and ISBR amendments to all points of the contaminant plume; however, this constraint could be managed by using additional injection and/or monitoring wells. Both Alternative 4 and Alternative 7 require ICs, which have already been implemented via a local ordinance restricting groundwater use for consumption, as described in Section E.6.

7. Cost

The order-of-magnitude level estimates for total project costs (shown as present value estimates taken over 30 years at a discount rate of 5%) for the three alternatives are presented in Table 1 along with anticipated capital expenditures (including design, project management, and related expenses).

Table 1
Cost Estimates for Proposed Remedial Alternatives

Alternative	Capital Cost	30 Year Present Value
Alternative 1	$0	$1,308,000
Alternative 4	$529,000	$4,732,000
Alternative 7	**$794,000**	**$1,629,000**

8. State Acceptance

The Commonwealth of Pennsylvania concurs with EPA's Selected Remedy, as modified by the Remedy Modification, for the Site; a concurrence letter was received by EPA on June 7, 2017 (Appendix C).

9. Community Acceptance

A public comment period for the Proposed Plan was held from June 1, 2016 through June 30, 2016. EPA also held a public meeting on June 14, 2016 to present EPA's Proposed Plan to the community and solicit comments. Approximately ten people attended the meeting, including township officials and local residents. A summary of the comments submitted during the comment period, as well as EPA responses, is provided in the Responsiveness Summary (Part III) of this ROD Amendment.

K. Principal Threat Waste

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a Site wherever practicable (40 CFR Section 300.430(a)(1)(iii)(A)). The principal threat concept is applied to the characterization of source materials at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination, for example, to groundwater. Principal threat wastes are

those source materials considered to be highly toxic or highly mobile, which would present a significant risk to human health or the environment should exposure occur.

The 1995 ROD identified VOC contaminated soil as principal threat waste. Treatment of the contaminated soil was determined to be impracticable in the 1995 FS and removal was selected as the remedial technology. During the OU-3 Soil RA completed in 2000, contaminated soil was removed and disposed offsite, thereby removing the principal threat waste from the Site. Contaminated groundwater is not considered a principal threat waste. Therefore, no additional actions to address principal threat waste are required by this ROD Amendment.

L. Remedy Modification: Description and Performance Standards

Based on consideration of the CERCLA requirements and analysis of alternatives using the nine evaluation criteria, including public comments, EPA's selected remedial alternative is Alternative 7: ISCO, Enhanced Bioremediation, LTM, and ICs. EPA's Remedy Modification makes the following changes to the original Selected Remedy:

1. Remove the GETS as a component of the Selected Remedy. In place of the GETS, this ROD Amendment requires ISCO and ISBR treatment technologies to remediate groundwater contamination at the Site.
2. Modification of groundwater COCs and RGs.

The following components of the original Selected Remedy will be retained:

1. *Provision of point-of-use carbon filtration units (for residents at risk until the waterline is extended);
2. *Installation of a waterline and service connections;
3. *Performance of a Phase I archeological survey prior to any intrusive remedial activities;
4. *Excavation and off-site disposal of contaminated soils, following pre-remedial design soil investigations;
5. *Removal, decontamination, and off-site disposal of drums and sump;
6. *Structure demolition/restoration;
7. ICs (to prevent the consumption of contaminated groundwater and creation of any hydraulically adverse influence on the extraction system operation, including deed restrictions until cleanup levels are met);
8. *Performance of an additional Ecological Assessment;
9. Long-term groundwater monitoring.

(Note: Remedy components preceded by an asterisk (*) have already been completed.)

L.1 ISCO and ISBR

L.1.1 Remedy Components

The ISCO and ISBR component of the Remedy Modification will consist of the following components:

1. Installation of additional injection and/or monitoring wells to distribute the oxidants/amendments and monitor effectiveness.
    a. Injection and monitoring well locations shall be determined during RD; and
    b. Enhancement of the transmissivity of wells via hydrofracturing or pneumatic fracturing shall be performed if determined to be appropriate during RD and/or by groundwater monitoring.
2. Injection of ISCO amendment material throughout the groundwater contaminant plume until RGs are achieved for 1,4-dioxane.
    a. The type of ISCO amendment material and injection locations shall be determined during RD and/or by groundwater monitoring; and
    b. Additional amendment materials, such as iron catalysts, caustic, or acids, may be injected if determined to be appropriate for ISCO during RD and/or by groundwater monitoring.
    c. Details regarding the specific oxidants and amendments to be used, as well as anticipated outcomes of the ISCO injections, will be finalized during RD, and will be shared with the public prior to implementation.
3. Injection of ISBR amendment material throughout the groundwater contaminant plume after the RG for 1,4-dioxane has been achieved and until RGs are achieved for all Site COCs.
    a. The type of ISBR amendment material and injection locations shall be determined during RD and/or by groundwater monitoring; and
    b. Bioaugmentation shall be conducted if bacterial populations are insufficient for complete biodegradation of Site COCs as determined during groundwater monitoring.
    c. Details regarding the specific amendments to be used, as well as anticipated outcomes of the ISBR injections, will be shared with the public prior to implementation.
4. Periodic groundwater monitoring throughout the groundwater contaminant plume.
    a. Once the groundwater cleanup goals are achieved, a risk assessment shall be performed to confirm that exposure to groundwater would result in a cumulative excess carcinogenic risk of less than or equal to 10^{-4} and a cumulative excess non-carcinogenic HI of less than or equal to 1 throughout the groundwater contaminant plume.
5. Maintaining the existing GETS in operational condition.

a. Prior to implementing the Remedy Modification, the GETS shall be inspected, tested, and, if necessary, repaired to ensure it is in operational condition.

b. The GETS shall be utilized to pump Site groundwater for mixing ISCO and ISBR amendments during injection activities.

c. The GETS may be utilized to treat water generated during well installation and sampling activities.

d. Maintaining the GETS in operational condition may be discontinued once RGs are achieved for all Site COCs.

L.1.2 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 levels at or below 6.4 µg/L, 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 2 of this ROD Amendment through use of ISCO and/or ISBR.

Table 2
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	1000 µg/L
1,4-dioxane	*6.4 µg/L

Notes:
µg/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

L.1.3 Design Considerations

Since the pilot studies indicated that ISCO was more effective at treating 1,4-dioxane (see Section E.8), ISCO will be utilized initially at the Site until the RG for 1,4-dioxane is achieved throughout the plume. ISBR will be conducted after ISCO as a final polishing step to achieve the remaining

RGs for the VOCs. For both ISCO and ISBR, additional pilot studies may be required to determine if a different oxidant or amendment would be better suited to treat Site contamination and determine what doses would be required to reach the RGs. The fractured bedrock conditions at the Site may complicate amendment distribution and could result in pockets of contaminated groundwater remaining in the subsurface. Hydrofracturing or pneumatic fracturing could be employed to improve amendment distribution as seen during the pilot studies. Additional injection points may be necessary to adequately distribute the oxidant within the contaminated areas.

L.1.4 Rationale for Remedy Modification

The 1995 ROD required the use of a GETS to remediate contaminated groundwater at the Site. After eight years of operation and monitoring, EPA determined that the GETS was no longer generating a hydraulic capture zone, due to several of the extraction wells being shut down over the years, and was having minimal impact on the dissolved plume. Additionally, the influent groundwater concentrations were less than the PADEP NPDES requirements. The reduction in contaminant concentration in influent groundwater was due to the fact that ISCO and ISBR was successfully conducted in several of the GETS extraction wells. The GETS was therefore turned off by EPA on April 24, 2008, but has been maintained in operational condition.

In order to optimize the groundwater remedy, EPA conducted a series of pilot studies between 2005 and 2011 to determine if chemical oxidants and/or biological amendments could be injected into the aquifer to naturally degrade Site COCs. Post-injection sampling confirmed that both ISCO and ISBR were able to reduce groundwater contamination and could be used as a viable option for future treatment. Given the positive results of the ISCO and ISBR pilot studies, a FFS was completed by EPA in June 2015 to determine whether it would be beneficial to amend the remedy specified in the 1995 ROD. EPA's FFS concluded that when compared to extraction and treatment, a remedy which includes ISCO and ISBR technologies would require less time and less funding to achieve RGs. Therefore, this ROD Amendment requires the use of ISCO and ISBR as treatment technologies at the Site.

L.2 Modification of Groundwater COCs and RGs

L.2.1 Remedy Components

As part of this ROD Amendment, 1,4-dioxane will be added as a new COC with a RG of 6.4 µg/L. Additionally, 1,1-DCA will remain a COC, but will have a revised RG of 31 µg/L. Finally, chloroform, arsenic and manganese will be removed from the list of Site COCs.

L.2.2 Performance Standards

An updated list of COCs and associated RGs for groundwater is presented above in Table 2. Table 3, below, provides further explanation of the COC and RG modifications associated with this ROD Amendment.

Table 3 Groundwater COCs and RGs			
Chemical	**1995 RG[(1)]**	**2017 RG[(2)]**	**Status / Basis**
Trichloroethene	5 µg/L	5 µg/L	Current COC / Drinking Water MCL
1,1,1-TCA	200 µg/L	200 µg/L	Current COC / Drinking Water MCL
1,1-DCE	7 µg/L	7 µg/L	Current COC / Drinking Water MCL
1,1-DCA	81 µg/L	31 µg/L [(3)]	Current COC / PA Act 2 Groundwater MSC
1,1,2-Trichloroethane	5 µg/L	5 µg/L	Current COC / Drinking Water MCL
cis-1,2-DCE	70 µg/L	70 µg/L	Current COC / Drinking Water MCL
1,2-Dichloropropane	5 µg/L	5 µg/L	Current COC / Drinking Water MCL
Tetrachloroethene	5 µg/L	5 µg/L	Current COC / Drinking Water MCL
Vinyl Chloride	2 µg/L	2 µg/L	Current COC / Drinking Water MCL
Toluene	1000 µg/L	1000 µg/L	Current COC / Drinking Water MCL
Chloroform	100 µg/L	N/A	Eliminated COC
Arsenic	50 µg/L	N/A	Eliminated COC
Manganese	80 µg/L	N/A	Eliminated COC
1,4-dioxane	N/A	6.4 µg/L	New COC / PA Act 2 Groundwater MSC

Notes:
µg/L – micrograms per liter
RG – remediation goal
MCL – maximum contaminant level
MSC – medium specific concentration
COC – contaminant of concern
RSL – regional screening level (May 2016)
(1) – Original RG's specified in 1995 ROD
(2) – Updated RG's specified in 2017 ROD Amendment
(3) – RG different from 1995 ROD performance standard due to updated MCLs/RSLs

L.2.3 Design Considerations

These COC and RG modifications must be incorporated into any LTM and risk assessment associated with the ISCO and ISBR injections.

L.2.4 Rationale for Remedy Modification

Although not included in the original list of COCs for the Site, recent monitoring data indicates that 1,4-dioxane concentrations exceed EPA's tap water RSL of 0.46 µg/L (May 2016). The highest concentration of 1,4-dioxane (250 µg/L) was observed in wells EW-4 and MW-108A in October 2003. Since these concentrations exceed EPA's acceptable risk range, 1,4-dioxane will be added as a COC. Because there is no MCL for 1,4-dioxane under the SDWA, EPA will use Pennsylvania's Act 2 groundwater MSC for 1,4-dioxane as the RG for this COC. The Act 2 state-wide health standard groundwater MSC for 1,4-dioxane in residential used aquifers with TDS less than or equal 2500 µg/L is 6.4 µg/L, which has an associated excess carcinogenic risk level of approximately 1.39×10^{-5} and non-carcinogenic HIs of 1.21×10^{-1} (child) and 1.14×10^{-1} (adult). These risk levels are within EPA's acceptable risk range and the new RG is therefore protective of human health.

Like 1,4-dioxane, 1,1-DCA also does not have an MCL under the SDWA. In the 1995 ROD, EPA's tap water RSL (81 µg/L) was used as the RG for 1,1-DCA. Since the 1995 ROD, the RSL for 1,1 DCA has decreased from 81 µg/L to 2.7 µg/L based on updated toxicity data. Therefore, as part of EPA's 2015 FFS, an additional risk evaluation was conducted for 1,1-DCA concentrations in groundwater from monitoring well samples collected in 2011. The risk evaluation concluded that

1,1-DCA does not pose a threat to human health at the Site. However, there are still two monitoring wells at the Site that have had recent detections of 1,1-DCA that exceed the new RSL. For this reason, 1,1-DCA will remain on the list of Site COCs. EPA will use the Pennsylvania Act 2 MSC for 1,1-DCA as the RG for this COC. The Act 2 state-wide health standard groundwater MSC for 1,1-DCA in residential used aquifers with TDS less than or equal 2500 µg/L is 31 µg/L, which has an associated excess carcinogenic risk level of approximately 1.13×10^{-5} and non-carcinogenic risk levels of 8.26×10^{-3} (child) and 5.00×10^{-3} (adult). These risk levels are within EPA's acceptable risk range and the new RG is therefore protective of human health.

As part of the 2015 FFS, additional risk evaluations were also conducted for chloroform, arsenic, and manganese concentrations in groundwater from monitoring well samples collected in 2011 due to the changes in screening levels since the 1995 ROD. These risk evaluations concluded that chloroform, arsenic, and manganese do not pose a threat to human health at the Site and therefore will be removed from the list of Site COCs.

An updated list of COCs and associated RGs for groundwater is presented in Table 2.

L.3 Cost Estimate for the Remedy Modification

It is estimated that this Remedy Modification would require an initial capital expenditure of approximately $794,000 to implement. These costs would include installation of injection/monitoring wells, the first ISCO injection, and performance groundwater monitoring. Sodium permanganate was assumed for the oxidant in the development of this cost, however, the oxidant may be modified based on Site conditions during implementation. An additional ISCO injection would be completed in Year 2 at a cost of $100,000. ISBR injections will occur in Year 3 and Year 6 at an estimated cost of $99,000 per injection. ABC was selected as the amendment, and inoculation with *Dehalococcoides* was assumed for the development of these costs, however, the amendment and bioaugmentation methodology may be modified based on Site conditions during implementation. Initial monitoring, projected to continue on a semiannual basis for approximately 10 years, is estimated at $71,000 per year. Annual groundwater sampling would be conducted for an additional 10 years at an estimated cost of $39,000 per year. The LTM schedule may be modified during implementation based on Site conditions. Additional costs of approximately $35,000 every five years would be incurred for each FYR that would be required until RGs are met for all Site COCs. It is expected that four FYRs will be required. The 30-year present value cost of Alternative 7 would be approximately $1,629,000. Detailed cost estimates and present-worth calculations for Alternative 7 are provided in Appendix B.

The information in this cost estimate is based upon the best available information regarding the anticipated scope of the RA. Some changes to the cost estimates are expected to occur during implementation of the remedy. Remedy modification will be documented in the form of a memorandum to the file, an Explanation of Significant Differences (ESD), or an additional ROD Amendment, as appropriate. This cost estimate is expected to be within +50 to -30 percent of the actual project cost.

L.4 Expected Outcomes of the Remedy Modification

This section presents how the expected outcomes of the Remedy Modification would modify the expected outcomes of the Selected Remedy in terms of land and groundwater use and risk reduction achieved as a result of the response action.

The Remedy Modification is expected to protect current and future commercial and residential receptors from adverse health effects that may result from exposure to contaminated groundwater in the long-term. Additionally, the Remedy Modification is expected to restore groundwater to beneficial use by achieving groundwater RGs more effectively and in a shorter time frame than the current Selected Remedy. The Site is currently zoned and utilized for commercial/residential use. It is expected that the Remedy Modification will continue to allow the Site to be utilized for those purposes.

M. Statutory Determinations

Under CERCLA § 121 and the NCP at 40 CFR § 300.430(f)(5)(ii), EPA must select remedies that are protective of human health and the environment, comply with ARARs, are cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery to the maximum extent possible. There is also a preference for remedies that use treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as a principal element. The following sections discuss how the Selected Remedy, as modified by the Remedy Modification, meets these statutory requirements.

M.1. Protection of Human Health and the Environment

The Selected Remedy for OU1, as modified by the Remedy Modification, will be protective of human health and the environment. Protection of human health will be achieved by meeting groundwater RGs via ISCO and ISBR. Finally, long-term protection of human health and the environment will be ensured by the LTM and ICs required by the Selected Remedy.

M.2. Compliance with ARARs

The NCP at 40 CFR § 300.430(f)(5)(ii)(B) and (C) require that a ROD describe Federal and State ARARs that the remedy modification will attain or provide a justification for any waivers. Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, or contaminant; RA; location; or other circumstance at a CERCLA site. Relevant and appropriate requirements, while not legally applicable to circumstances at a particular CERCLA site, address problems or situations similar to those encountered at the site such that their use is considered relevant and appropriate.

All ARARs and TBCs cited in the 1995 ROD remain unchanged, and are included in this ROD Amendment. However, the Remedy Modification described above requires additional ARARs and TBCs that were not cited in the 1995 ROD. Specifically, SDWA Underground Injection Control (UIC) regulations will be included as an ARAR since this ROD Amendment requires the injection of oxidants and biological amendments into groundwater. Similarly, the Pennsylvania Act 2 numerical state-wide health standards will be added as an ARAR because they form the basis for

the new 1,1-DCA and 1,4-dioxane RGs. Finally, EPA's November 2013 *Guidance for Evaluating Completion of Groundwater Restoration Remedial Actions* (OSWER Directive 9355.0-129) and May 2014 *Groundwater Remedy Completion Strategy* (OSWER Directive 9200.2-144) will be included as TBCs because they will be used to evaluate remedy performance and achievement of Site RAOs. A complete list of new ARARs and TBCs associated with this ROD Amendment are identified in Table 4.

Table 4 New ARARs and TBCs				
Requirement/ Standard	**Legal Citation**	**ARAR/TBC Classification**	**Requirement Synopsis**	**Applicability to Remedy Modification**
SDWA UIC Regulations	40 CFR §§144.1(g), 144.11, 144.12(a), 144.82, 146.6, 146.7, 146.8, 146.10(c)	Applicable	Establishes classes of injection wells and requirements for those wells pursuant to the Underground Injection Control Program.	These regulations apply to the installation of injection wells with respect to the selected remedy. The selected remedy will comply with these regulations.
PA Land Recycling and Environmental Remediation Standards Act (Act 2)	25 Pa. Code § 250.301(a) and Appendix A, Tables 1 and 2	Relevant and Appropriate; Chemical-Specific ARAR	Establishes a statewide standard for 1,4-dioxane for aquifers of the type underlying the Site, i.e., used for potable purposes with a total dissolved solids concentration of less than or equal to 2,500 milligrams per liter	The Act 2 groundwater MSC for 1,4-dioxane will be used as the RG for 1,4-dioxane
EPA Guidance for Evaluating Completion of Groundwater Restoration RA	EPA Office of Solid Waste and Emergency Response Directive 9355.0-129. November 25, 2013	TBC	Presents EPA's recommendations for evaluating Superfund groundwater remedy performance and making decisions to help facilitate achievement of RAOs and associated cleanup levels.	This guidance will be used to evaluate remedy performance and achievement of RAOs.
EPA Groundwater Remedy Completion Strategy	EPA Office of Solid Waste and Emergency Response Directive 9200.2-144. May 12, 2014	TBC	Presents EPA's recommendations for evaluating Superfund groundwater remedy performance and making decisions to help facilitate achievement of RAOs and associated cleanup levels.	This guidance will be used to evaluate remedy performance and achievement of RAOs.

M.3. Cost Effectiveness

Cost effectiveness is determined by evaluating the remedy's long-term effectiveness and permanence; reduction in toxicity, mobility, or volume through treatment; and short-term effectiveness. If the overall cost of the remedy is proportional to its overall effectiveness, then it is considered to be cost effective. The Remedy Modification satisfies the criteria listed above because it offers a permanent solution through the treatment of contaminants in groundwater, and costs less than the other protective remedies that were evaluated. Therefore, the Remedy Modification is cost effective.

M.4. Utilization of Permanent Solutions to the Maximum Extent Practicable

EPA has determined that the Remedy Modification represents the maximum extent to which permanent solutions and treatment are practicable at the Site. When compared to the other protective alternatives that were evaluated, EPA has determined that the Remedy Modification

provides the best balance of tradeoffs in terms of the five balancing criteria, as well as the preference for treatment as a principal element. Alternative 7 will achieve RGs in the shortest period of time at a lower cost than Alternative 4. The Remedy Modification also has State and community acceptance.

The Remedy Modification will meet the statutory preference for treatment as a principal element by addressing contaminated groundwater at the Site through ISCO and ISBR.

M.5. Five-Year Review Requirements

CERCLA § 121(c) and the NCP at 40 CFR § 300.430(f)(4)(ii) provide the statutory and legal basis for conducting FYRs. The Selected Remedy, as modified by the Remedy Modification, will result in hazardous substances remaining onsite above levels that allow for unlimited use and unrestricted exposure. Therefore, statutory reviews will continue to be conducted every five years to ensure that the Selected Remedy, as modified by the Remedy Modification, is, or will be, protective of human health and the environment.

N. Documentation of Significant Changes

The public comment period for the Proposed Plan was held from June 1, 2016 to June 30, 2016. EPA also held a public meeting on June 14, 2016 to present the Preferred Alternative in the Proposed Plan to the public. Comments that were received during the comment period were considered, but did not result in significant changes from the Preferred Alternative in the Proposed Plan.

However, after further internal review, EPA has made two significant changes between the Proposed Plan and this ROD Amendment. First, the Proposed Plan indicated that the RG for chloroform would be modified, whereas this ROD Amendment removes chloroform as a COC entirely, as explained in Section L.2.4.

Second, Table 4 of this ROD Amendment includes revisions to the ARARs and TBCs identified in the Proposed Plan. EPA has determined that the SDWA UIC regulations identified as ARARs in the Proposed Plan included many provisions that would not be required under Sections 121(d) and 121(e) of CERCLA because they contain procedural requirements, rather than substantive requirements. In this ROD Amendment, EPA has therefore identified only the specific sections within the SDWA UIC regulations that are relevant and appropriate requirements for this Remedy Modification.

EPA has also added as a TBC the *EPA Groundwater Remedy Completion Strategy* (OSWER Directive 9200.2-144. May 12, 2014). This Directive was not included as a TBC in the Proposed Plan, but is part of a suite of groundwater guidance documents developed by EPA to help focus resources on the information and decisions needed to effectively complete groundwater cleanups. This Directive follows, among others, EPA's *Guidance for Evaluating Completion of Groundwater Restoration Remedial Actions* (OSWER Directive 9355.0-129. November 25, 2013), which EPA identified as a TBC in the Proposed Plan. Directive 9200.2-144 compliments Directive 9355.0-129 by recommending step-wise planning and decision-making processes for evaluating

Superfund groundwater remedy performance, operation and progress toward attainment of remedial action objectives and associated cleanup goals in a reasonable timeframe.

O. State Role

PADEP, on behalf of the Commonwealth of Pennsylvania, has reviewed the Remedial Alternatives presented in this ROD Amendment and has indicated its concurrence with the Remedy Modification. PADEP has also reviewed the list of ARARs to determine if the Remedy Modification is in compliance with appropriate State environmental laws and regulations. Correspondence with PADEP regarding the Remedy Modification is included as Appendix C.

PART III- THE RESPONSIVENESS SUMMARY

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III. RESPONSIVENESS SUMMARY

This section summarizes the questions and comments received during the public comment period for the AIW Frank/Mid-County Mustang Superfund Site. The public comment period extended from June 1, 2016 to June 30, 2016. A public meeting was held at the West Whiteland Township Building in Exton, PA on the evening of June 14, 2016. A transcript of the public meeting is available in the Administrative Record for the Site. Approximately 10 people attended the meeting, including Township officials and local residents.

During the public comment period, one comment letter was submitted to EPA for review. The comments in that letter, along with EPA's response, are provided below:

Commenter: Lewis R. Frame, Jr.

Comment 1: *According to the proposed plan, the only risk remaining at the site is associated with groundwater. In 2000 EPA's remedy OU-2 supplied potable public water to all affected parties. As an additional IC, besides the one administered by the public water provider, CCHD controls the installation of wells by their permitting program.*

Because of the availability of public water and the IC, we question the need to establish Preliminary Remediation Goals (PRGs) for COCs based on drinking water MCLs. EPA may produce the cleanest groundwater in Chester County, but who is going to drink it?

EPA pumped and treated groundwater between 2000 and 2008 with their GETS eventually turning the GETS off in 2008 because the PRG's had been met, only to have the COCs return to levels, identified in 2015, that are being proposed for future alternative treatment to MCL concentrations. We believe a more reasonable approach would be to establish PRGs based on protecting the flora and fauna of the site, the surrounding properties and West Valley Creek. The risk to the public of potentially implying the groundwater is treated to MCL levels is much too high based on what has happened in the past. In our opinion, it would be better for EPA to acknowledge that the groundwater is not potable and to discourage its use for drinking.

EPA Response: **Groundwater response actions, such as the Selected Remedy for the AIW Frank/Mid-County Mustang Site, are governed in part by Section 121(d)(2)(A) of CERCLA, the federal Superfund law. This provision of the law requires that selected cleanups of groundwater contamination shall require a level or standard of control which at least attains MCLs where they are relevant and appropriate under the circumstances of the release or potential release. *See* 42 U.S.C. § 121(d)(2)(A). This requirement is also reflected in the NCP, which states, "Maximum contaminant level goals (MCLGs), established under the Safe Drinking Water Act, that are set at levels above zero, . . . [or] maximum contaminant level (MCL) shall be attained where relevant and appropriate to the circumstances of the release . . ." 40 C.F.R. § 300.430(3)(B) and (C).**

Consistent with these requirements, Superfund response actions protect human health and the environment in a number of ways, including, as in this case, restoring contaminated groundwater to its beneficial uses, preventing migration of contaminant plumes, and protecting groundwater and other environmental resources. To ensure protective cleanups, CERCLA response actions, such as this Remedy Modification, which clean up contaminated groundwater, generally address all pathways of exposures posing an actual or potential threat to human health and the environment. For instance, groundwater response actions generally address the actual or potential direct-contact risk posed by contaminated groundwater (e.g., human consumption, dermal contact, or inhalation).

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes general expectations for purposes of groundwater restoration as follows:

> **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. When restoration of ground water to beneficial uses is not practicable, EPA expects to prevent further migration of the plume, prevent exposure to the contaminated ground water, and evaluate further risk reduction.**

Thus, EPA carries out CERCLA response actions, like the Selected Remedy, in a manner that ensures the cleanups are protective by, among other things, restoring contaminated groundwater to beneficial uses. This means, generally, attaining MCLs for current or potential drinking-water aquifers like the one at the Site.

Regarding whether ICs alone would be an adequate remedy for this Site, the Preamble[1] to the NCP states, "Institutional controls will usually be used as *supplementary* protective measures during implementation of ground-water remedies." See 55 Fed. Reg. 8732 (March 8, 1990) (emphasis added).

The NCP itself provides the following information on ICs:

> **EPA expects to use institutional controls such as water-use and deed restrictions to supplement engineering controls as appropriate for short- and long-term management to prevent or limit exposure to hazardous substances, pollutants, or contaminants. Institutional controls may be used during the conduct of the remedial investigation/feasibility study (RI/FS) and implementation of the remedial action and, where necessary, as a component of the completed remedy. <u>The use of institutional controls shall not</u>**

[1] A preamble is the part of a Federal agency's rulemaking document, usually published in the Federal Register with the final rulemaking, explaining the reasons for the Federal agency regulatory action. In a sense, the preamble provides regulatory history explaining the rationale for the rule.

> **substitute for active response measures (e.g., treatment and/or containment of source material, restoration of ground waters to their beneficial uses) as the sole remedy unless such active measures are determined not to be practicable, based on the balancing of trade-offs among alternatives that is conducted during the selection of remedy (emphasis added).**

***See* 40 C.F.R. § 300.430(a)(iii)(D). Thus, in accordance with the Agency's longstanding interpretation of the NCP, EPA does not agree that the institutional controls (including the Chester County Board of Health regulations prohibiting the drilling of new wells at the Site) can take the place of a cleanup of the COCs at the Site to the RGs selected in the ROD and this ROD Amendment. Rather, the ICs play an important role of supplementing the Selected Remedy until RGs have been reached.**

Comment 2: *We understand that Alternative 7 involves the batch addition of a common water treatment chemical oxidant and, subsequently, the batch addition of a biological agent and nutrient to enhance a bioremediation process. The Proposed Plan of June 2016 is relatively silent on the details of the bioremediation processes for the COCs other than to say that the COCs will be broken down "into chemicals and compounds that do not pose a threat to human health." The Proposed Plan also discusses "degrading the VOC contaminants in groundwater and converting them to less toxic end products." There is still some degree of toxicity. Since the information is so slight, we have concerns regarding human pathogens and the persistence of these biological additive in the groundwater. Since it was discussed at the public meeting that there are numerous suppliers of these biological agents and that a public procurement process would be used to select a supplier, we need to understand the specific components of the biological additives that are eventually selected.*

EPA Response: **In response to this comment, EPA has included additional information in this ROD Amendment to explain ISCO and ISBR in greater detail (See Sections E.8 and E.9). Alternative 7 involves the technologies of ISCO and ISBR. When implementing these technologies there are numerous types of amendments that can be utilized to treat the groundwater at the Site. The amendments selected will be commercially available materials that have been developed specifically for groundwater treatment. The actual amendments that will be utilized will be determined during the Remedial Design. The documents developed for the Remedial Design will be made available to the public via the Site webpage. Additionally, details regarding the specific oxidants and amendments to be used, as well as anticipated outcomes of the ISCO and ISBR injections, will be shared with the public via factsheets that get distributed to the community prior to implementation. Further, at completion of the Remedial Design, the NCP at 40 CFR § 300.435(c)(3) requires that the public be notified, with the option for a public meeting. Finally, regarding concerns about the 'persistence of biological additives', it is important to note that once all**

RGs for all COCs have been achieved, a final risk assessment will be performed to ensure that groundwater meets the Site RAOs. The purpose of this final risk assessment is to ensure there are no Site-related contaminants in groundwater that present unacceptable risk to human health or the environment. As always, any questions or concerns can be brought to the attention of the EPA Remedial Project Manager.

Comment 3: *Our greatest concern with the Proposed Plan of June 2016, is the extended period of time to implement the Remedial Alternative. Alternative 7 is projected to last 20 years and Alternative 4 is projected to last 30 years. This is much too long where there is a need for local economic development. The stigma of an active Superfund site dampens the desire for private and/or public investments.*

The ROD was approved in 1995 and the first remedy OU-3 involving source removal and decontamination was started in 1997, OU-2 involving the public water installation was started and completed in 2000 and OU-1 involving groundwater extraction and treatment was started in 2000 and ended in 2008. LTM has continued to 2016. EPA has had an active role at the Site for nearly 20 years and at least 20 more years are being proposed.

Because public water has been supplied to affected parties, ICs have been established to limit access to groundwater and EPA has treated the groundwater for 8 years, we would recommend the selection of Alternative 1. Admittedly, the COCs have returned to PRG levels for some undefined reason but that might happen again in a limestone environment where there are known off-site sources or ambient residual contamination. EPA has expressed a preference for Alternative 7 which uses in-situ oxidation and bioremediation. We have pointed out some concerns in our earlier comments. If that is the chosen Alternative, we would suggest that the treated groundwater be extracted from the most concentrated levels of COC at a down gradient location in the plume and to be returned for injection into an up gradient location in the plume thus creating a treatment zone (much like a digester) where the oxidation and bioremediation can be repeated until the PRGs are met. Our purpose is to reduce the remediation period to something less than 20 years.

Our goal is to protect human health and the environment. We think that providing public water to affected parties, implementing ICs over groundwater use and the eight-year treatment effort by EPA has satisfied the 1995 ROD. We cannot see an absolute solution to the groundwater issue because of the limestone geology around the site.

EPA Response: **The Agency's goal in selecting this Remedial Modification is to complete this cleanup in a shorter amount of time. Although the proposed remediation period for Alternative 7 is as much as 20 years, this timeframe may actually be reduced, depending on the effectiveness of the initial injections. It should also be noted that EPA encourages responsible reuse**

of this Site, and believes that remediation and redevelopment efforts can occur simultaneously. In other words, redevelopment does not need to wait until EPA's clean-up is complete. EPA is committed to working with current and future property owners to ensure that responsible reuse occurs in a way that satisfies the desire for local economic development while also ensuring that protection of human health and the environment is achieved.

The process for how the injections will be conducted will be documented in the Remedial Design Plans. The commenter's suggested method of recirculating the water, as well as other enhancements for implementation of ISCO and ISBR will be evaluated to determine if they would be appropriate for the Site during the design phase. In accordance with Section 300.435(c)(3) of the NCP, details regarding the specific oxidants and amendments to be used, as well as anticipated outcomes of the ISCO and ISBR injections, will be shared with the public via factsheets, which will be distributed to the community prior to implementation, or by a public meeting.

FIGURES

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\\gst-srv-01\HGLGIS\AIW_Frank_MSIW\PP\(1)Site_Location.mxd
2/11/2016 CNL
Source: HGL, ESRI, U.S. Census Bureau

Statewide Location

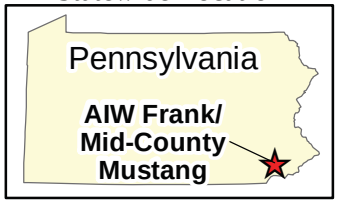
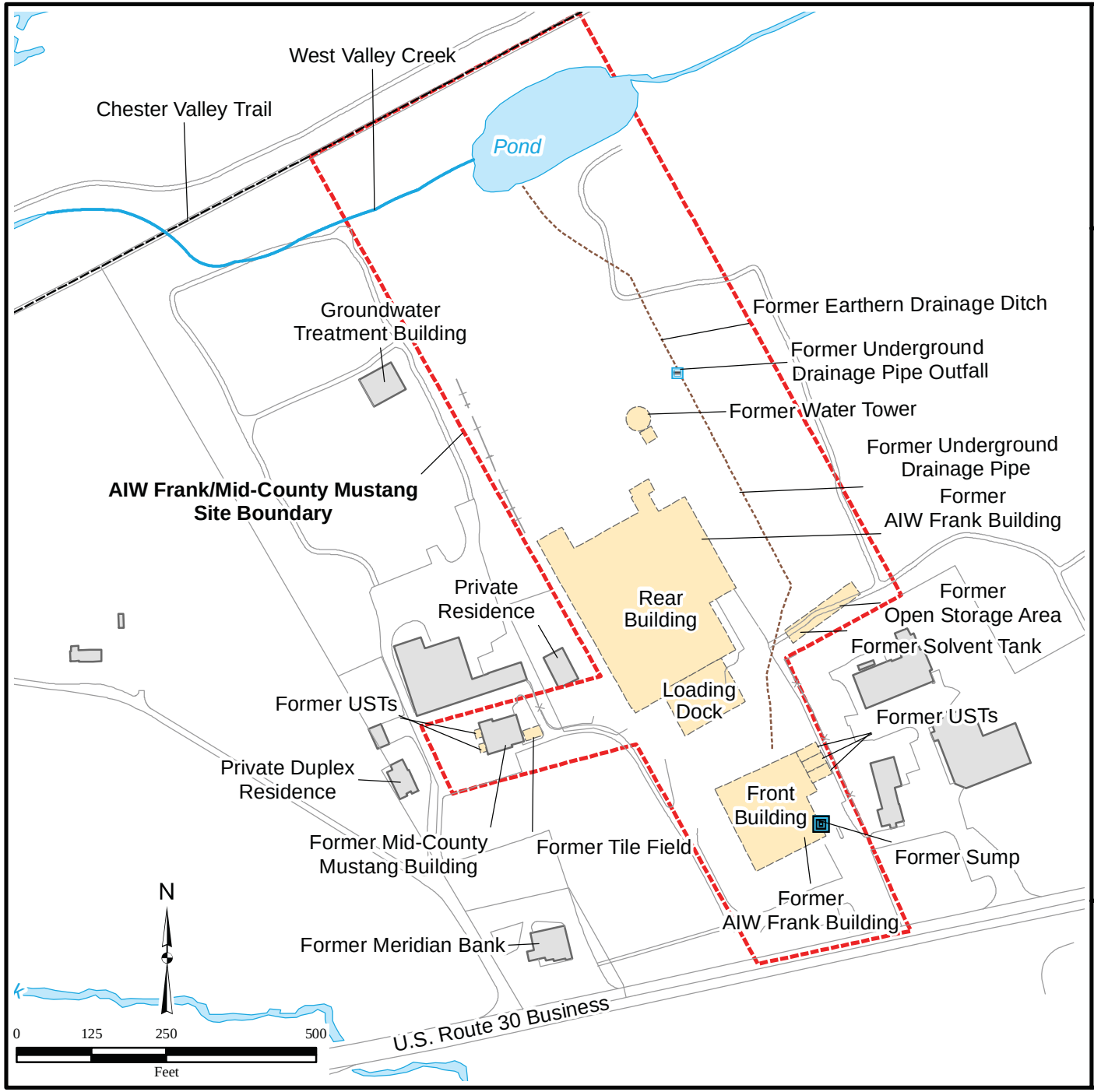


Figure 1
AIW Frank/ Mid-County Mustang Site Location Map

AR301830

Figure 2
Site Layout
AIW Frank/Mid-County Mustang Site
Chester County, Pennsylvania

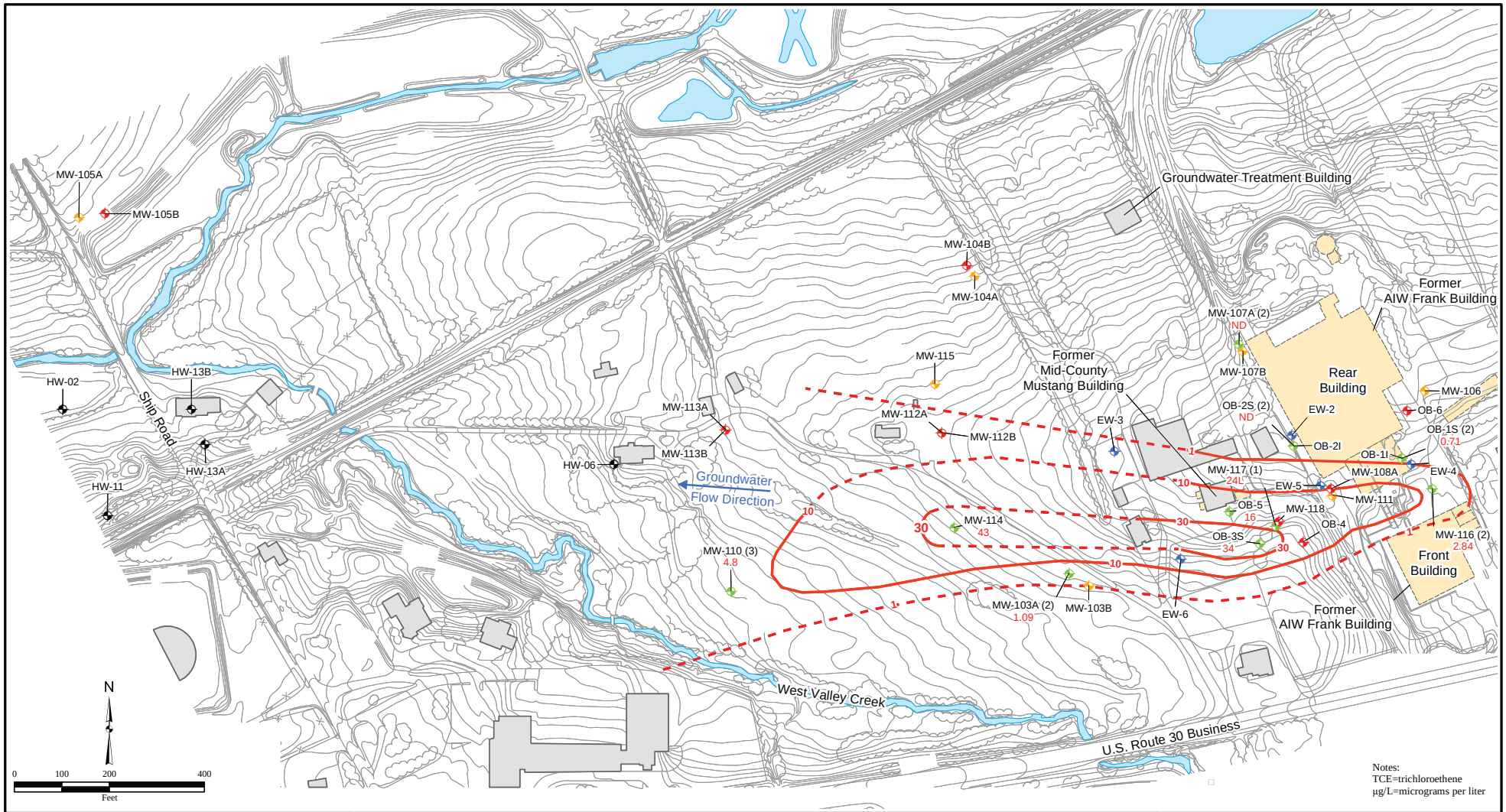


Legend

- Former Sump
- Former Pipe Outfall
- Trail
- Drainage Ditch
- Creek
- Site Boundary
- Existing Structure
- Former Structure
- Surface Water

\\gst-srv-01\HGLGIS\AIW_Frank_MSIW\PP\(2)Site_Layout.mxd
2/11/2016 CNL
Source: HGL, EPA

AR301831



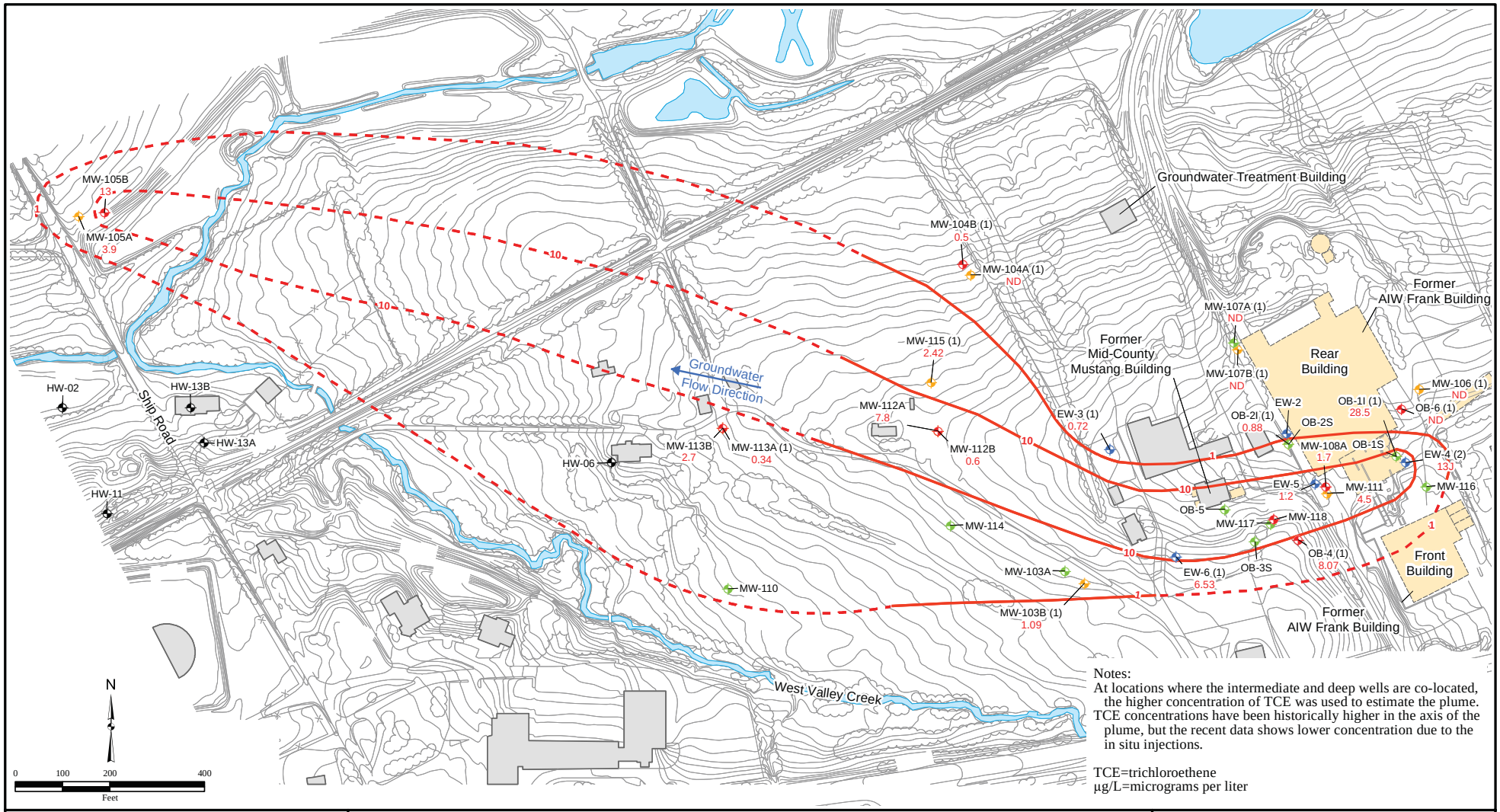
\\gst-srv-01\HGLGIS\AIW_Frank_MSIW\PP\
(3)TCE_Shallow_Bedrock_Nov2013.mxd
3/23/2016 CNL
Source: HGL, EPA

Legend

Shallow Well	1	TCE Concentration Contour (µg/L)
Intermediate Well	10	Estimated TCE Concentration Contour (µg/L)
Deep Well	1.7	TCE Concentration (µg/L)
Extraction Well	ND	Not Detected
Residential Well	L	Analyte Present (reported value may be biased low)

	Existing Structure
	Former Structure
	Surface Water
(1)	Data from Dec 2011
(2)	Data from April 2012
(3)	Data from Oct 2011

Figure 3
TCE Concentrations for Shallow Bedrock Wells November 2013
AIW Frank/Mid-County Mustang Site
Chester County, Pennsylvania



Notes:
At locations where the intermediate and deep wells are co-located, the higher concentration of TCE was used to estimate the plume.
TCE concentrations have been historically higher in the axis of the plume, but the recent data shows lower concentration due to the in situ injections.

TCE=trichloroethene
µg/L=micrograms per liter

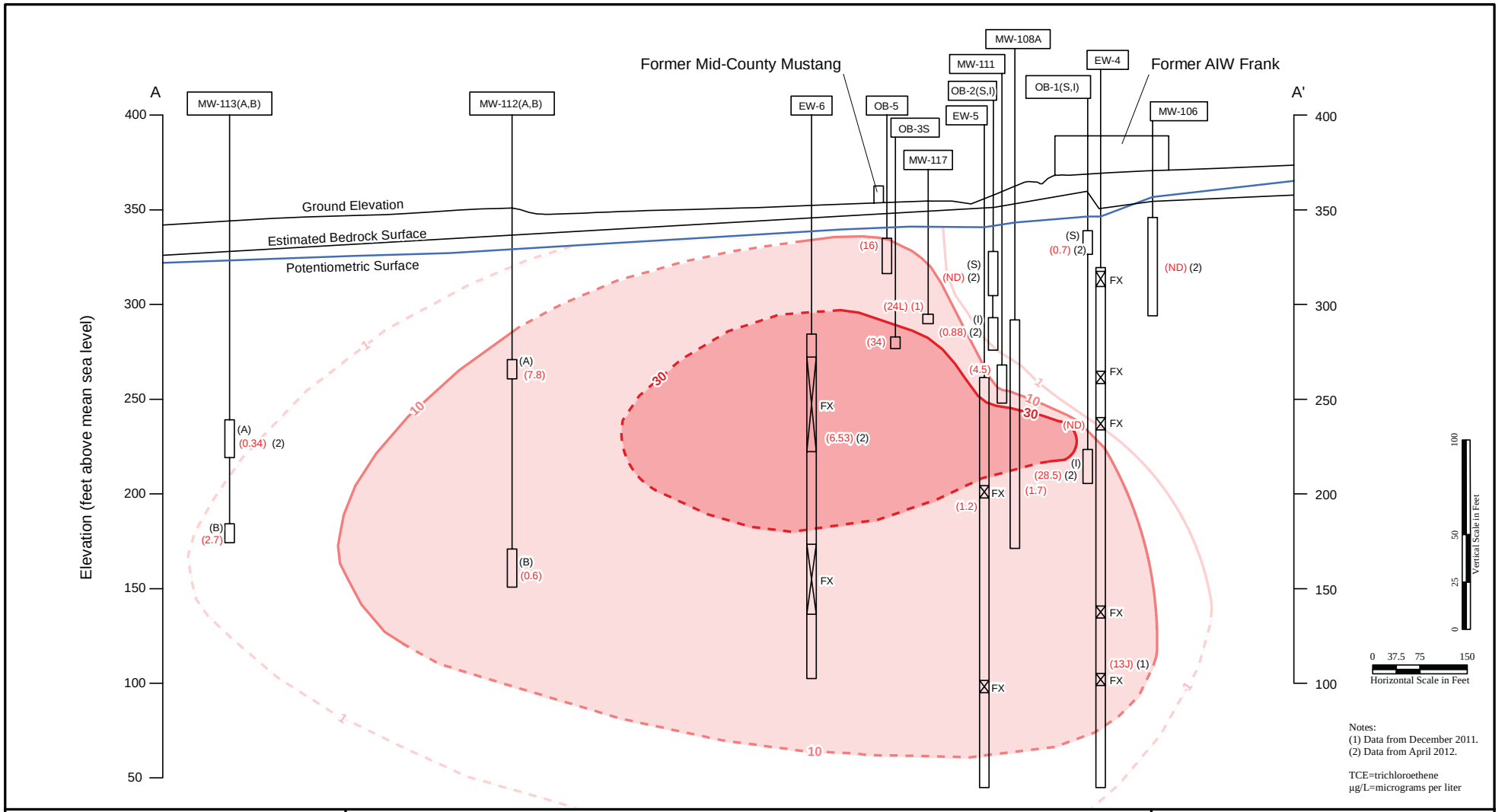
\\gst-srv-01\HGLGIS\AIW_Frank_MSIW\PP\(4)TCE_Intermediate_Bedrock_Nov2013.mxd
3/23/2016 CNL
Source: HGL, EPA

Legend

- Shallow Well
- Intermediate Well
- Deep Well
- Extraction Well
- Residential Well
- —1— TCE Concentration Contour (µg/L)
- – 10 – Estimated TCE Concentration Contour (µg/L)
- 1.7 TCE Concentration (µg/L)
- ND Not Detected
- (1) Data from April 2012
- J Analyte Present (reported value may not be accurate or precise)
- Existing Structure
- Former Structure
- Surface Water
- (2) Data from Dec 2011

Figure 4
TCE Concentrations for Intermediate and Deep Bedrock Wells November 2013
AIW Frank/Mid-County Mustang Site
Chester County, Pennsylvania

AR301833



Notes:
(1) Data from December 2011.
(2) Data from April 2012.

TCE=trichloroethene
µg/L=micrograms per liter

\\gst-srv-01\HGLGIS\AIW_Frank_MSIW\PP\(5)Vert_Distr_TCE_Nov2013.mxd
2/11/2016 CNL
Source: HGL

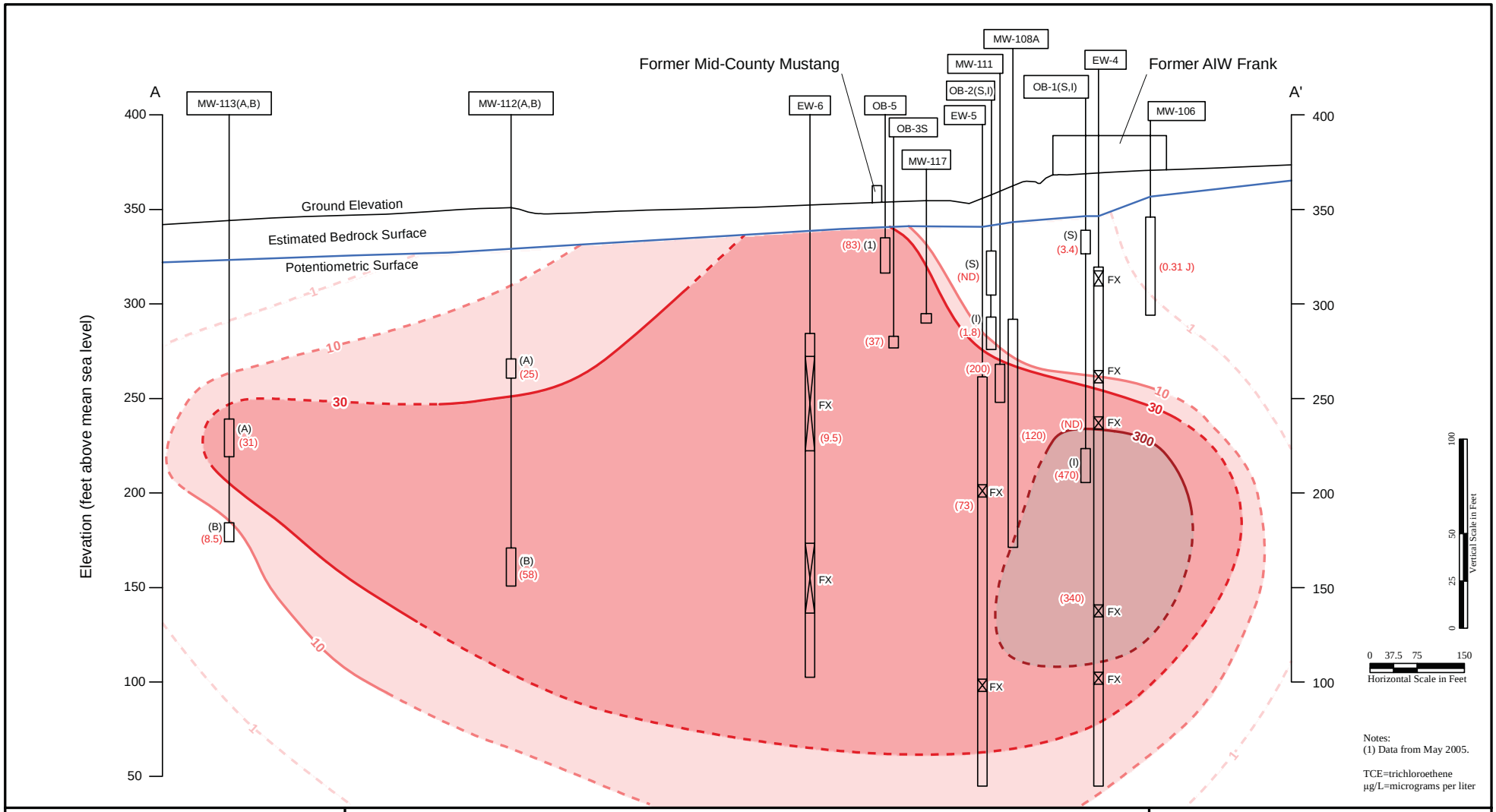
Typical Borehole:
- Cased Interval
- Open or Screened Interval
- FX — Approximate Depth of Identified Fracture in Open Borehole

Legend

ND	Not Detected
(16)	TCE Concentration (µg/L)
1	TCE Concentration Contour (µg/L)
1	Estimated TCE Concentration Contour (µg/L)
J	Analyte Present (reported value may not be accurate or precise)
L	Analyte Present (reported value may be biased low)

TCE Concentration (µg/L):
- 1
- 10
- 30

Figure 5
Vertical Distribution of TCE Contamination
November 2013
AIW Frank/Mid-County Mustang Site
Chester County, Pennsylvania



Notes:
(1) Data from May 2005.

TCE=trichloroethene
µg/L=micrograms per liter

\\gst-srv-01\HGLGIS\AIW_Frank_MSIW\PP\(6)Vert_Distr_TCE_Oct2005.mxd
2/11/2016 CNL
Source: HGL

Typical Borehole:
- Cased Interval
- Open or Screened Interval
- FX — Approximate Depth of Identified Fracture in Open Borehole

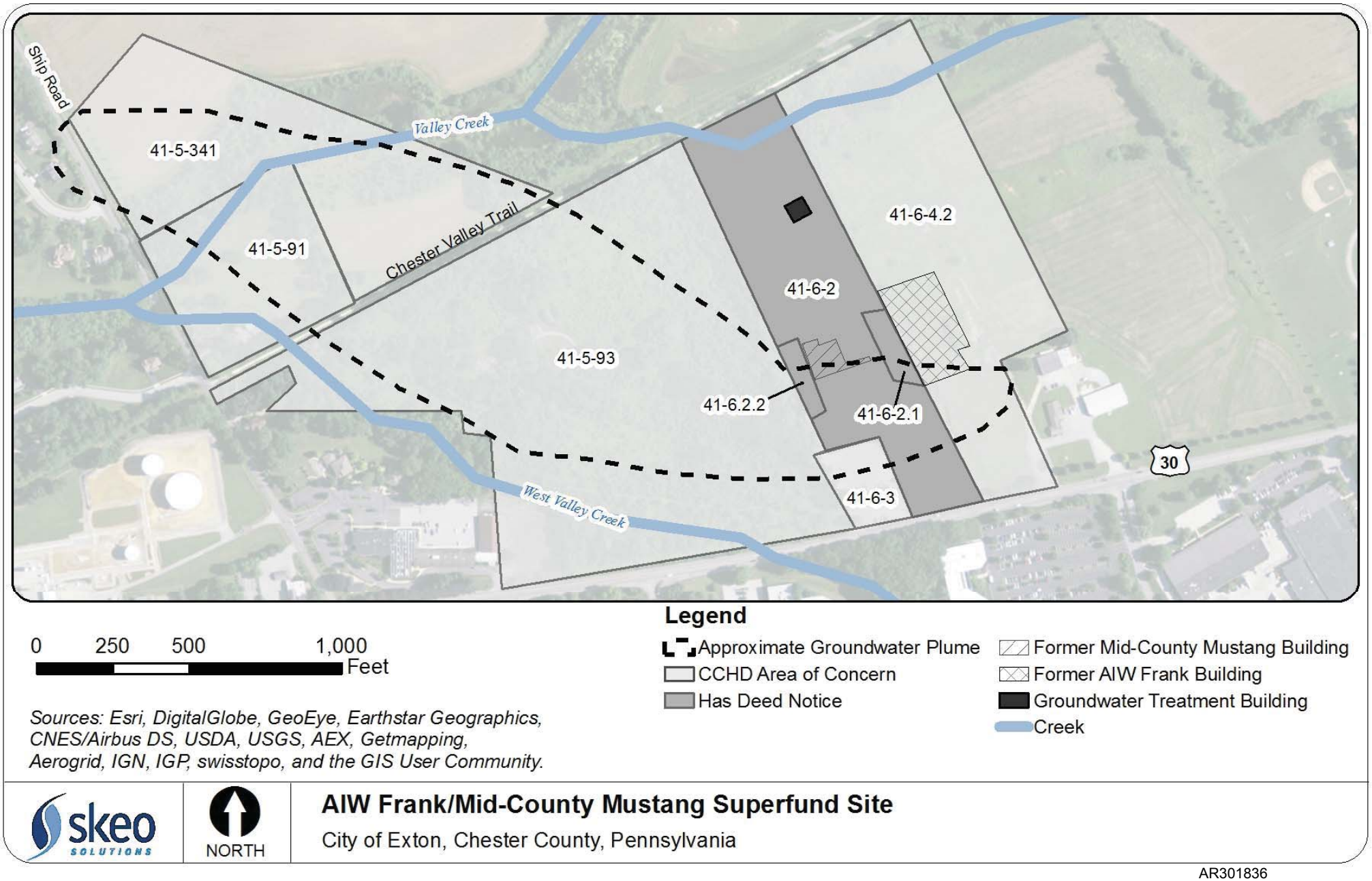
Legend

ND	Not Detected
(37)	TCE Concentration (µg/L)
1	TCE Concentration Contour (µg/L)
1	Estimated TCE Concentration Contour (µg/L)
J	Analyte Present (reported value may not be accurate or precise)

TCE Concentration (µg/L):
- 1
- 10
- 30
- 300

Figure 6
Vertical Distribution of TCE Contamination
October 2005
AIW Frank/Mid-County Mustang Site
Chester County, Pennsylvania

Figure 7: Chester County Health Department Area of Concern Base Map



AR301836

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APPENDIX A
ADMINISTRATIVE RECORD INDEX

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A.I.W. FRANK/MID-COUNTY MUSTANG
OU1 RECORD OF DECISION (ROD) AMENDMENT * **
ADMINISTRATIVE RECORD FILE
INDEX OF DOCUMENTS

III. REMEDIAL RESPONSE PLANNING

1. Report: Streamlined Optimization Evaluation *** Report, AIW Frank/Mid-County Mustang Site, Exton, Pennsylvania, prepared by GeoTrans, Inc., 7/29/05. P. 2217965.

2. Report: Draft (for Release) Pilot Test Summary Report, In Situ Chemical Oxidation, Treatability Study, AIW Frank/Mid-County Mustang Site, Exton, PA, prepared by Xpert Design and Diagnostics (XDD), LLC, 3/22/06. P. 2215725.

3. Report: Pilot-Scale In-Situ, Chemical Oxidation Application Summary Report, AIW Frank/Mid-County Mustang Site, Exton, Pennsylvania, prepared by XDD, 12/07. P. 2215726.

4. Letter to Mr. Steve O'Neil, Pennsylvania *** Department of Environmental Protection (PADEP), from Mr. Jonathan Rihs, HydroGeoLogic, Inc. (HGL), re: Notification of shutdown to the groundwater pump and treat system, 4/25/08. P. 2217966.

5. Report: Semiannual Groundwater Monitoring Report, *** October 2009, for Operable Unit 1 (OU-1), Long-Term Response Action, AIW Frank/Mid-County Mustang Site, Chester County, Pennsylvania, prepared by HGL, 12/09. P. 2217967.

6. Report: Semiannual Groundwater Monitoring Report, *** April 2010, for Operable Unit 1 (OU-1), Long-Term Response Action, AIW Frank/Mid-County Mustang Site,

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* Administrative Record File available //.

** The AIW Frank/Mid Administrative Record File dated 10/10/95 is incorporated herein by reference. The Index of Documents is attached.

*** Document has been redacted due to confidential business information or deliberative content. Redactions are evident from the face of the document.

Chester County, Pennsylvania, prepared by HGL, 6/10. P. 2217968.

7. Second Five-Year Review Report, AIW Frank/Mid-County Mustang Superfund Site, West Whiteland Township, Chester County, PA, 3/17/11. P. 2104944.

8. Report: LactOil™ Injection Work Plan, Revision 2, AIW Frank/Mid-County Mustang Site, Chester County, Pennsylvania, prepared HGL, 6/11. P. 2217826.

9. Report: Semiannual Groundwater Monitoring Report, *** April 2011, for Operable Unit 1 (OU-1), Long-Term Response Action, AIW Frank/Mid-County Mustang Site, Chester County, Pennsylvania, prepared by HGL, 8/11. P. 2217969.

10. Report: Semiannual Groundwater Monitoring Report, *** October 2011, for Operable Unit 1 (OU-1), Long-Term Response Action, AIW Frank/Mid-County Mustang Site, Chester County, Pennsylvania, prepared by HGL, 1/12. P. 2217970.

11. Report: Pilot Study In Situ Enhanced Bioremediation Application Summary Report, Revision 1, AIW Frank/Mid-County Mustang Site, Chester County, Pennsylvania, prepared by HGL, 3/12. P. 2217971.

12. Report: Focused Feasibility Study Groundwater Sampling Work Plan, Revision 0, AIW Frank/Mid-County Mustang Site, Chester County, Pennsylvania, prepared by HGL, 9/13. P. 2217825.

13. Electronic memorandum to Mr. Jonathan Rihs, HGL, *** from Mr. Mike Mazzarese, Vironex, re: Injection estimate, 4/8/14. P. 2217972. An April 7, 2014, electronic memorandum to Mr. Brendan Gerber and Mr. Andy Joy, Vironex, from Mr. Jonathan Rihs, HGL, regarding an injection estimate, is attached.

14. Letter to Mr. Charlie Root, U.S. EPA, from Mr. David Ewald, PADEP, re: Draft Focused Feasibility Study for Operable Unit 1 (OU-1), 11/3/14. P. 2217822.

15. Letter to Mr. Charlie Root, U.S. EPA, from Mr. David Ewald, PADEP, re: Final Focused Feasibility Study Report

for Operable Unit 1 (OU-1) revisions related to DEP's comments, 4/21/15. P. 2217821.

16. Report: Final Focused Feasibility Study Report for Operable Unit 1 (OU-1), AIW Frank/Mid-County Mustang Site, Chester County, Pennsylvania, prepared by HGL, 6/15. P. 2217828.

17. Letter to Mr. Gregory Voigt, U.S. EPA, from Mr. David Ewald, PADEP, re: DEP comments on OU1 Proposed Plan, 12/17/15. P. 2217962.

18. Electronic memoranda from Ms. Nancy Rios-Jafolla, U.S. EPA, to Mr. Greg Voigt, U.S. EPA, re: Comments on the Proposed Plan – new language, toxicological review for 1,4-dioxane, 1/6/16. P. 2217963. Related electronic memoranda are attached.

19. Letter to Mr. Gregory Voigt, U.S. EPA, from Mr. David Ewald, PADEP, re: DEP comments on Draft March 2016 Five Year Review Report, 2/19/16. P. 2217961.

20. Proposed Plan for Record of Decision Amendment, AIW Frank/Mid-County Mustang Site Operable Unit 1 (OU-1), Exton, Pennsylvania, 6/16. P. 2217959.

GUIDANCE DOCUMENTS

1. EPA, 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. OSWER Directive #9355.3-01, EPA-540-G-89-004. Washington, DC. October.

2. EPA, 2000. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. OSWER Directive #9355.0-75, EPA-540-R-00-002. Washington, DC. July.

3. EPA, 2003. Human Health Toxicity Values in Superfund Risk Assessments. OSWER Directive #9285.7-53, EPA-540-R-1-89-009. Washington, DC. December.

4. EPA, 2004. Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). OSWER Directive #9285.7-02EP, EPA-540-R-99-005. Washington, DC. July.

5. EPA, 2013. Guidance for Evaluating Completion of Groundwater Restoration Remedial Actions. OSWER #9355.0-129. Washington, DC. November.

TECHNICAL LITERATURE ++

1. Journal article entitled, "Isolation of a Bacterium That Reductively Dechlorinates Tetrachloroethene to Ethene", Science, Volume 276, written by Mr. Xavier Maymo-Gatell, et al., 1/6/97. Available on the Internet at www.sciencemag.org.

2. Technical/Regulatory Guidance: Evaluating LNAPL Remedial Technologies for Achieving Project Goals, prepared by The Interstate Technology & Regulatory Council (ITRC), 12/09. Available on the Internet at http://www.itrcweb.org/GuidanceDocuments/LNAPL-2.pdf.

3. Technical/Regulatory Guideline: Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater, Second Edition, prepared ITRC, 1/05. Available on the Internet at http://www.itrcweb.org/Guidance/GetDocument?documentID=45.

4. Report: Final Report – ER-1422: Biodegradation of 1,4-Dioxane, prepared by Shaw Environmental, Inc., 8/1/07. Available on the Internet at https://www.serdp-estcp.org/Program-Areas/Environmental-Restoration/Contaminated-Groundwater/Emerging-Issues/ER-1422; select Final Report.

5. Remediation Technologies Screening Matrix and Reference Guide, Version 4.0, Table 3-2: Treatment Technologies Screening Matrix, updated in 2007, accessed on 7/14/14. Available on the Internet at https://frtr.gov/matrix2/section3/table3_2.pdf.

++ These documents are hereby incorporated by reference into this Administrative Record File for the OU1 Record of Decision Amendment Index of Documents and can be found at the Internet site provided or at U.S. EPA's Region III offices in Philadelphia, Pennsylvania.

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APPENDIX B
COST ESTIMATE INFORMATION

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Table B.1
Detailed Cost Estimate
Alternative 1 - No Additional Action
AIW Frank/Mid-County Mustang Site

Phase: Remedial Action - Alternative 1 - No Additional Action
General Comments: Markups - Professional Labor Overhead/G&A (includes project managmenet) = 135%; Field Office Overhead/G&A = 5%; Subcontractor Profit = 8%; Prime Contractor Profit = 8%; Contingency/Escalation= 25%

Technology: Fall LTM - Groundwater
Comment: Fall LTM every year for 30 years
Element: Groundwater Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33020401	Disposable Materials per Sample	39	EA	10.24	0.00	0.00	0.00	$399.22	$565.90
33020402	Decontamination Materials per Sample	39	EA	13.45	0.00	0.00	0.00	$524.64	$743.68
33020561	Lysimeter accessories, nylon tubing, 1/4" OD	475	LF	0.19	0.00	0.00	0.00	$88.92	$126.04
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	0.00	0.00	0.00	312.00	$312.00	$421.20
33021618	Testing, purgeable organics (6,248,260)	39	EA	0.00	0.00	0.00	201.34	$7,852.42	$10,600.76
33022124	Testing, RCRA evaluations, EP toxicity analysis, metals (60,107,470)	1	EA	0.00	0.00	0.00	110.76	$110.76	$149.53
33190403	DOT steel drums, 55 gal., closed only, 17H	10	EA	61.36	0.00	0.00	0.00	$613.60	$869.78
33220102	Project Manager	5	HR	0.00	86.40	0.00	0.00	$432.02	$1,370.59
33220112	Field Technician	82	HR	0.00	39.81	0.00	0.00	$3,264.33	$10,356.09
33230506	2" Submersible Pump Rental, Day	4	DAY	0.00	0.00	0.00	96.20	$384.80	$519.48
	Total Element Cost:							$13,982.71	$25,723.05

Element: Data Management and Monitoring Reports

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	7	HR	0.00	86.40	0.00	0.00	$604.83	$1,918.82
33220108	Project Scientist	29	HR	0.00	79.83	0.00	0.00	$2,315.00	$7,344.35
33220110	QA/QC Officer	3	HR	0.00	79.83	0.00	0.00	$239.48	$759.76
33220112	Field Technician	3	HR	0.00	39.81	0.00	0.00	$119.43	$378.88
33220114	Word Processing/Clerical	3	HR	0.00	43.09	0.00	0.00	$129.27	$410.11
33220115	Draftsman/CADD	3	HR	0.00	46.21	0.00	0.00	$138.62	$439.78
33240101	Other Direct Costs	1	LS	80.68	0.00	0.00	0.00	$88.67	$125.68
	Total Element Cost:							$3,635.30	$11,377.38

Table B.1
Detailed Cost Estimate
Alternative 1 - No Additional Action
AIW Frank/Mid-County Mustang Site

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33010104	Sample collection, vehicle mileage charge, car or van	80	MI	0.00	0.00	0.00	0.51	$40.80	$40.80
33022043	Overnight delivery service, 51 to 70 lb packages	180	LB	0.00	0.00	0.00	1.41	$254.59	$343.70
33220112	Field Technician	12	HR	0.00	39.81	0.00	0.00	$477.71	$1,515.53
	Total Element Cost:							$773.10	$1,900.03
	Total 1st Year Tech Cost:							$ 18,391.11	$ 39,000.46
	Total 30 Year Tech Cost							**$551,733.30**	**$1,170,013.80**

Technology: Spring LTM - Groundwater
Comment: Spring LTM every year for 30 years
Element: Groundwater Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33020401	Disposable Materials per Sample	30	EA	10.24	0.00	0.00	0.00	$307.09	$435.31
33020402	Decontamination Materials per Sample	30	EA	13.45	0.00	0.00	0.00	$403.57	$572.06
33020561	Lysimeter accessories, nylon tubing, 1/4" OD	355	LF	0.19	0.00	0.00	0.00	$66.46	$94.20
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	0.00	0.00	0.00	312.00	$312.00	$421.20
33021618	Testing, purgeable organics (6,248,260)	30	EA	0.00	0.00	0.00	201.34	$6,040.32	$8,154.43
33022124	Testing, RCRA evaluations, EP toxicity analysis, metals (60,107,470)	1	EA	0.00	0.00	0.00	110.76	$110.76	$149.53
33190403	DOT steel drums, 55 gal., closed only, 17H	8	EA	61.36	0.00	0.00	0.00	$490.88	$695.82
33220102	Project Manager	4	HR	0.00	86.40	0.00	0.00	$345.62	$1,096.47
33220112	Field Technician	64	HR	0.00	39.81	0.00	0.00	$2,547.77	$8,082.80
33230506	2" Submersible Pump Rental, Day	4	DAY	0.00	0.00	0.00	96.20	$384.80	$519.48
	Total Element Cost:							$11,009.27	$20,221.30

Table B.1
Detailed Cost Estimate
Alternative 1 - No Additional Action
AIW Frank/Mid-County Mustang Site

Element: Data Management and Monitoring Reports

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	7	HR	0.00	86.40	0.00	0.00	$604.83	$1,918.82
33220108	Project Scientist	25	HR	0.00	79.83	0.00	0.00	$1,995.69	$6,331.34
33220110	QA/QC Officer	3	HR	0.00	79.83	0.00	0.00	$239.48	$759.76
33220112	Field Technician	3	HR	0.00	39.81	0.00	0.00	$119.43	$378.88
33220114	Word Processing/Clerical	3	HR	0.00	43.09	0.00	0.00	$129.27	$410.11
33220115	Draftsman/CADD	3	HR	0.00	46.21	0.00	0.00	$138.62	$439.78
33240101	Other Direct Costs	1	LS	80.68	0.00	0.00	0.00	$80.68	$114.37
	Total Element Cost:							$3,308.00	$10,353.06

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33010104	Sample collection, vehicle mileage charge, car or van	80	MI	0.00	0.00	0.00	0.51	$40.80	$40.80
33022043	Overnight delivery service, 51 to 70 lb packages	120	LB	0.00	0.00	0.00	1.41	$169.73	$229.13
33220112	Field Technician	12	HR	0.00	39.81	0.00	0.00	$477.71	$1,515.53
	Total Element Cost:							$688.24	$1,785.46
	Total 1st Year Tech Cost:							$ 15,005.51	$ 32,359.82
	Total 30 Year Tech Cost							**$450,165.30**	**$970,794.60**

Technology: Five-Year Review
Comment: Begins in 2016.
Element: Document Review

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220105	Project Engineer	7	HR	0.00	72.16	0.00	0.00	$505.12	$1,602.51
33220108	Project Scientist	4	HR	0.00	79.83	0.00	0.00	$319.31	$1,013.01
33220109	Staff Scientist	9	HR	0.00	46.21	0.00	0.00	$415.87	$1,319.34
	Total Element Cost:							$1,240.30	$3,934.86

Table B.1
Detailed Cost Estimate
Alternative 1 - No Additional Action
AIW Frank/Mid-County Mustang Site

Element: Site Inspection

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	8	HR	0.00	86.40	0.00	0.00	$691.23	$2,192.94
33220105	Project Engineer	19	HR	0.00	72.16	0.00	0.00	$1,371.05	$4,349.66
33220108	Project Scientist	15	HR	0.00	79.83	0.00	0.00	$1,197.42	$3,798.80
33220109	Staff Scientist	16	HR	0.00	46.21	0.00	0.00	$739.32	$2,345.49
	Total Element Cost:							$3,999.02	$12,686.89

Element: Report

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	9	HR	0.00	86.40	0.00	0.00	$777.64	$2,467.06
33220105	Project Engineer	20	HR	0.00	72.16	0.00	0.00	$1,443.21	$4,578.59
33220108	Project Scientist	21	HR	0.00	79.83	0.00	0.00	$1,676.38	$5,318.32
33220109	Staff Scientist	39	HR	0.00	46.21	0.00	0.00	$1,802.09	$5,717.13
	Total Element Cost:							$5,699.32	$18,081.10

Element: Travel

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33010108	Sedan, Automobile, Rental	1	DAY	0.00	0.00	0.00	55.43	$55.43	$74.83
33010202	Per Diem (per person)	1	DAY	0.00	0.00	0.00	123.00	$123.00	$123.00
	Total Element Cost:							$178.43	$197.83
	Total Year 2 Tech Cost:							$11,117.07	$34,900.68
	Total 30 Year Tech Cost							**$66,702.42**	**$209,404.08**

Table B.1
Detailed Cost Estimate
Alternative 1 - No Additional Action
AIW Frank/Mid-County Mustang Site

Technology: GETS Operations and Maintenance
Comment: Minimal GETS operation to treat IDW water only. 1 annual compliance sample. Estimated at $2,000/year.
Element: Misc. Support Cost

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33020401	Disposable Materials per Sample	1	EA	10.24	0.00	0.00	0.00	$10.24	$14.51
33020402	Decontamination Materials per Sample	1	EA	13.45	0.00	0.00	0.00	$13.45	$19.07
33021618	Testing, purgeable organics (6,248,260)	1	EA	0.00	0.00	0.00	166.40	$166.40	$224.64
33022042	Overnight delivery service, 21 to 50 lb packages	35	LB	0.00	0.00	0.00	1.54	$53.87	$72.73
33220102	Project Manager	1	HR	0.00	86.40	0.00	0.00	$86.40	$274.12
33220108	Project Scientist	2	HR	0.00	79.83	0.00	0.00	$159.66	$506.51
33220112	Field Technician	3	HR	0.00	39.81	0.00	0.00	$119.43	$378.88
33240101	Other Direct Costs	1	LS	14.44	0.00	0.00	0.00	$14.44	$20.47
	Total Element Cost:							$623.89	$1,510.93

Element: Carbon Adsorption (Liquid) and Air Stripping

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33132051	Bulk liquid-phase activated carbon, Coal-based General Purpose, 8 x 30 Sieve, 900 Iodine, < 2,000 Lb	68	LB	3.07	0.00	0.00	0.00	$207.21	$293.72
33132065	Removal, Transport, Regeneration of Spent Carbon, < 2K lb	68	LB	0.46	0.00	0.00	0.00	$30.91	$43.81
33420101	Electrical Charge	265	KWH	0.11	0.00	0.00	0.00	$30.33	$42.99
	Total Element Cost:							$268.45	$380.52
	Total 1st Year Tech Cost:							$892.34	$1,891.45
	Total 30 Year Tech Cost:							**$26,770.20**	**$56,743.50**

Table B.1
Detailed Cost Estimate
Alternative 1 - No Additional Action
AIW Frank/Mid-County Mustang Site

Technology: GETS - Grounds Maintenance
Comment: User Defined estimate of $500/yr
Element:

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
95010502	Grounds Maintenance, Moderate Snow Removal	30	YR	0.00	0.00	0.00	370.37	$11,111.10	$14,999.99
	Total Element Cost:							$11,111.10	$14,999.99
	Total 30 Year Tech Cost:							**$11,111.10**	**$14,999.99**

Alternative 1 Total:	**$2,421,955.97**

Note:
RACER assemblies are updated with the Micro-computer Aided Cost Estimating System, Second Generation (MII) software with the Government Cost Book (Cost Book) library. The Cost Book line items incorporated into the RACER database use the MasterFormat 2004 (MF04) numbering system. The line items are comprised of Construction Specifications Institute (CSI) tasks found in the Cost Book. The source of the Cost Book is the Tri-Service Automated Cost Engineering System (TRACES) English Cost Book with support from the U.S. Army Corps of Engineers (USACE) Environmental and Munitions Center of Expertise (EM CX) and USACE Support Center Huntsville

Table B.2
Present Net Worth Calculations
Alternative 1 - No Additional Action
AIW Frank/Mid-County Mustang Site

Year	Capital Cost	O&M Costs	Total	Inerest Rate[(1)]	PNW Factor	Present Net Worth
0	$0	$73,752	$73,752	5.0%	1.00	$73,752
1	$0	$108,652	$108,652	5.0%	0.95	$103,478
2	$0	$73,752	$73,752	5.0%	0.91	$66,895
3	$0	$73,752	$73,752	5.0%	0.86	$63,710
4	$0	$73,752	$73,752	5.0%	0.82	$60,676
5	$0	$73,752	$73,752	5.0%	0.78	$57,786
6	$0	$108,652	$108,652	5.0%	0.75	$81,078
7	$0	$73,752	$73,752	5.0%	0.71	$52,414
8	$0	$73,752	$73,752	5.0%	0.68	$49,918
9	$0	$73,752	$73,752	5.0%	0.64	$47,541
10	$0	$73,752	$73,752	5.0%	0.61	$45,277
11	$0	$108,652	$108,652	5.0%	0.58	$63,527
12	$0	$73,752	$73,752	5.0%	0.56	$41,068
13	$0	$73,752	$73,752	5.0%	0.53	$39,112
14	$0	$73,752	$73,752	5.0%	0.51	$37,250
15	$0	$73,752	$73,752	5.0%	0.48	$35,476
16	$0	$108,652	$108,652	5.0%	0.46	$49,775
17	$0	$73,752	$73,752	5.0%	0.44	$32,178
18	$0	$73,752	$73,752	5.0%	0.42	$30,645
19	$0	$73,752	$73,752	5.0%	0.40	$29,186
20	$0	$73,752	$73,752	5.0%	0.38	$27,796
21	$0	$108,652	$108,652	5.0%	0.36	$39,000
22	$0	$73,752	$73,752	5.0%	0.34	$25,212
23	$0	$73,752	$73,752	5.0%	0.33	$24,011
24	$0	$73,752	$73,752	5.0%	0.31	$22,868
25	$0	$73,752	$73,752	5.0%	0.30	$21,779
26	$0	$108,652	$108,652	5.0%	0.28	$30,557
27	$0	$73,752	$73,752	5.0%	0.27	$19,754
28	$0	$73,752	$73,752	5.0%	0.26	$18,814
29	$0	$73,752	$73,752	5.0%	0.24	$17,918

Total: $1,308,000

Notes:

(1) Interest rates based on EPA guidance "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study". EPA 540-R-00-002, OSWER. Directive 9355.0-75. July 2000.

Total has been rounded to the nearest thousand dollars.

Table B.3
Detailed Cost Estimate
Alternative 4 - Groundwater Extraction Treatment with UV Oxidation, MNA and ICs
AIW Frank/Mid-County Mustang Site

Phase: Remedial Action - Alternative 4 - Groundwater Extraction Treatment with UV Oxidation, MNA and ICs
General Comments: Markups - Professional Labor Overhead/G&A (includes project managmenet) = 135%; Field Office Overhead/G&A = 5%; Subcontractor Profit = 8%; Prime Contractor Profit = 8%; Contingency/Escalation= 25%

Technology: Advanced Oxidation Process with UV
Comment: Assume UV treats 1,4-dioxane from 0.05 to .001 mg/L. No additional transfer pump.
Element:

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
19040437	2,200 Gallon Conical Bottom Vertical XLPE Tank	2	EA	1,283.72	344.00	77.49	0.00	$3,410.42	$4,834.27
19040444	2,200 Gallon Conical Tank Stand	2	EA	859.70	137.60	31.00	0.00	$2,056.58	$2,915.20
33120803	Peroxide System Mob/Assembly/Shakedown	1	EA	0.00	17,653.57	0.00	0.00	$17,653.57	$25,023.94
33120805	Operator Health and Safety Course	1	EA	0.00	0.00	0.00	403.00	$403.00	$544.05
33120820	70 KW High Intensity Ultraviolet, H2O2 Capital Equipment	1	EA	0.00	0.00	0.00	232,915.76	$232,915.76	$314,436.27
33120848	Fugitive Emission Control System	1	EA	55,244.97	4,368.20	984.02	0.00	$60,597.20	$85,896.53
33130116	0 - 50 GPM Cartridge Filter Equipment	4	EA	32.92	110.16	0.00	0.00	$572.31	$811.25
33260203	3" Stainless Steel Piping, Schedule 40, Threaded	50	LF	81.64	35.54	0.00	0.00	$5,858.90	$8,304.99
	Total Element Cost:							$323,467.74	$442,766.50
	Total 1st Year Tech Cost:							**$323,467.74**	**$442,766.50**

Table B.3
Detailed Cost Estimate
Alternative 4 - Groundwater Extraction Treatment with UV Oxidation, MNA and ICs
AIW Frank/Mid-County Mustang Site

Technology: Operations and Maintenance of UV
Comment: System runs for 10 years. Startup costs in Year 1.
Element: Misc. Support Cost, 1st Year with Startup

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33223001	Treatment System Operator	64	HR	0.00	44.51	0.00	0.00	$2,848.32	$4,037.50
33240101	Other Direct Costs	1	LS	71.21	0.00	0.00	0.00	$71.21	$100.94
33240104	Startup Costs	1	LS	2,546.81	7,764.65	3,820.21	0.00	$14,131.66	$20,031.63
	Total Element Cost:							$17,051.19	$24,170.07

Element: Misc. Support Cost, Out Year

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33223001	Treatment System Operator	64	HR	0.00	44.51	0.00	0.00	$2,848.32	$4,037.50
33240101	Other Direct Costs	1	LS	71.21	0.00	0.00	0.00	$71.21	$100.94
	Total Element Cost:							$2,919.53	$4,138.44

Element: Advanced Oxidation Processes O&M

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33120851	7.5 KW Ultraviolet Source High Intensity Lamp	29	EA	124.80	0.00	0.00	0.00	$3,619.20	$5,130.22
33330171	Hydrogen Peroxide, 50% Solution, 500 Lb Drums	288	EA	348.40	0.00	0.00	0.00	$100,339.20	$142,230.81
33420101	Electrical Charge	486,488	KWH	0.11	0.00	0.00	0.00	$55,654.23	$78,889.86
	Total Element Cost:							$159,612.63	$226,250.89
	Total 1st Year Tech Cost:							$176,663.82	$250,420.96
	Total Out Year Tech Cost:							$162,532.16	$230,389.33
	Total 10 Year Tech Cost:							**$1,639,453.26**	**$2,323,924.93**

Table B.3
Detailed Cost Estimate
Alternative 4 - Groundwater Extraction Treatment with UV Oxidation, MNA and ICs
AIW Frank/Mid-County Mustang Site

Technology: GETS Monthly O&M, sampling, and reporting, Years 1-10
Comment: User defined yearly costs based on actual costs of existing system ($160,000/yr). Project Management costs includec
Element:

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
95010503	Monthly O&M and reporting	10	YR	0.00	0.00	0.00	118,518.52	$1,185,185.19	$1,600,000.00
	Total Element Cost:							$1,185,185.19	$1,600,000.00
	Total 10 Year Tech Cost:							**$1,185,185.19**	**$1,600,000.00**

Technology: GETS startup (restart) and O&M manual updates
Comment: User defined hours
Element: Misc. Support Cost

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	4	HR	0.00	86.40	0.00	0.00	$345.62	$1,096.47
33220105	Project Engineer	40	HR	0.00	72.16	0.00	0.00	$2,886.43	$9,157.19
33220110	QA/QC Officer	1	HR	0.00	79.83	0.00	0.00	$79.83	$253.25
33220114	Word Processing/Clerical	8	HR	0.00	43.09	0.00	0.00	$344.72	$1,093.63
33220115	Draftsman/CADD	8	HR	0.00	46.21	0.00	0.00	$369.66	$1,172.75
33223001	Treatment System Operator	20	HR	0.00	44.51	0.00	0.00	$890.10	$1,261.72
	Total Element Cost:							$4,916.36	$14,035.01
	Total 1st Year Tech Cost:							**$4,916.36**	**$14,035.01**

Technology: Grounds Maintenance
Comment: User defined cost, estimated at $500/yr
Element:

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
95010502	Grounds Maintenance, Moderate Snow Removal	30	YR	0.00	0.00	0.00	370.37	$11,111.10	$14,999.99
	Total Element Cost:							$11,111.10	$14,999.99
	Total 30 Year Tech Cost:							**$11,111.10**	**$14,999.99**

Table B.3
Detailed Cost Estimate
Alternative 4 - Groundwater Extraction Treatment with UV Oxidation, MNA and ICs
AIW Frank/Mid-County Mustang Site

Technology: Groundwater Extraction Well
Comment: Install new groundwater extraction well. Air rotary drilling to 250
Element:

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
17020203	Demolish Bituminous Pavement with Air Equipment	0.2	CY	0.00	80.70	18.06	0.00	$19.75	$28.00
33010101	Mobilize/DeMobilize Drilling Rig & Crew	1	LS	0.00	1,560.55	618.18	0.00	$2,178.73	$3,088.35
33020303	Organic Vapor Analyzer Rental, per Day	3	DAY	0.00	0.00	0.00	35.29	$105.86	$142.91
33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	2	DAY	26.26	624.71	0.00	0.00	$1,301.95	$1,845.51
33220112	Field Technician	34	HR	0.00	39.81	0.00	0.00	$1,353.50	$4,293.99
33230104	8" PVC, Schedule 40, Well Casing	40	LF	0.00	0.00	0.00	45.00	$1,800.00	$2,430.00
33230157	2" Pitless Adapter	1	EA	795.60	78.44	0.00	0.00	$874.04	$1,238.95
33230545	4" Submersible Pump, 21-32 GPM, 281'< Head <=340', 3 hp, w/ controls	1	EA	1,875.12	160.73	0.00	0.00	$2,035.85	$2,885.82
33231129	Air Rotary, 8" Dia Borehole (Consolidated), 100 < Depth <= 500 ft	210	LF	0.00	0.00	0.00	27.00	$5,669.99	$7,654.49
33231132	Air Rotary, 10" Dia Borehole (Consolidated), 100 ft < Depth <= 500 ft	40	LF	0.00	0.00	0.00	35.00	$1,400.00	$1,890.00
33231182	DOT steel drums, 55 gal., open, 17C	72	EA	73.86	0.00	0.00	0.00	$5,317.98	$7,538.23
33231186	Well Development Equipment Rental (weekly)	1	WK	0.00	0.00	0.00	551.20	$551.20	$744.12
33232206	Restricted Area, Well Protection (with 4 Posts & Explosionproof Receptacle)	1	EA	1,097.55	912.15	1.22	0.00	$2,010.91	$2,850.47
	Total Element Cost:							$24,619.76	$36,630.84
	Total 1st Year Tech Cost:							**$24,619.76**	**$36,630.84**

Table B.3
Detailed Cost Estimate
Alternative 4 - Groundwater Extraction Treatment with UV Oxidation, MNA and ICs
AIW Frank/Mid-County Mustang Site

Technology: Trenching/Piping
Comment: Piping for groundwater extraction well connection to treatment plant, estimated to be 700
Element:

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
17020201	Demolish Bituminous Road with Power Equipment	13	CY	0.00	22.84	6.38	0.00	$378.65	$536.74
17030257	Cat 215, 1.0 CY, Soil, Shallow, Trenching, Excludes Sheeting, Excludes Dewatering	26	BCY	0.00	0.81	0.33	0.00	$29.80	$42.24
17030415	On-Site Backfill for Large Excavations, Includes Compaction	35	ECY	0.00	0.95	0.82	0.04	$63.88	$90.45
18020301	Asphalt Pavement - 10" Subgrade, 9" Base, 1 1/2" Topping	78	SY	10.02	2.12	1.30	0.00	$1,045.14	$1,481.48
33260430	1/C #4 Copper Grounded 600V Direct Burial, Wire	700	LF	0.13	0.96	0.00	0.00	$762.51	$1,080.85
33260430	4" PVC, Schedule 80, Connection Piping	700	LF	5.98	12.74	0.00	0.00	$13,104.00	$18,574.92
	Total Element Cost:							$15,383.98	$21,806.68
	Total 1st Year Tech Cost:							**$15,383.98**	**$21,806.68**

Table B.3
Detailed Cost Estimate
Alternative 4 - Groundwater Extraction Treatment with UV Oxidation, MNA and ICs
AIW Frank/Mid-County Mustang Site

Technology: Residual Waste Management
Comment: Wastes from new extraction well and trenching. Nonhazardous waste hauled 60 miles to landfill
Element:

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33190102	Bulk Solid Waste Loading Into Disposal Vehicle or Bulk Disposal Container	13	BCY	0.94	1.30	0.38	0.00	$33.97	$48.15
33190103	Load Drums on Disposal Vehicle	50	EA	0.00	5.91	1.55	0.00	$372.79	$528.43
33190204	Transport 55 Gallon Drums of Hazardous Waste, Max 80 drums (per Mile)	60	MI	0.00	0.00	0.00	2.70	$162.24	$219.02
33190205	Transport Bulk Solid Hazardous Waste, Maximum 20 CY (per Mile)	60	MI	0.00	0.00	0.00	2.70	$162.24	$219.02
33190317	Waste Stream Evaluation Fee, Not Including 50% Rebate on 1st Shipment	2	EA	0.00	0.00	0.00	65.00	$130.00	$175.50
33190807	32 Ft. Dump Truck, 6 Mil Liner, disposable	1	EA	24.11	0.00	0.00	0.00	$24.11	$34.17
33197205	Landfill Nonhazardous Solid Waste, 55 Gallon Drum	50	EA	0.00	0.00	0.00	74.88	$3,744.00	$5,054.40
33197270	Landfill Nonhazardous Solid Bulk Waste by CY	13	CY	0.00	0.00	0.00	23.54	$305.96	$413.04
	Total Element Cost:							$4,935.31	$6,691.73
	Total 1st Year Tech Cost:							**$4,935.31**	**$6,691.73**

Technology: Groundwater Extraction Pump
Comment: Reinstall a groundwater extraction pump into existing extraction wells
Element:

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220112	Field Technician	24	HR	0.00	39.81	0.00	0.00	$955.41	$3,031.05
33230545	4" Submersible Pump, 21-32 GPM 281'< Head <=340', 3 hp, w/ controls. Driling contractor install existing pump.	1	EA	0.00	0.00	0.00	2500.00	$2,500.00	$3,375.00
33231186	Well Development Equipment Rental (weekly)	1	WK	0.00	0.00	0.00	551.20	$551.20	$744.12
	Total Element Cost:							$4,006.61	$7,150.17
	Total 1st Year Tech Cost:							**$4,006.61**	**$7,150.17**

Table B.3
Detailed Cost Estimate
Alternative 4 - Groundwater Extraction Treatment with UV Oxidation, MNA and ICs
AIW Frank/Mid-County Mustang Site

Technology: Fall LTM - Groundwater
Comment: Fall LTM every year, Year 1-10
Element: Groundwater Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33020401	Disposable Materials per Sample	39	EA	10.24	0.00	0.00	0.00	$399.22	$565.90
33020402	Decontamination Materials per Sample	39	EA	13.45	0.00	0.00	0.00	$524.64	$743.68
33020561	Lysimeter accessories, nylon tubing, 1/4" OD	475	LF	0.19	0.00	0.00	0.00	$88.92	$126.04
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	0.00	0.00	0.00	312.00	$312.00	$421.20
33021618	Testing, purgeable organics (6,248,260)	39	EA	0.00	0.00	0.00	201.34	$7,852.42	$10,600.76
33022124	Testing, RCRA evaluations, EP toxicity analysis, metals (60,107,470)	1	EA	0.00	0.00	0.00	110.76	$110.76	$149.53
33190403	DOT steel drums, 55 gal., closed only, 17H	10	EA	61.36	0.00	0.00	0.00	$613.60	$869.78
33220102	Project Manager	5	HR	0.00	86.40	0.00	0.00	$432.02	$1,370.59
33220112	Field Technician	82	HR	0.00	39.81	0.00	0.00	$3,264.33	$10,356.09
33230506	2" Submersible Pump Rental, Day	4	DAY	0.00	0.00	0.00	96.20	$384.80	$519.48
	Total Element Cost:							$13,982.71	$25,723.05

Element: Data Management and Monitoring Reports

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	7	HR	0.00	86.40	0.00	0.00	$604.83	$1,918.82
33220108	Project Scientist	29	HR	0.00	79.83	0.00	0.00	$2,315.00	$7,344.35
33220110	QA/QC Officer	3	HR	0.00	79.83	0.00	0.00	$239.48	$759.76
33220112	Field Technician	3	HR	0.00	39.81	0.00	0.00	$119.43	$378.88
33220114	Word Processing/Clerical	3	HR	0.00	43.09	0.00	0.00	$129.27	$410.11
33220115	Draftsman/CADD	3	HR	0.00	46.21	0.00	0.00	$138.62	$439.78
33240101	Other Direct Costs	1	LS	88.67	0.00	0.00	0.00	$88.67	$125.68
	Total Element Cost:							$3,635.30	$11,377.38

Table B.3
Detailed Cost Estimate
Alternative 4 - Groundwater Extraction Treatment with UV Oxidation, MNA and ICs
AIW Frank/Mid-County Mustang Site

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33010104	Sample collection, vehicle mileage charge, car or van	80	MI	0.00	0.00	0.00	0.51	$40.80	$40.80
33022043	Overnight delivery service, 51 to 70 lb packages	180	LB	0.00	0.00	0.00	1.41	$254.59	$343.70
33220112	Field Technician	12	HR	0.00	39.81	0.00	0.00	$477.71	$1,515.53
	Total Element Cost:							$773.10	$1,900.03
	Total 1st Year Tech Cost:							$18,391.11	$39,000.46
	Total 10 Year Tech Cost:							**$183,911.10**	**$390,004.60**

Technology: Spring LTM - Groundwater
Comment: Spring LTM every year, Years 1-10
Element: Groundwater Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33020401	Disposable Materials per Sample	30	EA	10.24	0.00	0.00	0.00	$307.09	$435.31
33020402	Decontamination Materials per Sample	30	EA	13.45	0.00	0.00	0.00	$403.57	$572.06
33020561	Lysimeter accessories, nylon tubing, 1/4" OD	355	LF	0.19	0.00	0.00	0.00	$66.46	$94.20
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	0.00	0.00	0.00	312.00	$312.00	$421.20
33021618	Testing, purgeable organics (6,248,260)	30	EA	0.00	0.00	0.00	201.34	$6,040.32	$8,154.43
33022124	Testing, RCRA evaluations, EP toxicity analysis, metals (60,107,470)	1	EA	0.00	0.00	0.00	110.76	$110.76	$149.53
33190403	DOT steel drums, 55 gal., closed only, 17H	8	EA	61.36	0.00	0.00	0.00	$490.88	$695.82
33220102	Project Manager	4	HR	0.00	86.40	0.00	0.00	$345.62	$1,096.47
33220112	Field Technician	64	HR	0.00	39.81	0.00	0.00	$2,547.77	$8,082.80
33230506	2" Submersible Pump Rental, Day	4	DAY	0.00	0.00	0.00	96.20	$384.80	$519.48
	Total Element Cost:							$11,009.27	$20,221.30

Table B.3
Detailed Cost Estimate
Alternative 4 - Groundwater Extraction Treatment with UV Oxidation, MNA and ICs
AIW Frank/Mid-County Mustang Site

Element: Data Management and Monitoring Reports

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	7	HR	0.00	86.40	0.00	0.00	$604.83	$1,918.82
33220108	Project Scientist	25	HR	0.00	79.83	0.00	0.00	$1,995.69	$6,331.34
33220110	QA/QC Officer	3	HR	0.00	79.83	0.00	0.00	$239.48	$759.76
33220112	Field Technician	3	HR	0.00	39.81	0.00	0.00	$119.43	$378.88
33220114	Word Processing/Clerical	3	HR	0.00	43.09	0.00	0.00	$129.27	$410.11
33220115	Draftsman/CADD	3	HR	0.00	46.21	0.00	0.00	$138.62	$439.78
33240101	Other Direct Costs	1	LS	80.68	0.00	0.00	0.00	$80.68	$114.37
	Total Element Cost:							$3,308.00	$10,353.06

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33010104	Sample collection, vehicle mileage charge, car or van	80	MI	0.00	0.00	0.00	0.51	$40.80	$40.80
33022043	Overnight delivery service, 51 to 70 lb packages	120	LB	0.00	0.00	0.00	1.41	$169.73	$229.13
33220112	Field Technician	12	HR	0.00	39.81	0.00	0.00	$477.71	$1,515.53
	Total Element Cost:							$688.24	$1,785.46
	Total 1st Year Tech Cost:							$15,005.51	$32,359.82
	Total 10 Year Tech Cost:							**$150,055.10**	**$323,598.20**

Technology: Annual LTM - Groundwater, Year 11-30
Comment: Annual LTM for years 11-30. Same yearly costs as Fall LTM groundwater event (see above for cost breakdown
Element: Groundwater Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33020401	Disposable Materials per Sample	39	EA	10.24	0.00	0.00	0.00	$399.22	$565.90
33020402	Decontamination Materials per Sample	39	EA	13.45	0.00	0.00	0.00	$524.64	$743.68
33020561	Lysimeter accessories, nylon tubing, 1/4" OD	475	LF	0.19	0.00	0.00	0.00	$88.92	$126.04
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	0.00	0.00	0.00	312.00	$312.00	$421.20
33021618	Testing, purgeable organics (6,248,260)	39	EA	0.00	0.00	0.00	201.34	$7,852.42	$10,600.76
33022124	Testing, RCRA evaluations, EP toxicity analysis, metals (60,107,470)	1	EA	0.00	0.00	0.00	110.76	$110.76	$149.53
33190403	DOT steel drums, 55 gal., closed only, 17H	10	EA	61.36	0.00	0.00	0.00	$613.60	$869.78
33220102	Project Manager	5	HR	0.00	86.40	0.00	0.00	$432.02	$1,370.59
33220112	Field Technician	82	HR	0.00	39.81	0.00	0.00	$3,264.33	$10,356.09
33230506	2" Submersible Pump Rental, Day	4	DAY	0.00	0.00	0.00	96.20	$384.80	$519.48
	Total Element Cost:							$13,982.71	$25,723.05

Table B.3
Detailed Cost Estimate
Alternative 4 - Groundwater Extraction Treatment with UV Oxidation, MNA and ICs
AIW Frank/Mid-County Mustang Site

Element: Data Management and Monitoring Reports

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	7	HR	0.00	86.40	0.00	0.00	$604.83	$1,918.82
33220108	Project Scientist	29	HR	0.00	79.83	0.00	0.00	$2,315.00	$7,344.35
33220110	QA/QC Officer	3	HR	0.00	79.83	0.00	0.00	$239.48	$759.76
33220112	Field Technician	3	HR	0.00	39.81	0.00	0.00	$119.43	$378.88
33220114	Word Processing/Clerical	3	HR	0.00	43.09	0.00	0.00	$129.27	$410.11
33220115	Draftsman/CADD	3	HR	0.00	46.21	0.00	0.00	$138.62	$439.78
33240101	Other Direct Costs	1	LS	88.67	0.00	0.00	0.00	$88.67	$125.68
	Total Element Cost:							$3,635.30	$11,377.38

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33010104	Sample collection, vehicle mileage charge, car or van	80	MI	0.00	0.00	0.00	0.51	$40.80	$40.80
33022043	Overnight delivery service, 51 to 70 lb packages	180	LB	0.00	0.00	0.00	1.41	$254.59	$343.70
33220112	Field Technician	12	HR	0.00	39.81	0.00	0.00	$477.71	$1,515.53
	Total Element Cost:							$773.10	$1,900.03
	Total Year 11 Tech Cost:							$18,391.11	$39,000.46
	Total Year 11-30 Tech Cost:							**$367,822.20**	**$780,009.20**

Table B.3
Detailed Cost Estimate
Alternative 4 - Groundwater Extraction Treatment with UV Oxidation, MNA and ICs
AIW Frank/Mid-County Mustang Site

Technology: Five-Year Review
Comment: Begins in 2016.
Element: Document Review

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220105	Project Engineer	7	HR	0.00	72.16	0.00	0.00	$505.12	$1,602.51
33220108	Project Scientist	4	HR	0.00	79.83	0.00	0.00	$319.31	$1,013.01
33220109	Staff Scientist	9	HR	0.00	46.21	0.00	0.00	$415.87	$1,319.34
	Total Element Cost:							$1,240.30	$3,934.86

Element: Site Inspection

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	8	HR	0.00	86.40	0.00	0.00	$691.23	$2,192.94
33220105	Project Engineer	19	HR	0.00	72.16	0.00	0.00	$1,371.05	$4,349.66
33220108	Project Scientist	15	HR	0.00	79.83	0.00	0.00	$1,197.42	$3,798.80
33220109	Staff Scientist	16	HR	0.00	46.21	0.00	0.00	$739.32	$2,345.49
	Total Element Cost:							$3,999.02	$12,686.89

Element: Report

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	9	HR	0.00	86.40	0.00	0.00	$777.64	$2,467.06
33220105	Project Engineer	20	HR	0.00	72.16	0.00	0.00	$1,443.21	$4,578.59
33220108	Project Scientist	21	HR	0.00	79.83	0.00	0.00	$1,676.38	$5,318.32
33220109	Staff Scientist	39	HR	0.00	46.21	0.00	0.00	$1,802.09	$5,717.13
	Total Element Cost:							$5,699.32	$18,081.10

Table B.3
Detailed Cost Estimate
Alternative 4 - Groundwater Extraction Treatment with UV Oxidation, MNA and ICs
AIW Frank/Mid-County Mustang Site

Element: Travel

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33010108	Sedan, Automobile, Rental	1	DAY	0.00	0.00	0.00	55.43	$55.43	$74.83
33010202	Per Diem (per person)	1	DAY	0.00	0.00	0.00	123.00	$123.00	$123.00
	Total Element Cost:							$178.43	$197.83
	Total Year 2 Tech Cost:							$11,117.07	$34,900.68
	Total 30 Year Tech Cost:							**$66,702.42**	**$209,404.08**

Alternative 4 Total:	**$6,171,021.93**

Note:

RACER assemblies are updated with the Micro-computer Aided Cost Estimating System, Second Generation (MII) software with the Government Cost Book (Cost Book) library. The Cost Book line items incorporated into the RACER database use the MasterFormat 2004 (MF04) numbering system. The line items are comprised of Construction Specifications Institute (CSI) tasks found in the Cost Book. The source of the Cost Book is the Tri-Service Automated Cost Engineering System (TRACES) English Cost Book with support from the U.S. Army Corps of Engineers (USACE) Environmental and Munitions Center of Expertise (EM CX) and USACE Support Center Huntsville

Table B.4
Present Net Worth Calculations
Alternative 4 - Groundwater Extraction Treatment with UV Oxidation, MNA and ICs
AIW Frank/Mid-County Mustang Site

Year	Capital Cost	O&M Costs	Total	Inerest Rate[(1)]	PNW Factor	Present Net Worth
0	$529,081	$482,281	$1,011,362	5.0%	1.00	$1,011,362
1	$0	$497,150	$497,150	5.0%	0.95	$473,476
2	$0	$462,250	$462,250	5.0%	0.91	$419,274
3	$0	$462,250	$462,250	5.0%	0.86	$399,309
4	$0	$462,250	$462,250	5.0%	0.82	$380,294
5	$0	$462,250	$462,250	5.0%	0.78	$362,185
6	$0	$497,150	$497,150	5.0%	0.75	$370,981
7	$0	$462,250	$462,250	5.0%	0.71	$328,512
8	$0	$462,250	$462,250	5.0%	0.68	$312,869
9	$0	$462,250	$462,250	5.0%	0.64	$297,970
10	$0	$39,500	$39,500	5.0%	0.61	$24,250
11	$0	$74,401	$74,401	5.0%	0.58	$43,501
12	$0	$39,500	$39,500	5.0%	0.56	$21,995
13	$0	$39,500	$39,500	5.0%	0.53	$20,948
14	$0	$39,500	$39,500	5.0%	0.51	$19,950
15	$0	$39,500	$39,500	5.0%	0.48	$19,000
16	$0	$74,401	$74,401	5.0%	0.46	$34,084
17	$0	$39,500	$39,500	5.0%	0.44	$17,234
18	$0	$39,500	$39,500	5.0%	0.42	$16,413
19	$0	$39,500	$39,500	5.0%	0.40	$15,631
20	$0	$39,500	$39,500	5.0%	0.38	$14,887
21	$0	$74,401	$74,401	5.0%	0.36	$26,706
22	$0	$39,500	$39,500	5.0%	0.34	$13,503
23	$0	$39,500	$39,500	5.0%	0.33	$12,860
24	$0	$39,500	$39,500	5.0%	0.31	$12,248
25	$0	$39,500	$39,500	5.0%	0.30	$11,664
26	$0	$74,401	$74,401	5.0%	0.28	$20,925
27	$0	$39,500	$39,500	5.0%	0.27	$10,580
28	$0	$39,500	$39,500	5.0%	0.26	$10,076
29	$0	$39,500	$39,500	5.0%	0.24	$9,596

Total: $4,732,000

Notes:

(1) Interest rates based on EPA guidance "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study". EPA 540-R-00-002, OSWER. Directive 9355.0-75. July 2000.

Total has been rounded to the nearest thousand dollars.

Table B.5
Detailed Cost Estimate
Alternative 7 - In Situ Chemical Oxidation, Enhanced Bioremediation with MNA and ICs
AIW Frank/Mid-County Mustang Site

Phase: Remedial Action - Alternative 7 - In Situ Chemical Oxidation, Enhanced Bioremediation with MNA and ICs
General Comments: Markups - Professional Labor Overhead/G&A (includes project managmenet) = 135%; Field Office Overhead/G&A = 5%; Subcontractor Profit = 8%; Prime Contractor Profit = 8%; Contingency/Escalation= 25%

Technology: Injection Wells
Comment: Install five 65' injection well/monitoring well
Element:

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33020537	Water level indicators, water level chart recorder, battery operated	1	EA	1,195.48	0.00	0.00	0.00	$1,195.48	$1,694.59
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	0.00	0.00	0.00	312.00	$312.00	$421.20
33230126	8" Stainless Steel Well Casing, 10' Sections, Flush Threaded	205	LF	352.56	102.37	100.26	0.00	$113,815.25	$161,333.15
33231128	Air Rotary, 8" Dia Borehole (Consolidated), Depth <= 100 ft	125	LF	0.00	0.00	0.00	27.00	$3,375.00	$4,556.25
33231131	Air Rotary, 10" Dia Borehole (Consolidated), Depth <= 100 ft	205	LF	0.00	0.00	0.00	35.00	$7,175.00	$9,686.25
33231180	Mobilization/Demobilization, Drill Equipment or Trencher, Crew	1	EA	379.60	975.34	386.36	0.00	$1,741.31	$2,468.30
33231182	DOT steel drums, 55 gal., open, 17C	20	EA	73.86	0.00	0.00	0.00	$1,477.20	$2,093.95
33231187	Load Supplies/Equipment	1	LS	227.76	585.21	231.82	0.00	$1,044.78	$1,480.98
33231502	Surface Pad, Concrete, 4' x 4' x 4"	5	EA	77.17	27.13	0.28	0.00	$522.90	$741.25
33231814	8" Well, Portland Cement Grout	205	LF	2.35	0.00	0.00	0.00	$482.05	$683.30
33232105	8" Well, Bentonite Seal	5	EA	53.03	60.72	59.47	0.00	$866.10	$1,227.70
	Total Element Cost:							$132,007.07	$186,386.92
	Total 1st Year Tech Cost:							**$132,007.07**	**$186,386.92**

Table B.5
Detailed Cost Estimate
Alternative 7 - In Situ Chemical Oxidation, Enhanced Bioremediation with MNA and ICs
AIW Frank/Mid-County Mustang Site

Technology: Injection Wells
Comment: Install five 150' injection/monitoring well
Element:

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33020537	Water level indicators, water level chart recorder, battery operated	1	EA	1,195.48	0.00	0.00	0.00	$1,195.48	$1,694.59
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	0.00	0.00	0.00	312.00	$312.00	$421.20
33230126	8" Stainless Steel Well Casing, 10' Sections, Flush Threaded	205	LF	352.56	124.84	100.26	0.00	$113,815.25	$161,333.15
33231129	Air Rotary, 8" Dia Borehole (Consolidated), 100 < Depth <= 500 ft	545	LF	0.00	0.00	0.00	27.00	$14,715.00	$19,865.25
33231131	Air Rotary, 10" Dia Borehole (Consolidated), Depth <= 100 ft	205	LF	0.00	0.00	0.00	35.00	$7,175.00	$9,686.25
33231180	Mobilization/Demobilization, Drill Equipment or Trencher, Crew	1	EA	379.60	975.34	386.36	0.00	$1,741.31	$2,468.30
33231182	DOT steel drums, 55 gal., open, 17C	45	EA	73.86	0.00	0.00	0.00	$2,954.45	$4,187.90
33231187	Load Supplies/Equipment	1	LS	227.76	585.21	231.82	0.00	$1,044.78	$1,480.98
33231502	Surface Pad, Concrete, 4' x 4' x 4"	5	EA	77.17	27.13	0.28	0.00	$522.90	$741.25
33231814	8" Well, Portland Cement Grout	205	LF	2.35	0.00	0.00	0.00	$482.05	$683.30
33232105	8" Well, Bentonite Seal	5	EA	53.03	60.72	59.47	0.00	$866.10	$1,227.70
	Total Element Cost:							$144,824.32	$203,789.87
	Total 1st Year Tech Cost:							**$144,824.32**	**$203,789.87**

Table B.5
Detailed Cost Estimate
Alternative 7 - In Situ Chemical Oxidation, Enhanced Bioremediation with MNA and ICs
AIW Frank/Mid-County Mustang Site

Technology: Residual Waste Management
Comment: Waste disposal from injection well installation. Nonhazardous waste hauled 60 miles to landfill
Element:

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33190103	Load Drums on Disposal Vehicle	65	EA	0.00	5.91	1.55	0.00	$484.90	$687.39
33190204	Transport 55 Gallon Drums of Hazardous Waste, Max 80 drums (per Mile)	60	MI	0.00	0.00	0.00	2.70	$162.24	$219.02
33190317	Waste Stream Evaluation Fee, Not Including 50% Rebate on 1st Shipment	1	EA	0.00	0.00	0.00	65.00	$65.00	$87.75
33197205	Landfill Nonhazardous Solid Waste, 55 Gallon Drum	65	EA	0.00	0.00	0.00	74.88	$4,867.20	$6,570.72
	Total Element Cost:							$5,579.34	$7,564.88
	Total 1st Year Tech Cost:							**$5,579.34**	**$7,564.88**

Technology: Inject Permanganate
Comment: LS costs from quotes by Carrus and Redox Tech
Element:

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220105	Project Engineer	40	HR	0.00	72.16	0.00	0.00	$2,886.43	$9,157.19
95010210	In Situ Remediation Injection Services	4	DAY	0.00	0.00	0.00	2,500.00	$10,000.00	$13,500.00
95010211	Sodium Permanganate, 24 drums	1	LS	0.00	0.00	0.00	39,152.00	$39,152.00	$52,855.20
	Total Element Cost:							$52,038.43	$75,512.39
	Total 1st Year Tech Cost:							$52,038.43	$75,512.39
	Total 2 Year Tech Cost:							**$104,076.86**	**$151,024.78**

Table B.5
Detailed Cost Estimate
Alternative 7 - In Situ Chemical Oxidation, Enhanced Bioremediation with MNA and ICs
AIW Frank/Mid-County Mustang Site

Technology: Post Injection GW Monitoring
Comment: 3 months after injections
Element: Groundwater

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33020401	Disposable Materials per Sample	20	EA	10.24	0.00	0.00	0.00	$204.73	$290.20
33020402	Decontamination Materials per Sample	20	EA	13.45	0.00	0.00	0.00	$269.05	$381.38
33020561	Lysimeter accessories, nylon tubing, 1/4" OD	250	LF	0.19	0.00	0.00	0.00	$46.80	$66.34
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	0.00	0.00	0.00	312.00	$312.00	$421.20
33021618	Testing, purgeable organics (6,248,260)	20	EA	0.00	0.00	0.00	201.34	$4,026.88	$5,436.29
33022124	Testing, RCRA evaluations, EP toxicity analysis, metals (60,107,470)	1	EA	0.00	0.00	0.00	110.76	$110.76	$149.53
33190403	DOT steel drums, 55 gal., closed only, 17H	5	EA	61.36	0.00	0.00	0.00	$306.80	$434.89
33220102	Project Manager	3	HR	0.00	86.40	0.00	0.00	$259.21	$822.35
33220112	Field Technician	42	HR	0.00	39.81	0.00	0.00	$1,671.97	$5,304.34
33230506	2" Submersible Pump Rental, Day	2	DAY	0.00	0.00	0.00	96.20	$192.40	$259.74
	Total Element Cost:							$7,400.60	$13,566.26

Element: Data Management and Monitoring Reports

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	6	HR	0.00	86.40	0.00	0.00	$518.43	$1,644.70
33220108	Project Scientist	22	HR	0.00	79.83	0.00	0.00	$1,756.21	$5,571.58
33220110	QA/QC Officer	2	HR	0.00	79.83	0.00	0.00	$159.66	$506.51
33220112	Field Technician	2	HR	0.00	39.81	0.00	0.00	$79.62	$252.59
33220114	Word Processing/Clerical	2	HR	0.00	43.09	0.00	0.00	$86.18	$273.41
33220115	Draftsman/CADD	2	HR	0.00	46.21	0.00	0.00	$92.41	$293.19
33240101	Other Direct Costs	1	LS	67.31	0.00	0.00	0.00	$67.31	$95.42
	Total Element Cost:							$2,759.82	$8,637.40

Table B.5
Detailed Cost Estimate
Alternative 7 - In Situ Chemical Oxidation, Enhanced Bioremediation with MNA and ICs
AIW Frank/Mid-County Mustang Site

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33010104	Sample collection, vehicle mileage charge, car or van	80	MI	0.00	0.00	0.00	0.51	$40.80	$40.80
33022043	Overnight delivery service, 51 to 70 lb packages	120	LB	0.00	0.00	0.00	1.41	$169.73	$229.13
33220112	Field Technician	12	HR	0.00	39.81	0.00	0.00	$477.71	$1,515.53
	Total Element Cost:							$688.24	$1,785.46
	Total 1st Year Tech Cost:							$10,848.66	$23,989.12
	Total 2 Year Tech Cost:							**$21,697.32**	**$47,978.24**

Technology: Inject ABC Amendment
Comment: LS costs from quotes by Sirem and Redox Tech
Element:

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220105	Project Engineer	50	HR	0.00	72.16	0.00	0.00	$3,608.03	$11,446.48
95010210	In Situ Remediation Injection Services	5	DAY	0.00	0.00	0.00	2,500.00	$12,500.00	$16,875.00
95010212	ABC, 330 gallon tote	6	EA	0.00	0.00	0.00	3,962.50	$23,775.00	$32,096.25
95010213	KB-1 Amendment, 1 Liter	40	EA	0.00	0.00	0.00	261.75	$10,470.00	$14,134.50
	Total Element Cost:							$50,353.03	$74,552.23
	Total 1st Year Tech Cost:							$50,353.03	$74,552.23
	Total 2 Year Tech Cost:							**$100,706.06**	**$149,104.46**

Table B.5
Detailed Cost Estimate
Alternative 7 - In Situ Chemical Oxidation, Enhanced Bioremediation with MNA and ICs
AIW Frank/Mid-County Mustang Site

Technology: Post Injection GW Monitoring
Comment: Same yearly costs as post-injection GW sampling (see above for cost breakdown)
Element: Groundwater

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33020401	Disposable Materials per Sample	20	EA	10.24	0.00	0.00	0.00	$204.73	$290.20
33020402	Decontamination Materials per Sample	20	EA	13.45	0.00	0.00	0.00	$269.05	$381.38
33020561	Lysimeter accessories, nylon tubing, 1/4" OD	250	LF	0.19	0.00	0.00	0.00	$46.80	$66.34
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	0.00	0.00	0.00	312.00	$312.00	$421.20
33021618	Testing, purgeable organics (6,248,260)	20	EA	0.00	0.00	0.00	201.34	$4,026.88	$5,436.29
33022124	Testing, RCRA evaluations, EP toxicity analysis, metals (60,107,470)	1	EA	0.00	0.00	0.00	110.76	$110.76	$149.53
33190403	DOT steel drums, 55 gal., closed only, 17H	5	EA	61.36	0.00	0.00	0.00	$306.80	$434.89
33220102	Project Manager	3	HR	0.00	86.40	0.00	0.00	$259.21	$822.35
33220112	Field Technician	42	HR	0.00	39.81	0.00	0.00	$1,671.97	$5,304.34
33230506	2" Submersible Pump Rental, Day	2	DAY	0.00	0.00	0.00	96.20	$192.40	$259.74
33230614	Peristaltic Pump, Weekly Rental	0	WK	0.00	0.00	0.00	93.60	$0.00	$0.00
	Total Element Cost:							$7,400.60	$13,566.26

Element: Data Management and Monitoring Reports

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	6	HR	0.00	86.40	0.00	0.00	$518.43	$1,644.70
33220108	Project Scientist	22	HR	0.00	79.83	0.00	0.00	$1,756.21	$5,571.58
33220110	QA/QC Officer	2	HR	0.00	79.83	0.00	0.00	$159.66	$506.51
33220112	Field Technician	2	HR	0.00	39.81	0.00	0.00	$79.62	$252.59
33220114	Word Processing/Clerical	2	HR	0.00	43.09	0.00	0.00	$86.18	$273.41
33220115	Draftsman/CADD	2	HR	0.00	46.21	0.00	0.00	$92.41	$293.19
33240101	Other Direct Costs	1	LS	67.31	0.00	0.00	0.00	$67.31	$95.42
	Total Element Cost:							$2,759.82	$8,637.40

Table B.5
Detailed Cost Estimate
Alternative 7 - In Situ Chemical Oxidation, Enhanced Bioremediation with MNA and ICs
AIW Frank/Mid-County Mustang Site

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33010104	Sample collection, vehicle mileage charge, car or van	80	MI	0.00	0.00	0.00	0.51	$40.80	$40.80
33022043	Overnight delivery service, 51 to 70 lb packages	120	LB	0.00	0.00	0.00	1.41	$169.73	$229.13
33220112	Field Technician	12	HR	0.00	39.81	0.00	0.00	$477.71	$1,515.53
	Total Element Cost:							$688.24	$1,785.46
	Total 1st Year Tech Cost:							$10,848.66	$23,989.12
	Total 2 Year Tech Cost:							**$21,697.32**	**$47,978.24**

Technology: Fall LTM - Groundwater
Comment: Fall LTM every year, Years 1-10
Element: Groundwater Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33020401	Disposable Materials per Sample	39	EA	10.24	0.00	0.00	0.00	$399.22	$565.90
33020402	Decontamination Materials per Sample	39	EA	13.45	0.00	0.00	0.00	$524.64	$743.68
33020561	Lysimeter accessories, nylon tubing, 1/4" OD	475	LF	0.19	0.00	0.00	0.00	$88.92	$126.04
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	0.00	0.00	0.00	312.00	$312.00	$421.20
33021618	Testing, purgeable organics (6,248,260)	39	EA	0.00	0.00	0.00	201.34	$7,852.42	$10,600.76
33022124	Testing, RCRA evaluations, EP toxicity analysis, metals (60,107,470)	1	EA	0.00	0.00	0.00	110.76	$110.76	$149.53
33190403	DOT steel drums, 55 gal., closed only, 17H	10	EA	61.36	0.00	0.00	0.00	$613.60	$869.78
33220102	Project Manager	5	HR	0.00	86.40	0.00	0.00	$432.02	$1,370.59
33220112	Field Technician	82	HR	0.00	39.81	0.00	0.00	$3,264.33	$10,356.09
33230506	2" Submersible Pump Rental, Day	1	WK	0.00	0.00	0.00	237.90	$237.90	$321.16
	Total Element Cost:							$13,835.81	$25,524.73

Table B.5
Detailed Cost Estimate
Alternative 7 - In Situ Chemical Oxidation, Enhanced Bioremediation with MNA and ICs
AIW Frank/Mid-County Mustang Site

Element: Data Management and Monitoring Reports

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	7	HR	0.00	86.40	0.00	0.00	$604.83	$1,918.82
33220108	Project Scientist	29	HR	0.00	79.83	0.00	0.00	$2,315.00	$7,344.35
33220110	QA/QC Officer	3	HR	0.00	79.83	0.00	0.00	$239.48	$759.76
33220112	Field Technician	3	HR	0.00	39.81	0.00	0.00	$119.43	$378.88
33220114	Word Processing/Clerical	3	HR	0.00	43.09	0.00	0.00	$129.27	$410.11
33220115	Draftsman/CADD	3	HR	0.00	46.21	0.00	0.00	$138.62	$439.78
33240101	Other Direct Costs	1	LS	88.67	0.00	0.00	0.00	$88.67	$125.68
	Total Element Cost:							$3,635.30	$11,377.38

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33010104	Sample collection, vehicle mileage charge, car or van	80	MI	0.00	0.00	0.00	0.51	$40.80	$40.80
33022043	Overnight delivery service, 51 to 70 lb packages	180	LB	0.00	0.00	0.00	1.41	$254.59	$343.70
33220112	Field Technician	12	HR	0.00	39.81	0.00	0.00	$477.71	$1,515.53
	Total Element Cost:							$773.10	$1,900.03
	Total 1st Year Tech Cost:							$18,244.21	$38,802.14
	Total 10 Year Tech Cost:							**$182,442.10**	**$388,021.40**

Table B.5
Detailed Cost Estimate
Alternative 7 - In Situ Chemical Oxidation, Enhanced Bioremediation with MNA and ICs
AIW Frank/Mid-County Mustang Site

Technology: Spring LTM - Groundwater
Comment: Spring LTM every year, Years 1-10
Element: Groundwater Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33020401	Disposable Materials per Sample	30	EA	10.24	0.00	0.00	0.00	$307.09	$435.31
33020402	Decontamination Materials per Sample	30	EA	13.45	0.00	0.00	0.00	$403.57	$572.06
33020561	Lysimeter accessories, nylon tubing, 1/4" OD	355	LF	0.19	0.00	0.00	0.00	$66.46	$94.20
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	0.00	0.00	0.00	312.00	$312.00	$421.20
33021618	Testing, purgeable organics (6,248,260)	30	EA	0.00	0.00	0.00	201.34	$6,040.32	$8,154.43
33022124	Testing, RCRA evaluations, EP toxicity analysis, metals (60,107,470)	1	EA	0.00	0.00	0.00	110.76	$110.76	$149.53
33190403	DOT steel drums, 55 gal., closed only, 17H	8	EA	61.36	0.00	0.00	0.00	$490.88	$695.82
33220102	Project Manager	4	HR	0.00	86.40	0.00	0.00	$345.62	$1,096.47
33220112	Field Technician	64	HR	0.00	39.81	0.00	0.00	$2,547.77	$8,082.80
33230506	2" Submersible Pump Rental, Day	1	WK	0.00	0.00	0.00	237.90	$237.90	$321.16
	Total Element Cost:							$10,862.37	$20,022.98

Element: Data Management and Monitoring Reports

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	7	HR	0.00	86.40	0.00	0.00	$604.83	$1,918.82
33220108	Project Scientist	25	HR	0.00	79.83	0.00	0.00	$1,995.69	$6,331.34
33220110	QA/QC Officer	3	HR	0.00	79.83	0.00	0.00	$239.48	$759.76
33220112	Field Technician	3	HR	0.00	39.81	0.00	0.00	$119.43	$378.88
33220114	Word Processing/Clerical	3	HR	0.00	43.09	0.00	0.00	$129.27	$410.11
33220115	Draftsman/CADD	3	HR	0.00	46.21	0.00	0.00	$138.62	$439.78
33240101	Other Direct Costs	1	LS	80.68	0.00	0.00	0.00	$80.68	$114.37
	Total Element Cost:							$3,308.00	$10,353.06

Table B.5
Detailed Cost Estimate
Alternative 7 - In Situ Chemical Oxidation, Enhanced Bioremediation with MNA and ICs
AIW Frank/Mid-County Mustang Site

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33010104	Sample collection, vehicle mileage charge, car or van	80	MI	0.00	0.00	0.00	0.51	$40.80	$40.80
33022043	Overnight delivery service, 51 to 70 lb packages	120	LB	0.00	0.00	0.00	1.41	$169.73	$229.13
33220112	Field Technician	12	HR	0.00	39.81	0.00	0.00	$477.71	$1,515.53
	Total Element Cost:							$688.24	$1,785.46
	Total 1st Year Tech Cost:							$14,858.61	$32,161.50
	Total 10 Year Tech Cost:							**$148,586.10**	**$321,615.00**

Technology: Annual LTM - Groundwater
Comment: Annual LTM, Years 11-20. Same yearly costs as Fall LTM groundwater event (see above for cost breakdown)
Element: Groundwater Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33020401	Disposable Materials per Sample	39	EA	10.24	0.00	0.00	0.00	$399.22	$565.90
33020402	Decontamination Materials per Sample	39	EA	13.45	0.00	0.00	0.00	$524.64	$743.68
33020561	Lysimeter accessories, nylon tubing, 1/4" OD	475	LF	0.19	0.00	0.00	0.00	$88.92	$126.04
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	0.00	0.00	0.00	312.00	$312.00	$421.20
33021618	Testing, purgeable organics (6,248,260)	39	EA	0.00	0.00	0.00	201.34	$7,852.42	$10,600.76
33022124	Testing, RCRA evaluations, EP toxicity analysis, metals (60,107,470)	1	EA	0.00	0.00	0.00	110.76	$110.76	$149.53
33190403	DOT steel drums, 55 gal., closed only, 17H	10	EA	61.36	0.00	0.00	0.00	$613.60	$869.78
33220102	Project Manager	5	HR	0.00	86.40	0.00	0.00	$432.02	$1,370.59
33220112	Field Technician	82	HR	0.00	39.81	0.00	0.00	$3,264.33	$10,356.09
33230506	2" Submersible Pump Rental, Day	1	WK	0.00	0.00	0.00	237.90	$237.90	$321.16
	Total Element Cost:							$13,835.81	$25,524.73

Table B.5
Detailed Cost Estimate
Alternative 7 - In Situ Chemical Oxidation, Enhanced Bioremediation with MNA and ICs
AIW Frank/Mid-County Mustang Site

Element: Data Management and Monitoring Reports

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	7	HR	0.00	86.40	0.00	0.00	$604.83	$1,918.82
33220108	Project Scientist	29	HR	0.00	79.83	0.00	0.00	$2,315.00	$7,344.35
33220110	QA/QC Officer	3	HR	0.00	79.83	0.00	0.00	$239.48	$759.76
33220112	Field Technician	3	HR	0.00	39.81	0.00	0.00	$119.43	$378.88
33220114	Word Processing/Clerical	3	HR	0.00	43.09	0.00	0.00	$129.27	$410.11
33220115	Draftsman/CADD	3	HR	0.00	46.21	0.00	0.00	$138.62	$439.78
33240101	Other Direct Costs	1	LS	88.67	0.00	0.00	0.00	$88.67	$125.68
	Total Element Cost:							$3,635.30	$11,377.38

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33010104	Sample collection, vehicle mileage charge, car or van	80	MI	0.00	0.00	0.00	0.51	$40.80	$40.80
33022043	Overnight delivery service, 51 to 70 lb packages	180	LB	0.00	0.00	0.00	1.41	$254.59	$343.70
33220112	Field Technician	12	HR	0.00	39.81	0.00	0.00	$477.71	$1,515.53
	Total Element Cost:							$773.10	$1,900.03
	Total 1st Year Tech Cost:							$18,244.21	$38,802.14
	Total 10 Year Tech Cost:							**$182,442.10**	**$388,021.40**

Technology: Five-Year Review
Comment: Begins in 2016. No site inspections. Ends 2031, (Year 17)
Element: Document Review

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220105	Project Engineer	7	HR	0.00	72.16	0.00	0.00	$505.12	$1,602.51
33220108	Project Scientist	4	HR	0.00	79.83	0.00	0.00	$319.31	$1,013.01
33220109	Staff Scientist	9	HR	0.00	46.21	0.00	0.00	$415.87	$1,319.34
	Total Element Cost:							$1,240.30	$3,934.86

Table B.5
Detailed Cost Estimate
Alternative 7 - In Situ Chemical Oxidation, Enhanced Bioremediation with MNA and ICs
AIW Frank/Mid-County Mustang Site

Element: Site Inspection

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	8	HR	0.00	86.40	0.00	0.00	$691.23	$2,192.94
33220105	Project Engineer	19	HR	0.00	72.16	0.00	0.00	$1,371.05	$4,349.66
33220108	Project Scientist	15	HR	0.00	79.83	0.00	0.00	$1,197.42	$3,798.80
33220109	Staff Scientist	16	HR	0.00	46.21	0.00	0.00	$739.32	$2,345.49
	Total Element Cost:							$3,999.02	$12,686.89

Element: Report

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	9	HR	0.00	86.40	0.00	0.00	$777.64	$2,467.06
33220105	Project Engineer	20	HR	0.00	72.16	0.00	0.00	$1,443.21	$4,578.59
33220108	Project Scientist	21	HR	0.00	79.83	0.00	0.00	$1,676.38	$5,318.32
33220109	Staff Scientist	39	HR	0.00	46.21	0.00	0.00	$1,802.09	$5,717.13
	Total Element Cost:							$5,699.32	$18,081.10

Element: Travel

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33010108	Sedan, Automobile, Rental	1	DAY	0.00	0.00	0.00	55.43	$55.43	$74.83
33010202	Per Diem (per person)	1	DAY	0.00	0.00	0.00	123.00	$123.00	$123.00
	Total Element Cost:							$178.43	$197.83
	Total 1st Year Tech Cost:							$11,117.07	$34,900.68
	Total 30 Year Tech Cost:							**$44,468.28**	**$139,602.72**

Table B.5
Detailed Cost Estimate
Alternative 7 - In Situ Chemical Oxidation, Enhanced Bioremediation with MNA and ICs
AIW Frank/Mid-County Mustang Site

Technology: Site Close-Out Documentation
Comment: Begins in Year 2035
Element: Work Plans & Reports

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	15	HR	0.00	86.40	0.00	0.00	$1,296.06	$4,111.76
33220109	Staff Scientist	2	HR	0.00	46.21	0.00	0.00	$92.41	$293.19
33220114	Word Processing/Clerical	8	HR	0.00	43.09	0.00	0.00	$344.72	$1,093.63
33220115	Draftsman/CADD	5	HR	0.00	46.21	0.00	0.00	$231.04	$732.97
	Total Element Cost:							$1,964.23	$6,231.55

Element: Documents

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Sub Bid Cost	Extended Cost	Extended Cost with Markup
33220102	Project Manager	7	HR	0.00	86.40	0.00	0.00	$604.83	$1,918.82
33220104	Senior Staff Engineer	2	HR	0.00	111.83	0.00	0.00	$223.67	$709.59
33220106	Staff Engineer	22	HR	0.00	96.68	0.00	0.00	$2,126.98	$6,747.85
33220114	Word Processing/Clerical	9	HR	0.00	43.09	0.00	0.00	$387.81	$1,230.33
33220115	Draftsman/CADD	7	HR	0.00	46.21	0.00	0.00	$323.45	$1,026.15
	Total Element Cost:							$3,666.74	$11,632.74
	Total 1st Year Tech Cost:							**$5,630.97**	**$17,864.29**

Alternative 7 Total:	**$2,048,952.20**

Note:
RACER assemblies are updated with the Micro-computer Aided Cost Estimating System, Second Generation (MII) software with the Government Cost Book (Cost Book) library. The Cost Book line items incorporated into the RACER database use the MasterFormat 2004 (MF04) numbering system. The line items are comprised of Construction Specifications Institute (CSI) tasks found in the Cost Book. The source of the Cost Book is the Tri-Service Automated Cost Engineering System (TRACES) English Cost Book with support from the U.S. Army Corps of Engineers (USACE) Environmental and Munitions Center of Expertise (EM CX) and USACE Support Center Huntsville

Table B.6
Present Net Worth Calculations
Alternative 7 - In Situ Chemical Oxidation, Enhanced Bioremediation with MNA and ICs
AIW Frank/Mid-County Mustang Site

Year	Capital Cost	O&M Costs	Total	Inerest Rate[(1)]	PNW Factor	Present Net Worth
0	$497,243	$70,964	$568,207	5.0%	1.00	$568,207
1	$99,502	$105,864	$205,366	5.0%	0.95	$195,587
2	$98,541	$70,964	$169,505	5.0%	0.91	$153,746
3	$0	$70,964	$70,964	5.0%	0.86	$61,301
4	$0	$70,964	$70,964	5.0%	0.82	$58,382
5	$98,541	$70,964	$169,505	5.0%	0.78	$132,812
6	$0	$105,864	$105,864	5.0%	0.75	$78,997
7	$0	$70,964	$70,964	5.0%	0.71	$50,433
8	$0	$70,964	$70,964	5.0%	0.68	$48,031
9	$0	$70,964	$70,964	5.0%	0.64	$45,744
10	$0	$38,802	$38,802	5.0%	0.61	$23,821
11	$0	$73,703	$73,703	5.0%	0.58	$43,093
12	$0	$38,802	$38,802	5.0%	0.56	$21,606
13	$0	$38,802	$38,802	5.0%	0.53	$20,578
14	$0	$38,802	$38,802	5.0%	0.51	$19,598
15	$0	$38,802	$38,802	5.0%	0.48	$18,664
16	$0	$73,703	$73,703	5.0%	0.46	$33,764
17	$0	$38,802	$38,802	5.0%	0.44	$16,929
18	$0	$38,802	$38,802	5.0%	0.42	$16,123
19	$0	$38,802	$38,802	5.0%	0.40	$15,355
20	$0	$17,848	$17,848	5.0%	0.38	$6,727
21	$0	$0	$0	5.0%	0.36	$0
22	$0	$0	$0	5.0%	0.34	$0
23	$0	$0	$0	5.0%	0.33	$0
24	$0	$0	$0	5.0%	0.31	$0
25	$0	$0	$0	5.0%	0.30	$0
26	$0	$0	$0	5.0%	0.28	$0
27	$0	$0	$0	5.0%	0.27	$0
28	$0	$0	$0	5.0%	0.26	$0
29	$0	$0	$0	5.0%	0.24	$0

Total: $1,629,000

Notes:

(1) Interest rates based on EPA guidance "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study". EPA 540-R-00-002, OSWER. Directive 9355.0-75. July 2000.

Total has been rounded to the nearest thousand dollars.

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APPENDIX C
CORRESPONDENCE WITH PADEP REGARDING THE REMEDY MODIFICATION

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

May 16, 2017

Josh Crooks
Department of Environmental Protection
Southeast Regional Office
2 East Main Street
Norristown, PA 19401

RE: Transmittal of Draft AIW Frank/Mid-County Mustang Superfund Site Record of Decision (ROD) Amendment

Dear Mr. Crooks,

Enclosed for your review is a copy of the *Record of Decision Amendment, AIW Frank/Mid-County Mustang Site, West Whiteland Township, Chester County, Pennsylvania*. This version of the ROD Amendment provides additional language regarding maintenance of the Site's groundwater extraction and treatment system (see Section L.1.1). EPA is requesting DEP's concurrence on this draft ROD Amendment by May 31, 2017. If you have any questions, please feel free to contact me at 215-814-5737 or voigt.gregory@epa.gov.

Sincerely,

Gregory Voigt
Remedial Project Manager

Enclosure

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

June 7 2017

Ms. Karen Melvin
Director
Hazardous Sites Cleanup Division
US EPA Region III
1650 Arch Street (3HS00)
Philadelphia, PA 19103-2029

Re: Record of Decision (ROD) Amendment
AIW Frank/Mid-County Mustang Superfund Site
West Whiteland Township, Chester County

Dear Ms. Melvin:

The Department of Environmental Protection (the Department) has received and reviewed the Record of Decision (ROD) Amendment, dated May 2017 for the AIW Frank/Mid-County Mustang Superfund Site (Site) in West Whiteland Township, Chester County. This ROD Amendment selects a modification to the remedy selected for the Site in EPA's 1995 ROD Operable Unit 1 (OU1), which addresses groundwater contamination beneath the Site. The amendment for OU1 includes the following major components:

- Replacement of the groundwater extraction and treatment via air stripping of groundwater with in-situ chemical oxidation (ISCO) and in situ bioremediation (ISBR); and
- Modification of groundwater contaminants of concern (COCs) and remediation goals (RGs).

The DEP has the following comments regarding the ROD Amendment. The fate of the Groundwater Extraction and Treatment System (GETS) requires some clarification. Section L states that the GETS will be removed as a component of the remedy.

"L. Remedy Modification: Description and Performance Standards ....Alternative 7: ISCO, Enhanced Bioremediation, LTM, and ICs. EPA's Remedy Modification makes the following changes to the original Selected Remedy: 1. Remove the GETS as a component of the Selected Remedy. In place of the GETS, this ROD Amendment requires ISCO and ISBR treatment technologies to remediate groundwater contamination at the Site."

Southeast Regional Office
2 East Main Street | Norristown, PA 19401-4915 | 484.250.5960 | Fax 484.250.5961 | www.dep.pa.gov

However, later in Section L.1.1, one of the remedy components is maintaining the GETS.

L.1.1 Remedy Components

5. *Maintaining the existing GETS in operational condition.*
   a. *Prior to implementing the Remedy Modification, the GETS shall be inspected, tested, and, if necessary, repaired to ensure it is in operational condition.*
   b. *The GETS shall be utilized to pump Site groundwater for mixing ISCO and ISBR amendments during injection activities.*
   c. *The GETS may be utilized to treat water generated during well installation and sampling activities.*
   d. *Maintaining the GETS in operational condition may be discontinued once RGs are achieved for COCs*

Additionally, the "*Request for Fund-financed Remedy Modifications During State Funded Operations and Maintenance Memo"* dated March 20, 2017, states the following:

"PADEP will assume the responsibility for performing and funding O&M of the Remedy Modification, including the following tasks: 4. Maintain the GETS in operating condition."

If the GETS is not needed after the completion of ISCO/ISBR, the DEP believes the GETS should not have to be maintained, specifically since the ROD Amendment states it is no longer a component of the remedy.

The DEP hereby concurs with EPA's proposed remedy with the following conditions:

A. The DEP will be given the opportunity to review and comment on documents and concur with decisions related to the design and implementation of the remedial action, to assure compliance with Pennsylvania's Applicable, Relevant and Appropriate Requirements (ARARs) and to be considered requirements (TBCs).

B. This concurrence with the selected remedial action is not intended to provide any assurances pursuant to CERCLA Section 104(c)(3), 42 U.S.C. § 9604(c)(3).

C. Concurrence with the remedy should not be interpreted as acceptance of on-site Operation and Maintenance (O&M) by the DEP. State O&M obligations, including, but not limited to, funding apportionment, will be determined during the negotations and completion of a Superfund State Contract (SSC). The DEP would like the comments identified in this letter to be addressed during the drafting of the revised SSC.

D. EPA will assure that the DEP is provided an opportunity to fully participate in any negotiations with responsible parties.

E. DEP reserves the right and responsibility to take independent enforcement actions pursuant to state law.

F. Pennsylvania asserts that the Land Recycling and Environmental Remediation Standards Act, Act of May 19, 1995, P.L. 4, 35 P.S. §§ 6026.101-6026.908 ("Land Recycling Act" or "Act 2") and the regulations promulgated under the Act (25 Pa. Code Chapter 250, et seq.) are also ARARS for the selected remedy under CERCLA Section 121(d)(2), 42 U.S.C. § 9621(d)(2). The Act 2 regulations specifically identified in this ROD Amendment are: *25 Pa. Code § 250.301(a) and Appendix A, Tables 1 and 2*

Thank you for the opportunity to comment and concur on this EPA ROD Amendment. If you have any questions regarding this matter, please do not hesitate to contact me.

Sincerely,

Patrick Patterson
Regional Director

cc: Mr. Voight - EPA Region III RPM
West Whiteland Township
Chester County Health Department
Ms. Wagner-PADEP
Mr. Shankar-PADEP
Mr. R. Patel-PADEP
Ms. McClennen-PADEP
Mr. Crooks-PADEP
Mr. McClain-PADEP
Mr. Bram, Esq.-PADEP
File
Re 30 (rc17ecb) 153.4

APPENDIX D
FOCUSED FEASIBILITY STUDY RISK TABLES

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Table 1.10
Groundwater - Direct Contact
Occurrence, Distribution and Selection of Chemicals Requiring Further Evaluation

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Groundwater

CAS Number	Chemical	Minimum Concentration (µg/L)	Minimum Qualifier	Maximum Concentration (µg/L)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Detection Limits (µg/L)	Concentration Used for Screening [1]	Screening Toxicity Value Value [2]		Chemical Retained for Further Evaluation	Rationale for Selection or Deletion [3]
7440-38-2	Arsenic	2.60E+00		1.03E+01		ug/L	MW-112B	2/38	1.00E+00	1.0E+01	5.2E-02	C	NO	INF
7439-96-5	Manganese	3.90E-01	B	1.60E+03		ug/L	MW-112B	38/38	1.00E+00 - 1.50E+00	1.6E+03	4.3E+01	N	YES	ASL
75-34-3	1,1-Dichloroethane	2.40E-01	J	1.90E+01		ug/L	MW-112B	13/38	5.00E-01	1.9E+01	2.7E+00	C	YES	ASL
67-66-3	Chloroform	ND		ND		ug/L		0/38	5.00E-01	ND	2.2E-01	C	NA	NA

[1] Maximum detected concentration is used for screening.
[2] The Tap Water RSL, November 2012 (risk = 1E-06; HQ = 0.1),
[3] Rationale Codes: Above Screening Levels (ASL), Below Screening Level (BSL), 5% or less detection frequency (INF)

Table 1.11
Groundwater - Direct Exposure
Exposure Point Concentration Summary

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Groundwater

Chemical of Concern	Units	Maximum Detected Concentration	Maximum Qualifier	Reasonable Maximum Exposure		
				Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Manganese	ug/L	1.6E+03		4.1E+02	97.5% Chebyshev (Mean, Sd) UCL	[1]
1,1-Dichloroethane	ug/L	1.9E+01		2.6E+00	95% KM (t) UCL	[1]

All statistical analyses performed with ProUCL Version 4.00.05.
[1] Data appear nonparametric. Use of ProUCL recommended value.

Table 1.18
Calculation of Chemical Hazards
Future Child Resident

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

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC Value	EPC Units	Intake Value	Intake Units	RfD Value	RfD Units	Hazard Quotient
Groundwater	Water	Tap	Ingestion	Manganese	4.1E-01	mg/L	2.0E-02	mg/kg-day	2.4E-02	mg/kg-day	1
				1,1-Dichloroethane	2.6E-03	mg/L	1.3E-04	mg/kg-day	2.0E-01	mg/kg-day	0.0006
										Total	1
Groundwater	Water	Bath	Dermal contact	Manganese	4.1E-01	mg/L	1.7E-04	mg/kg-day	9.6E-04	mg/kg-day	0.2
				1,1-Dichloroethane	2.6E-03	mg/L	1.3E-05	mg/kg-day	2.0E-01	mg/kg-day	0.00006
										Total	0.2
										Exposure Medium Total	1

Table 1.19
Calculation of Chemical Hazards
Future Adult Resident

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

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-cancer Risk Calculations				Hazard Quotient
					Value	Units	Intake		RfD		
							Value	Units	Value	Units	
Groundwater	Water	Tap	Ingestion	Manganese	4.1E-01	mg/L	1.2E-02	mg/kg-day	2.4E-02	mg/kg-day	0.5
				1,1-Dichloroethane	2.6E-03	mg/L	7.8E-05	mg/kg-day	2.0E-01	mg/kg-day	0.0004
										Total	0.5
Groundwater	Water	Bath	Dermal contact	Manganese	4.1E-01	mg/L	6.0E-05	mg/kg-day	9.6E-04	mg/kg-day	0.06
				1,1-Dichloroethane	2.60E-03	mg/L	5.7E-06	mg/kg-day	2.0E-01	mg/kg-day	0.00003
										Total	0.06
										Exposure Medium Total	0.6

Table 1.23
Summary of Receptor Risks and Hazards for COPCs
Child Resident

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

Medium	Exposure Medium	Exposure Point	Chemical	Non-Carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap	Manganese	Neurological	1	--	0.2	1
			1,1-Dichloroethane	Kidney	0.0006	--	0.00006	0.0007
			Total		1	--	0.2	1
							Total Hazard Index Across All Media and All Exposure Routes	1

Table 1.24
Summary of Receptor Risks and Hazards for COPCs
Adult Resident

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

Medium	Exposure Medium	Exposure Point	Chemical	Non-Carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap	Manganese	Neurological	0.5	--	0.06	0.6
			1,1-Dichloroethane	Kidney	0.0004	NV	0.00003	0.0004
			Total		0.5	--	0.06	0.6
							Total Hazard Index Across All Media and All Exposure Routes	0.6

Table 1.25
Summary of Receptor Risks and Hazards for COPCs
Age-Adjusted Resident

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Age-adjusted

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap	Manganese	NA	NA	NA	NA
			1,1-Dichloroethane	2.E-07	1.E-07	2.E-08	3.E-07
			Total	2.E-07	1.E-07	2.E-08	3.E-07
						Total Risk Across All Media and All Exposure Routes	3.E-07

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