REVISED REMEDIAL ACTION OPTIONS REPORT

FORMER KOPPERS TAR PLANT
AND WABASH ALLOYS SITE
Oak Creek, WI
FID # 241379050
BRRTS # 02-41-553761
Connell VPLE BRRTS # 06-41-560058
Beazer VPLE BRRTS # 06-41-561509

CITY OF OAK CREEK UTILITY CORRIDOR LOT 1
FID # 341074470
BRRTS # 02-41-561425
Beazer VPLE BRRTS # 06-41-561426

Prepared for:

Beazer

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Prepared by:

TETRA TECH

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July 2021

CERTIFICATION

"I, Michael R. Noel, hereby certify that I am a scientist as that term is defined in s. NR 712.03 (3), Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."

______________________________ July 1, 2021

Michael R. Noel, P.G. Date
Vice President, Principal Hydrogeologist

"I, James R. Dickson, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the requirements of ch. A-E 4, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Adm. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."

______________________________ July 1, 2021

James R. Dickson, P.E. Date
Principal Engineer

SECTION NO. AND TITLE PAGE NO.

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1.0 EXECUTIVE SUMMARY

A joint Remedial Action Options Report (RAOR) was prepared and submitted in January 2015 for the Former Koppers Tar Plant and Wabash Alloys site (Site) located in the City of Oak Creek, Milwaukee County, Wisconsin, on the western shore of Lake Michigan. The responsible parties that jointly submitted the 2015 RAOR are Beazer East Inc. (Beazer) and Connell Aluminum Properties, LLC (Connell). The 2015 RAOR report was completed to satisfy the Voluntary Party Liability Exemption (VPLE) program needs by addressing all areas of concern (AOCs) identified in the January 14, 2014 Site Investigation Report.

In correspondence dated March 3, 2021, the DNR requested that Beazer prepare and submit a revised RAOR that presents an overall remedial strategy to address the known contamination at the Site and include the remedial actions proposed by the DNR in a May 15, 2018 matrix of remedial options for each area of the property. Whenever possible in this revised RAOR, remedial technologies consistent with the remedial options proposed in the DNR matrix were retained for use in the development of remedial alternatives, even when screening criteria would have ordinarily eliminated the technology. Unlike the January 2015 RAOR, this revised RAOR is limited to addressing coal tar-related impacts (PAHs and VOCs). This revised RAOR does not include the portion of remedial work that Connell is responsible for (PCB and metal impacts), although implementation of any remedial action will take the cooperation and coordination of both parties.

The purpose of the evaluation process described in this RAOR is to determine which remedial action option constitutes the most appropriate technology or combination of technologies to restore the environment, to the extent practicable, within a reasonable period of time and to minimize harmful effects to the air, land, or waters of the state, to address the exposure pathways of concern, and effectively and efficiently address the source of the environmental impact.

Based upon the Site conditions, Remedial Action Objectives (RAOs) for coal tar-related impacts were developed for the following media or migration/exposure pathway at the Site:

- **Soil**
    - Prevent direct contact with soil exceeding direct contact Residual Contaminant Levels (RCLs).
    - Prevent leaching of contaminants that may result in groundwater contamination in excess of groundwater RCLs.
    - Prevent potentially mobile tar-like dense non-aqueous phase liquid (DNAPL) from seeping to the ground surface or daylighting along the ravine bluff.
- **Groundwater**
    - Prevent potential potable use of impacted groundwater.
    - Restore groundwater to NR140 RCLs to the extent technically and economically feasible.
- **Utility Trenches**
    - Mitigate the potential for impacted groundwater migration along preferential pathways created by utility conduits and trenches.

- **Vapor Intrusion**
  - Prevent unacceptable vapor intrusion from impacted soil and groundwater into potential future occupied structures.
- **Ecological/Wetlands**
  - Restore and/or mitigate disturbance to wetlands in the eastern portion of the Wabash Parcel.

Based on the development and screening of general response actions and remedial technologies, remedial alternatives for coal tar-related impacts were developed for detailed evaluation. The alternatives evaluated included:

Site Wide Alternative:
- SW-1: Institutional Controls

Soil Alternatives:
- S-1: Soil Barrier
- S-2: Impermeable Cover
- S-3: Soil Excavation with Off-Site Disposal
- S-4: Soil Excavation with High-Temperature Thermal Desorption (HTTD)
- S-5: In-Situ Chemical Oxidation with Solidification (ISCO-ISS)
- S-6: In-Situ Soil Stabilization/Solidification (ISS)
- S-7: In-Situ Thermal Desorption (ISTD)

Groundwater Alternatives:
- GW-1: Monitored Plume Stability (MPS)
- GW-2: Funnel & Gate In-Situ Treatment
- GW-3: Groundwater Extraction & Treatment
- GW-4: Containment with In-Situ Treatment

Utility Trench Alternatives:
- UT-1: Trench Plug
- UT-2: In-Situ Treatment
- UT-3: Groundwater Extraction & Treatment

Vapor Intrusion Alternative:
- VI-1: Institutional Controls

The recommended combination of alternatives for Site remediation for coal tar-related impacts includes:
- Alternative SW-1: Institutional Controls
- Alternative S-1: Soil Barrier
- Alternative S-6C: In-Situ Soil Stabilization/Solidification (ISS) (0-6 Ft)
- Alternative GW-1: Monitored Plume Stability
- Alternative UT-1: Trench Plugs
- Alternative VI-1: Institutional Control

2.0 BACKGROUND

2.1 General Information

This NR 722 revised Remedial Action Options Report (RAOR) evaluates remedial action options for the Former Koppers Tar Plant and Wabash Alloys site (Site) located in the City of Oak Creek, Milwaukee County, Wisconsin, on the western shore of Lake Michigan. The responsible party is Beazer East Inc. (Beazer). This revised RAOR is limited to addressing coal tar-related impacts.

2.1.1 Project Title and Report Purpose

Revised Remedial Action Options Report
Former Koppers Tar Plant and Wabash Alloys Site
FID #: 241379050
BRRTS#: 02-41-553761
Beazer VPLE BRRTS#: 06-41-561509

City of Oak Creek Utility Corridor Lot 1
FID # 341074470
BRRTS # 02-41-561425
Beazer VPLE BRRTS # 06-41-561426

2.1.2 Current Property Owners

Former Wabash Alloys Site:
Connell Aluminum Properties, LLC
Project Contact: Mr. Mike Kellogg
(919) 744-7522

City Utility Corridor Parcel:
City of Oak Creek
Project Contact: Mr. Larry Haskins
(414) 762-5105

2.1.3 Consultant

Tetra Tech, Inc.
175 N. Corporate Drive, Suite 100
Brookfield, WI 53045
Contact: Michael Noel, P.G.
(262) 792-1282

2.1.4 Site Location, Zoning and Land Use

The Site is located on the east side of 5th Avenue, south of E. Depot Road and west of Lake Michigan. The Site is comprised of two parcels:

- Wabash Alloys Parcel (Wabash Parcel):

  SW ¼ of the NW ¼, and the NW ¼ of the SW ¼
  Section 24, T5N, R22E
  9100 South 5th Avenue
  Oak Creek, Milwaukee County, Wisconsin
  Current Zoning: Agricultural
  Previous Land Use: Industrial
  Future Expected Land Use: Non-Residential

- City of Oak Creek Utility Corridor Lot 1 (City Parcel):

NW ¼ of the SW ¼
Section 24, T5N, R22E
9170 South 5th Avenue
Oak Creek, Milwaukee County, Wisconsin
Current Zoning: Institutional
Current and Future Expected Land Use: Restricted Access Utility Corridor

2.1.5 Location map

Figure 1 shows the general Site location within Milwaukee County. Figure 2 shows the subject parcels and property boundaries.

2.1.6 Geographic Position of Properties

The Wisconsin Trans Mercator (WTM) coordinates (meters) that define the approximate parcel corners, as determined from the WDNR Bureau of Remediation and Re-development web site are as follows:

Wabash Parcel

- Northwest Corner – 695,330; 269,610
- Southwest Corner – 695,330; 269,425
- Southeast Corner – 696,060; 269,535
- Northeast Corner – 696,046; 269,585

City Parcel

- Northwest Corner – 695,330; 269,425
- Southwest Corner – 695,330; 269,395
- Southeast Corner – 695,627; 269,395
- Northeast Corner – 695,656; 269,425

2.1.7 Definitions

- *Wabash Parcel* – Connell-owned 20-acre parcel where the Wabash Alloys facility operated and a majority of the Koppers plant historically operated.
- *City Parcel* – A 2-acre portion (Lot 1) of the Utility Corridor owned by the City of Oak Creek where a small portion of the Koppers plant historically operated.
- *Utility Corridor* - The entire City-owned property from 5th Avenue to Lake Michigan.
- *Depot Road* – Off-site road adjacent to north property line of Wabash Parcel.
- *Former Dupont Parcel* – Property south of Utility Corridor now owned by the City of Oak Creek.
- *Beazer VPLE properties* – Wabash and City Parcels
- *Site* - Includes both the Wabash Parcel and the City Parcel. Where it is important to distinguish environmental impacts located on a VPLE property from that located off, or migrated from the VPLE property, references to the Wabash Parcel, City Parcel, or Utility Corridor are used. These parcel and property boundaries are clearly identified on all figures. Throughout this RAOR, use of the terms “off-site” and “on-site” were avoided to reduce confusion.

- *Constituents of Potential Concern (COPCs)* – VOCs, PAHs and coal tar related to the former tar plant operations. PCBs and metals related to the former secondary aluminum smelting operations of Wabash Alloys are not included in this revised RAOR.

2.2 Site Regulatory Status

The Site is regulated under the Voluntary Party Liability Exemption (VPLE) program. Beazer has enrolled two properties in the VPLE program including the 20-acre Wabash Parcel and a 2-acre portion of the Utility Corridor owned by the City of Oak Creek (City Parcel).

2.3 Summary of Geologic and Hydrogeologic Characteristics

The uppermost unit across much of the Site is comprised of silty clay and clay fill materials that typically range between 5 to 10 feet thick but can be up to 15 feet thick in some locations. The fill materials are more granular in some areas. Beneath the fill, the native unconsolidated materials in the Site vicinity consist of silty clay glacial sediments belonging to the Oak Creek and New Berlin Formations that extend to a depth of approximately 190 feet bgs, which, in turn, are underlain by Silurian dolomite. The depth to groundwater ranges from 1-3 feet bgs along the northern property line to as much as 12 feet bgs in the Utility Corridor. Groundwater flow at the water table generally mimics topography and is to the south toward the Utility Corridor and then turns east toward Lake Michigan. Deeper groundwater flow (50 feet bgs) is generally to the east toward the lake. The hydraulic conductivity averages 3.9E-04 cm/sec for the fill and/or fractured clay till and 3.4E-06 cm/sec for the unfractured clay till. For the shallow ground water, calculated flow velocities range between 5 to 100 feet per year. The lower annual flow velocity correlates better to observed groundwater plume maps. For the deep groundwater, the calculated groundwater flow velocity is less than one foot per year.

2.4 Summary of Nature and Extent of Environmental Impacts

Constituents of potential concern (COPCs) associated with the former coal tar plant include benzene, toluene, ethylbenzene, xylene, trimethylbenzenes (collectively, BTEXTM) and polyaromatic hydrocarbons (PAHs). Primary source areas occur in the vicinity of the former tar plant lagoon/ponds, tank farm and truck loading area. Non-industrial direct contact RCLs are exceeded for one or more compounds (primarily benzo(a)pyrene) across most of the Site. Groundwater RCLs in vadose zone soils is exceeded for PAH compounds (benzo(a)pyrene primarily and naphthalene in limited areas). Leaching of these relatively insoluble compounds in the vadose zone soils does not contribute materially to the magnitude of groundwater impacts in areas of observed DNAPL. Figures 3 through 7 present the areal extent of PAH-impacted soil across each four-foot depth interval. PAH results instead of BTEXTM results were used to define impacted soil volumes because BTEXTM-impacted soils have a smaller footprint within the PAH-impacted soil areas. Figures 8 through 12 present the areal extent of observed potentially mobile DNAPL in soil across each four-foot depth interval. Table 1 provides a summary of impacted soil volumes for all impacted soil and for the subset of DNAPL-impacted soil for each of the Site parcels (Wabash Parcel and Utility Corridor) and for the adjacent parcels (Depot Road to the north and Former Dupont Parcel to the south).

Observations of subsurface DNAPL at the Site are defined as “potentially mobile DNAPL”. This is because, under static and undisturbed conditions, the capillary pressure of DNAPL is not high enough to exceed groundwater pore entry pressure, creating a condition whereby DNAPL is not expected to displace groundwater or migrate. Therefore, under such static undisturbed conditions, the DNAPL footprint is expected to be immobile. A disturbance to the static condition (a "dynamic" condition) may allow DNAPL to become mobile. For example, locating a newly-installed well's screened interval or a utility trench in or adjacent to an area of potentially mobile DNAPL may be sufficient to make a previously static condition dynamic and thereby make previously immobile DNAPL become mobile as the DNAPL begins moving toward the newly-created void space. Even so, observation of this type of induced mobility by DNAPL collection in a newly-installed well may not occur immediately. Rather, DNAPL mobility occurs at a micro-scale and requires enough time for the DNAPL to reach the void space, saturate the sand pack, and then sufficiently accumulate in the well before it will be observed.

DNAPL has been observed in Site monitoring wells with maximum product thickness observations ranging from 0.2 to 9 feet. Mobility/recoverability testing found that the amount of product that was able to be removed was minimal (< a few gallons) and, after purging, the product level recovery was very slow. The lack of accumulating DNAPL in several wells within the delineation areas and the low recovery of product to wells after bailing suggests that most of the DNAPL in the delineated area is immobile and not recoverable. Despite the long term (80+ years) presence of DNAPL below the water table, the horizontal and vertical extent of the dissolved groundwater plume is nearly coincident with the residual DNAPL source areas (Figure 13). The lack of horizontal and vertical migration of impacted groundwater is due to the low permeability of the native clay till. The maximum vertical extent of impacted soil and groundwater is less than 50 feet.

The Utility Corridor provides a preferential pathway for potential contaminated groundwater migration due to the more permeable backfill placed within the utility trenches. The City of Oak Creek constructed the Utility Corridor in the early 1970's. These initial construction activities included the installation of a 78-inch diameter stormwater sewer that was built through the former tar lagoon area associated with past tar distillation operations. Other utilities have been installed within the corridor over time including raw water lines, sanitary sewer mains and laterals, natural gas lines, overhead and buried electric lines and fiber optic line. The storm sewer trench is the deepest of the utilities installed along the corridor which creates a groundwater discharge zone along the storm sewer alignment and may serve as a preferential groundwater migration pathway downhill to the east. While impacted groundwater is present within the storm sewer trench, downgradient monitoring wells show the extent is limited (Figure 13) and that contaminants are not discharging to Lake Michigan.

3.0 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

3.1 Overview

The purpose of this section is to identify site-specific Remedial Action Objectives (RAOs), General Response Actions (GRAs), and specific technologies that may be appropriate for the identified RAOs and GRAs for the coal tar-related impacts at the Site. After development of the RAOs and GRAs, the identified remedial technologies are screened to eliminate those that are inappropriate for inclusion in specific integrated alternatives. The technologies identified that satisfy the RAO criteria and appear acceptable as components of final remedial actions will be retained for further evaluation and potential inclusion in remedial alternatives developed for the Site.

3.2 Remedial Action Objectives

Based upon the Site conditions, RAOs were developed for the following media and COPCs at the Site:

- **Soil**
  - Prevent direct contact with soil exceeding direct contact RCLs.
  - Prevent leaching of contaminants that may result in groundwater contamination in excess of groundwater RCLs.
  - Prevent potentially mobile DNAPL from seeping to the ground surface or daylighting along the ravine bluff.

- **Groundwater**
  - Prevent potential potable use of impacted groundwater.
  - Restore groundwater to NR140 RCLs to the extent technically and economically feasible.

- **Utility Trenches**
  - Mitigate impacted groundwater migration that may be occurring along preferential pathways created by utility conduits and trenches.

- **Vapor Intrusion**
  - Prevent unacceptable vapor intrusion from impacted soil and groundwater into potential future occupied structures.

- **Ecological/Wetlands**
  - Restore and/or mitigate disturbance to wetlands in the eastern portion of the Wabash Parcel.

3.3 General Response Actions

The remedial action options evaluation process involves the development of general response actions, followed by identification, screening, and selection of remedial technologies. The general response actions are broad classes of actions or remedies that will satisfy the remediation goals. Available technologies and process options that correspond to the general response actions are identified and screened in sections 3.4 and 3.5. The following general response actions have been identified for coal tar-related impacts:

- Institutional controls, which involve the creation and implementation of responsibilities for restricting public and environmental contact with Site COPCs.
- Containment, which involves physical restrictions on direct contact with Site COPCs, their mobility, and water infiltration.
- Removal, which involves the direct physical removal of impacted media or source areas.
- Treatment, which involves on-site and/or off-site measures to reduce toxicity, mobility, and volume of the impacted materials.
- Discharge or Disposal, which involves measures to relocate impacted materials in such a way as to reduce their interaction with the public and the environment.

3.4 Identification of Technologies and Process Options

Table 2 lists the potential treatment technologies and corresponding process options for environmental media or migration/exposure pathway. The technologies and process options listed in these tables were selected based on the fate and transport characteristics of the COPCs identified in each medium and on the applicability of a given technology or process option to a specific medium. In addition, remedial actions proposed by the DNR in a May 15, 2018 matrix of remedial options (Appendix A) were also included. This included on-site and in-situ treatment technologies applied to all impacted soil and to DNAPL impacted soil for each area of the Site including the adjacent Former Dupont Parcel and Depot Road.

3.5 Initial Screening of Technologies and Process Options

An initial screening of remedial technologies was conducted to identify remedial action options for further evaluation that are reasonably likely to be feasible for the Site based on the coal tar-related COPCs present, media affected and Site characteristics. Table 2 describes the process options and applicable areas of concern and summarizes the technology screening process for the options. A description of each process option is included in the table to provide an understanding of each option and to assist in the evaluation of each option's technical effectiveness and implementability. The screening comments address the technical feasibility and the ability of a given process option to serve its intended purpose. The screening comments include a statement as to whether each process option was determined to be potentially applicable or was rejected. The technologies and process options that cannot be effectively implemented at the Site were screened out using the most current Site information such as COPC types and concentrations and Site characteristics. On-site and in-situ soil options consistent with the options identified in the 2018 DNR matrix were retained for use in remedial alternatives despite effectiveness and implementability issues. The evaluation of the process options based on technical effectiveness, implementability and cost is summarized in Table 2. Those process options that were retained after the evaluation were used in the development of the remedial alternatives presented in Section 4.0.

3.6 Retained Technologies and Process Options for Site Wide Application

3.6.1 Institutional Controls

Institutional controls to include continuing obligations, ordinances, or zoning rules acceptable to authorities having jurisdiction are to be applied site wide in conjunction with other selected alternatives include the following:

- Access restrictions limiting future use of the Site to non-residential uses and establishing a post-closure plan for managing residual soil that may be excavated and/or removed in the future.
- A soil management plan establishing a continuing obligation for the Site outlining the procedures and requirements for management of any future soil disturbance or excavation at the Site.
- Land use restrictions to prevent installation of drinking water wells at the Site and other areas of impacted groundwater to prevent the use of impacted groundwater as source of drinking water.
- Controls to maintain undisturbed wetland areas.
- Requirements to install groundwater migration barriers along future utility trenches that may be installed below the water table at the Site and in other areas of impacted groundwater. The required barrier would typically include construction of an impermeable clay or bentonite dike around the exterior of the utility pipe to block potential migration along the utility trench.
- Requirements to install vapor mitigation systems for any potential future occupied structures constructed at the Site and over other areas of residual soil and impacted groundwater that have the potential for volatilization.

To ensure the durability of institutional controls, the preparation of a verification plan, inspection of properties and annual verifications that the restrictions remain in place and are being adhered to will be required.

3.7 Retained Technologies and Process Options for Soil

Table 2 provides a list of retained technologies and process options for impacted soil. The following sections describe the retained technologies and process options in greater detail. Technologies and process options from the retained list were used to assemble the alternatives in Section 4.0.

3.7.1 No Action

The no action option was carried forward as potentially applicable for soils that exceed the protection of groundwater standard for the following reasons:

- The native clay till provides natural attenuation of constituents leaching from shallow vadose zone soils.
- The only VOC to exceed the groundwater protection standard was benzene, in only 2 of 61 samples.
- Several PAH compounds exceed the groundwater protection standard, however, the contribution to groundwater impacts from leaching is considered minimal compared to existing groundwater impacts and does not materially affect the stability of the plume.
- The no action option minimizes wetland area disturbance.

A separate alternative was not developed for the "No Action" option, but its application was used in evaluating the engineered soil barrier alternative (S-1).

3.7.2 Engineered Barrier

Potentially applicable engineered barriers include a 24-inch thick soil cover to prevent direct contact, an impermeable cover constructed of compacted clay or geomembranes to prevent direct contact and be protective of groundwater, and asphalt or concrete barriers that either already exist (e.g. road along Utility Corridor) or that may be constructed as part of any future redevelopment activities that would also serve to prevent direct contact and be protective of groundwater. Engineered barriers do not actively reduce source area concentrations, but work to minimize or prevent direct contact exposure to the affected soils and leaching to groundwater. A maintenance plan would also be required after the barrier is installed to inspect and repair damage to the barrier.

3.7.3 Excavation

This process option consists of excavating impacted soils for off-site disposal or on-site treatment. Excavated areas would require backfilling.

3.7.4 Disposal

This process option includes the disposal of excavated soils into a solid waste landfill. Based on the TCLP analysis of the soil indicating that the soil is non-hazardous, off-site disposal would likely be to an approved landfill. Excavated areas would require backfilling with imported clean fill.

3.7.5 On-Site Treatment with High-Temperature Thermal Desorption (HTTD)

This process option includes the on-site treatment of excavated soils to pre-approved clean-up levels using high-temperature thermal desorption. A thermal treatment plant would be built on site and operated continuously until all soil met the predetermined treatment objectives. While retained, this technology is unlikely to achieve reduction in constituent concentrations to below target levels. Excavated areas would be backfilled with treated soil and match exiting grades with offsite fill and topsoil due to organic losses.

3.7.6 In-Situ Chemical Oxidation with Solidification (ISCO-ISS)

The ISCO technology consists of treating the soils with a chemical oxidant or reductant through soil mixing. ISCO is different than in-situ geochemical stabilization (ISGS). ISGS requires injection of the reagent to encapsulate and geochemically stabilize NAPL globules. It does not work with soil mixing which would smear and blend globules in the soil. ISGS was screened out (Table 2) and determined not to be a viable technology due to the subsurface conditions at the Site where the clay soil matrix is not amenable to injection.

The objective of the ISCO application is to reduce constituent concentrations to below target levels through direct chemical reaction in contact with the soils. While retained, this technology is unlikely to achieve reduction in constituent concentrations to below target levels. This in-situ approach involves the application of chemical oxidant/reductant directly onto exposed soils using mechanical mixing. Mixing can be accomplished in-situ using excavators, large diameter (5-foot) augers or mechanical mixers to blend in oxidant. ISCO-treated soil would have a relatively high moisture content which will compromise the structural integrity of the mixed soil areas. Therefore, ISCO remediated soil areas would also require mixing in a solidification agent (ISS) to accommodate future land uses.

This alternative includes blending in PeroxyChem's Klozur® SP chemical oxidant with a Portland cement binder via soil mixing. The combined ISCO-ISS would be designed to remove the more soluble, mobile fraction of the contamination (lower molecular weight compounds) via chemical oxidation while cementing the remaining higher molecular weight fraction of the tar in place. The addition of cement was also intended to activate the Klozur SP by generating alkaline conditions, significantly improving the kinetics of the ISCO reactions.

3.7.7 In-Situ Solidification/Stabilization (ISS)

This process option consists of mixing soils with binding agents to solidify soil and further reduce potential DNAPL mobility to mitigate potential seepage and migration of DNAPL. Solidification would also reduce the leachability of COPCs from the soil. Mixing can be accomplished in-situ using excavators, large diameter (5-foot) augers or mechanical mixers to blend in potential binding agents such as Portland cement, blast furnace slag, fly ash, cement kiln dust, or bentonite.

3.7.8 In-Situ Thermal Desorption (ISTD)

This process option is an in-situ technology that heats soil through electrodes (electrical resistance heating (ERH)) or through heater wells (thermal conduction heating (TCH)). Multi-phase extraction (MPE) wells would be used to remove steam, VOC vapors, groundwater, and liquid hydrocarbons from the wells for treatment and disposal of extracted contaminants. ERH can achieve maximum temperatures of 100^{o} C and could remove the lighter end fractions (BTEXTM and some naphthalene). TCH can achieve maximum temperatures of $325\text{-}400^{o}$ C and could possibly remove the higher boiling point compounds (e.g., benzo (a) pyrene), but the soils would need to be dewatered to achieve those temperatures and a slurry wall would be required to prevent groundwater flow into the treatment area. Because of the high costs associated with the TCH technology, the ISTD alternative includes applying the ERH technology only. While retained, the ERH technology is unlikely to achieve reduction in constituent concentrations to below target levels.

3.8 Retained Technologies and Process Options for Groundwater

Table 2 provides a list of retained technologies and process options for groundwater. The following sections describe the retained technologies and process options in greater detail. The retained technologies and process options are assembled into alternatives in Section 4.0.

3.8.1 Groundwater Monitoring

This process option includes routine monitoring of groundwater to ensure the dissolved phase groundwater plume is not migrating or expanding. At least two years of quarterly sampling data would be required to demonstrate the stability of the groundwater plume.

3.8.2 Slurry Wall

This process option is a non-structural subsurface vertical cutoff wall constructed to prevent the horizontal movement of impacted groundwater. A shallow trench drain may need to be installed adjacent to and upgradient of the slurry wall to prevent mounding of groundwater behind the wall.

3.8.3 Aerobic Treatment Curtain

This process option involves the in-situ treatment of impacted groundwater as it passes through an aerobic treatment curtain (ATC) where aerobic biodegradation of VOCs and PAHs takes place along with VOC volatilization. This option could be used independently but more likely in conjunction with a slurry wall that would funnel groundwater through an ATC gate.

3.8.4 Groundwater Interception Trench

This process option includes constructing a trench backfilled with gravel to intercept the dissolved phase groundwater plume. Intercepted groundwater that collects in the trench would be extracted for subsequent treatment and discharge.

3.8.5 On-Site Treatment

This process option includes the on-site treatment of extracted groundwater. Applicable treatment technologies include air stripping and/or granular activated carbon with subsequent discharge.

3.8.6 Discharge

This process option includes the discharge of collected and treated water to the storm sewer under a WPDES permit or to the Milwaukee Metropolitan Sewerage District (MMSD) sanitary sewer under a MMSD pretreatment permit.

3.9 Retained Technologies and Process Options for Utility Trenches

Table 2 provides a list of retained technologies and process options for the utility trenches. The following sections describe the retained technologies and process options in greater detail. The retained technologies and process options are assembled into alternatives in Section 4.0.

3.9.1 No Action

This process option is potentially applicable if further investigation and monitoring demonstrate that COPC concentrations and/or migration potential are low enough that no further or minimal action is needed to prevent COPC migration.

3.9.2 Low Permeability Trench Plugs

This process option would include construction of a low permeability plug around the exterior of the utility pipe to block impacted groundwater migration along the utility trench. The plug would be installed by jet grouting with a compatible expanding urethane of similar product injected through the walls of the pipe. DNAPL collection sumps and nested monitoring wells would be included to ensure the plugs are directing DNAPL to the sumps for collections and controlling groundwater levels upstream. Approval and coordination with the Oak Creek Sewer and Water Utility and other utility companies would be required to ensure no damage would occur to existing infrastructure and does not include any structural repairs to the existing pipe that may be required upon inspection prior to implementation of this option. This option includes monitoring of well nests and DNAPL accumulation in the sumps at the following frequency:

- Year 1-2: Quarterly Monitoring
- Year 3-5: Semiannual Monitoring
- Years 6-15: Annual Monitoring
- Years 16-30: Biannual Monitoring

For the purpose of this report, annual removal of accumulated DNAPL on average has been assumed.

3.9.3 Groundwater Extraction

This process option includes extracting groundwater from wells, or a permeable trench installed along utility trenches and within or at the downgradient extent of impacted groundwater. Extracted groundwater would require subsequent treatment and discharge.

3.9.4 On-Site Treatment

This process option includes the on-site treatment of extracted groundwater. Potentially applicable treatment technologies include air stripping and/or granular activated carbon with subsequent discharge.

3.9.5 Aerobic Treatment Curtain

This process option involves the in-situ treatment of groundwater as it passes through an ATC where aerobic biodegradation of VOCs and PAHs takes place along with VOC volatilization. This option would include construction of air sparge wells within utility trenches and within or at the downgradient extent of impacted groundwater that would be used to introduce air to the groundwater to aerobically degrade COPCs. Approval and coordination with the Oak Creek Sewer and Water Utility and other utility companies would be required to ensure no damage would occur to existing infrastructure.

3.9.6 Discharge

This process option includes the discharge of collected and treated water to the storm sewer under a WPDES permit or to the Milwaukee Metropolitan Sewerage District (MMSD) sanitary sewer under an MMSD pretreatment permit.

3.10 Retained Technologies and Process Options for Vapor Intrusion

Table 2 provides a list of retained technologies and process options for vapor intrusion. The following sections describe the retained technologies and process options in greater detail. The retained technologies and process options are assembled into alternatives in Section 4.0.

3.10.1 Institutional Controls

As stated in Section 3.6.1, Site wide institutional controls to be applied in conjunction with other remedial alternatives include requirements to install vapor mitigation systems for any potential future occupied structures constructed at the Site and over other areas of impacted residual soil and groundwater that have the potential for volatilization. It has been assumed that the responsibility for installing and monitoring the vapor mitigation system would be on the developer or owner of the property at the time of construction of any future occupied structures, so no costs have been included.

4.0 DEVELOPMENT AND ANALYSIS OF REMEDIAL ALTERNATIVES

4.1 Introduction

This section presents a more detailed description and analysis of the remedial alternatives selected for further evaluation as part of the initial screening presented in Section 3.0. This analysis assesses each remedial alternative against a set of evaluation criteria outlined in NR722. This evaluation process was used to determine which remedial action option constitutes the most appropriate technology or combination of technologies to restore the environment, to the extent practicable, within a reasonable period of time and to minimize harmful effects to the air, land, or waters of the state, to address the exposure pathways of concern, and effectively and efficiently address the source of the environmental impact.

4.2 Evaluation Criteria

In accordance NR722, the evaluation included an assessment and comparison of the technical and economic feasibility of various options.

4.2.1 Technical Feasibility

The technical feasibility of each remedial action option was evaluated based on long- and short-term effectiveness, implementability, and restoration time frame as summarized below:

- Long-term effectiveness
    - Degree to which the toxicity, mobility and volume of the contamination is expected to be reduced;
    - Degree to which a remedial action option, if implemented, will protect public health, safety, and welfare and the environment over time.
- Short-term effectiveness
    - Considers adverse impacts on public health, safety, or welfare or the environment that may be posed during the construction and implementation period.
- Implementability
    - Technical feasibility of constructing and implementing the remedial action option at the Site given the type of contaminants and hydrogeologic conditions present;
    - Availability of materials, equipment, technologies, and services needed to conduct the remedial action option;
    - Potential difficulties and constraints associated with on-site construction or off-site disposal and treatment;
    - Difficulties associated with monitoring the effectiveness of the remedial action option;
    - Administrative feasibility of the remedial action option, including activities and time needed to obtain any necessary licenses, permits or approvals;
    - Presence of any federal or state, threatened or endangered species;
    - Technical feasibility of recycling, treatment, engineering controls or disposal;
    - Technical feasibility of naturally occurring biodegradation at the site or facility, if responsible parties evaluate this option;
    - Redevelopment potential of the site once the remedy has been implemented;
    - Reduction of greenhouse gases consistent with federal or state climate action policies.

- Restoration timeframe, taking into account
    - o Proximity of contamination to receptors;
    - o Presence of sensitive receptors;
    - o Presence of threatened or endangered species or habitats, as defined by state and federal law;
    - o Current and potential use of the aquifer, including proximity to private and public water supplies and surface water bodies;
    - o Magnitude, mobility, and toxicity of the contamination;
    - o Geologic and hydrogeologic conditions;
    - o Effectiveness, reliability, and enforceability of continuing obligations;
    - o Naturally occurring biodegradation processes at the Site;
    - o Degradation potential of the compounds.

4.2.2 Economic Feasibility

The economic feasibility of each remedial action option was evaluated using the following criteria:

- Capital costs, including both direct and indirect costs;
- Initial costs, including design and testing costs;
- Annual operation and maintenance costs;
- Total present worth of the costs;
- Costs associated with potential future liability.

4.3 Description and Evaluation of Remedial Alternatives

This section describes the development of the preliminary remedial action options along with an evaluation of each option in comparison to the evaluation criteria outlined in Section 4.2 above. Remedial alternatives have been developed for each media or migration/exposure pathway separately to reduce the number of possible permutations of site-wide remedial alternatives. One alternative for each medium should be implemented at the Site to provide the most adequate degree of protection to human health and the environment and attainment of the Remedial Action Objectives.

One site-wide remedial alternative (SW-1); seven remedial alternatives for soil (S-1, S-2, S-3, S-4, S-5, S-6 and S-7); four remedial alternatives for groundwater (GW-1, GW-2,GW-3, and GW-4); three remedial alternatives for utility trenches (UT-1, UT-2 and UT-3) and one remedial alternative for vapor intrusion (VI-1) have been assembled from the technologies and process options that were retained from the technology screening process. The alternatives evaluated include:

Site-Wide Alternative:

- SW-1: Institutional Controls

Soil Alternatives:

- S-1: Soil Barrier
- S-2: Impermeable Cover
- S-3: Excavation with Off-Site Disposal
- S-4: Excavation with On-Site High-Temperature Thermal Desorption (HTTD) Treatment

- S-5: In-Situ Chemical Oxidation with Solidification (ISCO-ISS)
- S-6: In-Situ Stabilization/Solidification (ISS)
- S-7: In-Situ Thermal Desorption (ISTD)

Groundwater Alternatives:
- GW-1: Monitored Plume Stability (MPS)
- GW-2: Funnel & Gate In-Situ Treatment
- GW-3: Groundwater Extraction & Treatment
- GW-4: Containment with In-Situ Treatment

Utility Trench Groundwater Alternatives:
- UT-1: Trench Plug
- UT-2: In-Situ Treatment
- UT-3: Groundwater Extraction & Treatment

Vapor Intrusion Alternative:
- VI-1: Institutional Controls

4.3.1 Alternative SW-1: Site Wide Institutional Controls

4.3.1.1 Description

This alternative would include institutional controls for the following:
- Access restrictions limiting future use of the Wabash Parcel to non-residential uses and establishing a post-closure plan for managing residual soil that may be excavated and/or removed in the future.
- A soil management plan establishing a continuing obligation for the Site outlining the procedures and requirements for management of any future soil disturbance or excavation at the Site.
- Land use restrictions to prevent installation of drinking water wells at the Site and other areas of impacted groundwater to prevent the use of impacted groundwater as source of drinking water.
- Controls to maintain undisturbed wetland areas.
- Requirements to install groundwater migration barriers along future utility trenches that would be installed below the water table at the Site and in other areas of contaminated groundwater. The required barrier would typically include construction of an impermeable clay or bentonite dike around the exterior of the utility pipe to block potential migration along the utility trench.
- Requirements to install vapor mitigation systems for any potential future occupied structures constructed at the Site and over other areas of residual soil and impacted groundwater that have the potential for volatilization.

4.3.1.2 Detailed Evaluation

Long-term effectiveness

This alternative does not reduce the toxicity, mobility, or volume of COPCs, however:

- Limiting land use to non-residential purposes only decreases potential exposure opportunities to more sensitive populations.
- Procedures and requirements for management of any future soil disturbance or excavation at the Site decreases potential exposure to Site workers.
- Placing a restriction on groundwater use eliminates potential exposure to impacted drinking water and is therefore protective of public health, safety, and welfare.
- Placing continuing obligations on the property to require the installation of groundwater migration barriers along future utilities constructed through areas of affected groundwater eliminates the creation of possible migration pathway and is therefore protective of public health, safety, and welfare.
- Placing continuing obligations on the property to require the installation of a vapor mitigation system beneath the construction of any future occupied structure is protective of public health, safety, and welfare by eliminating the potential vapor intrusion pathway.

Short-term effectiveness
There would be no adverse impacts on public health, safety, or welfare or the environment by implementing this institutional control.

Implementability
The current owner of the Wabash Parcel (Connell) intends to place continuing obligations on the property to restrict groundwater use, limit future land use to non-residential, require the installation of groundwater migration barriers along future utilities, and to require the installation of a vapor mitigation system beneath the construction of an occupied structure. The Utility Corridor is currently zoned institutional and will remain a utility corridor and access for the Oak Creek Sewer and Water Utility's water intake facility.

Restoration Time Frame
The continuing obligation of an institutional control is immediately effective, reliable, and enforceable.

Economic Feasibility
Appendix SW-1 presents a detailed cost analysis for Alternative SW-1. In summary, capital costs including legal and administrative are estimated to be $25,000 for institutional controls. OM&M costs are estimated at a 30-year net present value (NPV) of $26,035 for a total cost estimate of $51,035 for Alternative SW-1.

4.3.2 Alternative S-1: Soil Barrier

4.3.2.1 Description

This alternative includes a soil cover to eliminate direct contact with PAHs (primarily benzo(a)pyrene) that exceed the non-industrial direct contact residual contaminant level (0.02 mg/kg). The dermal contact barrier would be comprised of a 2-foot thickness of clean soil placed over the area of impacted soil that exceeds direct contact RCLs. The soil cover would be graded for proper control of storm water run-off. The upper 3 to 6 inches of the 2-foot cover would be comprised of topsoil with established vegetation to prevent erosion and deterioration of the cover. Figure 14 shows the area of the dermal contact barrier over affected areas of the Site. The paved road in the Utility Corridor serves as a component of the dermal contact barrier. The surface area of the soil cover for the combined Wabash and City Parcels is approximately 910,115 square feet or approximately 21 acres. The volume of soil needed for a 2-foot thick cover would be 67,415 cubic yards (yds^3). This alternative does not include a barrier over affected wetlands soils, which are addressed below by other soil remedial alternatives.

Continuing obligations for the dermal cover would include regular inspections and a maintenance program, including the regular repair and/or replacement of any eroded or deteriorated areas, to ensure its long-term effectiveness. The maintenance plan would prohibit activities that may disturb the dermal cover or change the condition of the cover without prior written WDNR approval. Additionally, note that Alternative SW-1 includes a soil management plan establishing a continuing obligation for the Site outlining the procedures and requirements for management of any future soil disturbance or excavation at the Site.

4.3.2.2 Detailed Evaluation

Long-term effectiveness

Placing a dermal contact barrier over the soils with benzo(a)pyrene) concentrations that exceed the direct contact residual contaminant level does not lessen toxicity or volume of COPCs, but it does mitigate mobility. The cover reduces the mobility of constituents in the soil by eliminating potentially impacted runoff. The vegetated soil layer also reduces the amount of infiltration through evapotranspiration which in turn reduces the production of leachate.

This alternative would be protective of public health, safety and welfare and the environment. The covering of impacted soil would reduce risk to public health by direct contact and soil ingestion.

Short-term effectiveness

Short-term risks to the community associated with implementation of the remedy involve health and safety risks to those living around the Site. Community impacts include increased dust/exhaust, noise and traffic congestion from construction and truck traffic. These can be mitigated through conventional health and safety measures as well as controlling daily working hours and days of operation. Risks to on-site workers include inhalation of dust and direct contact with impacted soils during excavation and grading activities. These are easily controlled through conventional dust control and health and safety measures.

Short term risks to the environment include potential release of COPCs through off-site run-off during excavation and grading activities. These can be mitigated through readily available erosion/sedimentation control features such as silt fences. Short-term risks to the environment also include disruption of animal habitat through necessary clearing of brush and trees and construction of a cover over the impacted soil area. Disruptive activities would be limited when possible and would take place only during implementation of the remedy. The dermal cover would be revegetated providing healthy wildlife habitats.

Implementability

This alternative is technically straight forward to construct and was recently completed for the Former DuPont Parcel to the south of the Site. The equipment and services needed to construct the dermal barrier are readily available. Approximately 25,000 cubic yards of clean soil were imported to the Site in 2016 for use as a soil cover, but due to lack of availability, there may be some difficulty in obtaining the remaining quantity of required imported soil (over 40,000 cubic yards). Imported soil will need to be sampled and approved by WDNR prior to bringing on Site. The soil cover will need to be properly graded to promote directed stormwater runoff. Future redevelopment over the soil cover would need to comply with the cover maintenance requirements and soil management plan.

Restoration Time Frame
The construction of the dermal contact barrier could be completed in a few months providing a restored surface soil environment that is protective of public health and the environment. Continuing obligations for the property owner would include maintenance of the barrier and adherence to a soil management plan which are effective, reliable, and enforceable institutional controls.

Economic Feasibility
Appendix S-1 presents a detailed cost analysis for Alternative S-1. In summary, capital costs including engineering and contingency are estimated to be $2,654,469 for the dermal contact barrier. OM&M costs are estimated at a 30-year net present value (NPV) of $26,035 for a total cost estimate of $2,680,504 for Alternative S-1.

4.3.3 Alternative S-2: Impermeable Cover

4.3.3.1 Description

This alternative is the same as Alternative S-1 except the engineered barrier would be constructed of an impermeable cover that would not only serve as a dermal contact barrier but would also limit infiltration and thereby minimize the leaching of COPCs in soil to groundwater. The impermeable cover would be comprised of a geomembrane infiltration barrier. It is assumed that a soil barrier layer beneath the geomembrane would not be needed if the surface soil being covered is properly graded and free of objects that could penetrate the geomembrane. A 2-foot thick soil cover would be placed over the geomembrane infiltration barrier to provide rooting depth for vegetation and to protect the geomembrane layer from freeze-thaw damage and other environmental effects. The dimensions of the impermeable cover would be the same as those for the dermal cover and is shown in Figure 14.

4.3.3.2 Detailed Evaluation

Long-term effectiveness
Placing an impermeable cover over the impacted soils does not lessen toxicity or volume of COPCs, but it does mitigate their mobility. The cover reduces the mobility of COPCs in the soil by eliminating potentially impacted runoff. The cover also eliminates infiltration and the production of leachate.

This alternative would be protective of public health, safety and welfare and the environment. The covering of the impacted soil would reduce risk to public health by direct contact and soil ingestion.

Short-term effectiveness
Short-term risks to the community associated with implementation of the remedy involve health and safety risks to those living around the Site. Community impacts include increased dust/exhaust, noise and traffic congestion from construction and truck traffic. These can be controlled through conventional health and safety measures as well as controlling daily working hours and days of operation. Risks to on-site workers include inhalation of dust and direct contact with impacted soils during excavation and grading activities. These are easily controlled through conventional dust control and health and safety measures.

Short term risks to the environment include potential release of COPCs through off-site run-off during excavation and grading activities. These can be controlled through readily available erosion/sedimentation control features such as silt fences. Short-term risks to the environment also include disruption of animal habitat through necessary clearing of brush and trees and construction of a cover over the impacted soil area. Disruptive activities would be limited when possible and would take place only during implementation of the remedy. The impermeable cover would be revegetated providing healthy habitats for wildlife.

Implementability
This alternative is technically straight forward to construct. Installation of a geomembrane requires contractors to properly install the geomembrane according to manufacturer's instructions. The equipment and services needed to construct the impermeable cover are readily available, but there may be some difficulty in obtaining the quantity of required imported soil (over 65,000 cubic yards). Imported soil will need to be sampled and approved by WDNR prior to bringing on site. The soil cover will need to be properly graded to promote directed stormwater runoff. Future redevelopment over the impermeable cover would need to comply with the cover maintenance requirements and soil management plan.

Restoration Time Frame
The construction of an impermeable cover could be completed in a few months providing a restored surface soil environment that is protective of public health and the environment. Continuing obligations for the property owner would include maintenance of the cover and adherence to a soil management plan which are effective, reliable, and enforceable institutional controls.

Economic Feasibility
Appendix S-2 presents a detailed cost analysis for Alternative S-2. In summary, capital costs including engineering and contingency are estimated to be $6,086,369 for the land use restrictions and impermeable cover. OM&M costs are estimated at a 30-year NPV of $26,035 for a total cost estimate of $6,112,404 for Alternative S-2.

4.3.4 Alternative S-3: Excavation & Off-Site Landfill Disposal

4.3.4.1 Description
This alternative consists of excavation of impacted soil to remove on-site contamination for off-site landfill disposal; collection of confirmation samples at the base of excavations; and backfilling excavations with clean soil. Based on the TCLP analysis of the soil indicating that the soil is non-

hazardous, off-site disposal would be to an approved sanitary landfill; provided, however, WDNR has yet to concur in Beazer's proposed regulatory determination that excavated soil remediation material is not a listed hazardous waste. Disturbed wetland areas would be restored or filled with clean soil. The WDNR Wetlands Program has confirmed that the wetlands can be disturbed to clean-up the contamination, with required wetland permits and possible mitigation credits. Soil excavation in the vicinity of buried utilities would require approval and coordination with the City of Oak Creek Water and Sewer Utility and other utility companies.

The impacted areas for each 4-foot depth interval are shown on Figures 3 to 7 for all impacted soil and in Figures 8 to 12 for the subareas of impacted soil containing DNAPL. The area, volume, and tonnage of all impacted soil and DNAPL impacted soil for each interval is provided in Table 1 for each of the Site parcels (Wabash Parcel and Utility Corridor) and for the adjacent off-site parcels (Depot Road to the north and Former Dupont Parcel to the south).

Alternative S-3 includes four options: all impacted soil (S-3A), DNAPL soil to full depth (S-3B), DNAPL soil to depth of 6 ft (Figure 15) (S-3C), and all soil to depth of 4 ft (S-3D) as an alternative to soil capping (S-1). Options S-3A, S-3B and S-3D are included in the DNR May 2018 matrix of options. Option S-3C was added as a viable option to achieve the remedial action objectives.

Soil Volume (CY)	S-3A	S-3B	S-3C	S-3D
	All Soil	DNAPL Soil	DNAPL Soil (0-6')	Cover (0-4')
Wabash Parcel	327,524	79,742	16,221	134,831
Utility Corridor	45,491	4,775	1,143	NA
Depot Road	6,651	0	0	NA
Former Dupont Parcel	2,160	284	120	NA
All Parcels	381,826	84,801	17,484	134,831

4.3.4.2 Detailed Evaluation

Long-term effectiveness

This alternative would achieve reduction of mobility, volume, and toxicity for excavated materials that are subject to off-site disposal.

This alternative would be protective of public health, safety and welfare and the environment. The removal and off-site disposal of impacted surface soil and tar would eliminate the risk to public health by direct contact and soil ingestion. The removal and off-site disposal of DNAPL in the surface soil eliminates the potential for DNAPL seepage to the ground surface, reduces the mobility of COPCs in the soil by eliminating potentially impacted runoff, and also eliminates the production of leachate from the COPCs contained in the removed subsurface soil.

Short-term effectiveness

This alternative would be effective over the short term. Waste excavation and off-site transportation and disposal work is predominantly conducted using conventional, heavy construction equipment. There would be some specialized equipment required for excavating within the Utility Corridor, but the quantity of excavated soil would be limited in comparison to other contaminated areas.

Some direct entry of personnel into deeper excavation areas, while in progress, would be required for periodic tasks, such as excavation, dewatering system installation, surveying, and confirmatory soil sampling. Risks to on-site workers include inhalation of dust and vapor and direct contact with impacted soils during excavation and grading activities. These are easily controlled through conventional dust and odor control and health and safety measures. It is anticipated that most of the work could be conducted using Level D and modified Level D personnel protection. Level C may also be required for work performed inside deeper excavations, where health and safety breathing zone air quality measurements may trigger the need for respiratory protection.

Short-term risks to the community associated with implementation of the remedy involve health and safety risks to those living around the Site. Community impacts would include increased dust/exhaust, noise and traffic congestion from construction and truck traffic. While these can be mitigated through conventional health and safety measures as well as controlling daily working hours and days of operation the amount of truck traffic would be significant as shown in the table below. Trucks hauling soil for disposal would not likely return with clean soil for backfill, so the amount of truck traffic would be double that reported in the table. Conventional traffic controls for waste transport, such as defining specific travel routes to/from the Site for waste transportation vehicles and coordinating waste shipments to avoid peak traffic hours, would be used to minimize the potential for accidents.

Truck Loads	S-3A	S-3B	S-3C	S-3D
	All Soil	DNAPL Soil	DNAPL Soil (0-6’)	All Soil (0-4')
Wabash Parcel	21,835	5,316	1,081	8,989
Utility Corridor	3,033	318	76	NA
Depot Road	443	0	0	NA
Former Dupont Parcel	144	19	8	NA
All Parcels	25,455	5,653	1,166	8,989

Short term risks to the environment include potential release of COPCs through dust and off-site run-off during excavation and grading activities. Conventional engineering controls would be used to prevent contaminated materials from migrating with runoff water or becoming airborne during construction. Short-term risks to the environment also include disruption of animal habitat through necessary clearing of brush and removal of soil in the excavation area. Disruptive activities would be limited when possible and would take place only during implementation of the remedy. The excavations would be backfilled with clean soil and revegetated providing healthy habitats for wildlife.

Implementability

This alternative is technically and administratively implementable. Construction and off-site disposal can be conducted using conventional heavy-construction equipment and services, which are readily available in the commercial market, but due to lack of availability, there would likely be difficulty in obtaining the quantity of required imported soil to backfill the excavations for the S-3A (381,826 cy), S-3B (84,801cy) and S-3D (162,979 cy) options. Related to the amount of truck traffic, this alternative would generate greenhouse gases orders of magnitude more than any other alternative. Imported soil will need to be sampled and approved by WDNR prior to bringing on Site. The backfilled areas will need to be properly graded to promote directed stormwater runoff. The WDNR Wetlands Program has confirmed that the wetlands can be disturbed to clean-up the contamination, with required wetland permits. Disturbed wetlands would either be restored or compensated using the Wisconsin Wetland Conservation Trust (WWCT), an in-lieu fee program that allows permittees to purchase credits in exchange for satisfying compensatory mitigation requirements for state and federal wetland permits.

Restoration Time Frame

The work weeks required for the different options and parcels are summarized in the table below. Work could not be performed during the colder 6-month period from late fall to early spring. Depending on the quantity of material to be excavated and, this alternative would take up to five years to complete.

Timeframe (work weeks) *	S-3A	S-3B	S-3C	S-3D
	All Soil	DNAPL Soil	DNAPL Soil (0-6’)	All Soil (0-4')
Wabash Parcel	131	22	6	NA
Utility Corridor	18	1	1	NA
Depot Road	3	0	0	NA
Former Dupont Parcel	1	1	1	NA
All Parcels**	153	22	7	54

* Excludes mob/demob and downtime during non-construction season winter months.

** Less than the sum of the parts due to efficiencies gained by concurrent performance at all parcels.

Economic Feasibility

Appendix S-3 presents a detailed cost analysis for Alternative S-3 and its options. A summary of total cost is provided in the table below:

Cost	S-3A	S-3B	S-3C	S-3D
	All Soil	DNAPL Soil	DNAPL Soil (0-6’)	All Soil (0-4')
Wabash Parcel	$45,476,166	$10,539,180	$2,142,764	NA
Utility Corridor	$6,045,081	$687,296	$190,652	NA
Depot Road	$918,796	$0	$0	NA
Former Dupont Parcel	$329,536	$79,420	$54,474	NA
All Parcels	$52,617,797	$11,237,393	$2,299,926	$16,189,641

4.3.5 Alternative S-4: Excavation & High-Temperature Thermal Desorption (HTTD)

4.3.5.1 Description

This alternative consists of excavation of impacted soil with on-site treatment using HTTD to achieve pre-approved clean-up levels and replacement of soil back into the excavations. While retained, this technology is unlikely to achieve reduction in constituent concentrations to below target levels. If post-treatment concentrations are above direct contact RCLs, two feet of clean soil cover would need to be added. Disturbed wetland areas would be restored or filled with clean soil. The WDNR Wetlands Program has confirmed that the wetlands can be disturbed to clean-up the contamination, with required wetland permits. Disturbed wetlands would either be restored or compensated using the WWCT, an in-lieu fee program that allows permittees to purchase credits in exchange for satisfying compensatory mitigation requirements for state and federal wetland permits. Soil excavation in the vicinity of buried utilities would require approval and coordination with the City of Oak Creek Water and Sewer Utility and other utility companies.

To remain cost competitive in the remediation industry, providers of HTTD services no longer offer treatment with mobile units, but rather provide services at fixed-base treatment centers. There are no HTTD treatment locations near the site, however, manufacturers of HTTD equipment provide modular equipment that can be purchased to establish a fixed base treatment system. Therefore, this alternative would require the purchase, on-site assembly, and operation of an HTTD system. Pre-treatment would include screening the excavated contaminated soil to remove debris and to crush or shred oversize clumps of clay. Material would be stockpiled prior to treatment and blending of materials may be necessary to provide a uniform feed material suitable for treatment. If the material has a high moisture content, an initial drying step may be required, otherwise drying would need to be accounted for in the thermal treatment stage.

Treatment would include heating of the contaminated material to remove the volatile fraction from the soil and DNAPL (e.g., benzene and naphthalene) and render the DNAPL inert with respect to the ability to leach constituents to groundwater. Soils are heated indirectly in a rotary dryer with a treatment temperature of approximately 800^{o}F. Given the high boiling point of the higher molecular PAHs, higher temperatures than 800^{o}F may be required for total destruction. Off-gas would be collected and treated to remove dust particles and vapor emissions.

The impacted areas for each 4-foot depth interval are shown on Figures 3 to 7 for all impacted soil and in Figures 8 to 12 for the subareas of impacted soil containing DNAPL. The area, volume, and tonnage of all impacted soil and DNAPL impacted soil for each interval is provided in Table 1 for each of the Site parcels (Wabash Parcel and Utility Corridor) and for the adjacent off-site parcels (Depot Road to the north and Former Dupont Parcel to the south).

Alternative S-3 includes three options: all impacted soil (S-4A), DNAPL soil to full depth (S-4B), and DNAPL soil to depth of 6 ft (S-4C). Options S-4A and S-4B are included in the DNR May 2018 matrix of options for on-site treatment. Option S-4C was added as a lower cost option to achieve the remedial action objectives.

Soil Volume (CY)	S-4A	S-4B	S-4C
	All Soil	DNAPL Soil	DNAPL Soil (0-6’)
Wabash Parcel	327,524	79,742	16,221
Utility Corridor	45,491	4,775	1,143
Depot Road	6,651	0	0
Former Dupont Parcel	2,160	284	120
All Parcels	381,826	84,801	17,484

4.3.5.2 Detailed Evaluation

Long-term effectiveness

This remedy would reduce the volume and toxicity of COPCs and DNAPL in soil through volatilization and oxidation. While retained, this technology is unlikely to achieve reduction in constituent concentrations to below target levels. It is estimated that the HTTD process could remove much of the contaminant mass but may require more than one pass through the treatment system and still not achieve cleanup levels.

This alternative would be protective of public health, safety and welfare and the environment. The reduction in volume and toxicity of COPCs and DNAPL would reduce the risk to public health by direct contact and soil ingestion. The treatment would eliminate the potential for DNAPL seepage to the ground surface and reduce the production of leachate from the COPCs contained in the treated soil.

Short-term effectiveness

Short-term risks to the community associated with implementation of the remedy involve health and safety risks to those living around the Site. Community impacts include increased dust/exhaust, noise and traffic congestion from construction and truck traffic, and HTTD system emissions. These can be mitigated through conventional health and safety measures as well as controlling daily working hours and days of operation. Risks to on-site workers include inhalation of dust and vapor and HTTD system emissions, and direct contact with impacted soils during excavation and grading activities. These are easily controlled through conventional dust and odor control; monitoring and maintenance of off-gas controls; and health and safety measures.

Short term risks to the environment include potential release of COPCs through off-site run-off during excavation and grading activities. These can be mitigated through vapor emissions. These can be mitigated through readily available vapor control technologies such as oxidation or carbon. Short-term risks to the environment also include disruption of animal habitat through necessary clearing of brush and removal of soil in the excavation area. Disruptive activities would be limited when possible and would take place only during implementation of the remedy. The excavations would be backfilled with treated soil and revegetated providing healthy habitats for wildlife.

Implementability

This alternative would technically difficult to implement. The equipment would need to be purchased and assembled. The system would need to be winterized at the end of each construction season. Depending on treatment efficiency and approved clean-up level, some soil may require more than one pass through the treatment system. Related to the fuel source for the HTTD system, this alternative would generate a large quantity of greenhouse gases. The backfilled areas will need to be properly graded to promote directed stormwater runoff. The WDNR Wetlands Program has confirmed that the wetlands can be disturbed to clean-up the contamination, with required wetland permits. Disturbed wetlands would either be restored or compensated using the WWCT, an in-lieu fee program that allows permittees to purchase credits in exchange for satisfying compensatory mitigation requirements for state and federal wetland permits.

Restoration Time Frame

The work weeks required for the different options and parcels for this remedy are summarized in the table below. Work could not be performed during the colder 6-month period from late fall to early spring. Depending on the quantity of material to be excavated, treated, and backfilled it would require up to 13 years to complete the work.

Time Frame (work weeks) *	S-4A	S-4B	S-4C
	All Soil	DNAPL Soil	DNAPL Soil (0-6')
Wabash Parcel	293	72	15
Utility Corridor	41	5	2
Depot Road	7	0	0
Former Dupont Parcel	2	1	1
All Parcels**	342	76	16

* Excludes mob/demob and downtime during non-construction season winter months.

** Less than the sum of the parts due to efficiencies gained by concurrent performance at all parcels.

Economic Feasibility

Appendix S-4 presents a detailed cost analysis for Alternative S-4 and its options. A summary is provided in the table below:

Cost	S-4A	S-4B	S-4C
	All Soil	DNAPL Soil	DNAPL Soil (0-6')
Wabash Parcel	$45,160,785	$14,999,365	$4,590,347
Utility Corridor	$8,457,968	$3,684,786	$3,117,153
Depot Road	$3,739,028	$0	$0
Former Dupont Parcel	$3,208,829	$3,031,376	$3,004,738
All Parcels	$51,646,411	$15,325,120	$4,725,438

4.3.6 Alternative S-5: In-Situ Chemical Oxidation with Solidification (ISCO-ISS)

4.3.6.1 Description

This technology consists of treating the soils with a chemical oxidant or reductant through soil mixing. The objective of this approach is to reduce constituent concentrations to below target levels through direct chemical reaction in contact with the soils. While retained, this technology is unlikely to achieve sufficient reduction in constituent concentrations to below target levels. This in-situ approach involves the application of chemical oxidant/reductant directly onto exposed soils using mechanical mixing. Mixing can be accomplished in-situ using excavators, large diameter (5-foot) augers or mechanical mixers to blend in oxidant. The oxidizing agents most commonly used for treatment of tar-related constituents are hydrogen peroxide and permanganate. ISCO-treated soil would have a relatively high moisture content which will compromise the structural integrity of the mixed soil areas. Therefore, ISCO remediated soil areas would also require the addition during mixing of a solidification agent (ISS) to accommodate future land uses.

This alternative includes blending in PeroxyChem's Klozur® SP (sodium persulfate) chemical oxidant with a Portland cement binder via soil mixing. The combined ISCO-ISS would be designed to remove the more soluble, mobile fraction of the contamination (lower molecular weight compounds) via chemical oxidation while cementing the remaining higher molecular weight fraction of the DNAPL in place. The addition of cement was also intended to activate the Klozur SP by generating alkaline conditions, significantly improving the kinetics of the ISCO reactions. A bench scale treatability study would be required to evaluate dose response on leachability, soil strength, hydraulic conductivity, and contaminant destruction to determine dose rates.

If post-treatment concentrations are above direct contact RCLs, two feet of clean soil cover would need to be added. The WDNR Wetlands Program has confirmed that the wetlands can be disturbed to clean-up the contamination, with required wetland permits. Disturbed wetlands would either be restored or compensated using the WWCT, an in-lieu fee program that allows permittees to purchase credits in exchange for satisfying compensatory mitigation requirements for state and federal wetland permits. This alternative is not applicable to soils in the Utility Corridor because incompatible conduit, pipe or other underground materials could be damaged by the strongly oxidizing environment.

The impacted areas for each 4-foot depth interval are shown on Figures 3 to 7 for all impacted soil and in Figures 8 to 12 for the subareas of impacted soil containing DNAPL. The area, volume, and tonnage of all impacted soil and DNAPL impacted soil for each interval is provided in Table 1 for each of the Site parcels (Wabash Parcel and Utility Corridor) and for the adjacent off-site parcels (Depot Road to the north and Former Dupont Parcel to the south).

Alternative S-4 includes three options: all impacted soil (S-5A), DNAPL soil to full depth (S-5B), and DNAPL soil to depth of 6 ft (S-5C). Options S-5A and S-5B are included in the DNR May 2018 matrix of options for on-site treatment. Option S-5C was added as a lower cost option to achieve the remedial action objectives. In line with what was proposed in the May 4, 2021 Interim Action Work Plan, option S-5C includes an ISS barrier approximately 320 feet long to a depth of 20 feet along the north property line of the Utility Corridor in the area where potentially mobile DNAPL has been observed.

Soil Volume (CY)	S-5A	S-5B	S-5C
	All Soil	DNAPL Soil	DNAPL Soil (0-6')
Wabash Parcel	327,524	79,742	16,221
Utility Corridor	45,491	4,775	1,143
Depot Road	6,651	0	0
Former Dupont Parcel	2,160	284	120
All Parcels	381,826	84,801	17,484

4.3.6.2 Detailed Evaluation

Long-term effectiveness

The treatment of contaminants through oxidation and solidification would reduce the mobility of the contaminants present in the soil. This option will not significantly reduce the volume of constituents removed from the Site but will reduce some toxicity. It is anticipated that a reduction of approximately half of the total hydrocarbon mass could be achieved within the treated area. A significantly larger percent reduction would be achieved in the more soluble, lower molecular weight fractions such as benzene and naphthalene. The remainder would be bound up by the Portland cement activator/binding agent.

This alternative would be protective of public health, safety and welfare and the environment. The treatment and immobilization of impacted surface soil and DNAPL would reduce the risk to public health by direct contact and soil ingestion. The process will significantly reduce and potentially eliminate DNAPL mobility and exposure at the Site and reduce potential leaching of COPCs contained in the treated soil.

Short-term effectiveness

Short-term risks to the community associated with implementation of the remedy involve health and safety risks to those living around the Site. Community impacts include increased dust/exhaust, organic vapors/odors, noise, and traffic congestion from construction and truck traffic. These can be mitigated through conventional health and safety measures, controlling daily working hours and days of operation to minimize disturbances to the surrounding community, and air monitoring during remedial activities with application of engineering controls if organic vapors exceed safe exposure levels. Risks to on-site workers during implementation of this alternative would include construction hazards associated with soil mixing using heavy equipment and potential exposure through inhalation of dust and vapor and direct contact with impacted soils during soil mixing activities. These are easily controlled through conventional dust and odor control and health and safety measures.

Short term risks to the environment include potential release of COPCs through off-site run-off during soil mixing activities. These will be mitigated through required erosion/sedimentation control features such as silt fences. Short-term risks to the environment also include disruption of animal habitat through necessary clearing of brush and disturbance of soils in the excavation area. Disruptive activities would be limited when possible and would take place only during implementation of the remedy. The treated areas would be covered with a 2-foot soil cover and revegetated (costed separately under Alternative S-1) providing healthy habitats for wildlife.

Implementability

This alternative is somewhat difficult to implement as a two-step mixing process would be involved to blend in the oxidant and the binder. Soil mixing in the vicinity of buried utilities would be more difficult. Bench testing would be performed to establish the proper proportion of oxidant and binding agent. Soil mixing is a specialty service that would not likely be provided by a local contractor. The treated areas may increase in volume due to localized swell of the treated materials and will need to be properly graded to promote directed stormwater runoff and revegetated. Future redevelopment over the treated and solidified areas would need to comply with specified maintenance requirements, regulatory requirements, and soil management plan. The WDNR Wetlands Program has confirmed that the wetlands can be disturbed to clean-up the contamination, with required wetland permits. Disturbed wetlands would either be restored or compensated using the WWCT, an in-lieu fee program that allows permittees to purchase credits in exchange for satisfying compensatory mitigation requirements for state and federal wetland permits.

Restoration Time Frame
The work weeks required for the different options and parcels are summarized in the table below. Work could not be performed during the colder 6-month period from late fall to early spring. Depending on the quantity of material to be treated, it would require multiple construction seasons to complete the work.

Time Frame (work weeks) *	S-5A	S-5B	S-5C
	All Soil	DNAPL Soil	DNAPL Soil (0-6')
Wabash Parcel	65	20	3
Utility Corridor	9	2	1
Depot Road	2	0	0
Former Dupont Parcel	1	1	1
All Parcels**	74	21	3

* Excludes mob/demob and downtime during non-construction season winter months.
** Less than the sum of the parts due to efficiencies gained by concurrent performance at all parcels.

Economic Feasibility
Appendix S-5 presents a detailed cost analysis for Alternative S-5 and its options. A summary is provided in the table below:

Cost	S-5A	S-5B	S-5
	All Soil	DNAPL Soil	DNAPL Soil (0-6')
Wabash Parcel	$46,608,765	$12,469,223	$6,452,398
Utility Corridor	$7,487,299	$1,016,979	$584,292
Depot Road	$1,570,843	$0	$0
Former Dupont Parcel	$530,800	$165,921	$132,732
All Parcels	$55,727,936	$13,407,126	$7,000,514

4.3.7 Alternative S-6: In-Situ Stabilization/Solidification (ISS)

4.3.7.1 Description
This alternative consists of mixing soils with binding agents to solidify soil and reduce DNAPL mobility to prevent seepage of DNAPL to the ground surface and to reduce leachability of VOCs and PAHs from the DNAPL to groundwater. Mixing would be accomplished in-situ using mechanical mixers to blend in binding agents such as Portland cement and potentially bentonite. Bench-scale testing would be performed to establish the proper proportion of binding agent(s) necessary to achieve specified strength and permeability criteria to be identified through the remedial design process. Strength criteria for solidification projects commonly ranges from 25-50 psi and permeability criteria typically range from $1x10^{-5}$ to $1x10^{-6}$ cm/sec. The WDNR Wetlands Program has confirmed that the wetlands can be disturbed to clean-up the contamination, with required wetland permits. Disturbed wetlands would either be restored or compensated using the WWCT, an in-lieu fee program that allows permittees to purchase credits in exchange for satisfying compensatory mitigation requirements for state and federal wetland permits. Mixing to be conducted in the vicinity of buried utilities would require approval and coordination with the City of Oak Creek Water and Sewer Utility and other utility companies.

The impacted areas for each 4-foot depth interval are shown on Figures 3 to 7 for all impacted soil and in Figures 8 to 12 for the subareas of impacted soil containing DNAPL. The area, volume, and tonnage of all impacted soil and DNAPL impacted soil for each interval is provided in Table 1 for each of the Site parcels (Wabash Parcel and Utility Corridor) and for the adjacent off-site parcels (Depot Road to the north and Former Dupont Parcel to the south).

Alternative S-6 includes three options: all impacted soil (S-6A), DNAPL soil to full depth (S-6B), and DNAPL soil to depth of 6 ft (S-6C). Options S-6A and S-6B are included in the DNR May 2018 matrix of options for on-site treatment. Option S-6C was added as a viable option to achieve the remedial action objectives. In line with what was proposed in the May 4, 2021 Interim Action Work Plan, option S-6C includes an ISS barrier approximately 320 feet long to a depth of 20 feet along the north property line of the Utility Corridor in the area where potentially mobile DNAPL has been observed.

Soil Volume (CY)	S-6A	S-6B	S-6C
	All Soil	DNAPL Soil	DNAPL Soil (0-6’)
Wabash Parcel	327,524	79,742	16,221
Utility Corridor	45,491	4,775	1,143
Depot Road	6,651	0	0
Former Dupont Parcel	2,160	284	120
All Parcels	381,826	84,801	17,484

4.3.7.2 Detailed Evaluation

Long-term effectiveness

Solidification of the soils containing potentially mobile DNAPL does not lessen toxicity or volume of COPCs or DNAPL, but it does mitigate their mobility. Solidification eliminates the potential for DNAPL seepage to the ground surface, reduces the mobility of COPCs in the soil by eliminating potentially impacted runoff, and eliminates production of leachate from residual DNAPL above and below the water table.

This alternative would be protective of public health, safety and welfare and the environment. The solidification of the impacted soil and potentially mobile DNAPL would reduce risk to public health by direct contact and soil ingestion and eliminate the generation of leachate from COPCs contained in the solidified soil. It also would eliminate the potential for DNAPL seepage to the ground surface.

Short-term effectiveness

Short-term risks to the community associated with implementation of the remedy involve health and safety risks to those living around the Site. Community impacts include increased dust/exhaust, noise and traffic congestion from construction and truck traffic. These can be mitigated through conventional health and safety measures as well as controlling daily working hours and days of operation. Risks to on-site workers include inhalation of dust and vapors and direct contact with impacted soils during soil mixing activities. These are easily controlled through conventional dust and odor control and health and safety measures.

Short term risks to the environment include potential release of vapors and impacted sediments through off-site run-off during mixing activities. Conducting solidification as a wet process that may mitigate the release of vapors and erosion/sedimentation control features such as silt fences can control any potential off-site run-off. Short-term risks to the environment also include disruption of animal habitat through necessary clearing of brush and disturbance of soils in the solidification area. Disruptive activities would be limited when possible and would take place only during implementation of the remedy. The solidified areas would be revegetated providing healthy habitats for wildlife.

Implementability

This alternative is a technically challenging but relatively straight forward to implement. Soil mixing in the vicinity of buried utilities would be more difficult. Bench testing would be performed to establish the proper proportion of binding agent. Soil mixing is a specialty service that would not likely be provided by a local contractor. The solidified areas will need to be properly graded to promote directed stormwater runoff and revegetated. Future redevelopment over the solidified areas would need to comply with specified maintenance requirements, regulatory requirements, and soil management plan. The WDNR Wetlands Program has confirmed that the wetlands can be disturbed to clean-up the contamination, with required wetland permits. Disturbed wetlands would either be restored or compensated using the WWCT, an in-lieu fee program that allows permittees to purchase credits in exchange for satisfying compensatory mitigation requirements for state and federal wetland permits.

Restoration Time Frame

The work weeks required for the different options and parcels are summarized in the table below. Work could not be performed during the colder 6-month period from late fall to early spring. Depending on the quantity of material to be treated, it would require multiple construction seasons to complete the work.

Time Frame (work weeks) *	S-6A	S-6B	S-6C
	All Soil	DNAPL Soil	DNAPL Soil (0-6’)
Wabash Parcel	65	20	4
Utility Corridor	9	2	1
Depot Road	2	0	0
Former Dupont Parcel	1	1	1
All Parcels**	74	21	4

* Excludes mob/demob and downtime during non-construction season winter months.

** Less than the sum of the parts due to efficiencies gained by concurrent performance at all parcels.

Economic Feasibility

Appendix S-6 presents a detailed cost analysis for Alternative S-6 and its options. A summary is provided in the table below:

Cost	S-6A	S-6B	S-6C
	All Soil	DNAPL Soil	DNAPL Soil (0-6’)
Wabash Parcel	$26,359,702	$7,041,961	$1,308,003
Utility Corridor	$3,223,878	$549,058	$247,171
Depot Road	$633,245	$0	$0
Former Dupont Parcel	$265,041	$147,525	$97,425
All Parcels	$30,542,091	$7,468,828	$1,564,170

4.3.8 Alternative S-7: In-Situ Thermal Desorption (ISTD)

4.3.8.1 Description

The ISTD alternative is unproven at coal tar-residual sites. This alternative theoretically could use the ERH technology to heat soils to 100^{o} C (boiling point of water) through electrodes. Multi-phase extraction (MPE) wells would be used to remove steam, VOC vapors, groundwater, and liquid hydrocarbons from the wells for treatment and disposal of extracted contaminants. ERH theoretically could remove the lighter end fractions (BTEXTM and some naphthalene) from the soil and coal tar, thereby rendering the soil inert with respect to the potential for leaching of these constituents to groundwater. The higher boiling point compounds (e.g., benzo (a) pyrene) would not be removed. Some of the DNAPL would likely be mobilized during heating due to viscosity reductions and recovered by the MPE system. The heating is theoretically expected to solidify and stabilize the remaining, higher boiling point coal tar residuals as an asphaltic material, no longer a DNAPL.

A vapor cap would be placed over the treatment area to provide thermal insulation and a barrier to vapor emissions. MPE wells, collocated with the electrodes, would be used to remove steam, VOC vapors, groundwater, and liquid hydrocarbons from the wells for treatment and disposal of extracted contaminants. Produced vapors are treated with an air pollution control (APC) system to remove residual contaminants that have not been destroyed in situ.

The impacted areas for each 4-foot depth interval are shown on Figures 3 to 7 for all impacted soil and in Figures 8 to 12 for the subareas of impacted soil containing DNAPL. The area, volume, and tonnage of all impacted soil and DNAPL impacted soil for each interval is provided in Table 1 for each of the Site parcels (Wabash Parcel and Utility Corridor) and for the adjacent off-site parcels (Depot Road to the north and Former Dupont Parcel to the south).

Alternative S-7 includes two options: all impacted soil (S-7A) and DNAPL soil (S-7B). Options S-7A and S-7B are included in the DNR May 2018 matrix of options for in-situ treatment. Due to the presence of utilities, pipes, drains and other subsurface utilities that could be damaged and/or could obstruct the ERH and MPE wells, this alternative is only feasible for the Wabash Parcel.

Wabash Parcel Soil Volume (20’ deep)	S-7A	S-7B
	All Soil	DNAPL Soil
Surface Area (Sq. Ft.)	899,136	172,303
Volume (CY)	666,027	127,632

Nested electrode/MPE wells would be installed at a spacing of 15.5 feet resulting in approximately 3,750 nested wells needed for all soil on the Wabash Parcel and approximately 720 nested wells for the DNAPL area.

4.3.8.2 Detailed Evaluation

Long-term effectiveness

This remedy would reduce the volume, mobility, and toxicity of COPCs and DNAPL in soil. The lighter end VOC fractions would be removed from the soil and DNAPL, thereby rendering the soil inert with respect to the potential for leaching of these constituents to groundwater. However, the higher boiling point PAH compounds would not be removed. Some of the DNAPL would be recovered by the MPE system and the residuals would ultimately solidify as an asphaltic material. While retained, this technology will not achieve reduction in constituent concentrations to below target levels.

This alternative would be protective of public health, safety and welfare and the environment and reduce the risk to public health.

Short-term effectiveness

Short-term risks to the community associated with implementation of the remedy involve health and safety risks to those living around the Site. Community impacts include increased dust/exhaust, risk of exposure to high-voltage electrical equipment, noise and traffic congestion from construction and truck traffic during the mobilization phase and demobilization phase only. These can be mitigated through conventional health and safety measures, increased Site fencing and security presence, as well as controlling daily working hours and days of operation. Risks to on-site workers include inhalation of dust and vapors and direct contact with impacted soils during electrode installation activities. These are easily controlled through conventional dust and odor control and health and safety measures.

Short term risks to the environment include high temperature collection systems and steam in the collection systems. These are controlled by fencing and security at the remediation areas to prevent access by non-qualified personnel. Short-term risks to the environment also include disruption of animal habitat through necessary clearing of brush, high-temperature heating of soils, and capping of the treatment area. Disruptive activities would be limited when possible and would take place only during implementation of the remedy. The treatment area will be restored with clean topsoil and revegetated providing healthy habitats for wildlife following remedy completion.

Implementability

This alternative is complicated and technically challenging to implement, however, it would only be implementable on the Wabash Parcel. The equipment and services needed to provide the heating and collection are readily available from several vendors. The WDNR Wetlands Program has confirmed that the wetlands can be disturbed to clean-up the contamination, with required wetland permits. Disturbed wetlands would either be restored or compensated using the WWCT, an in-lieu fee program that allows permittees to purchase credits in exchange for satisfying compensatory mitigation requirements for state and federal wetland permits.

Restoration Time Frame
ISTD would operate 24 hours a day, 7 days a week year-round for the duration of treatment. The work weeks required for the two different options are summarized in the table below. The treatment would require at least 1 year to complete the work.

Time Frame (work weeks) *	S-7A	S-7B
	All Soil	DNAPL Soil
Wabash Parcel	52	52

* Excludes mob/demob and ISTD system installation.

Economic Feasibility
Appendix S-7 presents a detailed cost analysis for Alternative S-7 and its options. These costs assume one year of operation which would remove most of the VOC contaminant mass but would achieve cleanup levels for PAH compounds. A summary is provided in the table below:

Cost	S-7A	S-7B
	All Soil	DNAPL Soil
Wabash Parcel	$115,178,610	$22,205,473

4.3.9 Alternative GW-1: Monitored Plume Stability (MPS)

4.3.9.1 Description
This alternative includes implementing a groundwater monitoring program to demonstrate that the dissolved phase groundwater plume is stable and not migrating. The monitoring well network would include several water table wells along the plume front and within the Utility Corridor, several wells within the plume and a few upgradient background locations. A few locations would include deeper nested wells to monitor the base of the plume. The network is assumed to include 32 shallow and 4 deep wells that would be sampled and analyzed for VOCs and PAHs on an annual basis and a subset of those wells would be sampled quarterly. It is assumed that 6 shallow and 2 deep wells will be installed to supplement/replace the existing well network.

4.3.9.2 Detailed Evaluation
Long-term effectiveness
As demonstrated by the limited horizontal and vertical extent of the groundwater plume, this alternative does not reduce the toxicity and volume of the plume but allows for monitoring of the plume's limited mobility. Groundwater monitoring to evaluate and demonstrate that natural attenuation is taking place and that the dissolved phase plume is stable and not migrating would be protective of public health and the environment. There are no receptors or current users of the aquifer or surface water in proximity to the impacted groundwater and future groundwater use restrictions would ensure that remains the case. The continuing obligation of groundwater use restriction is effective, reliable, and enforceable.

Short-term effectiveness
There are no adverse impacts on public health, safety, or welfare or the environment that may be posed during the construction and implementation period. Risks to on-site workers include inhalation of dust and vapor and direct contact with impacted soils and water during well

installation and sampling activities. These are easily controlled through conventional health and safety measures.

Implementability
This alternative is technically straight forward to construct and implement. The material, equipment, and services needed to construct, and sample groundwater monitoring wells are readily available. Natural attenuation of the dissolved phase groundwater plume is technically feasible considering the age of the plume and the limited horizontal and vertical extent of migration to date. Redevelopment potential of the Site would not be impeded once the remedy has been implemented.

Restoration Time Frame
While the more mobile VOC and PAH compounds are naturally biodegradable, because of the presence of DNAPL, groundwater restoration would take many decades to over a century. However, the low soil permeability and resultant slow groundwater travel times are such that the plume front appears to be stabilized by natural biodegradation processes. Groundwater monitoring would be used to evaluate and demonstrate that natural attenuation is taking place and that the dissolved phase plume is stable and not migrating. There are no receptors or current users of the aquifer or surface water in proximity to the impacted groundwater and future groundwater use restrictions would ensure that remains the case. The continuing obligation of groundwater use restriction is effective, reliable, and enforceable.

Economic Feasibility
Appendix GW-1 presents a detailed cost analysis for Alternative GW-1. It is expected that plume stability will be able to be confirmed within a two- year period, but groundwater monitoring is estimated for a 30-year period. In summary, capital costs including engineering and contingency are estimated to be $123,225 for groundwater use restrictions and monitoring well installation/repair. OM&M costs are estimated at $781,060 (30-year NPV) for a total cost estimate of $904,285 for Alternative GW-1.

4.3.10 Alternative GW-2: Funnel & Gate In-Situ Treatment

4.3.10.1 Description
This alternative includes the groundwater monitoring as in Alternative GW-1 with the addition of an in-situ groundwater treatment system using the funnel and gate technology. The funnel and gate system would include a slurry wall installed along the leading edge of the dissolved phase groundwater plume that would be used to direct the flow of groundwater through treatment gates using aerobic treatment curtains (ATCs). The portion of the plume within the Utility Corridor would be addressed under the UT alternatives. A conceptual layout of the funnel and gate system is shown in Figure 16. The approximately 1,000-foot long slurry wall would extend to a depth of 25 feet bgs. The location, number and width of treatment gates would need to be determined through groundwater modeling to ensure the funnel captures the plume, that groundwater mounding does not occur behind the wall and that adequate retention time occurs within the gate to degrade the COPCs. Groundwater may be recirculated within the ATC where oxygen and nutrients are added to enhance the growth of indigenous microbes that naturally degrade VOCs and PAHs.

4.3.10.2 Detailed Evaluation

Long-term effectiveness

This alternative reduces constituent mobility by funneling impacted groundwater through an in-situ treatment system. The toxicity and volume of COPCs in groundwater that pass through the in-situ treatment system would be reduced through biodegradation.

Control and treatment of the dissolved phase groundwater plume is protective of public health, safety, and welfare and the environment. Groundwater monitoring to evaluate and demonstrate that the dissolved phase plume is controlled and not migrating would be protective of public health and the environment. There are no receptors or current users of the aquifer or surface water in proximity to the impacted groundwater and future groundwater use restrictions would ensure that remains the case. The continuing obligation of groundwater use restriction is effective, reliable, and enforceable.

Short-term effectiveness

Short-term risks to the community associated with implementation of the remedy involve health and safety risks to those living around the Site. Community impacts include increased dust/exhaust, noise and traffic congestion from construction and truck traffic. These can be mitigated through conventional health and safety measures as well as controlling daily working hours and days of operation. Risks to on-site workers include inhalation of dust and vapor and direct contact with impacted soils during construction of the slurry wall and treatment gates. These are easily controlled through conventional dust and odor control and health and safety measures.

Short term risks to the environment include potential release of COPCs through off-site run-off during construction activities. These can be controlled through readily available erosion/sedimentation control features such as silt fences.

Implementability

This alternative is a bit more challenging technically to implement. Construction of the slurry wall portion is relatively straightforward. The critical part of the alternative is the design of the treatment gate to ensure that the funnel and gate system works hydraulically and that the treatment gate is effective in treating the impacted groundwater. The location, number and width of treatment gates would need to be determined through groundwater modeling to ensure the funnel captures the plume, that groundwater mounding does not occur behind the wall and that adequate retention time occurs within the gate to degrade the constituents.

The material, equipment, and services needed to construct the funnel and gate system are readily available. Aerobic biodegradation of the VOCs and PAHs in the dissolved phase groundwater plume is technically feasible. Redevelopment potential of the Site would not be impeded once the remedy has been implemented. Placing a groundwater use restriction on the property is administratively feasible and straight forward.

Restoration Time Frame

While the impacted groundwater that passes through the in-situ treatment system would be restored, due to the low soil permeability and resultant slow groundwater travel times and because of the presence of DNAPL, groundwater restoration of the entire plume would take many decades to over a century.

Economic Feasibility
Appendix GW-2 presents a detailed cost analysis for Alternative GW-2. In summary, capital costs including engineering and contingency are estimated to be $949,578 for groundwater use restrictions and funnel and gate construction. OM&M costs are estimated at a 30-year NPV of $1,431,944 for a total cost estimate of $2,381,521 for Alternative GW-2.

4.3.11 Alternative GW-3: Groundwater Extraction & Treatment

4.3.11.1 Description
This alternative is the same as Alternative GW-2, except instead of a funnel and gate treatment system, a groundwater collection trench would be installed along the same alignment (Figure 16) to intercept the dissolved phase groundwater plume for extraction and treatment through a granular activated carbon (GAC) treatment system. The trench would be 25 feet deep and be sloped to a central sump location where groundwater extraction would occur. The GAC treatment system would be housed in an aboveground building. Treated water would be discharged to the storm sewer under a WPDES permit.

4.3.11.2 Detailed Evaluation
Long-term effectiveness
This alternative reduces constituent mobility by intercepting impacted groundwater and treating the collected groundwater through an above ground treatment system. The toxicity and volume of COPCs in groundwater that are collected and treated would ultimately be reduced with the spent carbon units sent off-site for regeneration (thermal destruction of constituents adsorbed to carbon).

Control and treatment of the dissolved phase groundwater plume is protective of public health, safety, and welfare and the environment. Groundwater monitoring to evaluate and demonstrate that the dissolved phase plume is controlled and not migrating would be protective of public health and the environment. There are no receptors or current users of the aquifer or surface water in proximity to the impacted groundwater and future groundwater use restrictions would ensure that remains the case. The continuing obligation of groundwater use restriction is effective, reliable, and enforceable.

Short-term effectiveness
Short-term risks to the community associated with implementation of the remedy involve health and safety risks to those living around the Site. Community impacts include increased dust/exhaust, noise and traffic congestion from construction and truck traffic. These can be controlled through conventional health and safety measures as well as controlling daily working hours and days of operation. Risks to on-site workers include inhalation of dust and vapor and direct contact with impacted soils during construction of the collection trench and treatment system. These are easily controlled through conventional dust and odor control and health and safety measures.

Short term risks to the environment include potential release of COPCs through off-site run-off during construction activities. These can be controlled through readily available erosion/sedimentation control features such as silt fences.

Implementability
This alternative is technically straight forward to implement. The material, equipment, and services needed to construct the trench and treatment system are readily available. Treatment of the VOCs and PAHs in the extracted groundwater is technically feasible with granular activated carbon. Redevelopment potential of the Site would only be impeded to the extent that an above-ground treatment building is required to remain on-site once the remedy has been implemented.

Restoration Time Frame
While the impacted groundwater that is collected and treated would be restored, due to the low soil permeability and resultant slow groundwater travel times and because of the presence of DNAPL, groundwater restoration of the entire plume would take many decades to over a century.

Economic Feasibility
Appendix GW-3 presents a detailed cost analysis for Alternative GW-3. In summary, capital costs including engineering, legal, administrative, and contingency are estimated to be $763,606 for groundwater use restrictions and collection trench and treatment system construction. OM&M costs are estimated at a 30-year NPV of $2,082,827 for a total cost estimate of $2,846,433 for Alternative GW-3.

4.3.12 Alternative GW-4: Containment with In-Situ Treatment

4.3.12.1 Description

This alternative is similar to Alternative GW-2 except the slurry wall would encircle the entire area of observed DNAPL and impacted groundwater. A groundwater gate would be installed at the downgradient portion of the wall to prevent the buildup and mounding of groundwater inside the containment area. Similar to Alternative GW-2, the gate would be equipped with an aerobic treatment curtain to treat groundwater flowing through the gate. The portion of the plume within the Utility Corridor would be addressed under the UT alternatives. A conceptual layout of the slurry wall and gate system is shown in Figure 16. The approximately 3,000-foot long slurry wall would extend to a depth of 25 feet bgs. The location, number and width of treatment gates would need to be determined through groundwater modeling to ensure the funnel captures the plume, that groundwater mounding does not occur behind the wall and that adequate retention time occurs within the gate to degrade the COPCs. Groundwater may be recirculated within the ATC where oxygen and nutrients are added to enhance the growth of indigenous microbes that naturally degrade VOCs and PAHs.

4.3.12.2 Detailed Evaluation

Long-term effectiveness
This alternative contains and controls DNAPL and impacted groundwater mobility. The toxicity and volume of COPCs in groundwater that pass through the in-situ treatment system would be reduced through biodegradation.

Containment of DNAPL and control and treatment of the dissolved phase groundwater plume is protective of public health, safety, and welfare and the environment. Groundwater monitoring to evaluate and demonstrate that the dissolved phase plume is controlled and not migrating would be protective of public health and the environment. There are no receptors or current users of the aquifer or surface water in proximity to the impacted groundwater and future groundwater use restrictions would ensure that remains the case. The continuing obligation of groundwater use restriction is effective, reliable, and enforceable.

Short-term effectiveness

Short-term risks to the community associated with implementation of the remedy involve health and safety risks to those living around the Site. Community impacts include increased dust/exhaust, noise and traffic congestion from construction and truck traffic. These can be mitigated through conventional health and safety measures as well as controlling daily working hours and days of operation. Risks to on-site workers include inhalation of dust and vapor and direct contact with impacted soils during construction of the slurry wall and treatment gates. These are easily controlled through conventional dust and odor control and health and safety measures.

Short term risks to the environment include potential release of COPCs through off-site run-off during construction activities. These can be controlled through readily available erosion/sedimentation control features such as silt fences.

Implementability

This alternative is a bit more challenging technically to implement. Construction of the slurry wall portion is relatively straightforward. The critical part of the alternative is the design of the treatment gate to ensure that the gate system works hydraulically and that the treatment gate is effective in treating the impacted groundwater. The location, number and width of treatment gates would need to be determined through groundwater modeling to ensure the funnel captures the plume, that groundwater mounding does not occur inside the slurry wall containment and that adequate retention time occurs within the gate to degrade the ground water constituents passing through the gate.

The material, equipment, and services needed to construct the funnel and gate system are readily available. Aerobic biodegradation of the VOCs and PAHs in the dissolved phase groundwater plume is technically feasible. Redevelopment potential of the Site would not be impeded once the remedy has been implemented. Placing a groundwater use restriction on the property is administratively feasible and straight forward.

Restoration Time Frame

While the impacted groundwater that passes through the in-situ treatment system would be restored, due to the low soil permeability and resultant slow groundwater travel times and because of the presence of DNAPL, groundwater restoration of the entire plume would take many decades to over a century.

Economic Feasibility

Appendix GW-4 presents a detailed cost analysis for Alternative GW-4. In summary, capital costs including engineering and contingency are estimated to be $1,843,333 for groundwater use restrictions and slurry wall and gate construction. OM&M costs are estimated at a 30-year NPV of $1,431,944 for a total cost estimate of $3,275,277 for Alternative GW-4.

4.3.13 Alternative UT-1: Trench Plugs

4.3.13.1 Description

This alternative includes installing a low permeability trench plug in the large diameter storm sewer gravel bedding that may serve as a preferential pathway for the potential migration of impacted groundwater toward the Lake. The trench plugs would be created by directly injecting an expandable polyurethane or other compatible expanding foam from inside the storm sewer pipe at both the upgradient and the downgradient end of the zone of impacted groundwater (Figure 17). The trench plug is water reactive and expands to plug the bedding and thus the preferential pathway along the storm sewer. Upstream of both plugs will be a vertical collection sump and a pair of nested wells to monitor system performance. The sump will collect any mobile DNAPL for measurement and removal as needed. Vacuum excavation with an air knife will be used to install the slotted sump piping to the bottom of the bedding. The surface will be completed in a flush mount traffic rated cover. The well nests will be installed to monitor the water levels upstream of the plug and will also be completed with traffic rated flush mount covers. The work would require the approval and coordination with the Oak Creek Sewer and Water Utility and other utility companies to ensure no damage would occur to existing infrastructure.

4.3.13.2 Detailed Evaluation

Long-term effectiveness

Trench plugs placed along gravel bedding will allow for removal of accumulated DNAPL thus reducing toxicity and/or volume of COPCs while mitigating DNAPL mobility along this groundwater migration pathway. This alternative would be protective of public health, safety and welfare and the environment by eliminating constituent migration along potential preferential pathways. Associated groundwater monitoring to evaluate and demonstrate that the dissolved phase plume is controlled and not migrating would be protective of public health and the environment. There are no receptors or current users of the aquifer or surface water in proximity to the impacted groundwater and future groundwater use restrictions would ensure that remains the case. The continuing obligation of groundwater use restriction is effective, reliable, and enforceable.

Short-term effectiveness

There would be little to no short-term risks to the community associated with implementation of this remedy. Risks to on-site workers include confined space entry and handling of the grout material. These are easily controlled through conventional health and safety measures.

Short term risks to the environment include potential release of COPCs through sump and well construction. These can be controlled through readily available spill containment/control features and routine work practices.

Implementability

This alternative is technically challenging and would require the approval and coordination with the Oak Creek Sewer and Water Utility and other utility companies to ensure no damage would occur to existing infrastructure. The material, equipment, and services needed for installing a trench plug are readily available.

Restoration Time Frame
The construction of the trench plug could be completed in a few weeks and eliminate a potential preferential migration pathway.

Economic Feasibility
Appendix UT-1 presents a detailed cost analysis for Alternative UT-1. In summary, capital costs including engineering and contingency are estimated to be $133,825 for the institutional controls and trench plug construction. OM&M costs are estimated at a 30-year NPV of $64,000 for a total cost estimate of $197,825 for Alternative UT-1.

4.3.14 Alternative UT-2: In-Situ Treatment

4.3.14.1 Description

This alternative would include an in-situ groundwater treatment system installed across the utilities in the Utility Corridor that may be serving as preferential migration pathways for impacted groundwater. The location of the in-situ treatment system is shown in Figure 17. The in-situ treatment would be like that of Alternative GW-2 and include the injection of oxygen and nutrients into an interception trench to enhance the growth of indigenous microbes that naturally degrade VOCs and PAHs.

4.3.14.2 Detailed Evaluation

Long-term effectiveness
The toxicity, mobility, and volume of COPCs in groundwater that pass through the in-situ treatment system would be reduced through biodegradation. Control and treatment of impacted groundwater potentially migrating along this preferential pathway is protective of public health, safety, and welfare and the environment. Associated groundwater monitoring to evaluate and demonstrate that the dissolved phase plume is controlled and not migrating would be protective of public health and the environment. There are no receptors or current users of the aquifer or surface water in proximity to the impacted groundwater and future groundwater use restrictions would ensure that remains the case. The continuing obligation of groundwater use restriction is effective, reliable, and enforceable.

Short-term effectiveness
There would be little to no short-term risks to the community associated with implementation of this remedy. Risks to on-site workers include inhalation of dust and vapor and direct contact with impacted soils and groundwater during construction of the trench around the utilities. These are easily controlled through conventional dust and odor control and health and safety measures.

Short term risks to the environment include potential release of COPCs through off-site run-off during construction activities. These can be controlled through readily available erosion/sedimentation control features such as silt fences.

Implementability
This alternative is technically challenging and would require the approval and coordination with the Oak Creek Sewer and Water Utility and other utility companies to ensure no damage would occur to existing infrastructure. The material, equipment, and services needed for trenching around utilities and installing the treatment system are readily available. Aerobic biodegradation of the VOCs and PAHs in the treated groundwater is technically feasible.

Restoration Time Frame
Installation of the in-situ treatment system could be completed in a few weeks and would restore groundwater migrating along this preferential pathway.

Economic Feasibility
Appendix UT-2 presents a detailed cost analysis for Alternative UT-2. In summary, capital costs including engineering and contingency are estimated to be $229,075 for institutional controls and in-situ treatment system construction. OM&M costs are estimated at a 30-year NPV of $650,833 for a total cost estimate of $879,958 for Alternative UT-2.

4.3.15 Alternative UT-3: Groundwater Extraction & Treatment

4.3.15.1 Description
This alternative is the same as Alternative UT-2, except instead of an in-situ treatment system, groundwater would be extracted from an interception trench and treated using a granular activated carbon (GAC) treatment system. The trench location would be the same as that for Alternative UT-2 (Figure 7) The GAC treatment system would be housed in an aboveground building. Treated water would be discharged to the storm sewer under a WPDES permit.

4.3.15.2 Detailed Evaluation
Long-term effectiveness
This alternative reduces COPC mobility by intercepting impacted groundwater and treating the collected groundwater through an above ground treatment system. The toxicity and volume of dissolved phase constituents in groundwater that are collected and treated would be ultimately be reduced when the spent carbon units are sent off-site for regeneration. Control and treatment of impacted groundwater potentially migrating along this preferential pathway is protective of public health, safety, and welfare and the environment. Associated groundwater monitoring to evaluate and demonstrate that the dissolved phase plume is controlled and not migrating would be protective of public health and the environment. There are no receptors or current users of the aquifer or surface water in proximity to the impacted groundwater and future groundwater use restrictions would ensure that remains the case. The continuing obligation of groundwater use restriction is effective, reliable, and enforceable.

Short-term effectiveness
There would be little to no short-term risks to the community associated with implementation of this remedy. Risks to on-site workers include inhalation of dust and vapor and direct contact with impacted soils and groundwater during construction of the trench around the utilities. These are easily controlled through conventional dust and odor control and health and safety measures.

Short term risks to the environment include potential release of COPCs through off-site run-off during construction activities. These can be controlled through readily available erosion/sedimentation control features such as silt fences.

Implementability

This alternative is technically challenging and would require the approval and coordination with the Oak Creek Sewer and Water Utility and other utility companies to ensure no damage would occur to existing infrastructure. The material, equipment, and services needed for trenching around utilities and installing the treatment system are readily available, and a physical location for the treatment system would need to be procured from current landowners. Carbon treatment of the VOCs and PAHs in the dissolved phase groundwater plume is technically feasible.

Restoration Time Frame

The installation of the collection and treatment system could be completed in a few weeks and would restore groundwater potentially migrating along this preferential pathway.

Economic Feasibility

Appendix UT-3 presents a detailed cost analysis for Alternative UT-3. In summary, capital costs including engineering, legal, administrative, and contingency are estimated to be $263,450 for institutional controls and collection trench and treatment system construction. OM&M costs are estimated at a 30-year NPV of $1,301,767 for a total cost estimate of $1,565,217 for Alternative UT-3.

4.3.16 Alternative VI-1: Institutional Controls

See the description and detailed evaluation for Site wide institutional controls under section 4.3.1

5.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section presents a comparison of the alternatives for each media/pathway. Table 3 presents a summary of these comparisons by using an assessment index of high, medium, or low for the technical criteria: long-term effectiveness, short-term effectiveness and implementability. The selection of the assessment indices was based primarily on engineering judgment and on experience. Alternative SW-1 (Site wide Institutional Controls) will be implemented Site wide in conjunction with all selected alternatives and is not included in the comparative analysis.

5.1 Comparative Analysis of Direct Contact Barrier

Alternatives S-1, S-2 and S-3D were carried forward to address the remedial action objective of preventing direct contact with COPCs and preventing leaching of COPCs. Alternative S-1 is a 2-foot thick soil cover. Alternative S-2 is an impermeable cover. Alternative S-3D was added per the 2018 DNR matrix and includes excavation, disposal, and backfilling of the upper 4 feet of impacted soil to eliminate the direct contact pathway.

Long-term effectiveness

Alternative S-3D lessens both the toxicity and volume of COPCs by removal of some of the impacted areas compared to Alternatives S-1 and S-2. All three Alternatives eliminate direct contact and potentially impacted runoff from the Site. However, the reduction in mass in the top 4 feet would not make a significant difference in the groundwater plume considering the low mass of leachable COPCs in the unsaturated zone compared to the mass in the saturated zone. All three alternatives would be protective of public health, safety and welfare and the environment by reducing risk to public health by direct contact and soil ingestion.

Short-term effectiveness

The adverse impacts on public health, safety or welfare or the environment that may be posed during the construction and implementation period is greater for Alternative S-3D. There would be slightly more noise and traffic congestion from construction and truck traffic with Alternative S-3D as the excavation, hauling, and replacement of soil cover would require more time and materials to construct and more disturbance to the community.

Implementability

There is more availability of the materials, equipment, and services required for implementation of Alternative S-1 and Alternative S-2 compared to Alternative S-3D The removal and backfill of two times the volume of material as opposed to just clean fill and grading in one-half as much volume require more material procurement, coordination and hauling distances to implement S-3D compared to S-1 and S-2. Otherwise all other aspects for these two alternatives are similar.

Restoration Time Frame

The restoration timeframe is about twice as long for Alternative S-2 and Alternative S-3D than Alternative S-1. There may be slightly less leachate generation with Alternative S-2 and Alternative S-3D but not enough difference to be of material consequence.

Economic Feasibility
Total estimated costs for Alternative S-1 are significantly lower than costs for Alternative S-2 and S-3D.

Direct Contact Barrier	S-1	S-2	S-3D
Total Cost	$2,680,504	$6,112,404	$16,189,641

5.2 Comparative Analysis of Soil Alternatives
Alternatives S-3 through S-7 were carried forward to address the remedial action objective of preventing DNAPL seeps to the ground surface. It is believed that this objective can be met by remediating the 0-6-foot interval provided by Alternatives S-3C through S-7C. Alternatives S-3A through S-7A remediate all soil to the full depth of impacts and Alternatives S-3B through S-7B remediate areas of DNAPL to the full depth of impacts. While these alternatives (S-3A/B through S-7A/B) exceed what is needed to achieve the remedial objective of preventing DNAPL seeps, they were evaluated for comparison because they were included in the 2018 DNR matrix. All alternatives are protective of public health, safety and welfare and the environment over time. The comparative analysis of soil alternatives is provided below.

		Soil Volume Options		
	Remedial Alternative	All Soil	DNAPL	DNAPL 0-6'
S-3	Excavation with Off-Site Disposal	S3A	S-3B	S-3C
S-4	Excavation with On-Site HTTD	S4A	S-4B	S-4C
S-5	ISCO-ISS	S-5A	S-5B	S-5C
S-6	ISS	S-6A	S-6B	S-6C
S-7	ISTD	S-7A	S-7B	NA

Long-term effectiveness

- Excavation Alternative S-3 would provide the greatest reduction in the toxicity, mobility, and volume of COPCs at the Site through excavation.
- Treatment Alternatives S-4, S-5 and S-7 would provide reduction in the toxicity and mobility of COPCs at the Site through on-site or in-situ treatment. Although residual contamination would remain at the completion of treatment for any of these alternatives, each would be protective of public health, safety, and welfare and the environment over time.
- Alternative S-6 would not reduce the toxicity and volume of COPCs, but it would reduce the mobility of COPCs and therefore be protective of public health, safety, and welfare and the environment over time.
- The “All Soil” options (A) would provide a greater reduction in the toxicity, mobility, and volume of COPCs and hence be more protective of public health, safety, and welfare and the environment over time compared to the DNAPL options (B) and DNAPL 0-6’ options (C).

Short-term effectiveness

- Excavation Alternative S-3 would have the most adverse impact on the community living around the Site and to the environment due to increased dust/exhaust, noise and traffic congestion from construction and truck traffic hauling excavated materials off-site and bringing replacement soil to the Site.

- Alternatives S-4, S-5, S-6, and S-7 would have less impact on the community than Alternative S-3 because of less truck traffic hauling soil to and from the Site.
- Alternative S-7 would have the least impact on the community because the truck traffic would be limited to the mobilization/demobilization phase of the work.
- The all soil options (A) have the most adverse impact on the community living around the Site due to the duration of the remediation activities compared to the DNAPL options (B) and DNAPL 0-6' options (C).

Implementability

- Excavation Alternative S-3 would be difficult to implement for the large soil volume options because of the lack of available fill material to backfill the excavations and with the logistics of associated truck traffic.
- Treatment Alternatives S-4, S-5, and S-7 will not be able to achieve total reduction in COPCs and will leave residual contaminants. Greater reductions could be achieved by adding more heat, oxidants, or treatment duration which would increase costs significantly. These technologies are unlikely to achieve reduction in constituent concentrations to below target levels.
- In-situ mixing Alternatives S-5 and S-6 will require selecting and adequately mixing in the proper binding agent(s) to solidify the soil to ensure redevelopment potential of the Site once the remedy has been implemented.
- All alternatives would be difficult in implement in the Utility Corridor and Alternatives S-5 and S-7 could not be implemented in the Utility Corridor due to potential chemical or thermal damage to underground piping and materials.
- It would not be practical to apply Alternative S-7 to the shallow soil option (DNAPL 6') or to Depot Road with shallow (0-4') contamination.
- The all soil options (A) would be more difficult to implement than the smaller soil volume DNAPL options (B) and DNAPL 0-6' options (C).

Restoration Time Frame

Restoration Timeframe (work weeks*)		Soil Volume Options		
	Remedial Alternative	All Soil (A)	DNAPL (B)	DNAPL 0-6' (C)
S-3	Excavation with Off-Site Disposal	153	22	7
S-4	Excavation with On-Site HTTD	342	76	16
S-5	ISCO-ISS	74	21	3
S-6	ISS	74	21	4
S-7	ISTD	52	52	NA

* Excludes mob/demob time. Work can only be completed during 6-month construction season except for S-7 which can be completed year-round.

- The DNAPL 0-6' options (C) would take the least amount of time to provide a restored surface soil condition that is protective of public health and the environment compared to the all soil (A) and all DNAPL (B) options. Alternatives S-5C and S-6C would take about one month to complete.

- For the all soil options, Alternative S-7A provides the shortest restoration timeframe (one year) and Alternative S-4A has the longest restoration timeframe (13 years).
- For the DNAPL options (B), Alternatives S-5B and S-6B provide the shortest restoration timeframe (one construction season) and Alternative S-4B has the longest restoration timeframe (3 years).

Economic Feasibility

The costs for each alternative and option are provided below. The highest cost alternative for all of the options is Alternatives S-7 (ISTD), followed by Alternatives S-4 (HTTD) and S-3 (Excavation & Disposal). The soil mixing Alternatives S-5 (ISCO-ISS) and S-6 (ISS) are the lowest cost alternatives for all of the options with S-6 ISS being the lowest cost alternative.

All Parcels	Alternative	A (All Soil)	B (DNAPL)	C (DNAPL 0-6')
S-3	Excavation & Disposal	$52,617,797	$11,237,393	$2,299,926
S-4	Excavation with On-Site HTTD	$51,646,411	$15,325,120	$4,725,438
S-5	ISCO-ISS	$55,727,936	$13,407,126	$7,000,514
S-6	ISS	$30,542,091	$7,468,828	$1,564,170
S-7	ISTD	$115,261,410	$22,205,473	NA

5.3 Comparative Analysis of Groundwater Alternatives

Long-term effectiveness

Alternative GW-1 provides no reduction in the toxicity and volume of the dissolved phase constituents in groundwater. Alternatives GW-2, GW-3 and GW-4 provide some reduction in toxicity and volume of COPCs but given the low flow (< 1 gpm) and constituent flux into/through these treatment systems, the reduction would not be materially significant compared to Alternative GW-1. The same is true regarding constituent mobility. Alternative GW-1 provides no reduction in constituent mobility, but due to the nature of the clay geology at the Site and its corresponding low groundwater velocities, the mobility of COPCs is so low to begin with that the reduction in mobility provided by Alternatives GW-2, GW-3 and GW-4 is not materially significant compared to Alternative GW-1. As a result, the four alternatives are equally protective of public health, safety and welfare and the environment. However, Alternatives GW-2, GW-3 and GW-4 would prevent potential migration of DNAPL into the Utility Corridor through containment (GW-2 and GW-4) or collection (GW-3). There are no receptors or current users of the aquifer or surface water in proximity to the dissolved phase plume and future groundwater use restrictions would ensure that remains the case.

Short-term effectiveness

As there is no construction involved, Alternative GW-1 would have the least impact on public health, safety and welfare and the environment during implementation. For Alternatives GW-2 and GW-3, the impacts to the community from increased dust/exhaust, noise and traffic congestion from construction and truck traffic, the risks to on-site workers from inhalation of dust and vapor and direct contact with impacted soils, and the risks to the environment from potential release of constituents through off-site run-off during construction are about the same but less than the impact of Alternative GW-4 which has three times the slurry wall construction activity. These are easily controlled through conventional dust and odor control, erosion/sedimentation control, and health and safety measures.

Implementability
Alternative GW-1 (MPS) would be the easiest to implement as no construction is involved. Natural attenuation of the dissolved phase groundwater plume is technically feasible, especially when considering the age of the plume and the limited horizontal and vertical extent of migration to date. Alternatives GW-2 and GW-4 would be the most technically challenging to design insofar as any design must ensure the system works hydraulically while providing adequate treatment. Aboveground treatment of VOCs and PAHs with granular activated carbon (GW-3) is more technically feasible than in-situ aerobic biodegradation (GW-2 and GW-4).

Restoration Time Frame
Groundwater restoration of the entire plume would take many decades to over a century for all four alternatives due to the presence of DNAPL, the low soil permeability, and resultant slow groundwater travel times.

Economic Feasibility
The lowest cost alternative is GW-1 at $904,285. Alternative GW-4 has the highest estimated cost at $3,275,277.

	Groundwater Alternative	Total Cost
GW-1	Monitored Plume Stability	$904,285
GW-2	Funnel & Gate In-Situ Treatment	$2,381,521
GW-3	Groundwater Extraction & Treatment	$2,846,433
GW-4	Containment with In-Situ Treatment	$3,275,277

5.4 Comparative Analysis of Utility Trench Alternatives

Long-term effectiveness
Alternative UT-1 would provide no reduction in the toxicity and volume of the constituents in the groundwater. Alternatives UT-2 and UT-3 would provide some reduction in toxicity and volume of constituents but given the low flux into/through these treatment systems, the reduction would not be materially significant compared to Alternative UT-1. All three alternatives would provide an equivalent reduction in COPC mobility along the preferential pathway of buried utilities. As a result, the three alternatives are equally protective of public health, safety and welfare and the environment.

Short-term effectiveness
There would be little to no impact to the community during implementation of any of the three alternatives. Risks to on-site workers are comparable for all three alternatives and are easily controlled through conventional health and safety measures. Short term risks to the environment are also comparable between the alternatives and are controlled through readily available spill containment/control and erosion/sedimentation control features.

Implementability

All three alternatives are technically challenging and would require the approval and coordination with the Oak Creek Sewer and Water Utility and other utility companies to ensure no damage would occur to existing infrastructure during construction. For the alternatives that include treatment, aboveground treatment of VOCs and PAHs with granular activated carbon (UT-3) is more technically feasible than in-situ aerobic biodegradation (UT-2).

Restoration Time Frame

All three alternatives could be completed in similar time frames and provide elimination/control of the preferential migration pathway.

Economic Feasibility

The lowest cost alternative is UT-1 at $197,825. Alternative UT-3 has the highest estimated cost at $1,565,217.

	Utility Corridor Alternative	Total Cost
UT-1	Trench Plug	$197,825
UT-2	In-Situ Treatment	$879,958
UT-3	Groundwater Extraction & Treatment	$1,565,217

5.5 Comparative Analysis of Vapor Intrusion Alternatives

There is only one alternative for this media/pathway and therefore no comparison is provided.

6.0 SELECTED REMEDY AND SUSTAINABILITY EVALUATION

6.1 Site Wide Institutional Controls

The site wide institutional controls alternative (SW-1) was selected to be used in combination with all other selected alternatives.

6.2 Selected Remedial Alternatives

The recommended combination of alternatives for Site remediation of the former tar plant includes the following:

- **Alternative S-1: Soil Barrier**
  The two-foot thick soil barrier alternative (S-1) was selected because it meets the direct contact remedial action objective for surface soil and provides nearly the same level of direct contact protection as alternative (S-3D) at less than 20% of the cost. (Note that Alternative S-1 was also selected by Connell for the PCB and arsenic residual contamination.)

- **Alternative S-6C: ISS for DNAPL (0-6')**
  Alternative S-6C was selected because it meets the remedial objectives of preventing leaching of contaminants from the vadose zone and preventing potentially mobile DNAPL from seeping to the ground surface or daylighting along the ravine bluff. ISS will be applied site-wide in areas where potentially mobile DNAPL is present in the upper 6 feet of soil. The combined implementation of Alternatives S-1 and S-6C provide an 8-foot thick barrier over areas with potentially mobile DNAPL. To prevent the potential for discharge of DNAPL from the Wabash Parcel into the Utility Corridor, Alternative S-6C includes an ISS barrier approximately 320 feet long installed to a depth of 20 feet along the north property line of the Utility Corridor in the area where potentially mobile DNAPL has been observed.

- **Alternative GW-1: Monitored Plume Stability**
  The MPS alternative (GW-1) was selected for groundwater based on the limited plume migration that has occurred to date due to the extremely tight nature of glacial till. Further, with groundwater use restrictions in place this alternative is protective of public health. The other active groundwater alternatives (GW-2 and GW-3) do not restore groundwater any quicker and are significantly more costly.

- **Alternative UT-1: Trench Plugs**
  The trench plug alternative (UT-1) was selected because it meets the remedial action objective of preventing impacted groundwater migration along preferential pathways at the lowest cost.

- **Alternative VI-1: Institutional Control**
  This was the only alternative considered for this potential future pathway and is protective of public health, safety, and welfare.

6.3 Proposed Schedule for Implementation

The schedule for implementation will be provided in the remedial design report.

6.4 Estimated Cost

The estimated cost for the selected remedy is as follows:

Alternative	Description	Capital Cost	O&M Cost	Total Cost
SW-1	Site-Wide Institutional Controls	$25,000	$26,035	$51,035
S-1	Soil Cover	$2,654,469	$26,035	$2,680,504
S-6C	ISS DNAPL (0-6')	$1,564,170	$0	$1,564,170
GW-1	Monitored Plume Stability	$123,225	$781,060	$904,285
UT-1	Trench Plug	$133,825	$64,000	$197,825
	Total Remedy Cost	$4,500,688	$897,131	$5,397,819

6.5 Compliance Timeframe

For most media, compliance will be achieved with the completion of cover, barriers and trench plug installations and concrete and soil removal/disposal. For the groundwater remedy, it is assumed that closure will be requested once a demonstration is made that the groundwater plume is stable.

6.6 Performance Evaluation

The cover will be inspected for erosion and DNAPL seeps on an annual basis and maintained on an as needed basis. Groundwater monitoring will be performed on a quarterly basis initially and will continue until an MPS demonstration has been completed and closure is received.

6.7 Management of Treatment Residuals

Any soil or purge water generated from groundwater monitoring well installation and sampling events will be containerized and disposed of at an approved facility.

6.8 Redevelopment Considerations Concerning Remedial Design

The City of Oak Creek is pursuing opportunities to revitalize approximately 250 acres of former industrial waterfront sites along the shore of Lake Michigan. The Site is located within the proposed area for redevelopment, which is located east of South 5th Avenue and is bounded by Milwaukee County’s Bender Park on the south and the Metropolitan Milwaukee Sewerage District (MMSD) South Shore Water Reclamation Facility on the north.

Beazer is cognizant of the City’s Lake Vista redevelopment initiative and will work with the City during the remedial design phase for this Site to evaluate and incorporate design aspects, to the extent practical and foreseeable, for enabling construction of future, specific public infrastructure needs (e.g., altering cover or backfill in specific locations for future roadways and/or utilities) of the City related to the long term development plans for the Lake Vista area, including the installation and maintenance of such public infrastructure needs.

6.9 Cover Maintenance and Soil Management Plan

As noted in Section 6.1 above, Alternative SW-1 – Site-wide Institutional Controls is a component of the overall selected Site remedy. A detailed description of Alternative SW-1 is provided in Section 4.3.1.1. A soil cover maintenance and impacted soil management plan are components of the Alternative SW-1. As part of the remedial design, the soil cover maintenance and impacted soil management plan will be prepared to address long term cover maintenance requirements as well as soil management requirements during future redevelopment of the Site. The plan will include:

- a map showing the location of the extent and type of residual contamination and soil cover boundaries;
- a brief description of the type, depth, and location of residual contamination;
- a description of the maintenance actions required for maximizing effectiveness of the soil cover;
- the requirements for sampling, handling and disposal of contaminated soils generated during underground excavation and trenching;
- requirements for imported backfill sampling; and
- requirements for reconstruction of the existing cover in disturbed areas.

6.10 Sustainability Evaluation

A sustainability evaluation will be performed for the selected remedy using EPA's Spreadsheets for Environmental Footprint Analysis (SEFA). The results will be included in the remedial design report.

7.0 REFERENCES

Natural Resource Technology, Inc. and Tetra Tech, Inc., 2014. *Site Investigation Report, Former Koppers Tar Plant and Wabash Alloys Site, Oak Creek, WI,* January 2014.

Natural Resource Technology, Inc. and Tetra Tech, Inc., 2014. *Remedial Action Options Report, Former Koppers Tar Plant and Wabash Alloys Site, Oak Creek, WI,* December 2014.

Tetra Tech, Inc., 2019. *Supplemental Site Investigation Report, Former Koppers Tar Plant and Wabash Alloys Site, Oak Creek, WI*, January 2019.

Table 1. Area and Volume of Impacted Soil

Wabash Parcel	Impacted Soil (No DNAPL)			Impacted Soil (with DNAPL)			All Impacted Soil		
	Area (Sq Ft)	Volume (Cu Yds)	Weight (Tons)	Area (Sq Ft)	Volume (Cu Yds)	Weight (Tons)	Area (Sq Ft)	Volume (Cu Yds)	Weight (Tons)
0-4	855,466	126,736	190,104	43,670	6,470	9,704	899,136	133,205	199,808
4-8	296,903	43,986	65,978	131,647	19,503	29,255	428,550	63,489	95,233
8-12	264,454	39,178	58,768	172,303	25,526	38,290	436,757	64,705	97,057
12-16	169,109	25,053	37,580	152,893	22,651	33,976	322,002	47,704	71,556
16-20	86,591	12,828	19,242	37,748	5,592	8,388	124,339	18,421	27,631
Total		247,781	371,672		79,742	119,614		327,524	491,285

Utility Corridor	Impacted Soil (No DNAPL)			Impacted Soil (with DNAPL)			All Impacted Soil		
	Area (Sq Ft)	Volume (Cu Yds)	Weight (Tons)	Area (Sq Ft)	Volume (Cu Yds)	Weight (Tons)	Area (Sq Ft)	Volume (Cu Yds)	Weight (Tons)
0-4	142,903	21,171	31,756	2,071	307	460	144,974	21,478	32,216
4-8	66,731	9,886	14,829	11,285	1,672	2,508	78,016	11,558	17,337
8-12	37,791	5,599	8,398	12,171	1,803	2,705	49,962	7,402	11,103
12-16	19,481	2,886	4,329	6,706	993	1,490	26,187	3,880	5,819
16-20	7,926	1,174	1,761		-	-	7,926	1,174	1,761
Total		40,716	61,074		4,775	7,163		45,491	68,237

Depot Road	Impacted Soil (No DNAPL)			Impacted Soil (with DNAPL)			All Impacted Soil		
	Area (Sq Ft)	Volume (Cu Yds)	Weight (Tons)	Area (Sq Ft)	Volume (Cu Yds)	Weight (Tons)	Area (Sq Ft)	Volume (Cu Yds)	Weight (Tons)
0-4	44,893	6,651	9,976		-	-	44893	6,651	9,976
4-8	-	-	-		-	-		-	-
8-12	2,100	311	467		-	-	2100	311	467
12-16	-	-	-		-	-		-	-
16-20	-	-	-		-	-		-	-
Total		6,962	10,443		-	-		6,962	10,443

Former Dupont Parcel	Impacted Soil (No DNAPL)			Impacted Soil (with DNAPL)			All Impacted Soil		
	Area (Sq Ft)	Volume (Cu Yds)	Weight (Tons)	Area (Sq Ft)	Volume (Cu Yds)	Weight (Tons)	Area (Sq Ft)	Volume (Cu Yds)	Weight (Tons)
0-4	10,562	1,565	2,347	542	80	120	11104	1,645	2,468
4-8	1,050	156	233	531	79	118	1581	234	351
8-12	-	-	-	847	125	188	847	125	188
12-16	1,050	156	233		-	-	1050	156	233
16-20	-	-	-		-	-		-	-
Total		1,876	2,814		284	427		2,160	3,240

All Parcels	Impacted Soil (No DNAPL)			Impacted Soil (with DNAPL)			All Impacted Soil		
	Area (Sq Ft)	Volume (Cu Yds)	Weight (Tons)	Area (Sq Ft)	Volume (Cu Yds)	Weight (Tons)	Area (Sq Ft)	Volume (Cu Yds)	Weight (Tons)
0-4	1,053,824	156,122	234,183	46,283	6,857	10,285	1,100,107	162,979	244,468
4-8	364,684	54,027	81,041	143,463	21,254	31,881	508,147	75,281	112,922
8-12	304,345	45,088	67,632	185,321	27,455	41,182	489,666	72,543	108,815
12-16	189,640	28,095	42,142	159,599	23,644	35,466	349,239	51,739	77,609
16-20	94,517	14,003	21,004	37,748	5,592	8,388	132,265	19,595	29,392
Total		297,335	446,002		84,802	127,203		382,137	573,205

ENVIRONMENTAL MEDIA OR MIGRATION/EXPOSURE PATHWAY	REMEDIAL ACTION OBJECTIVES	GENERAL RESPONSE ACTIONS	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	AREA OF CONCERN	DESCRIPTION	EFFECTIVENESS	IMPLEMENTABILITY	COST	SCREENING SUMMARY
SOIL	PREVENT DIRECT CONTACT WITH SOIL EXCEEDING DIRECT CONTACT RCLs PREVENT LEACHING OF CONTAMINANTS THAT MAY RESULT IN GROUNDWATER CONTAMINATION IN EXCESS OF GROUNDWATER RCLs PREVENT POTENTIALLY MOBILE TAR FROM SEEPING/MIGRATING	NO ACTION	NOT APPLICABLE	NONE	VADOSE ZONE SOIL EXCEEDING PROTECTION OF GROUNDWATER RCLs	NO ACTION	LEACHING POTENTIAL OF VADOSE ZONE CONTAMINANTS IS MINIMAL COMPARED TO EXISTING WATER QUALITY	NO IMPLEMENTATION REQUIRED	NONE	POTENTIALLY APPLICABLE
		ENGINEERED BARRIER	CAPPING	SOIL COVER	SURFACE SOIL EXCEEDING DIRECT CONTACT RCLs	PLACE 24" THICK SOIL COVER AS CONTAMINANT BARRIER	EFFECTIVE TO PREVENT DIRECT EXPOSURE	EASILY IMPLEMENTED	MODERATE CAPITAL, LOW O&M	POTENTIALLY APPLICABLE
				IMPERMEABLE COVER	VADOSE ZONE SOIL EXCEEDING PROTECTION OF GROUNDWATER RCLs	CONSTRUCT BARRIER COMPRISED OF COMPACTED CLAY OR GEOSYNTHETIC MATERIALS	EFFECTIVE TO PREVENT DIRECT EXPOSURE; PROVIDES LITTLE VALUE IN PREVENTING INFILTRATION OF PRECIPITATION DUE TO SHALLOW WATER TABLE	EASILY IMPLEMENTED	HIGH CAPITAL, MODERATE O&M	POTENTIALLY APPLICABLE
				ASPHALT/CONCRETE	VADOSE ZONE SOIL EXCEEDING PROTECTION OF GROUNDWATER RCLs AND/OR SURFACE SOIL EXCEEDING DIRECT CONTACT RCLs	USE EXISITNG (CITY PARCEL) AND/OR FUTURE ASPHALT/CONCRETE SURFACES AS CONTAMINANT BARRIER	EFFECTIVE TO PREVENT DIRECT EXPOSURE AND PREVENT INFILTRATION OF PRECIPITATION	EASILY IMPLEMENTED IN AREAS OF ROAD, PARKING LOTS, BUILDINGS	NO ADDITIONAL CAPITAL IF COMPONENT OF REDEVELOPMENT, LOW O&M	POTENTIALLY APPLICABLE
		INSTITUTIONAL ACTIONS	ACCESS RESTRICTIONS	RESIDENTIAL USE RESTRICTION	AREAS OF INSTALLED BARRIER	RESTRICTS FUTURE LAND USE TO NON-RESIDENTIAL	EFFECTIVE IN ELIMINATING POTENTIAL SENSITIVE RECEPTOR EXPOSURE	EASILY IMPLEMENTED	LOW COST	POTENTIALLY APPLICABLE
				SOIL MANAGEMENT PLAN	AREAS OF INSTALLED BARRIER	PLAN FOR MANAGEMENT OF CONTAMINATED SOIL IF BARRIER IS REMOVED AND/OR SOILS ARE EXCAVATED	EFFECTIVE IN MANAGING EXPOSURE IF/WHEN COVERED AREAS ARE BREACHED	EASILY IMPLEMENTED	NO CAPITAL, LOW O&M	POTENTIALLY APPLICABLE
		REMOVAL	EXCAVATION	EXCAVATION FOR TREATMENT OR DISPOSAL	SOIL EXCEEDING PROTECTION OF GROUNDWATER RCLs AND/OR DIRECT CONTACT RCLs	EXCAVATION OF IMPACTED SOIL	EFFECTIVE FOR REMOVING ON-SITE SOIL CONTAMINATION	MODERATE DIFFICULTY FOR SHALLOW SOIL, MORE DIFFICULT TO IMPLEMENT WITH DEPTH	HIGH CAPITAL, NO O&M	POTENTIALLY APPLICABLE
		DISPOSAL	OFF-SITE	SOLID WASTE LANDFILL	EXCAVATED SOILS	DISPOSAL OF EXCAVATED SOIL AT OFF-SITE LANDFILL	EFFECTIVE FOR EXCAVATED SOIL DISPOSAL	EASILY IMPLEMENTED	HIGH CAPITAL, LOW O&M	POTENTIALLY APPLICABLE
		ON-SITE TREATMENT	THERMAL	ON SITE HIGH TEMP THERMAL DESORPTION (HTTD)	SOIL EXCEEDING DIRECT CONTACT AND/OR PROTECTION OF GROUNDWATER RCLs	ON-SITE TREATMENT OF EXCAVATED SOIL LOW TEMPERATURE THERMAL DESORPTION	EFFECTIVE FOR BTEX AND NAPHTHALENE; LESS EFFECTIVE ON TAR AND SOME PAHS;	MODERATE DIFFICULTY FOR SHALLOW SOIL, MORE DIFFICULT TO IMPLEMENT WITH DEPTH	HIGH CAPITAL, NO O&M	POTENTIALLY APPLICABLE
		IN-SITU TREATMENT	CHEMICAL	GEOCHEMICAL STABILIZATION (ISGS)	SOIL EXCEEDING DIRECT CONTACT AND/OR PROTECTION OF GROUNDWATER RCLs	INJECT OXIDANT AND AMENDMENTS INTO IMPACTED SOIL TO OXIDIZE CONTAMINANTS AND IMMOBILZE DNAPL	EFFECTIVE FOR TEX AND PAH; LESS EFFECTIVE ON BENZENE; CAN IMMOBILIZE DNAPL	INJECTION INTO INTO SILTY CLAY NOT FEASIBLE; HAS NEVER BEEN APPLIED VIA SOIL MIXING	HIGH CAPITAL, NO O&M	NOT APPLICABLE
			CHEMICAL	OXIDATION (ISCO)	SOIL EXCEEDING DIRECT CONTACT AND/OR PROTECTION OF GROUNDWATER RCLs	MIX OXIDANT INTO IMPACTED SOIL TO OXIDIZE CONTAMINANTS AND IMMOBILZE DNAPL; REQUIRES CEMENT TO SOLIDIFY	EFFECTIVE FOR TEX AND PAH; LESS EFFECTIVE ON BENZENE;	MODERATE DIFFICULTY FOR SHALLOW SOIL, MORE DIFFICULT TO IMPLEMENT WITH DEPTH	HIGH CAPITAL, NO O&M	POTENTIALLY APPLICABLE
			THERMAL	ELECTRICAL RESISTANCE HEATING (ERH)	SOIL EXCEEDING DIRECT CONTACT AND/OR PROTECTION OF GROUNDWATER RCLs	HEATING SOIL AND GROUNDWATER TO DESTROY CONTAMINANTS AND/OR REMOVE CONTAMINANTS THROUGH VAPOR RECOVERY	EFFECTIVE FOR BTEX, NOT EFFECTIVE FOR PAHS AND TAR	DIFFICULT TO IMPLEMENT	HIGH CAPITAL, NO O&M	POTENTIALLY APPLICABLE
			PHYSICAL	SOLIDIFICATION/ STABILIZATION (ISS)	SOIL EXCEEDING DIRECT CONTACT AND/OR PROTECTION OF GROUNDWATER RCLs	MIX BINDING AGENTS INTO IMPACTED SOIL TO SOLIDIFY/STABILIZE AND REDUCE MOBILITY AND LEACHABILITY	EFFECTIVE IN REDUCING CONTAMINANT MOBILITY AND LEACHABILITY	MODERATE DIFFICULTY FOR SHALLOW SOIL, MORE DIFFICULT TO IMPLEMENT WITH DEPTH	MODERATE TO HIGH CAPITAL, NO O&M	POTENTIALLY APPLICABLE
		EXTRACTION	PHYSICAL	SOIL VAPOR EXTRACTION (SVE)	VADOSE ZONE SOIL EXCEEDING PROTECTION OF GROUNDWATER RCLs	INSTALL SOIL VAPOR EXTRACTION WELLS WITHIN VADOSE ZONE TO REMOVE CONTAMINANTS	EFFECTIVE FOR VOCS BUT NOT FOR TAR AND PAH COMPOUNDS; ALSO NOT EFFECTIVE IN LOW PERMEABILITY SOIL	EASILY IMPLEMENTED	MODERATE CAPITAL, HIGH O&M	NOT APPLICABLE

ENVIRONMENTAL MEDIA OR MIGRATION/EXPOSURE PATHWAY	REMEDIAL ACTION OBJECTIVES	GENERAL RESPONSE ACTIONS	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	AREA OF CONCERN	DESCRIPTION	EFFECTIVENESS	IMPLEMENTABILITY	COST	SCREENING SUMMARY
GROUNDWATER	PREVENT POTENTIAL POTABLE USE OF IMPACTED GROUNDWATER RESTORE GROUNDWATER TO NR140 RCLs TO THE EXTENT TECHNICALLY AND ECONOMICALLY FEASIBLE	INSTITUTIONAL ACTIONS	ACCESS RESTRICTIONS	DEED RESTRICTIONS	SITE WIDE	IMPLEMENT LEGAL MECHANISM TO ENFORCE LAND USE RESTRICTIONS TO PREVENT INSTALLATION OF DRINKING WATER WELLS IN/NEAR IMPACTED GROUNDWATER	PREVENTS THE USE OF IMPACTED OF IMPACTED GROUNDWATER AS SOURCE OF DRINKING WATER	EASILY IMPLEMENTED	LOW COST	POTENTIALLY APPLICABLE
		MONITORING	GROUNDWATER MONITORING WELLS	GROUNDWATER MONITORING	SITE WIDE	CONDUCT ROUTINE MONITORING OF GROUNDWATER TO ENSURE CONTAMINANT PLUME IS NOT MIGRATING/EXPANDING	USEFUL FOR DOCUMENTING CONDITIONS, DOES NOT ACTIVELY REMEDIATE BUT MAY DEMONSTRATE THAT THERE IS NO NEED FOR ACTIVE REMEDY	EASILY IMPLEMENTED	LOW COST	POTENTIALLY APPLICABLE
		CONTAINMENT	PHYSICAL BARRIER	SLURRY WALL	ENCIRCLE OR DOWNGRADIENT OF PLUME AND OBSERVED DNAPL BOUNDARY	CONSTRUCT TRENCH BACKFILLED WITH SOIL AND/OR CEMENT BENTONITE SLURRY	EFFECTIVE IN CONTAINING GROUNDWATER CONTAMINATION	MODERATELY DIFFICULT TO IMPLEMENT	MODERATE CAPITAL, NO O&M	POTENTIALLY APPLICABLE
			HYDRAULIC BARRIER	FLOW DIVERSION DRAIN	DOWNGRADIENT PLUME BOUNDARY	CONSTRUCT A DRAIN IN CONJUNCTION WITH PHYSICAL BARRIER TO AVOID MOUNDING	EFFECTIVE IN PREVENTING MOUNDING BEHIND PHYSICAL BARRIER	EASILY IMPLEMENTED	MODERATE CAPITAL, LOW O&M	POTENTIALLY APPLICABLE
			REACTIVE BARRIER	AEROBIC TREATMENT CURTAIN (ATC)	DOWNGRADIENT PLUME BOUNDARY	INSTALL AN AIR CURTAIN TO AEROBICALLY BREAKDOWN CONTAMINANTS AS WATER PASSES THROUGH BARRIER	EFFECTIVE IN AEROBIC BIODEGRADTION OF VOCS AND PAHS ALONG WITH VOC VOLATILIZATION	MODERATELY DIFFICULT TO IMPLEMENT	MODERATE CAPITAL, LOW O&M	POTENTIALLY APPLICABLE
		REMOVAL	GROUNDWATER EXTRACTION	EXTRACTION WELLS	DOWNGRADIENT PLUME BOUNDARY	INSTALL EXTRACTION WELLS WITHIN PLUME TO RECOVER IMPACTED GROUNDWATER FOR TREATMENT	LOW PERMEABILTY OF SOIL WOULD REQUIRE CLOSELY SPACED WELLS DUE TO SMALL RADIUS OF INFLUENCE AND THEREFORE NOT PRACTICAL	EASILY IMPLEMENTED	MODERATE CAPITAL, LOW O&M	NOT APPLICABLE
				INTERCEPTION TRENCH	DOWNGRADIENT PLUME BOUNDARY	CONSTRUCT INTERCEPTION TRENCH AT PLUME BOUNDARY TO RECOVER IMPACTED GROUNDWATER FOR TREATMENT	EFFECTIVE IN COLLECTING IMPACTED GROUNDWATER FOR SUBSEQUENT TREATMENT	MODERATELY DIFFICULT TO IMPLEMENT	MODERATE CAPITAL, LOW O&M	POTENTIALLY APPLICABLE
		TREATMENT	ABOVE GRADE TREATMENT	ON-SITE TREATMENT PLANT	DOWNGRADIENT PLUME BOUNDARY	PASS WATER THROUGH AN ON-SITE TREATMENT PLANT TO TREAT IMPACTS UTILIZING MULTIPLE TECHNOLOGIES (I.E. AIR-STRIPPING, CARBON ADSORPTION ETC.)	EFFECTIVE IN TREATING VOCS AND PAHS	EASILY IMPLEMENTED	MODERATE CAPITAL, MODERATE O&M	POTENTIALLY APPLICABLE
		DISCHARGE	OFF-SITE	FORCE MAIN TO POTW	DOWNGRADIENT PLUME BOUNDARY	IMPACTED GROUNDWATER TREATED AT POTW	EFFECTIVE IN TREATING VOCS AND PAHS	EASILY IMPLEMENTED	LOW CAPITAL, MODERATE O&M	POTENTIALLY APPLICABLE
			ON-SITE	STORM SEWER TO LAKE	DOWNGRADIENT PLUME BOUNDARY	TREATED GROUNDWATER DISCHARGED TO SURFACE WATER	EFFECTIVE MEANS OF HANDLING TREATED WATER	EASILY IMPLEMENTED	LOW CAPITAL, LOW O&M	POTENTIALLY APPLICABLE

ENVIRONMENTAL MEDIA OR MIGRATION/EXPOSURE PATHWAY	REMEDIAL ACTION OBJECTIVES	GENERAL RESPONSE ACTIONS	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	AREA OF CONCERN	DESCRIPTION	EFFECTIVENESS	IMPLEMENTABILITY	COST	SCREENING SUMMARY
UTILITY CORRIDOR GROUNDWATER	MITIGATE IMPACTED GROUNDWATER MIGRATION THAT MAY BE OCCURRING ALONG PREFERENTIAL PATHWAYS CREATED BY UTILITY CONDUITS AND TRENCHES	NO ACTION	NOT APPLICABLE	NONE	EXISTING UTILITIES IN AREAS OF IMPACTED GROUNDWATER	NO ACTION	CONTAMINANT LEVELS AND/OR MIGRATION POTENTIAL LOW ENOUGH THAT NO FURTHER OR MINIMAL ACTION IS NEEDED TO PREVENT MIGRATION	NO IMPLEMENTATION REQUIRED	NONE	POTENTIALLY APPLICABLE
		INSTITUTIONAL ACTIONS	ACCESS RESTRICTION	DEED RESTRICTION	FUTURE UTILITY TRENCHES IN AREAS OF IMPACTED GROUNDWATER	IMPLEMENT LEGAL MECHANISM TO ENFORCE REQUIREMENT TO INSTALL MIGRATION BARRIERS ALONG FUTURE UTILITY TRENCH	PREVENTS CONSTRUCTION OF UTILITIES WITHOUT INCLUDING MIGRATION BARRIER	EASILY IMPLEMENTED	LOW COST	POTENTIALLY APPLICABLE
		CONTAINMENT	PHYSICAL BARRIER	JET GROUTING	EXISTING UTILITIES IN AREAS OF IMPACTED GROUNDWATER	JET GROUT ALONG EXTERIOR OF UTILITY TO ELIMINATE PREFERRENTIAL PATHWAY	EFFECTIVE IN ELIMINATING GROUNDWATER MIGRATION PATHWAY	NEED TO CONTROL INJECTION PRESSURE TO PREVENT DAMAGE TO PIPE MAKING IT MODERATELY DIFFICULT TO IMPLEMENT	MODERATE CAPITAL, NO O&M	POTENTIALLY APPLICABLE
				TRENCH PLUG	EXISTING UTILITIES IN AREAS OF IMPACTED GROUNDWATER	INSTALL LOW PERMEABILITY PLUG ACROSS UTILITIES DOWNGRDIENT OF PLUME TO BLOCK MIGRATION PATHWAY	EFFECTIVE IN BLOCKING PATHWAY, MAY REQUIRE COLLECTION OF GROUNDWATER TO PREVENT MOUNDING	EASILY IMPLEMENTED	LOW CAPITAL, LOW O&M	POTENTIALLY APPLICABLE
				SEWER RELINING	EXISTING STORM SEWERS IN AREAS OF IMPACTED GROUNDWATER	LINE STORM SEWER TO PREVENT INFILTRATION OF CONTAMINATED GROUNDWATER	EFFECTIVE IN PREVENTING INFILTRATION OF GROUNDWATER INTO SEWER	MODERATELY DIFFICULT TO IMPLEMENT DUE TO SIZE OF STORM SEWER	MODERATE CAPITAL, NO O&M	NOT APPLICABLE
		REMOVAL	GROUNDWATER EXTRACTION	EXTRACTION WELLS	EXISTING UTILITIES IN AREAS OF IMPACTED GROUNDWATER	INSTALL EXTRACTION WELLS ALONG UTILITIES WITHIN PLUME TO RECOVER IMPACTED GROUNDWATER FOR TREATMENT	EFFECTIVE IN COLLECTING IMPACTED GROUNDWATER FOR SUBSEQUENT TREATMENT	EASILY IMPLEMENTED	LOW CAPITAL, LOW O&M	POTENTIALLY APPLICABLE
				TRENCH	EXISTING UTILITIES IN AREAS OF IMPACTED GROUNDWATER	INSTALL COLLECTION TRENCH ACROSS UTILITIES WITHIN PLUME TO RECOVER IMPACTED GROUNDWATER FOR TREATMENT	EFFECTIVE IN COLLECTING IMPACTED GROUNDWATER FOR SUBSEQUENT TREATMENT	MODERATELY DIFFICULT TO IMPLEMENT	MODERATE CAPITAL, LOW O&M	POTENTIALLY APPLICABLE
		TREATMENT	ABOVE GRADE TREATMENT	ON-SITE TREATMENT PLANT	EXISTING UTILITIES IN AREAS OF IMPACTED GROUNDWATER	PASS WATER THROUGH AN ON-SITE TREATMENT PLANT TO TREAT IMPACTS UTILIZING MULTIPLE TECHNOLOGIES (I.E. AIR-STRIPPING, CARBON ADSORPTION ETC.)	EFFECTIVE IN TREATING VOCS AND PAHS	EASILY IMPLEMENTED	MODERATE CAPITAL, MODERATE O&M	POTENTIALLY APPLICABLE
			IN-SITU TREATMENT	AEROBIC TREATMENT CURTAIN (ATC)	EXISTING UTILITIES IN AREAS OF IMPACTED GROUNDWATER	INSTALL AIR SPARGE WELLS TO AEROBICALLY BREAKDOWN CONTAMINANTS	EFFECTIVE IN AEROBIC BIODEGRADTION OF VOCS AND PAHS ALONG WITH VOC VOLATILIZATION	EASILY IMPLEMENTED	LOW CAPITAL, LOW O&M	POTENTIALLY APPLICABLE
		DISCHARGE	OFF-SITE	FORCE MAIN TO POTW	EXISTING UTILITIES IN AREAS OF IMPACTED GROUNDWATER	IMPACTED GROUNDWATER TREATED AT POTW	EFFECTIVE IN TREATING VOCS AND PAHS	EASILY IMPLEMENTED	LOW CAPITAL, MODERATE O&M	POTENTIALLY APPLICABLE
			ON-SITE	STORM SEWER TO SURFACE WATER	EXISTING UTILITIES IN AREAS OF IMPACTED GROUNDWATER	TREATED GROUNDWATER DISCHARGED TO SURFACE WATER	EFFECTIVE MEANS OF HANDLING TREATED WATER	EASILY IMPLEMENTED	LOW CAPITAL, LOW O&M	POTENTIALLY APPLICABLE

ENVIRONMENTAL MEDIA OR MIGRATION/EXPOSURE PATHWAY	REMEDIAL ACTION OBJECTIVES	GENERAL RESPONSE ACTIONS	REMEDIAL TECHNOLOGY TYPES	PROCESS OPTIONS	AREA OF CONCERN	DESCRIPTION	EFFECTIVENESS	IMPLEMENTABILITY	COST	SCREENING SUMMARY
VAPOR INTRUSION	PREVENT VAPOR INTRUSION FROM IMPACTED SOIL AND GROUNDWATER INTO POTENTIAL FUTURE OCCUPIED STRUCTURES	INSTITUTIONAL ACTIONS	ACCESS RESTRICTIONS	DEED RESTRICTIONS	SITE WIDE	IMPLEMENT LEGAL MECHANISM TO ENFORCE REQUIREMENT FOR VAPOR MITIGATION SYSTEMS FOR ANY POTENTIAL FUTURE OCCUPIED STRUCTURES	PREVENTS CONSTRUCTION OF OCCUPIED STRUCTURES WITHOUT INCLUDING VAPOR MITIGATION SYSTEM	EASILY IMPLEMENTED	LOW COST	POTENTIALLY APPLICABLE
		TREATMENT	PHYSICAL	SOIL VAPOR EXTRACTION (SVE)	AREAS OF RESIDUAL SOIL AND/OR GROUNDWATER CONTAMINANTS HAVE THE POTENTIAL TO RELEASE CONTAMINANT VAPORS AT LEVELS ABOVE SCREENING CRITERIA	INSTALL SOIL VAPOR EXTRACTION WELLS WITHIN VADOSE ZONE TO PREVENT VAPOR INTRUSION INTO FUTURE OCCUPIED STRUCTURES	EFFECTIVE FOR VOCS BUT NOT EFFECTIVE IN LOW PERMEABILITY SOIL	EASILY IMPLEMENTED	MODERATE CAPITAL, HIGH O&M	NOT APPLICABLE

(green) RETAINED FOR USE IN REMEDIAL ALTERNATIVES

(orange) ELIMINATED FROM CONSIDERATION

							All Parcels Combined		
ID	Description	Long-Term Effectiveness	Short-Term Effectiveness	Implementability	Restoration Timeframe	Recommended Alternative	Capital Cost	NPV O&M Cost	Total Cost
Site-Wide Institutional Control									
SW-1	Institutional Control	High	High	High	Short	X	$ 25,000	$ 26,035	$ 51,035
Soil									
S-1	Soil Barrier	Medium	High	High	Short	X	$ 2,654,469	$ 26,035	$ 2,680,504
S-2	Impermeable Cover	Medium	High	High	Short		$ 6,086,369	$ 26,035	$ 6,112,404
S-3A	Excavation with Off-Site Disposal (All Soil)	High	Low	Low	Medium		$ 52,617,797	$ -	$ 52,617,797
S-4A	Excavation with On-Site Thermal Desorption (All Soil)	High	Medium	Low	Medium		$ 51,646,411	$ -	$ 51,646,411
S-5A	In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (All Soil)	High	Medium	Medium	Short		$ 55,727,936	$ -	$ 55,727,936
S-6A	In-Situ Stabilization/Solidification (ISS) (All Soil)	High	Medium	Medium	Short		$ 30,542,091	$ -	$ 30,542,091
S-7A	In-Situ Thermal Desorption (ISTD) (All Soil)	High	Medium	Medium	Short		$ 115,261,410	$ -	$ 115,261,410
S-3B	Excavation with Off-Site Disposal (DNAPL)	Medium	Low	Low	Short		$ 11,237,393	$ -	$ 11,237,393
S-4B	Excavation with On-Site Thermal Desorption (DNAPL)	Medium	Medium	Low	Short		$ 15,325,120	$ -	$ 15,325,120
S-5B	In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (DNAPL)	Medium	Medium	Medium	Short		$ 13,407,126	$ -	$ 13,407,126
S-6B	In-Situ Stabilization/Solidification (ISS) (DNAPL)	Medium	Medium	Medium	Short		$ 7,468,828	$ -	$ 7,468,828
S-7B	In-Situ Thermal Desorption (ISTD) (DNAPL)	Medium	Medium	Medium	Short		$ 22,205,473	$ -	$ 22,205,473
S-3C	Excavation with Off-Site Disposal (DNAPL) (6')	Medium	Medium	Medium	Short		$ 2,299,926	$ -	$ 2,299,926
S-4C	Excavation with On-Site Thermal Desorption (DNAPL) (6')	Medium	Medium	Low	Short		$ 4,725,438	$ -	$ 4,725,438
S-5C	In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (DNAPL) (6')	Medium	Medium	High	Short		$ 7,000,514	$ -	$ 7,000,514
S-6C	In-Situ Stabilization/Solidification (ISS) (DNAPL) (6')	Medium	Medium	High	Short	X	$ 1,564,170	$ -	$ 1,564,170
S-3D	Excavation with Off-Site Disposal (0-4' Direct Contact)	Medium	Medium	Medium	Short		$ 16,163,605	$ 26,035	$ 16,189,641
Groundwater									
GW-1	Monitored Plume Stability	Medium	High	High	Long	X	$ 123,225	$ 781,060	$ 904,285
GW-2	Funnel & Gate with In-Situ Treatment	High	Medium	Medium	Long		$ 949,578	$ 1,431,944	$ 2,381,521
GW-3	Groundwater Extraction & Treatment	High	Medium	Medium	Long		$ 763,606	$ 2,082,827	$ 2,846,433
GW-4	Containment with In-Situ Treatment	High	Medium	Medium	Long		$ 1,843,333	$ 1,431,944	$ 3,275,277
Utility Trench Groundwater Pathway									
UT-1	Trench Plug	Medium	High	Medium	Medium	X	$ 133,825	$ 64,000	$ 197,825
UT-2	In-Situ Treatment	High	High	Medium	Medium		$ 229,075	$ 650,883	$ 879,958
UT-3	Groundwater Extraction & Treatment	High	High	Medium	Medium		$ 263,450	$ 1,301,767	$ 1,565,217
Vapor Intrusion									
VI-1	Institutional Control (Included under SW-1)	High	High	High	Short	X	$ -	$ -	$ -

Notes:
(1) Assumes a discount rate of 0.94% (Average of Superfund Interest Rates for 2012-2021)
(2) Solidified, covered or excavated wetland areas will be mitigated using off-site mitigation credits or in-lieu fee program

							Wabash Parcel			Utility Corridor		
ID	Description	Long-Term Effectiveness	Short-Term Effectiveness	Implementability	Restoration Timeframe	Recommended Alternative	Capital Cost	NPV O&M Cost	Total Cost	Capital Cost	NPV O&M Cost	Total Cost
Site-Wide Institutional Control												
SW-1	Institutional Control	High	High	High	Short	X	$ 25,000	$ 26,035	$ 51,035	NA	NA	NA
Soil												
S-1	Soil Barrier	Medium	High	High	Short	X	NA	NA	NA	NA	NA	NA
S-2	Impermeable Cover	Medium	High	High	Short		NA	NA	NA	NA	NA	NA
S-3A	Excavation with Off-Site Disposal (All Soil)	High	Low	Low	Medium		$ 45,476,166	$ -	$ 45,476,166	$ 6,045,081	$ -	$ 6,045,081
S-4A	Excavation with On-Site Thermal Desorption (All Soil)	High	Medium	Low	Medium		$ 45,160,785	$ -	$ 45,160,785	$ 8,457,968	$ -	$ 8,457,968
S-5A	In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (All Soil)	High	Medium	Medium	Short		$ 46,608,765	$ -	$ 46,608,765	$ 7,487,299	$ -	$ 7,487,299
S-6A	In-Situ Stabilization/Solidification (ISS) (All Soil)	High	Medium	Medium	Short		$ 26,359,702	$ -	$ 26,359,702	$ 3,223,878	$ -	$ 3,223,878
S-7A	In-Situ Thermal Desorption (ISTD) (All Soil)	High	Medium	Medium	Short		$ 115,261,410	$ -	$ 115,261,410	NA	NA	NA
S-3B	Excavation with Off-Site Disposal (DNAPL)	Medium	Low	Low	Short		$ 10,539,180	$ -	$ 10,539,180	$ 687,296	$ -	$ 687,296
S-4B	Excavation with On-Site Thermal Desorption (DNAPL)	Medium	Medium	Low	Short		$ 14,999,365	$ -	$ 14,999,365	$ 3,684,786	$ -	$ 3,684,786
S-5B	In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (DNAPL)	Medium	Medium	Medium	Short		$ 12,469,223	$ -	$ 12,469,223	$ 1,016,979	$ -	$ 1,016,979
S-6B	In-Situ Stabilization/Solidification (ISS) (DNAPL)	Medium	Medium	Medium	Short		$ 7,041,961	$ -	$ 7,041,961	$ 549,058	$ -	$ 549,058
S-7B	In-Situ Thermal Desorption (ISTD) (DNAPL)	Medium	Medium	Medium	Short		$ 22,205,473	$ -	$ 22,205,473	NA	NA	NA
S-3C	Excavation with Off-Site Disposal (DNAPL) (6')	Medium	Medium	Medium	Short		$ 2,142,764	$ -	$ 2,142,764	$ 190,652	$ -	$ 190,652
S-4C	Excavation with On-Site Thermal Desorption (DNAPL) (6')	Medium	Medium	Low	Short		$ 4,590,347	$ -	$ 4,590,347	$ 3,117,153	$ -	$ 3,117,153
S-5C	In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (DNAPL) (6')	Medium	Medium	High	Short		$ 6,452,398	$ -	$ 6,452,398	$ 584,292	$ -	$ 584,292
S-6C	In-Situ Stabilization/Solidification (ISS) (DNAPL) (6')	Medium	Medium	High	Short	X	$ 1,308,003	$ -	$ 1,308,003	$ 247,171	$ -	$ 247,171
S-3D	Excavation with Off-Site Disposal (0-4' Direct Contact)	Medium	Medium	Medium	Short		NA	NA	NA	NA	NA	NA
Groundwater												
GW-1	Monitored Plume Stability	Medium	High	High	Long	X	$ 123,225	$ 781,060	$ 904,285	NA	NA	NA
GW-2	Funnel & Gate with In-Situ Treatment	High	Medium	Medium	Long		$ 949,578	$ 1,431,944	$ 2,381,521	NA	NA	NA
GW-3	Groundwater Extraction & Treatment	High	Medium	Medium	Long		$ 763,606	$ 2,082,827	$ 2,846,433	NA	NA	NA
GW-4	Containment with In-Situ Treatment	High	Medium	Medium	Long		$ 1,843,333	$ 1,431,944	$ 3,275,277	NA	NA	NA
Utility Trench Groundwater Pathway												
UT-1	Trench Plug	Medium	High	Medium	Medium	X	NA	NA	NA	$ 133,825	$ 64,000	$ 197,825
UT-2	In-Situ Treatment	High	High	Medium	Medium		NA	NA	NA	$ 229,075	$ 650,883	$ 879,958
UT-3	Groundwater Extraction & Treatment	High	High	Medium	Medium		NA	NA	NA	$ 263,450	$ 1,301,767	$ 1,565,217
Vapor Intrusion												
VI-1	Institutional Control (Included under SW-1)	High	High	High	Short	X	$ -	$ -	$ -	$ -	$ -	$ -

Notes:

(1) Assumes a discount rate of 0.94% (Average of Superfund Interest Rates for 2012-2021)

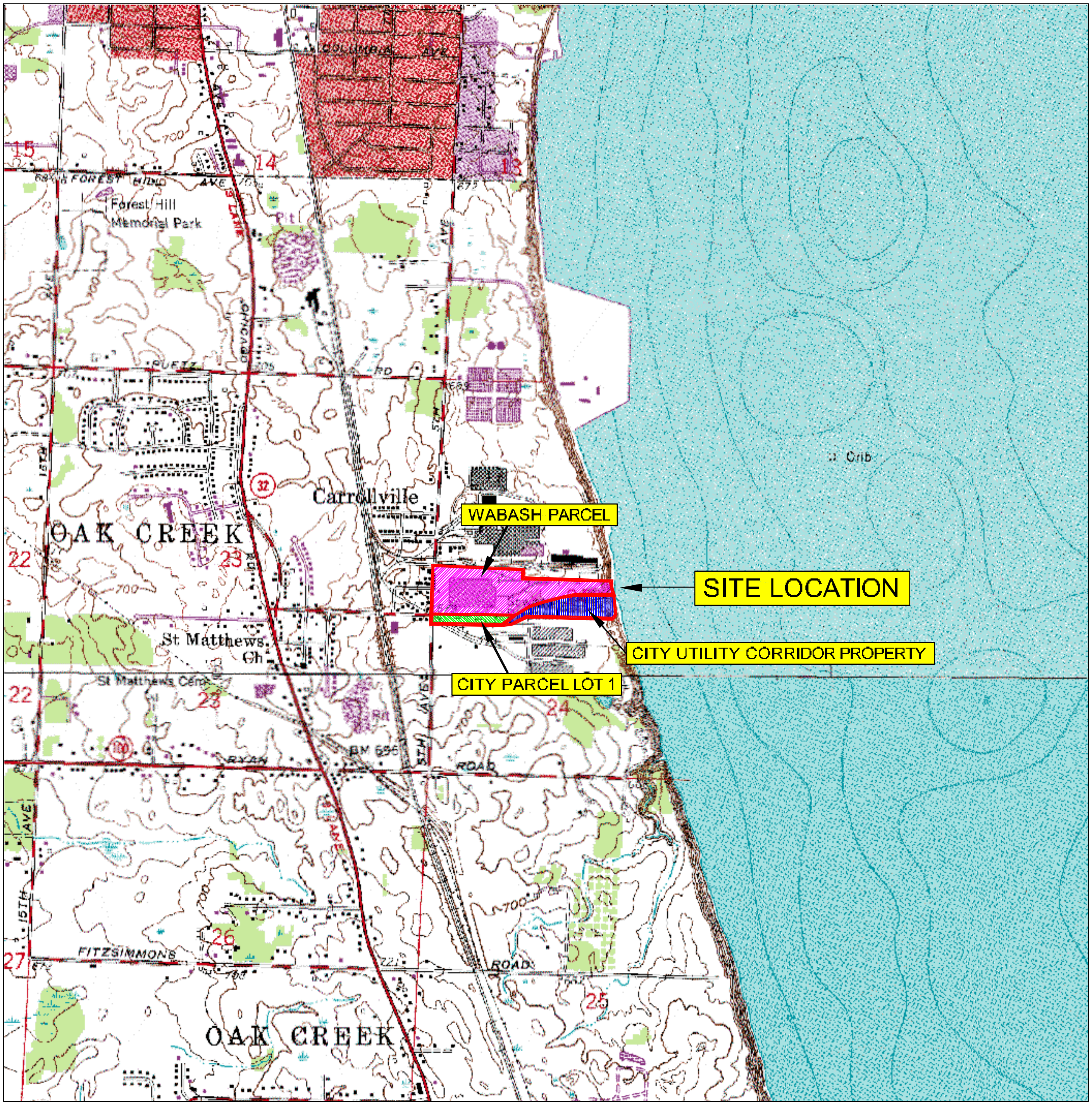
(2) Solidified, covered or excavated wetland areas will be mitigated using off-site mitigation credits or in-lieu fee program

							Depot Road			Former Dupont Parcel		
ID	Description	Long-Term Effectiveness	Short-Term Effectiveness	Implementability	Restoration Timeframe	Recommended Alternative	Capital Cost	NPV O&M Cost	Total Cost	Capital Cost	NPV O&M Cost	Total Cost
Site-Wide Institutional Control												
SW-1	Institutional Control	High	High	High	Short	X	NA	NA	NA	NA	NA	NA
Soil												
S-1	Soil Barrier	Medium	High	High	Short	X	NA	NA	NA	NA	NA	NA
S-2	Impermeable Cover	Medium	High	High	Short		NA	NA	NA	NA	NA	NA
S-3A	Excavation with Off-Site Disposal (All Soil)	High	Low	Low	Medium		$ 918,796	$ -	$ 918,796	$ 329,536	$ -	$ 329,536
S-4A	Excavation with On-Site Thermal Desorption (All Soil)	High	Medium	Low	Medium		$ 3,739,028	$ -	$ 3,739,028	$ 3,208,829	$ -	$ 3,208,829
S-5A	In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (All Soil)	High	Medium	Medium	Short		$ 1,570,843	$ -	$ 1,570,843	$ 530,800	$ -	$ 530,800
S-6A	In-Situ Stabilization/Solidification (ISS) (All Soil)	High	Medium	Medium	Short		$ 633,245	$ -	$ 633,245	$ 265,041	$ -	$ 265,041
S-7A	In-Situ Thermal Desorption (ISTD) (All Soil)	High	Medium	Medium	Short		NA	NA	NA	NA	NA	NA
S-3B	Excavation with Off-Site Disposal (DNAPL)	Medium	Low	Low	Short		NA	NA	NA	$ 79,420	$ -	$ 79,420
S-4B	Excavation with On-Site Thermal Desorption (DNAPL)	Medium	Medium	Low	Short		NA	NA	NA	$ 3,031,376	$ -	$ 3,031,376
S-5B	In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (DNAPL)	Medium	Medium	Medium	Short		NA	NA	NA	$ 165,921	$ -	$ 165,921
S-6B	In-Situ Stabilization/Solidification (ISS) (DNAPL)	Medium	Medium	Medium	Short		NA	NA	NA	$ 147,525	$ -	$ 147,525
S-7B	In-Situ Thermal Desorption (ISTD) (DNAPL)	Medium	Medium	Medium	Short		NA	NA	NA	NA	NA	NA
S-3C	Excavation with Off-Site Disposal (DNAPL) (6')	Medium	Medium	Medium	Short		NA	NA	NA	$ 54,474	$ -	$ 54,474
S-4C	Excavation with On-Site Thermal Desorption (DNAPL) (6')	Medium	Medium	Low	Short		NA	NA	NA	$ 3,004,738	$ -	$ 3,004,738
S-5C	In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (DNAPL) (6')	Medium	Medium	High	Short		NA	NA	NA	$ 132,732	$ -	$ 132,732
S-6C	In-Situ Stabilization/Solidification (ISS) (DNAPL) (6')	Medium	Medium	High	Short	X	NA	NA	NA	$ 97,425	$ -	$ 97,425
S-3D	Excavation with Off-Site Disposal (0-4' Direct Contact)	Medium	Medium	Medium	Short		NA	NA	NA	NA	NA	NA
Groundwater												
GW-1	Monitored Plume Stability	Medium	High	High	Long	X	NA	NA	NA	NA	NA	NA
GW-2	Funnel & Gate with In-Situ Treatment	High	Medium	Medium	Long		NA	NA	NA	NA	NA	NA
GW-3	Groundwater Extraction & Treatment	High	Medium	Medium	Long		NA	NA	NA	NA	NA	NA
GW-4	Containment with In-Situ Treatment	High	Medium	Medium	Long		NA	NA	NA	NA	NA	NA
Utility Trench Groundwater Pathway												
UT-1	Trench Plug	Medium	High	Medium	Medium	X	NA	NA	NA	NA	NA	NA
UT-2	In-Situ Treatment	High	High	Medium	Medium		NA	NA	NA	NA	NA	NA
UT-3	Groundwater Extraction & Treatment	High	High	Medium	Medium		NA	NA	NA	NA	NA	NA
Vapor Intrusion												
VI-1	Institutional Control (Included under SW-1)	High	High	High	Short	X	$ -	$ -	$ -	$ -	$ -	$ -

Notes:

(1) Assumes a discount rate of 0.94% (Average of Superfund Interest Rates for 2012-2021)

(2) Solidified, covered or excavated wetland areas will be mitigated using off-site mitigation credits or in-lieu fee program



National Geodetic Vertical Datum of 1929
Contour Interval 10 Feet

SCALE

0 5000

FEET

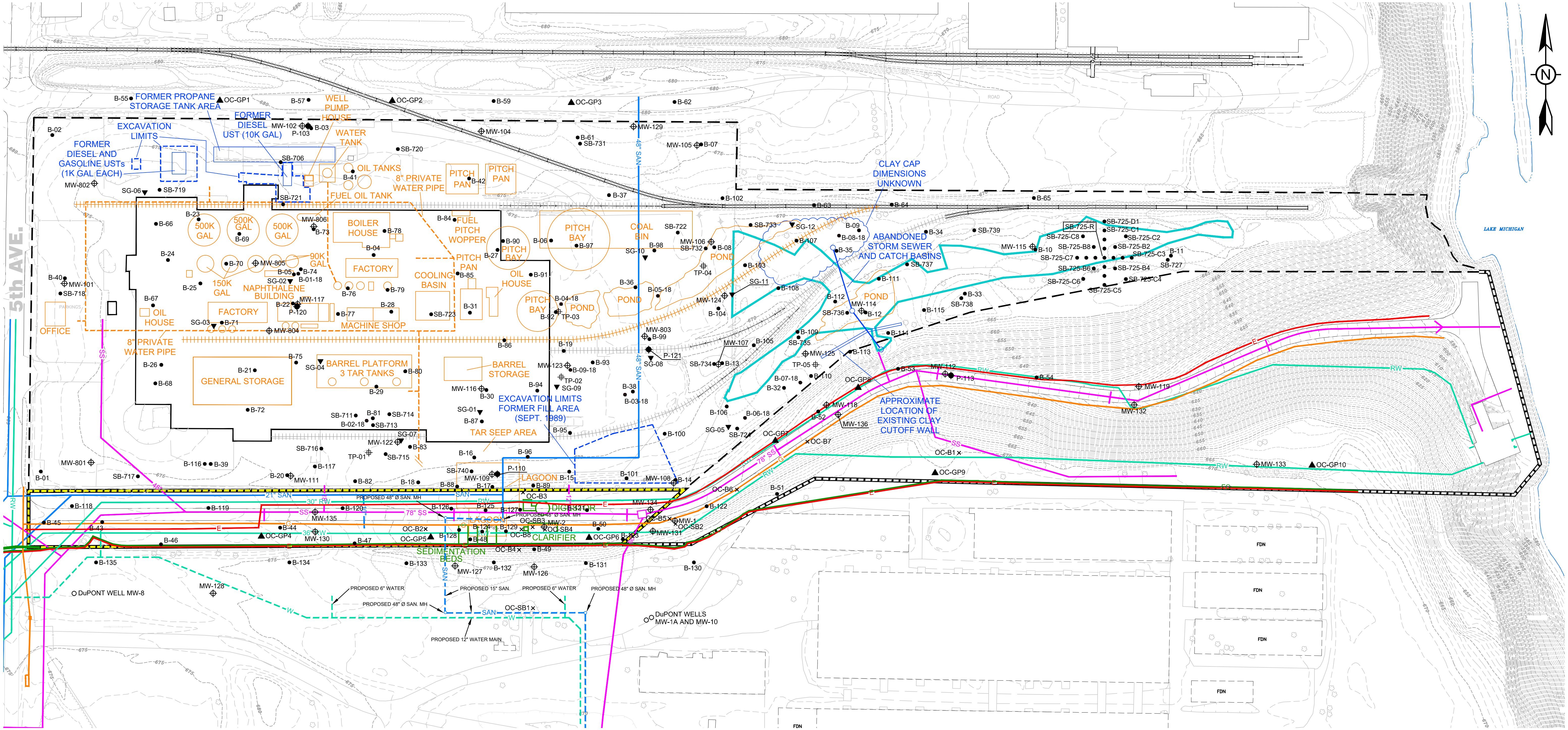
QUADRANGLE LOCATION

N

FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE OAK CREEK, WISCONSIN	DATE:	10/6/14
	DESIGNED:	HJW
SITE LOCATION and LOCAL TOPOGRAPHY	CHECKED:	DLM
	APPROVED:	DLM
	DRAWN:	HJW
	PROJ.: 117-2201323	
TETRA TECH	Figure 1	

Base map from U.S.G.S. 7.5' SOUTH MILWAUKEE, WISCONSIN and RACINE NORTH, WISCONSIN topographic quadrangle map.

S:\CAD\BEAZER\WABASH\RAO REPORT\10-2-14\SITE LOCATION.DWG



EXPLANATION

MW-101	WATER TABLE WELL
P-103	NESTED PIEZOMETER
B-01	SOIL BORING
OC-SB1	SOIL BORING (CITY OF OAK CREEK)
OC-GP1	GEOPROBE (CITY OF OAK CREEK)
TP-01	TEST PIT
SG-07	SOIL GAS PROBE

- APPROXIMATE WABASH PARCEL BOUNDARY (VPLE 06-41-560068)
- APPROXIMATE CITY PARCEL BOUNDARY (VPLE # TBD)
- FORMER TAR PLANT STRUCTURES
- PAST REMEDIAL ACTIVITIES
- FORMER WASTEWATER TREATMENT PLANT STRUCTURES
- APPROXIMATE WETLAND BOUNDARY
- APPROXIMATE CITY UTILITY CORRIDOR PROPERTY BOUNDARY

- E — ELECTRICAL
- G — NATURAL GAS
- RW — RAW WATER
- SAN — SANITARY
- SS — STORM SEWER
- FO — FIBER OPTIC

0 160 320
SCALE IN FEET

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY AND SITE FEATURES FROM LAND INFORMATION SERVICES, INC. - ENVIRONMENTAL SURVEY, 12/21/2001.
2. FORMER TAR PLANT STRUCTURES FROM THE SANBORN LIBRARY - EDR INQUIRY 2284158.1s, ©1950.
3. FORMER POND AND LAGOON LOCATIONS FROM 1937-1968 AERIAL PHOTOGRAPHY - COMPILED BY AERO-DATA CORPORATION, APRIL 2013.
4. FORMER WASTEWATER TREATMENT PLANT STRUCTURES FROM HARTMAN-STRASS, INC. - FILE NO. 72051-C-303, 12/1/1971.

TITLE: FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE
SITE LAYOUT

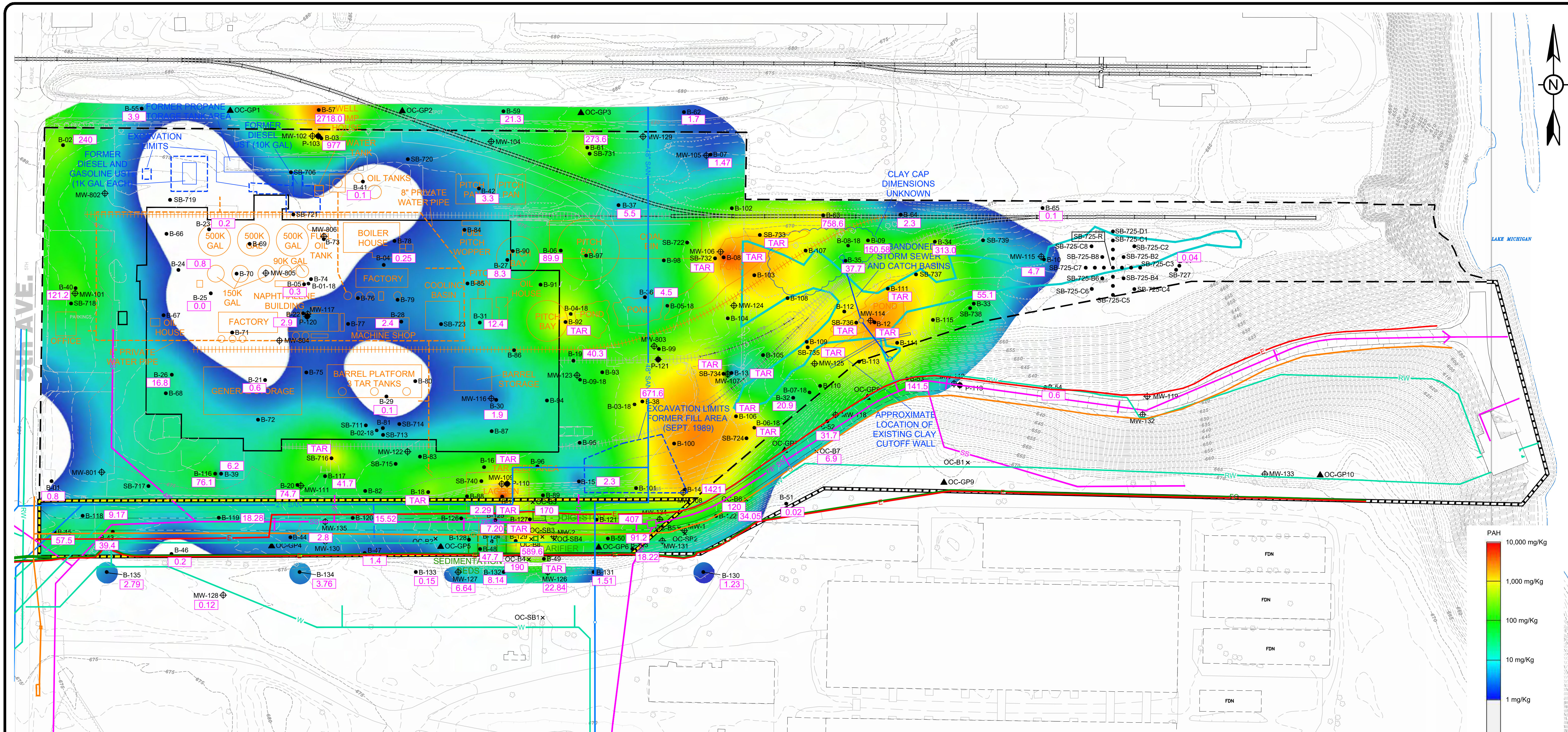
LOCATION: OAK CREEK, WISCONSIN

TETRA TECH

CHECKED	MRN
DRAFTED	CMP
PROJECT	117-2201472
DATE	05/20/21

FIGURE: 2

S:\CAD\BEAZER\WABASH\MAY 2021\FIGURE 2_SITE LAYOUT_05-20-21.DWG



EXPLANATION

MW-101	WATER TABLE WELL
P-103	NESTED PIEZOMETER
B-01	SOIL BORING
OC-SB1	SOIL BORING (CITY OF OAK CREEK)
OC-GP1	GEOPROBE (CITY OF OAK CREEK)
	APPROXIMATE WABASH PARCEL BOUNDARY (VPLE 06-41-560068)
	APPROXIMATE CITY PARCEL BOUNDARY (VPLE # TBD)
	FORMER TAR PLANT STRUCTURES
	PAST REMEDIAL ACTIVITIES
	FORMER WASTEWATER TREATMENT PLANT STRUCTURES
	APPROXIMATE WETLAND BOUNDARY
	APPROXIMATE CITY UTILITY CORRIDOR PROPERTY BOUNDARY
120.3	TOTAL PAH CONCENTRATION (mg/Kg) AT 0-4' BELOW GROUND SURFACE
TAR	TAR OBSERVED IN CLAY FRACTURES OR MATRIX
E	ELECTRICAL
G	NATURAL GAS
RW	RAW WATER
SAN	SANITARY
SS	STORM SEWER
FO	FIBER OPTIC

0 160 320
SCALE IN FEET

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY AND SITE FEATURES FROM LAND INFORMATION SERVICES, INC. - ENVIRONMENTAL SURVEY, 12/21/2001.
2. FORMER TAR PLANT STRUCTURES FROM THE SANBORN LIBRARY - EDR INQUIRY 2284158.1s, ©1950.
3. FORMER POND AND LAGOON LOCATIONS FROM 1937-1968 AERIAL PHOTOGRAPHY - COMPILED BY AERO-DATA CORPORATION, APRIL 2013.
4. FORMER WASTEWATER TREATMENT PLANT STRUCTURES FROM HARTMAN-STRASS, INC. - FILE NO. 72051-C-303, 12/1/1971.

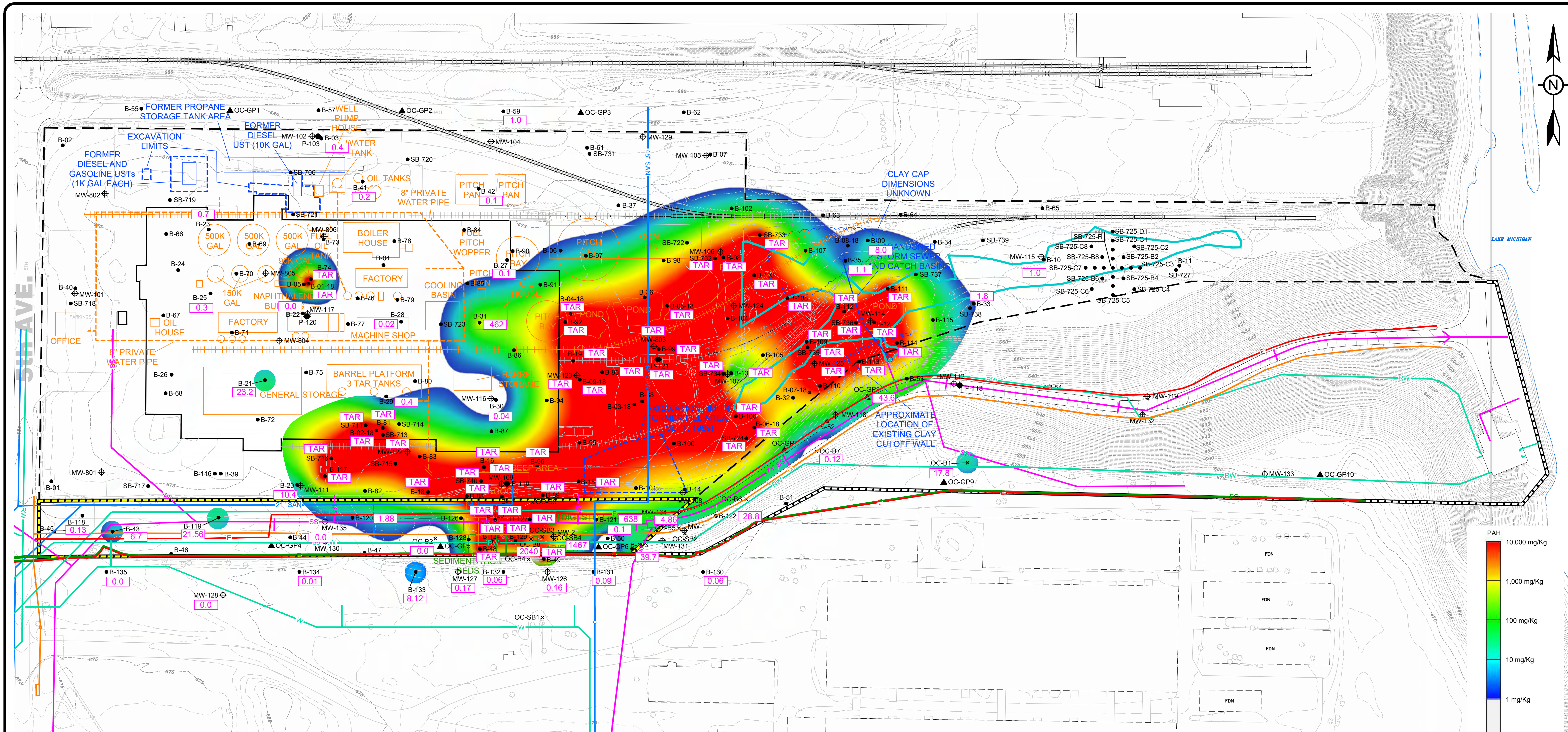
TITLE: FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE
PAH-IMPACTED SOIL (0-4 FT)

LOCATION: OAK CREEK, WISCONSIN

TETRA TECH

CHECKED	MRN	FIGURE:
DRAFTED	EBD/CMP	3
PROJECT	117-2201472	
DATE	05/20/21	

S:\CAD\BEAZER\WABASH\MAY 2021\FIGURE 3_PAH-IMPACTED SOIL (0-4 FT)_05-20-21.DWG



EXPLANATION

MW-101	WATER TABLE WELL
P-103	NESTED PIEZOMETER
B-01	SOIL BORING
× OC-SB1	SOIL BORING (CITY OF OAK CREEK)
▲ OC-GP1	GEOPROBE (CITY OF OAK CREEK)
— — —	APPROXIMATE WABASH PARCEL BOUNDARY (VPLE 06-41-560068)
(yellow dashed)	APPROXIMATE CITY PARCEL BOUNDARY (VPLE # TBD)
(orange outlines)	FORMER TAR PLANT STRUCTURES
(blue dashed)	PAST REMEDIAL ACTIVITIES
(green outlines)	FORMER WASTEWATER TREATMENT PLANT STRUCTURES
(cyan line)	APPROXIMATE WETLAND BOUNDARY
(black dashed)	APPROXIMATE CITY UTILITY CORRIDOR PROPERTY BOUNDARY
1359	TOTAL PAH CONCENTRATION (mg/Kg) AT 4-8' BELOW GROUND SURFACE
TAR	TAR OBSERVED IN CLAY FRACTURES OR MATRIX
—E—	ELECTRICAL
—G—	NATURAL GAS
—RW—	RAW WATER
—SAN—	SANITARY
—SS—	STORM SEWER
—FO—	FIBER OPTIC

0 160 320
SCALE IN FEET

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY AND SITE FEATURES FROM LAND INFORMATION SERVICES, INC. - ENVIRONMENTAL SURVEY, 12/21/2001.
2. FORMER TAR PLANT STRUCTURES FROM THE SANBORN LIBRARY - EDR INQUIRY 2284158.1s, ©1950.
3. FORMER POND AND LAGOON LOCATIONS FROM 1937-1968 AERIAL PHOTOGRAPHY - COMPILED BY AERO-DATA CORPORATION, APRIL 2013.
4. FORMER WASTEWATER TREATMENT PLANT STRUCTURES FROM HARTMAN-STRASS, INC. - FILE NO. 72051-C-303, 12/1/1971.

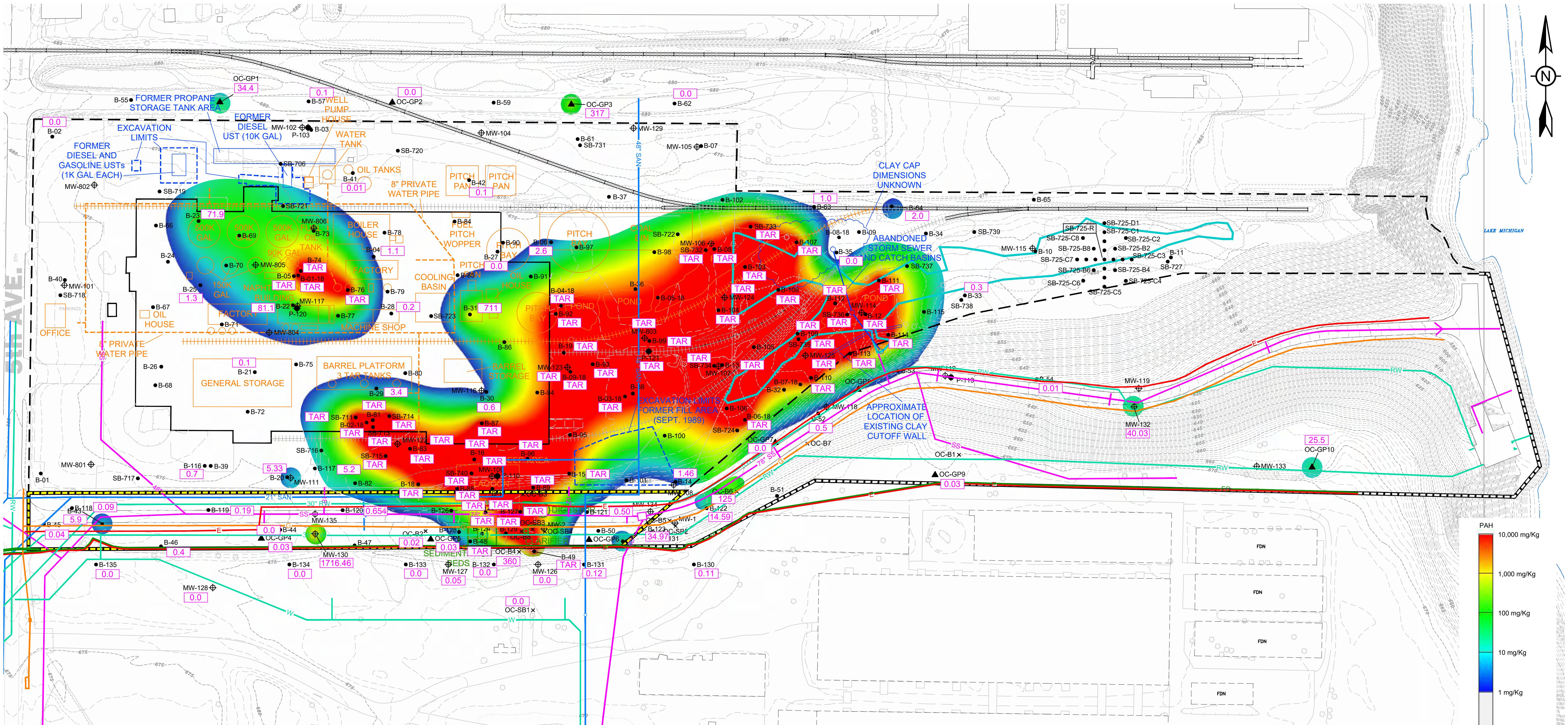
TITLE: FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE
PAH-IMPACTED SOIL (4-8 FT)

LOCATION: OAK CREEK, WISCONSIN

TETRA TECH

CHECKED	MRN	FIGURE:
DRAFTED	EBD/CMP	4
PROJECT	117-2201472	
DATE	05/20/21	

S:\CAD\BEAZER\WABASH\MAY 2021\FIGURE 4_PAH-IMPACTED SOIL (4-8 FT)_05-20-21.DWG



EXPLANATION

MW-101	WATER TABLE WELL
P-103	NESTED PIEZOMETER
B-01	SOIL BORING
OC-SB1	SOIL BORING (CITY OF OAK CREEK)
OC-GP1	GEOPROBE (CITY OF OAK CREEK)
	APPROXIMATE WABASH PARCEL BOUNDARY (VPLE 06-41-560068)
	APPROXIMATE CITY PARCEL BOUNDARY (VPLE # TBD)
	FORMER TAR PLANT STRUCTURES
	PAST REMEDIAL ACTIVITIES
	FORMER WASTEWATER TREATMENT PLANT STRUCTURES
	APPROXIMATE WETLAND BOUNDARY
	APPROXIMATE CITY UTILITY CORRIDOR PROPERTY BOUNDARY
39.3	TOTAL PAH CONCENTRATION (mg/Kg) AT 8-12' BELOW GROUND SURFACE
TAR	TAR OBSERVED IN CLAY FRACTURES OR MATRIX
E	ELECTRICAL
G	NATURAL GAS
RW	RAW WATER
SAN	SANITARY
SS	STORM SEWER
FO	FIBER OPTIC

0 160 320

SCALE IN FEET

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY AND SITE FEATURES FROM LAND INFORMATION SERVICES, INC. - ENVIRONMENTAL SURVEY, 12/21/2001.
2. FORMER TAR PLANT STRUCTURES FROM THE SANBORN LIBRARY - EDR INQUIRY 2284158.1s, ©1950.
3. FORMER POND AND LAGOON LOCATIONS FROM 1937-1968 AERIAL PHOTOGRAPHY - COMPILED BY AERO-DATA CORPORATION, APRIL 2013.
4. FORMER WASTEWATER TREATMENT PLANT STRUCTURES FROM HARTMAN-STRASS, INC. - FILE NO. 72051-C-303, 12/1/1971.

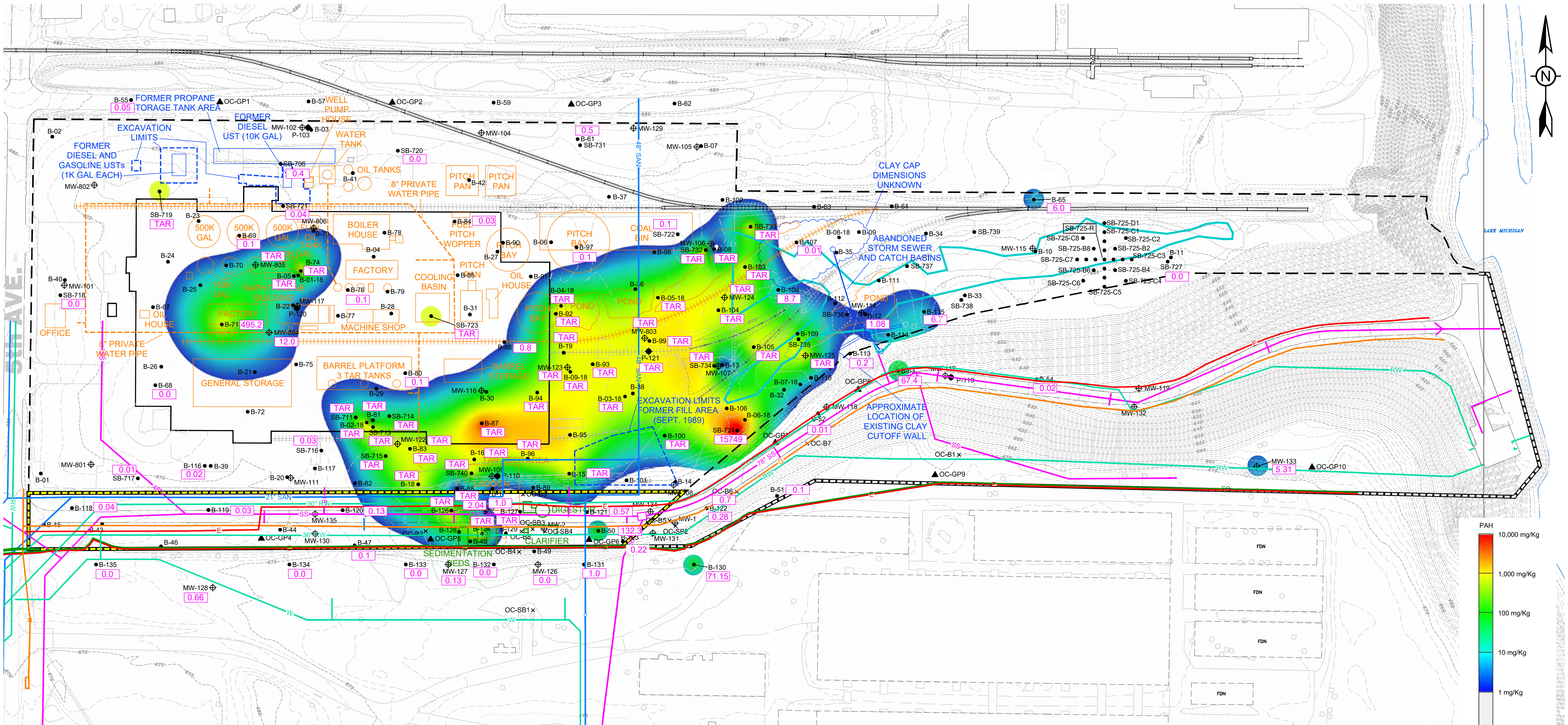
TITLE: FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE
PAH-IMPACTED SOIL (8-12 FT)

LOCATION: OAK CREEK, WISCONSIN

TETRA TECH

CHECKED	MRN	FIGURE:
DRAFTED	EBD/CMP	5
PROJECT	117-2201472	
DATE	05/20/21	

S:\CAD\BEAZER\WABASH\MAY 2021\FIGURE 5_PAH-IMPACTED SOIL (8-12 FT)_05-20-21.DWG



EXPLANATION

- MW-101 — WATER TABLE WELL
- P-103 — NESTED PIEZOMETER
- B-01 — SOIL BORING
- OC-SB1 — SOIL BORING (CITY OF OAK CREEK)
- OC-GP1 — GEOPROBE (CITY OF OAK CREEK)
- APPROXIMATE WABASH PARCEL BOUNDARY (VPLE 06-41-560068)
- APPROXIMATE CITY PARCEL BOUNDARY (VPLE # TBD)
- FORMER TAR PLANT STRUCTURES
- PAST REMEDIAL ACTIVITIES
- FORMER WASTEWATER TREATMENT PLANT STRUCTURES
- APPROXIMATE WETLAND BOUNDARY
- APPROXIMATE CITY UTILITY CORRIDOR PROPERTY BOUNDARY
- 54.5 — TOTAL PAH CONCENTRATION (mg/Kg) AT 12-16' BELOW GROUND SURFACE
- TAR — TAR OBSERVED IN CLAY FRACTURES OR MATRIX
- E — ELECTRICAL
- G — NATURAL GAS
- RW — RAW WATER
- SAN — SANITARY
- SS — STORM SEWER
- FO — FIBER OPTIC

0 160 320
SCALE IN FEET

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY AND SITE FEATURES FROM LAND INFORMATION SERVICES, INC. - ENVIRONMENTAL SURVEY, 12/21/2001.
2. FORMER TAR PLANT STRUCTURES FROM THE SANBORN LIBRARY - EDR INQUIRY 2284158.1s, ©1950.
3. FORMER POND AND LAGOON LOCATIONS FROM 1937-1968 AERIAL PHOTOGRAPHY - COMPILED BY AERO-DATA CORPORATION, APRIL 2013.
4. FORMER WASTEWATER TREATMENT PLANT STRUCTURES FROM HARTMAN-STRASS, INC. - FILE NO. 72051-C-303, 12/1/1971.

TITLE:	FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE PAH-IMPACTED SOIL (12-16 FT)
LOCATION:	OAK CREEK, WISCONSIN

TETRA TECH

CHECKED	MRN	FIGURE:
DRAFTED	EBD/CMP	6
PROJECT	117-2201472	
DATE	05/20/21	

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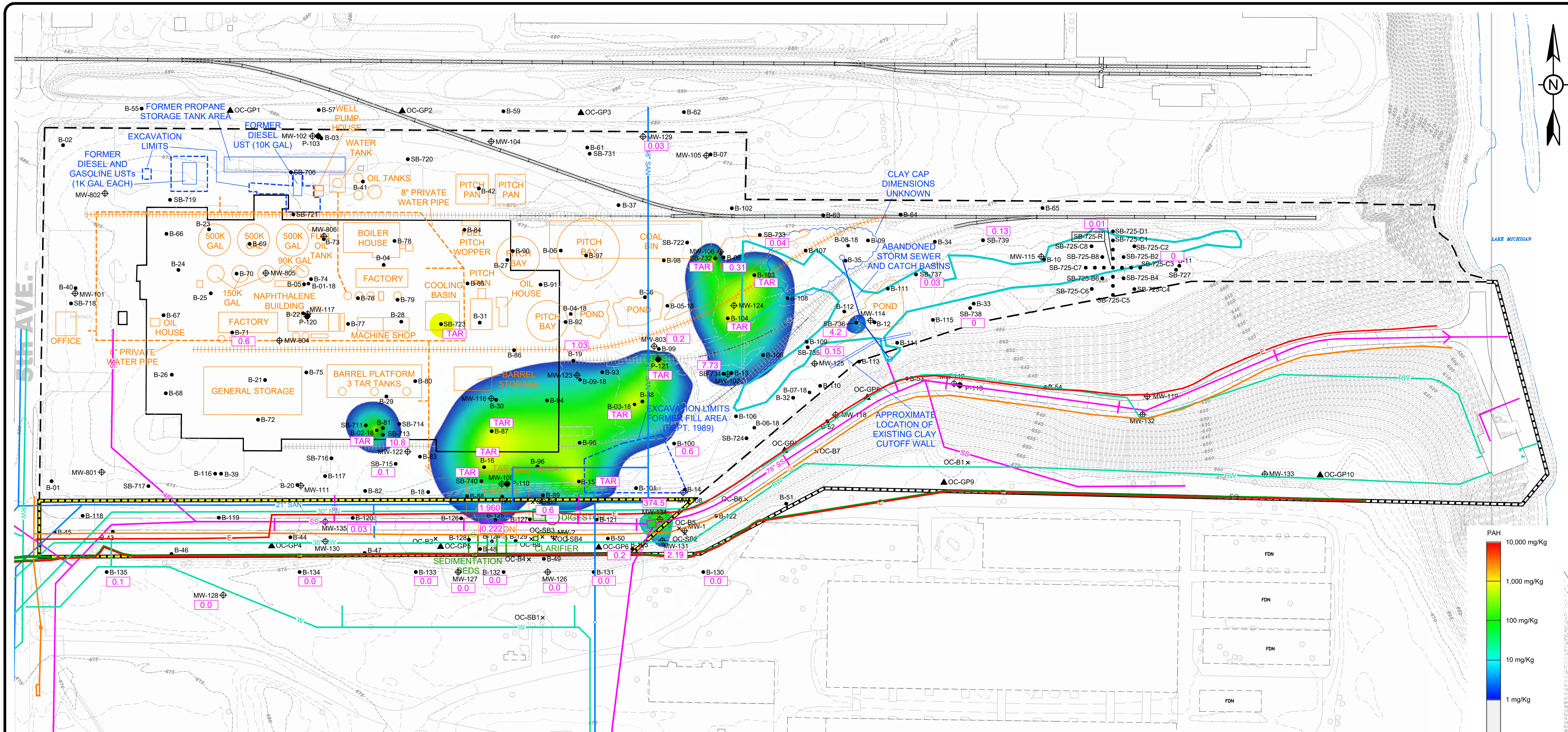


EXPLANATION

MW-101	WATER TABLE WELL
P-103	NESTED PIEZOMETER
B-01	SOIL BORING
OC-SB1	SOIL BORING (CITY OF OAK CREEK)
OC-GP1	GEOPROBE (CITY OF OAK CREEK)
	APPROXIMATE WABASH PARCEL BOUNDARY (VPLE 06-41-560068)
	APPROXIMATE CITY PARCEL BOUNDARY (VPLE # TBD)
	FORMER TAR PLANT STRUCTURES
	PAST REMEDIAL ACTIVITIES
	FORMER WASTEWATER TREATMENT PLANT STRUCTURES
	APPROXIMATE WETLAND BOUNDARY
	APPROXIMATE CITY UTILITY CORRIDOR PROPERTY BOUNDARY
337	TOTAL PAH CONCENTRATION (mg/Kg) AT 16-20' BELOW GROUND SURFACE
TAR	TAR OBSERVED IN CLAY FRACTURES OR MATRIX
E	ELECTRICAL
G	NATURAL GAS
RW	RAW WATER
SAN	SANITARY
SS	STORM SEWER
FO	FIBER OPTIC

0 160 320
SCALE IN FEET

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY AND SITE FEATURES FROM LAND INFORMATION SERVICES, INC. - ENVIRONMENTAL SURVEY, 12/21/2001.
2. FORMER TAR PLANT STRUCTURES FROM THE SANBORN LIBRARY - EDR INQUIRY 2284158.1s, ©1950.
3. FORMER POND AND LAGOON LOCATIONS FROM 1937-1968 AERIAL PHOTOGRAPHY - COMPILED BY AERO-DATA CORPORATION, APRIL 2013.
4. FORMER WASTEWATER TREATMENT PLANT STRUCTURES FROM HARTMAN-STRASS, INC. - FILE NO. 72051-C-303, 12/1/1971.

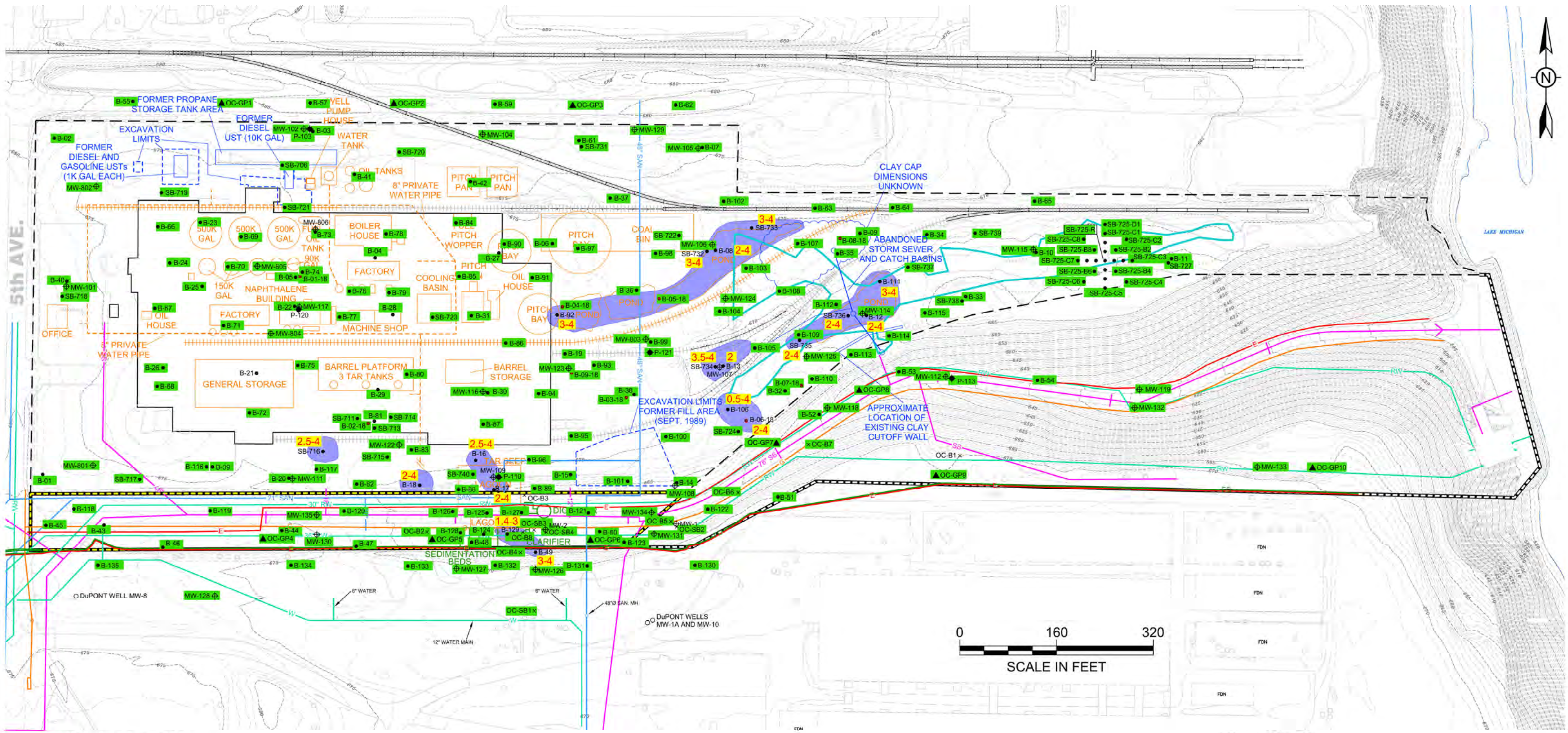
TITLE: FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE
PAH-IMPACTED SOIL (16-20 FT)

LOCATION: OAK CREEK, WISCONSIN

TETRA TECH

CHECKED	MRN	FIGURE:
DRAFTED	EBD/CMP	7
PROJECT	117-2201472	
DATE	05/20/21	

S:\CAD\BEAZER\WABASH\MAY 2021\FIGURE 7_PAH-IMPACTED SOIL (16-20 FT)_05-20-21.DWG



EXPLANATION

MW-101	WATER TABLE WELL
P-103	NESTED PIEZOMETER
B-01	SOIL BORING
OC-SB1	SOIL BORING (CITY OF OAK CREEK)
OC-GP1	GEOPROBE (CITY OF OAK CREEK)
	APPROXIMATE WABASH PARCEL BOUNDARY (VPLE 06-41-560068)
	APPROXIMATE CITY PARCEL BOUNDARY (VPLE # TBD)
	FORMER TAR PLANT STRUCTURES
	PAST REMEDIAL ACTIVITIES
	FORMER WASTEWATER TREATMENT PLANT STRUCTURES
	APPROXIMATE WETLAND BOUNDARY
	APPROXIMATE CITY UTILITY CORRIDOR PROPERTY BOUNDARY
	AREA OF OBSERVED TAR
2-4	OBSERVED TAR (0-4' BGS)
B-31	NO OBSERVED TAR
E	ELECTRICAL
G	NATURAL GAS
RW	RAW WATER
SAN	SANITARY
SS	STORM SEWER
FO	FIBER OPTIC

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY AND SITE FEATURES FROM LAND INFORMATION SERVICES, INC. - ENVIRONMENTAL SURVEY, 12/21/2001.
2. FORMER TAR PLANT STRUCTURES FROM THE SANBORN LIBRARY - EDR INQUIRY 2284158.1s, ©1950.
3. FORMER POND AND LAGOON LOCATIONS FROM 1937-1968 AERIAL PHOTOGRAPHY - COMPILED BY AERO-DATA CORPORATION, APRIL 2013.
4. FORMER WASTEWATER TREATMENT PLANT STRUCTURES FROM HARTMAN-STRASS, INC. - FILE NO. 72051-C-303, 12/1/1971.

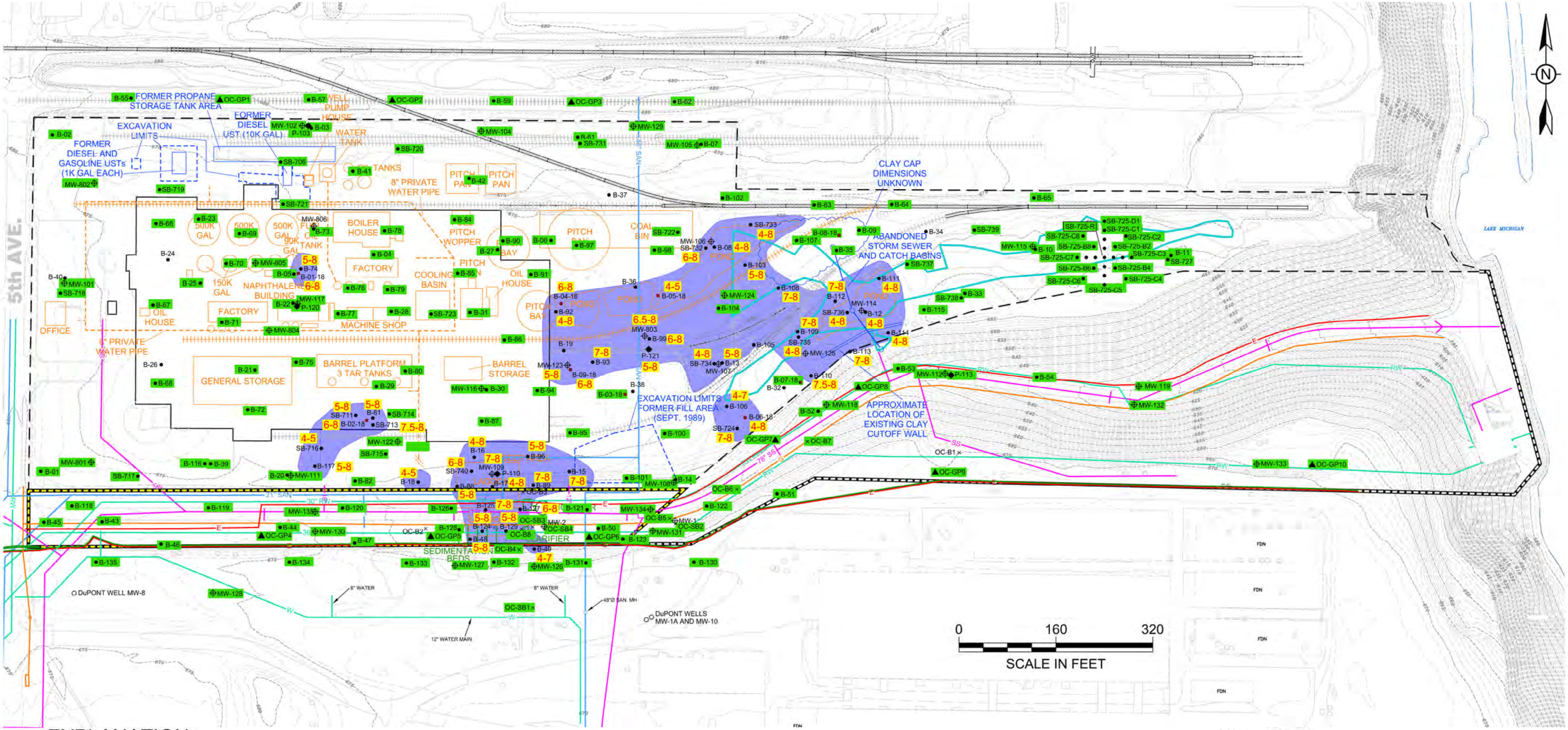
TITLE: FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE
OBSERVED POTENTIALLY MOBILE TAR (0-4 FT)

LOCATION: OAK CREEK, WISCONSIN

TETRA TECH

CHECKED	MRN
DRAFTED	CMP
PROJECT	117-2201472
DATE	05/20/21
FIGURE	8

S:\CAD\BEAZER\WABASH\MAY 2021\FIGURE 8_OBSERVED POTENTIALLY MOBILE TAR (0-4 FT)_05-20-21.DWG



EXPLANATION

MW-101	WATER TABLE WELL
P-103	NESTED PIEZOMETER
B-01	SOIL BORING
× OC-SB1	SOIL BORING (CITY OF OAK CREEK)
▲OC-GP1	GEOPROBE (CITY OF OAK CREEK)
— — —	APPROXIMATE WABASH PARCEL BOUNDARY (VPLE 06-41-560068)
	APPROXIMATE CITY PARCEL BOUNDARY (VPLE # TBD)
	FORMER TAR PLANT STRUCTURES
	PAST REMEDIAL ACTIVITIES
	FORMER WASTEWATER TREATMENT PLANT STRUCTURES
	APPROXIMATE WETLAND BOUNDARY
	APPROXIMATE CITY UTILITY CORRIDOR PROPERTY BOUNDARY
	AREA OF OBSERVED TAR
4-8	OBSERVED TAR (4-8' BGS)
B-31	NO OBSERVED TAR
E	ELECTRICAL
G	NATURAL GAS
RW	RAW WATER
SAN	SANITARY
SS	STORM SEWER
FO	FIBER OPTIC

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY AND SITE FEATURES FROM LAND INFORMATION SERVICES, INC. - ENVIRONMENTAL SURVEY, 12/21/2001.
2. FORMER TAR PLANT STRUCTURES FROM THE SANBORN LIBRARY - EDR INQUIRY 2284158.1s, ©1950.
3. FORMER POND AND LAGOON LOCATIONS FROM 1937-1968 AERIAL PHOTOGRAPHY - COMPILED BY AERO-DATA CORPORATION, APRIL 2013.
4. FORMER WASTEWATER TREATMENT PLANT STRUCTURES FROM HARTMAN-STRASS, INC. - FILE NO. 72051-C-303, 12/1/1971.

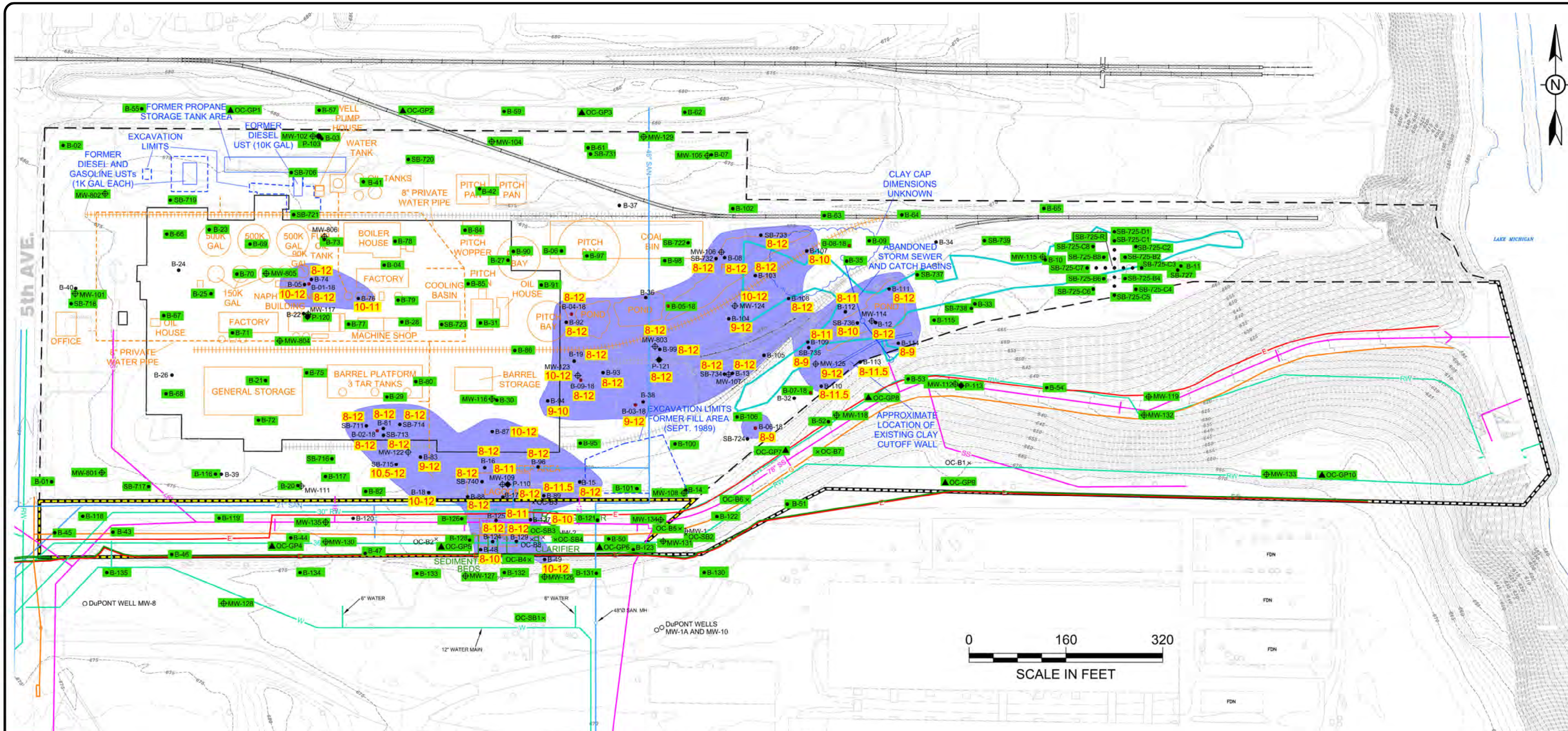
TITLE: FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE
OBSERVED POTENTIALLY MOBILE TAR (4-8 FT)

LOCATION: OAK CREEK, WISCONSIN

TETRA TECH

CHECKED	MRN	FIGURE:
DRAFTED	CMP	9
PROJECT	117-2201472	
DATE	05/20/21	

S:\CAD\BEAZER\WABASH\MAY 2021\FIGURE 9_OBSERVED POTENTIALLY MOBILE TAR (4-8 FT)_05-20-21.DWG



EXPLANATION

MW-101	WATER TABLE WELL
P-103	NESTED PIEZOMETER
B-01	SOIL BORING
OC-SB1	SOIL BORING (CITY OF OAK CREEK)
OC-GP1	GEOPROBE (CITY OF OAK CREEK)
	APPROXIMATE WABASH PARCEL BOUNDARY (VPLE 06-41-560068)
	APPROXIMATE CITY PARCEL BOUNDARY (VPLE # TBD)
	FORMER TAR PLANT STRUCTURES
	PAST REMEDIAL ACTIVITIES
	FORMER WASTEWATER TREATMENT PLANT STRUCTURES
	APPROXIMATE WETLAND BOUNDARY
	APPROXIMATE CITY UTILITY CORRIDOR PROPERTY BOUNDARY
	AREA OF OBSERVED TAR
8-12	OBSERVED TAR (8-12' BGS)
B-04	NO OBSERVED TAR
	ELECTRICAL
	NATURAL GAS
	RAW WATER
	SANITARY
	STORM SEWER
	FIBER OPTIC

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY AND SITE FEATURES FROM LAND INFORMATION SERVICES, INC. - ENVIRONMENTAL SURVEY, 12/21/2001.
2. FORMER TAR PLANT STRUCTURES FROM THE SANBORN LIBRARY - EDR INQUIRY 2284158.1s, ©1950.
3. FORMER POND AND LAGOON LOCATIONS FROM 1937-1968 AERIAL PHOTOGRAPHY - COMPILED BY AERO-DATA CORPORATION, APRIL 2013.
4. FORMER WASTEWATER TREATMENT PLANT STRUCTURES FROM HARTMAN-STRASS, INC. - FILE NO. 72051-C-303, 12/1/1971.

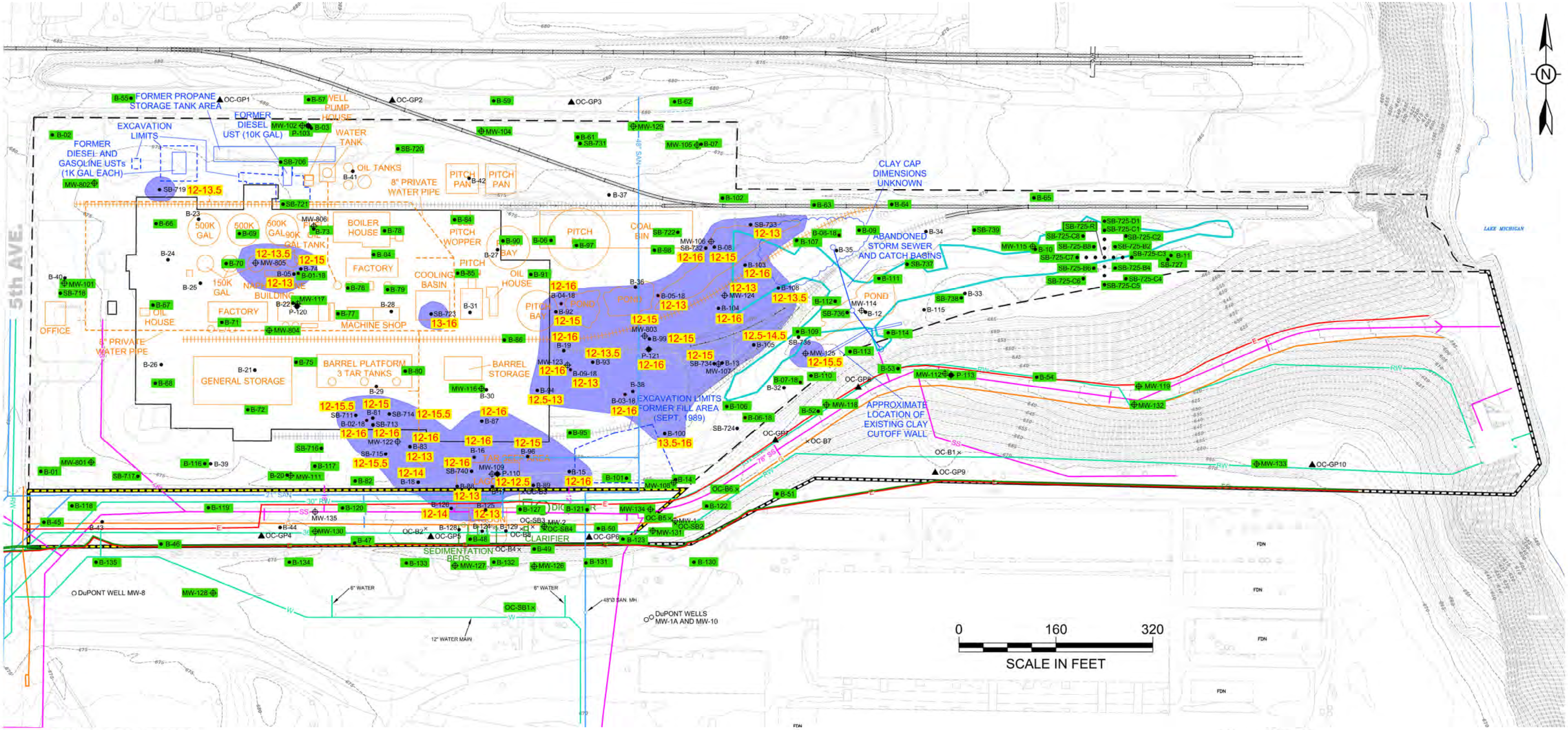
TITLE: FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE
OBSERVED POTENTIALLY MOBILE TAR (8-12 FT)

LOCATION: OAK CREEK, WISCONSIN

TETRA TECH

CHECKED	MRN	FIGURE:
DRAFTED	CMP	10
PROJECT	117-2201472	
DATE	05/20/21	

S:\CAD\BEAZER\WABASH\MAY 2021\FIGURE 10_OBSERVED POTENTIALLY MOBILE TAR (8-12 FT)_05-20-21.DWG



EXPLANATION

MW-101	WATER TABLE WELL
P-103	NESTED PIEZOMETER
B-01	SOIL BORING
OC-SB1	SOIL BORING (CITY OF OAK CREEK)
OC-GP1	GEOPROBE (CITY OF OAK CREEK)
	APPROXIMATE WABASH PARCEL BOUNDARY (VPLE 06-41-560068)
	APPROXIMATE CITY PARCEL BOUNDARY (VPLE # TBD)
	FORMER TAR PLANT STRUCTURES
	PAST REMEDIAL ACTIVITIES
	FORMER WASTEWATER TREATMENT PLANT STRUCTURES
	APPROXIMATE WETLAND BOUNDARY
	APPROXIMATE CITY UTILITY CORRIDOR PROPERTY BOUNDARY
	AREA OF OBSERVED TAR
12-13	OBSERVED TAR (12-16' BGS)
B-86	NO OBSERVED TAR
E	ELECTRICAL
	NATURAL GAS
	RAW WATER
SAN	SANITARY
SS	STORM SEWER
FO	FIBER OPTIC

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY AND SITE FEATURES FROM LAND INFORMATION SERVICES, INC. - ENVIRONMENTAL SURVEY, 12/21/2001.
2. FORMER TAR PLANT STRUCTURES FROM THE SANBORN LIBRARY - EDR INQUIRY 2284158.1s, ©1950.
3. FORMER POND AND LAGOON LOCATIONS FROM 1937-1968 AERIAL PHOTOGRAPHY - COMPILED BY AERO-DATA CORPORATION, APRIL 2013.
4. FORMER WASTEWATER TREATMENT PLANT STRUCTURES FROM HARTMAN-STRASS, INC. - FILE NO. 72051-C-303, 12/1/1971.

TITLE: FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE

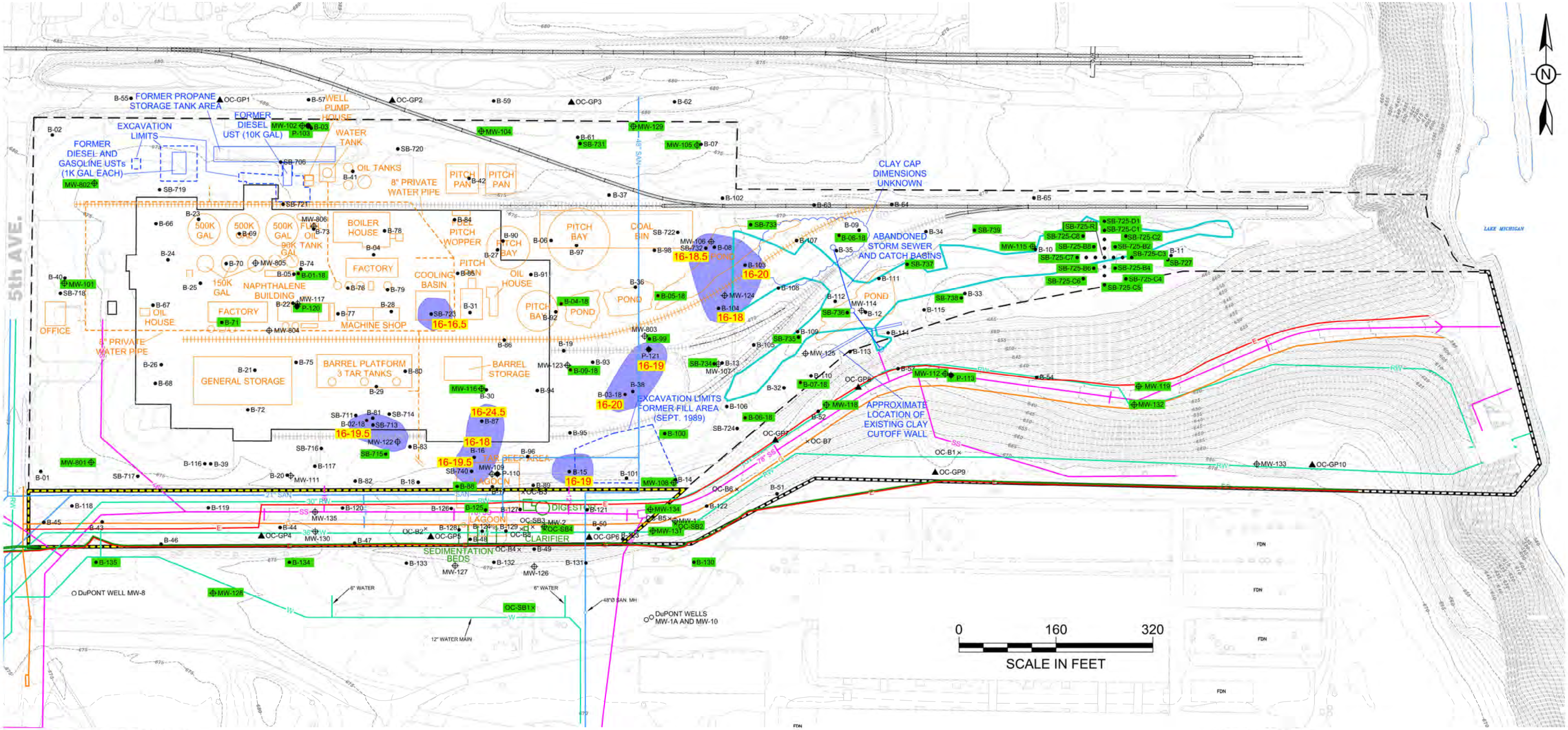
OBSERVED POTENTIALLY MOBILE TAR (12-16 FT)

LOCATION: OAK CREEK, WISCONSIN

TETRA TECH

CHECKED	MRN	FIGURE:
DRAFTED	CMP	11
PROJECT	117-2201472	
DATE	05/20/21	

S:\CAD\BEAZER\WABASH\MAY 2021\FIGURE 11_OBSERVED POTENTIALLY MOBILE TAR (12-16 FT)_05-20-21.DWG



EXPLANATION

MW-101	WATER TABLE WELL
P-103	NESTED PIEZOMETER
B-01	SOIL BORING
× OC-SB1	SOIL BORING (CITY OF OAK CREEK)
▲OC-GP1	GEOPROBE (CITY OF OAK CREEK)
	APPROXIMATE WABASH PARCEL BOUNDARY (VPLE 06-41-560068)
	APPROXIMATE CITY PARCEL BOUNDARY (VPLE # TBD)
	FORMER TAR PLANT STRUCTURES
	PAST REMEDIAL ACTIVITIES
	FORMER WASTEWATER TREATMENT PLANT STRUCTURES
	APPROXIMATE WETLAND BOUNDARY
	APPROXIMATE CITY UTILITY CORRIDOR PROPERTY BOUNDARY
	AREA OF OBSERVED TAR
16-20	OBSERVED TAR (16-20' BGS)
B-71	NO OBSERVED TAR
E	ELECTRICAL
	NATURAL GAS
	RAW WATER
	SANITARY
SS	STORM SEWER
FO	FIBER OPTIC

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY AND SITE FEATURES FROM LAND INFORMATION SERVICES, INC. - ENVIRONMENTAL SURVEY, 12/21/2001.
2. FORMER TAR PLANT STRUCTURES FROM THE SANBORN LIBRARY - EDR INQUIRY 2284158.1s, ©1950.
3. FORMER POND AND LAGOON LOCATIONS FROM 1937-1968 AERIAL PHOTOGRAPHY - COMPILED BY AERO-DATA CORPORATION, APRIL 2013.
4. FORMER WASTEWATER TREATMENT PLANT STRUCTURES FROM HARTMAN-STRASS, INC. - FILE NO. 72051-C-303, 12/1/1971.

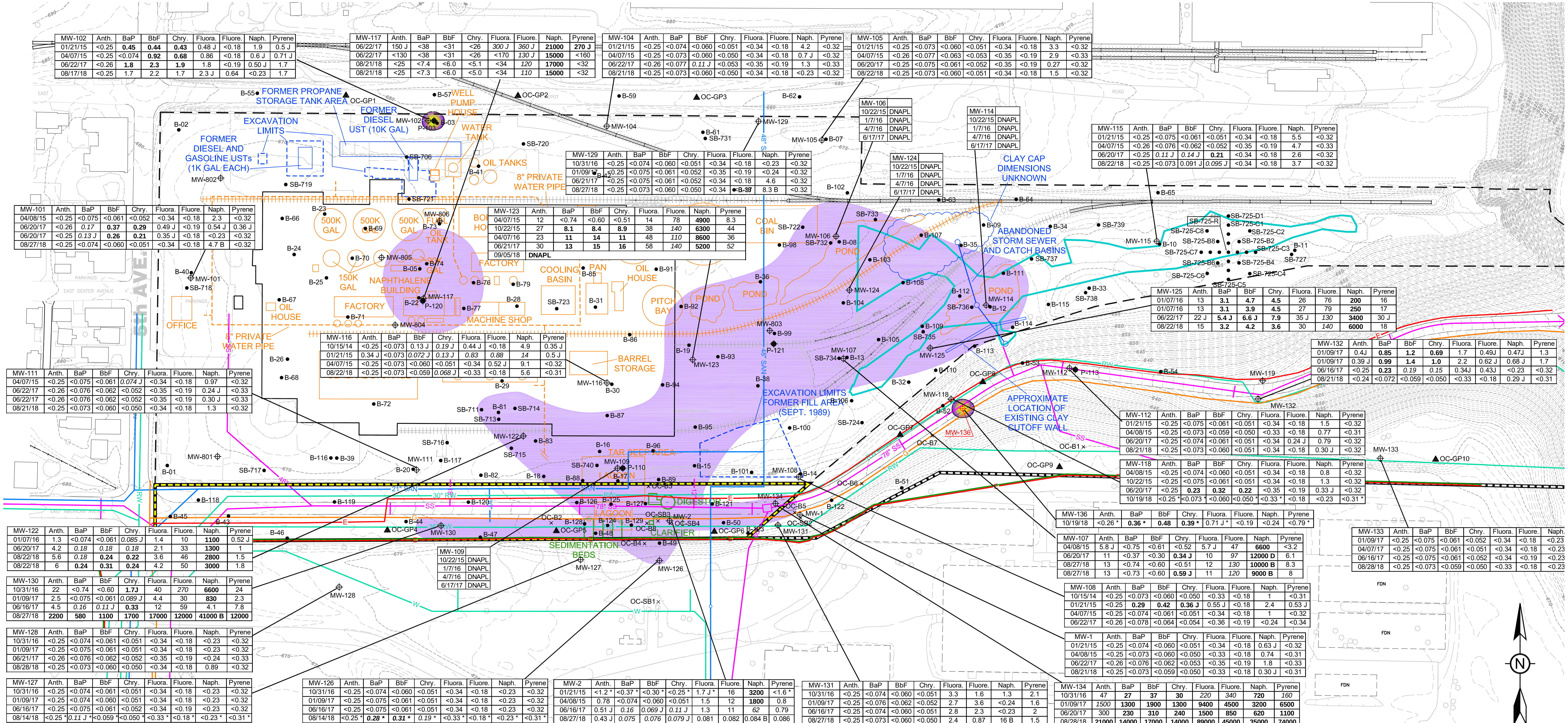
TITLE: FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE
OBSERVED POTENTIALLY MOBILE TAR (16-20 FT)

LOCATION: OAK CREEK, WISCONSIN

TETRA TECH

CHECKED	MRN	FIGURE:
DRAFTED	CMP	12
PROJECT	117-2201472	
DATE	05/20/21	

S:\CAD\BEAZER\WABASH\MAY 2021\FIGURE 12_OBSERVED POTENTIALLY MOBILE TAR (16-20 FT)_05-20-21.DWG



MW-102	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
01/21/15	<0.25	**0.45**	**0.44**	**0.43**	0.48 J	<0.18	1.9	0.5 J
04/07/15	<0.25	<0.074	**0.92**	**0.68**	0.86	<0.18	0.6 J	0.71 J
06/22/17	<0.26	**1.8**	**2.3**	**1.9**	1.8	<0.19	0.50 J	1.7
08/17/18	<0.25	1.7	2.2	1.7	2.3 J	0.64	<0.23	1.7

MW-117	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
06/22/17	150 J	<38	<31	<26	*300 J*	*360 J*	**21000**	**270 J**
06/22/17	<130	<38	<31	<26	<170	*130 J*	**15000**	<160
08/21/18	<25	<7.4	<6.0	<5.1	<34	*120*	**17000**	<32
08/21/18	<25	<7.3	<6.0	<5.0	<34	*110*	**15000**	<32

MW-104	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
01/21/15	<0.25	<0.074	<0.060	<0.051	<0.34	<0.18	4.2	<0.32
04/07/15	<0.25	<0.073	<0.060	<0.050	<0.34	<0.18	0.7 J	<0.32
06/22/17	<0.26	<0.077	*0.11 J*	<0.053	<0.35	<0.19	1.3	<0.33
08/21/18	<0.25	<0.073	<0.060	<0.050	<0.34	<0.18	<0.23	<0.32

MW-105	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
01/21/15	<0.25	<0.073	<0.060	<0.051	<0.34	<0.18	3.3	<0.32
04/07/15	<0.26	<0.077	<0.063	<0.053	<0.35	<0.19	2.9	<0.33
06/20/17	<0.25	<0.075	<0.061	<0.052	<0.35	<0.19	0.27	<0.32
08/22/18	<0.25	<0.073	<0.060	<0.051	<0.34	<0.18	1.5	<0.32

MW-106	
10/22/15	DNAPL
1/7/16	DNAPL
4/7/16	DNAPL
6/17/17	DNAPL

MW-114	
10/22/15	DNAPL
1/7/16	DNAPL
4/7/16	DNAPL
6/17/17	DNAPL

MW-124	
10/22/15	DNAPL
1/7/16	DNAPL
4/7/16	DNAPL
6/17/17	DNAPL

MW-115	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
01/21/15	<0.25	<0.075	<0.061	<0.051	<0.34	<0.18	5.5	<0.32
04/07/15	<0.26	<0.076	<0.062	<0.052	<0.35	<0.19	4.7	<0.33
06/20/17	<0.25	*0.11 J*	*0.14 J*	**0.21**	<0.34	<0.18	2.6	<0.32
08/22/18	<0.25	<0.073	0.091 J	*0.095 J*	<0.34	<0.18	3.7	<0.32

MW-129	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
10/31/16	<0.25	<0.074	<0.060	<0.051	<0.34	<0.18	<0.23	<0.32
01/09/17	<0.25	<0.075	<0.061	<0.052	<0.35	<0.19	<0.24	<0.32
06/21/17	<0.25	<0.075	<0.061	<0.052	<0.34	<0.18	4.6	<0.32
08/27/18	<0.25	<0.073	<0.060	<0.050	<0.34	<0.18	8.3 B	<0.32

MW-101	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
04/08/15	<0.25	<0.075	<0.061	<0.052	<0.34	<0.18	2.3	<0.32
06/20/17	<0.26	*0.17*	**0.37**	**0.29**	0.49 J	<0.19	0.54 J	0.36 J
06/20/17	<0.25	*0.13 J*	**0.26**	**0.21**	0.35 J	<0.18	<0.23	<0.32
08/27/18	<0.25	<0.074	<0.060	<0.051	<0.34	<0.18	4.7 B	<0.32

MW-123	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
04/07/15	12	<0.74	<0.60	<0.51	14	78	**4900**	8.3
10/22/15	27	**8.1**	**8.4**	**8.9**	38	*140*	**6300**	44
04/07/16	23	**11**	**14**	**11**	48	*110*	**8600**	36
06/21/17	30	**13**	**15**	**16**	58	*140*	**5200**	*52*
09/05/18	DNAPL							

MW-116	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
10/15/14	<0.25	<0.073	0.13 J	*0.19 J*	0.44 J	<0.18	4.9	0.35 J
01/21/15	0.34 J	<0.073	*0.072 J*	*0.13 J*	*0.83*	*0.88*	*14*	0.5 J
04/07/15	<0.25	<0.073	<0.060	<0.051	<0.34	0.52 J	9.1	<0.32
08/22/18	<0.25	<0.073	<0.059	*0.068 J*	<0.33	<0.18	5.6	<0.31

MW-111	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
04/07/15	<0.25	<0.075	<0.061	*0.074 J*	<0.34	<0.18	0.97	<0.32
06/22/17	<0.26	<0.076	<0.062	<0.052	<0.35	<0.19	0.24 J	<0.33
06/22/17	<0.26	<0.076	<0.062	<0.052	<0.35	<0.19	0.30 J	<0.33
08/21/18	<0.25	<0.073	<0.060	<0.050	<0.34	<0.18	1.3	<0.32

MW-125	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
01/07/16	13	**3.1**	**4.7**	**4.5**	26	76	**200**	16
01/07/16	13	**3.1**	**3.9**	**4.5**	27	79	**250**	17
06/22/17	22 J	**5.4 J**	**6.6 J**	**7.9**	35 J	*130*	**3400**	30 J
08/22/18	15	**3.2**	**4.2**	**3.6**	30	*140*	**6000**	18

MW-132	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
01/09/17	0.4J	**0.85**	**1.2**	**0.69**	1.7	0.49J	0.47J	1.3
01/09/17	0.39 J	**0.99**	**1.4**	**1.0**	2.2	0.62 J	0.68 J	1.7
06/16/17	<0.25	**0.23**	*0.19*	*0.15*	0.34J	0.43J	<0.23	<0.32
08/21/18	<0.24	<0.072	<0.059	<0.050	<0.33	<0.18	0.29 J	<0.31

MW-112	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
01/21/15	<0.25	<0.075	<0.061	<0.051	<0.34	<0.18	1.5	<0.32
04/08/15	<0.25	<0.073	<0.059	<0.050	<0.33	<0.18	0.77	<0.31
06/20/17	<0.25	<0.074	<0.061	<0.051	<0.34	0.24 J	0.79	<0.32
08/21/18	<0.25	<0.073	<0.060	<0.051	<0.34	<0.18	0.30 J	<0.32

MW-118	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
04/08/15	<0.25	<0.074	<0.060	<0.051	<0.34	<0.18	0.8	<0.32
10/22/15	<0.25	<0.075	<0.061	<0.051	<0.34	<0.18	1.3	<0.32
06/20/17	<0.25	**0.23**	**0.32**	**0.22**	<0.35	<0.19	0.33 J	<0.32
10/19/18	<0.25 *	<0.073 *	<0.060	<0.050 *	<0.33 *	<0.18	<0.23	<0.31 *

MW-136	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
10/19/18	<0.26 *	**0.36 ***	**0.48**	**0.39 ***	0.71 J *	<0.19	<0.24	<0.79 *

MW-107	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
04/08/15	5.8 J	<0.75	<0.61	<0.52	5.7 J	47	**6600**	<3.2
06/20/17	11	<0.37	<0.30	**0.34 J**	10	*97*	**12000 D**	6.1
08/27/18	13	<0.74	<0.60	<0.51	12	*130*	**10000 B**	8.3
08/27/18	13	<0.73	<0.60	**0.59 J**	11	*120*	**9000 B**	8

MW-133	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.
01/09/17	<0.25	<0.075	<0.061	<0.052	<0.34	<0.18	<0.23
04/07/17	<0.25	<0.075	<0.061	<0.051	<0.34	<0.18	<0.23
06/16/17	<0.25	<0.075	<0.061	<0.052	<0.34	<0.19	<0.23
08/28/18	<0.25	<0.073	<0.059	<0.050	<0.33	<0.18	<0.23

MW-108	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
10/15/14	<0.25	<0.073	<0.060	<0.050	<0.33	<0.18	1	<0.31
01/21/15	<0.25	**0.29**	**0.42**	**0.36 J**	0.55 J	<0.18	2.4	0.53 J
04/07/15	<0.25	<0.074	<0.061	<0.051	<0.34	<0.18	1	<0.32
06/22/17	<0.26	<0.078	<0.064	<0.054	<0.36	<0.19	<0.24	<0.34

MW-1	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
01/21/15	<0.25	<0.074	<0.060	<0.051	<0.34	<0.18	0.63 J	<0.32
04/08/15	<0.25	<0.073	<0.060	<0.050	<0.33	<0.18	0.74	<0.31
06/22/17	<0.26	<0.076	<0.062	<0.053	<0.35	<0.19	1.8	<0.33
08/21/18	<0.25	<0.073	<0.059	<0.050	<0.33	<0.18	0.30 J	<0.31

MW-109	
10/22/15	DNAPL
1/7/16	DNAPL
4/7/16	DNAPL
6/17/17	DNAPL

MW-122	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
01/07/16	1.3	<0.074	<0.061	*0.085 J*	1.4	10	**1100**	0.52 J
06/20/17	4.2	*0.18*	*0.18*	*0.18*	2.1	33	**1300**	1
08/22/18	5.6	*0.18*	**0.24**	**0.22**	3.6	46	**2800**	1.5
08/22/18	6	**0.24**	**0.31**	**0.24**	4.2	50	**3000**	1.8

MW-130	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
10/31/16	22	<0.74	<0.60	**1.7J**	40	*270*	**6600**	24
01/09/17	2.5	<0.075	<0.061	*0.089 J*	4.4	30	**830**	2.3
06/16/17	4.5	*0.16*	*0.11 J*	**0.33**	12	59	4.1	7.8
08/27/18	**2200**	**580**	**1100**	**1700**	**17000**	**12000**	**41000 B**	**12000**

MW-128	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
10/31/16	<0.25	<0.074	<0.061	<0.051	<0.34	<0.18	<0.23	<0.32
01/09/17	<0.25	<0.075	<0.061	<0.051	<0.34	<0.18	<0.23	<0.32
06/21/17	<0.26	<0.076	<0.062	<0.052	<0.35	<0.19	<0.24	<0.33
08/28/18	<0.25	<0.073	<0.060	<0.050	<0.34	<0.18	0.89	<0.32

MW-127	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
10/31/16	<0.25	<0.074	<0.061	<0.051	<0.34	<0.18	<0.23	<0.32
01/09/17	<0.25	<0.074	<0.060	<0.051	<0.34	<0.18	<0.23	<0.32
06/16/17	<0.25	<0.075	<0.061	<0.052	<0.34	<0.19	<0.23	<0.32
08/14/18	<0.25 *	*0.11 J* *	<0.059 *	<0.050 *	<0.33 *	<0.18 *	<0.23 *	<0.31 *

MW-126	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
10/31/16	<0.25	<0.074	<0.060	<0.051	<0.34	<0.18	<0.23	<0.32
01/09/17	<0.25	<0.075	<0.061	<0.051	<0.34	<0.18	<0.23	<0.32
06/16/17	<0.25	<0.075	<0.061	<0.051	<0.34	<0.18	<0.23	<0.32
08/14/18	<0.25 *	**0.28 ***	**0.31 ***	*0.19 **	<0.33 *	<0.18 *	<0.23 *	<0.31 *

MW-2	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
01/21/15	<1.2 *	<0.37 *	<0.30 *	<0.25 *	1.7 J *	16	**3200**	<1.6 *
04/08/15	0.78	<0.074	<0.060	<0.051	1.5	12	**1800**	0.8
06/16/17	0.51 J	*0.16*	*0.069 J*	*0.11 J*	1.3	11	*62*	0.79
08/27/18	0.43 J	*0.075*	*0.076*	*0.079 J*	0.081	0.082	0.084 B	0.086

MW-131	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
10/31/16	<0.25	<0.074	<0.060	<0.051	3.3	1.6	1.3	2.1
01/09/17	<0.25	<0.076	<0.062	<0.052	2.7	3.6	<0.24	1.6
06/16/17	<0.25	<0.074	<0.060	<0.051	2.8	2.3	<0.23	2
08/27/18	<0.25	<0.073	<0.060	<0.050	2.4	0.87	16 B	1.5

MW-134	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
10/31/16	47	**27**	**37**	**30**	*220*	*340*	**720**	*160*
01/09/17	*1500*	**1300**	**1900**	**1300**	**9400**	**4500**	**3200**	**6500**
06/20/17	300	**230**	**310**	**240**	**1500**	**850**	**620**	**1100**
08/28/18	**21000**	**14000**	**17000**	**14000**	**89000**	**45000**	**35000**	**74000**

EXPLANATION

- MW-101 WATER TABLE WELL
- MW-136 NEW WATER TABLE WELL
- P-103 NESTED PIEZOMETER
- B-01 SOIL BORING
- OC-SB1 SOIL BORING (CITY OF OAK CREEK)
- OC-GP1 GEOPROBE (CITY OF OAK CREEK)
- APPROXIMATE WABASH PARCEL BOUNDARY (VPLE 06-41-560068)
- APPROXIMATE CITY PARCEL BOUNDARY (VPLE # TBD)
- FORMER TAR PLANT STRUCTURES
- PAST REMEDIAL ACTIVITIES
- FORMER WASTEWATER TREATMENT PLANT STRUCTURES
- APPROXIMATE WETLAND BOUNDARY
- APPROXIMATE CITY UTILITY CORRIDOR PROPERTY BOUNDARY
- E ELECTRICAL
- G NATURAL GAS
- RW RAW WATER
- SAN SANITARY
- SS STORM SEWER
- FO FIBER OPTIC
- APPROXIMATE AREA OF GROUNDWATER THAT EXCEEDS ENFORCEMENT STANDARD
- INTERMITTENT DETECTIONS ABOVE AND BELOW STANDARDS

	PAH	Anth.	BaP	BbF	Chry.	Fluora.	Fluore.	Naph.	Pyrene
WDNR	PAL	*600*	*0.02*	*0.02*	*0.02*	*80*	*80*	*10*	*50*
NR140	ES	**3000**	**0.2**	**0.2**	**0.2**	**400**	**400**	**100**	**250**

ALL VALUES IN ug/L (ppb)
ITALIC VALUES EXCEED NR 140 PAL
BOLD VALUES EXCEED NR 140 ES

0 160 320
SCALE IN FEET

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY AND SITE FEATURES FROM LAND INFORMATION SERVICES, INC. - ENVIRONMENTAL SURVEY, 12/21/2001.
2. FORMER TAR PLANT STRUCTURES FROM THE SANBORN LIBRARY - EDR INQUIRY 2284158.1s, ©1950.
3. FORMER POND AND LAGOON LOCATIONS FROM 1937-1968 AERIAL PHOTOGRAPHY - COMPILED BY AERO-DATA CORPORATION, APRIL 2013.
4. FORMER WASTEWATER TREATMENT PLANT STRUCTURES FROM HARTMAN-STRASS, INC. - FILE NO. 72051-C-303, 12/1/1971.

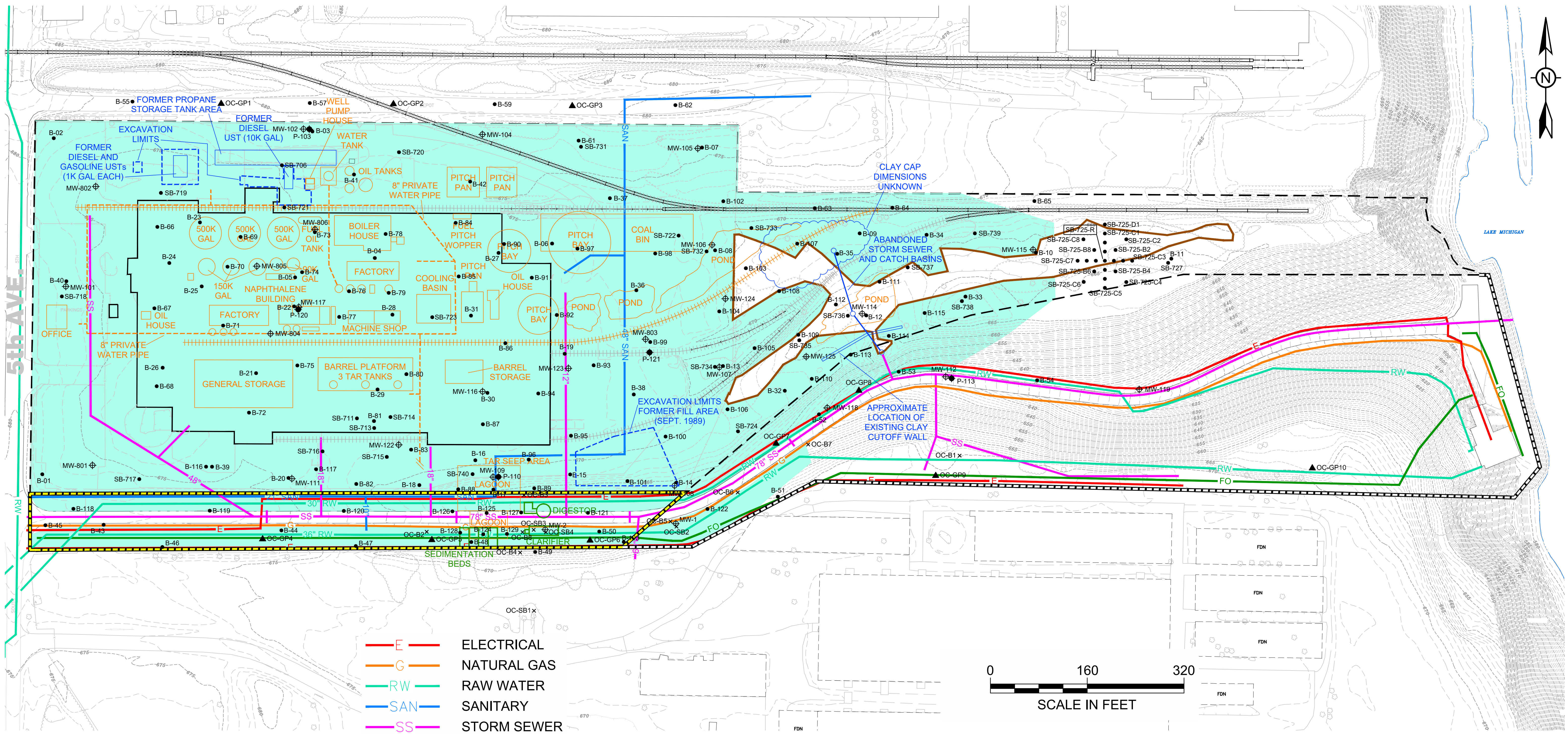
TITLE: FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE
PAH-IMPACTED GROUNDWATER EXTENT

LOCATION: OAK CREEK, WISCONSIN

TETRA TECH

CHECKED	MRN	FIGURE:
DRAFTED	CMP	13
PROJECT	117-2201472	
DATE	05-20-21	

S:\CAD\BEAZER\WABASH\MAY 2021\FIGURE 13_PAH-IMPACTED GROUNDWATER EXTENT_05-20-21.DWG



E	ELECTRICAL
G	NATURAL GAS
RW	RAW WATER
SAN	SANITARY
SS	STORM SEWER
FO	FIBER OPTIC

0 160 320
SCALE IN FEET

EXPLANATION

- MW-101 — WATER TABLE WELL
- P-103 — NESTED PIEZOMETER
- B-01 — SOIL BORING
- OC-SB1 — SOIL BORING (CITY OF OAK CREEK)
- OC-GP1 — GEOPROBE (CITY OF OAK CREEK)
- APPROXIMATE WABASH PARCEL BOUNDARY (VPLE 06-41-560068)
- APPROXIMATE CITY PARCEL BOUNDARY (VPLE # TBD)
- FORMER TAR PLANT STRUCTURES
- PAST REMEDIAL ACTIVITIES
- FORMER WASTEWATER TREATMENT PLANT STRUCTURES
- APPROXIMATE WETLAND BOUNDARY
- APPROXIMATE CITY UTILITY CORRIDOR PROPERTY BOUNDARY
- PROPOSED LIMIT OF DERMAL COVER FOR PAHs - 24" GENERAL FILL/ROOTING ZONE (910,114 FT^2)

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY AND SITE FEATURES FROM LAND INFORMATION SERVICES, INC. - ENVIRONMENTAL SURVEY, 12/21/2001.
2. FORMER TAR PLANT STRUCTURES FROM THE SANBORN LIBRARY - EDR INQUIRY 2284158.1s, ©1950.
3. FORMER POND AND LAGOON LOCATIONS FROM 1937-1968 AERIAL PHOTOGRAPHY - COMPILED BY AERO-DATA CORPORATION, APRIL 2013.
4. FORMER WASTEWATER TREATMENT PLANT STRUCTURES FROM HARTMAN-STRASS, INC. - FILE NO. 72051-C-303, 12/1/1971.

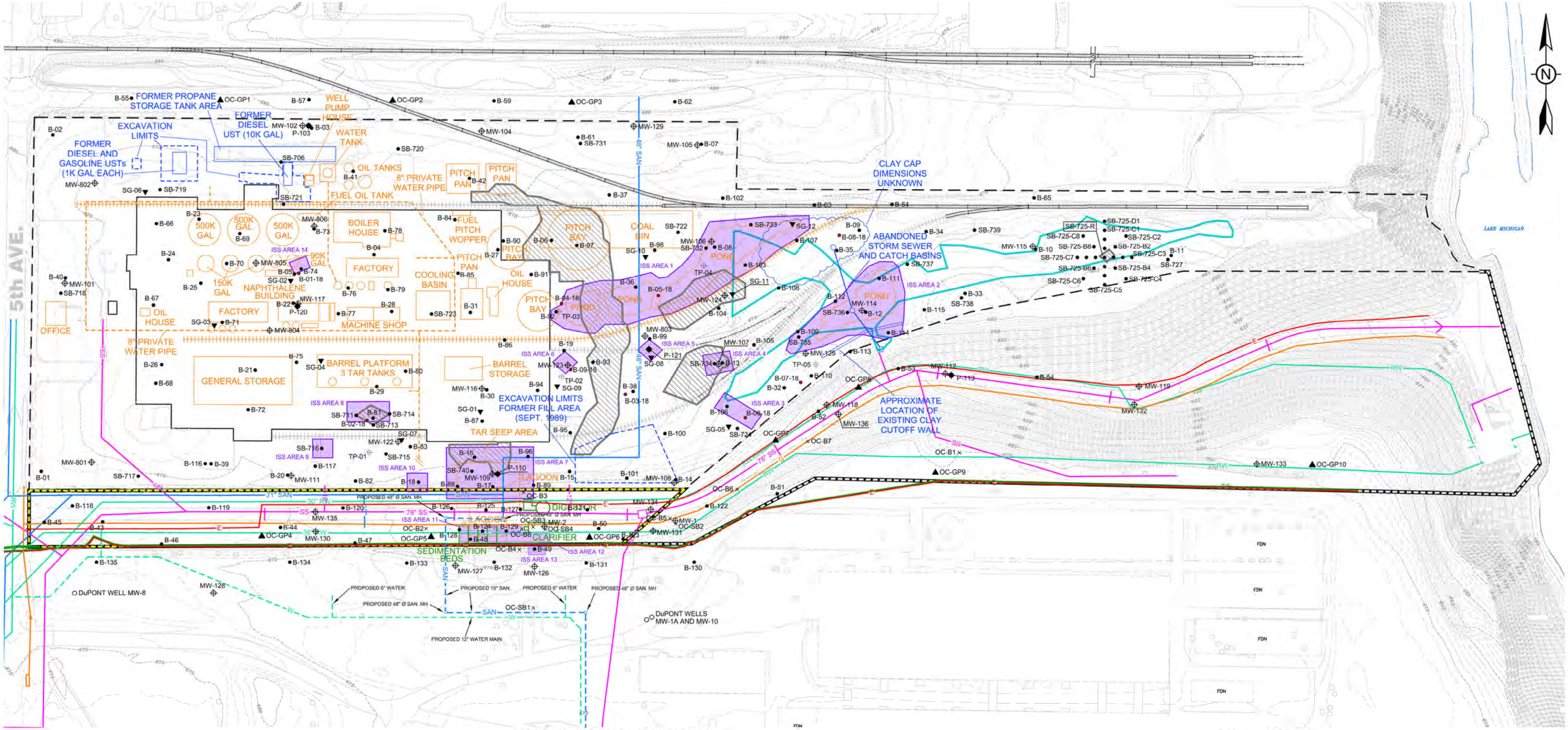
TITLE: FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE
SOIL BARRIER (ALTERNATIVE S-1)

LOCATION: OAK CREEK, WISCONSIN

TETRA TECH

CHECKED	MRN	FIGURE:
DRAFTED	CMP	14
PROJECT	117-2201472	
DATE	05-20-21	

S:\CAD\BEAZER\WABASH\MAY 2021\FIGURE 14 SOIL BARRIER (ALTERNATIVE S-1) 05-20-21.DWG



EXPLANATION

MW-101	WATER TABLE WELL
P-103	NESTED PIEZOMETER
B-01	SOIL BORING
OC-SB1	SOIL BORING (CITY OF OAK CREEK)
OC-GP1	GEOPROBE (CITY OF OAK CREEK)
TP-01	TEST PIT
SG-07	SOIL GAS PROBE
	AREAS OF OBSERVED TAR (0-6')
	APPROXIMATE WABASH PARCEL BOUNDARY (VPLE 06-41-560068)
	APPROXIMATE CITY PARCEL BOUNDARY (VPLE # TBD)
	FORMER TAR PLANT STRUCTURES
	PAST REMEDIAL ACTIVITIES
	FORMER WASTEWATER TREATMENT PLANT STRUCTURES
	APPROXIMATE WETLAND BOUNDARY
	APPROXIMATE CITY UTILITY CORRIDOR PROPERTY BOUNDARY
	PROPOSED EXCAVATION AREAS BOUNDARY FOR PCBs, APPROXIMATE
E	ELECTRICAL
G	NATURAL GAS
RW	RAW WATER
SAN	SANITARY
SS	STORM SEWER
FO	FIBER OPTIC

0 160 320
SCALE IN FEET

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY AND SITE FEATURES FROM LAND INFORMATION SERVICES, INC. - ENVIRONMENTAL SURVEY, 12/21/2001.
2. FORMER TAR PLANT STRUCTURES FROM THE SANBORN LIBRARY - EDR INQUIRY 2284158.1s, ©1950.
3. FORMER POND AND LAGOON LOCATIONS FROM 1937-1968 AERIAL PHOTOGRAPHY - COMPILED BY AERO-DATA CORPORATION, APRIL 2013.
4. FORMER WASTEWATER TREATMENT PLANT STRUCTURES FROM HARTMAN-STRASS, INC. - FILE NO. 72051-C-303, 12/1/1971.

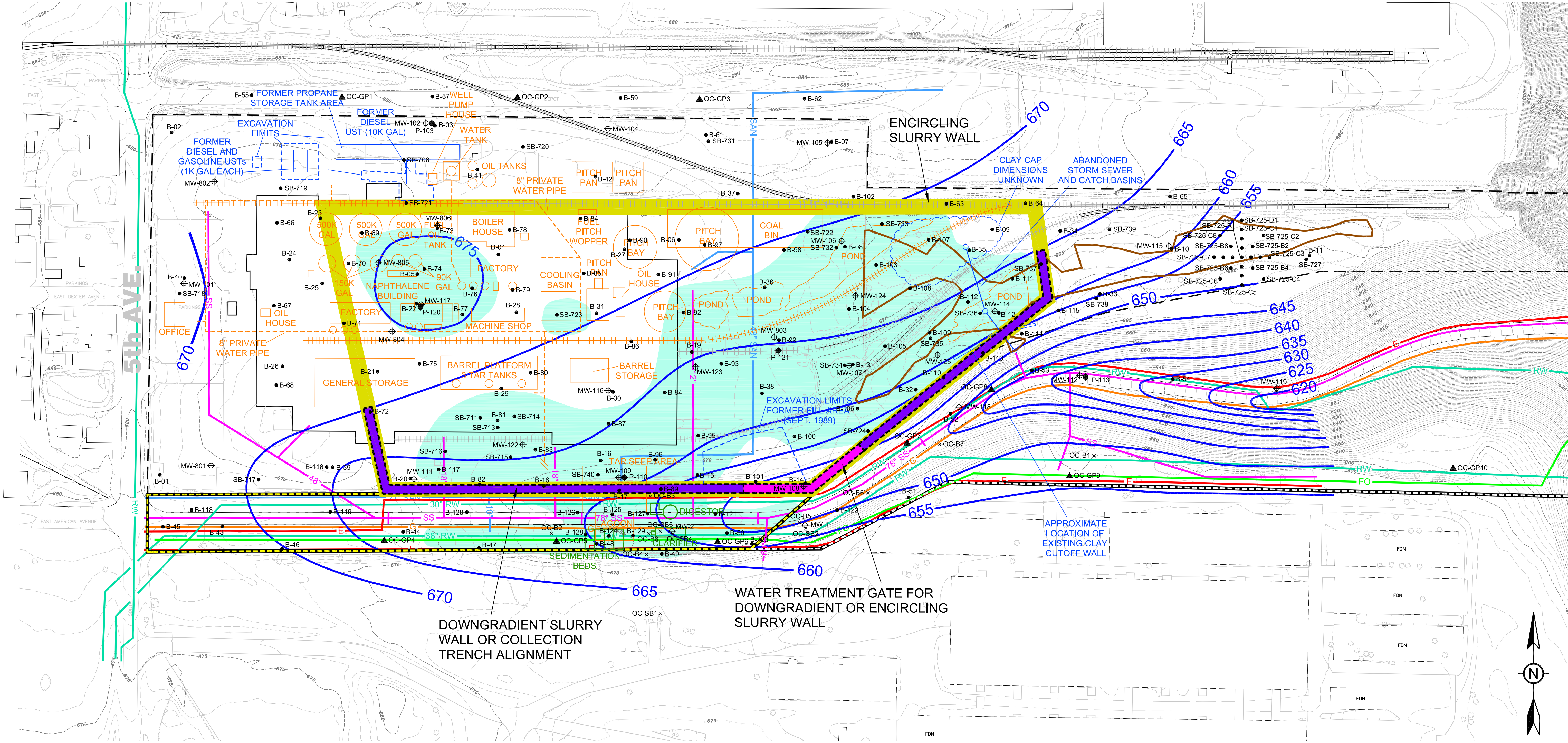
TITLE: FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE
OBSERVED POTENTIALLY MOBILE TAR (0-6 FT)

LOCATION: OAK CREEK, WISCONSIN

TETRA TECH

CHECKED	MRN	FIGURE: 15
DRAFTED	CMP	
PROJECT	117-2201472	
DATE	05/20/21	

S:\CAD\BEAZER\WABASH\MAY 2021\FIGURE 15_OBSERVED POTENTIALLY MOBILE TAR (0-6 FT)_05-20-21.DWG



EXPLANATION

MW-101	WATER TABLE WELL
P-103	NESTED PIEZOMETER
B-01	SOIL BORING
× OC-SB1	SOIL BORING (CITY OF OAK CREEK)
▲ OC-GP1	GEOPROBE (CITY OF OAK CREEK)
— — —	APPROXIMATE WABASH PARCEL BOUNDARY (VPLE 06-41-560068)
(yellow dashed line)	APPROXIMATE CITY PARCEL BOUNDARY (VPLE # TBD)
(orange box/circle)	FORMER TAR PLANT STRUCTURES
(blue dashed box)	PAST REMEDIAL ACTIVITIES
(green box/circle)	FORMER WASTEWATER TREATMENT PLANT STRUCTURES
(brown line)	APPROXIMATE WETLAND BOUNDARY
(black hatched line)	APPROXIMATE CITY UTILITY CORRIDOR PROPERTY BOUNDARY
— 670 —	SHALLOW WATER TABLE CONTOUR
— E —	ELECTRICAL
— G —	NATURAL GAS
— RW —	RAW WATER
— SAN —	SANITARY
— SS —	STORM SEWER
— FO —	FIBER OPTIC
(cyan fill)	APPROXIMATE AREA OF GROUNDWATER THAT EXCEEDS ENFORCEMENT STANDARD

0 160 320
SCALE IN FEET

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY AND SITE FEATURES FROM LAND INFORMATION SERVICES, INC. - ENVIRONMENTAL SURVEY, 12/21/2001.
2. FORMER TAR PLANT STRUCTURES FROM THE SANBORN LIBRARY - EDR INQUIRY 2284158.1s, ©1950.
3. FORMER POND AND LAGOON LOCATIONS FROM 1937-1968 AERIAL PHOTOGRAPHY - COMPILED BY AERO-DATA CORPORATION, APRIL 2013.
4. FORMER WASTEWATER TREATMENT PLANT STRUCTURES FROM HARTMAN-STRASS, INC. - FILE NO. 72051-C-303, 12/1/1971.

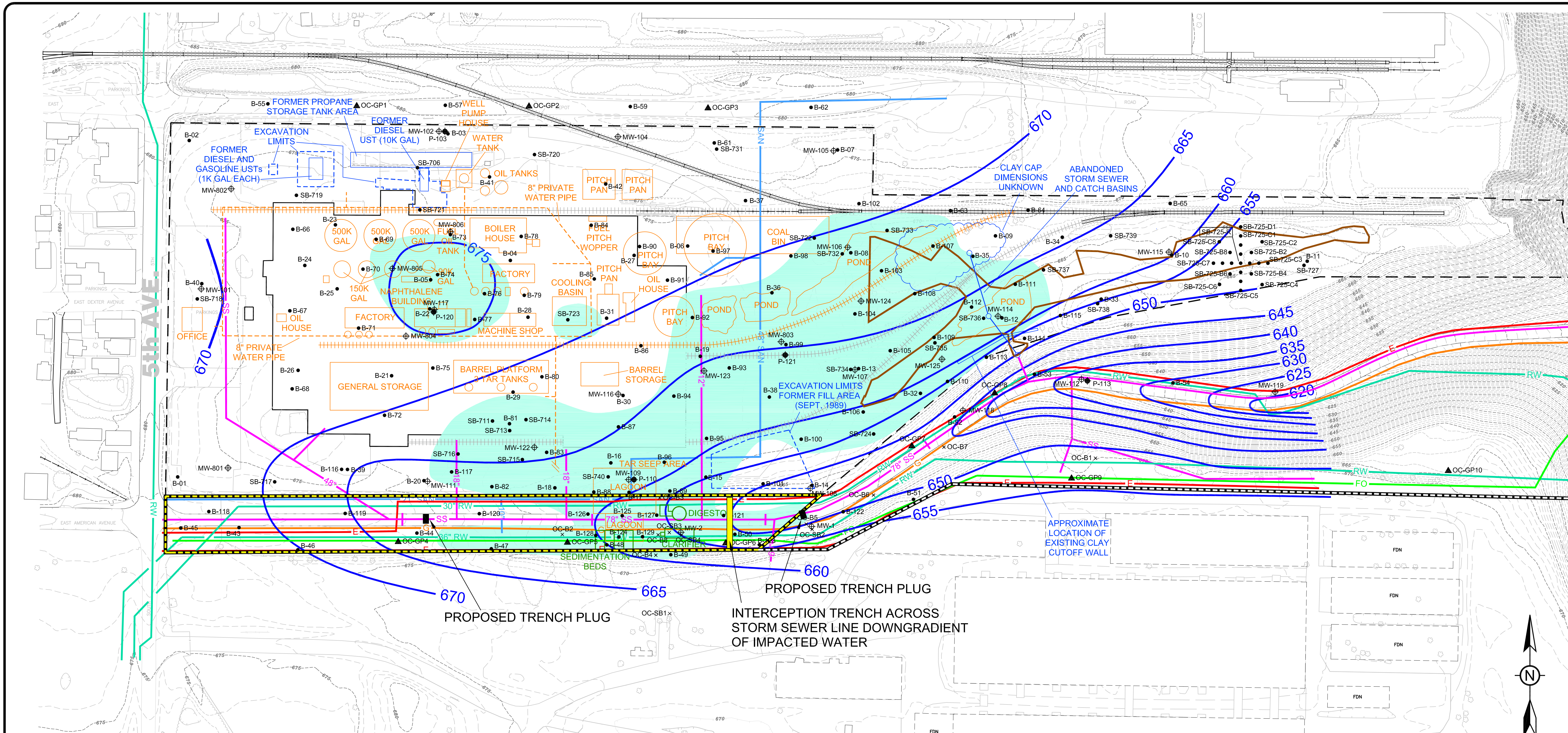
TITLE: FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE
GROUNDWATER PLUME (ALTERNATIVES GW-1, GW-2, AND GW-3)

LOCATION: OAK CREEK, WISCONSIN

TETRA TECH

CHECKED	MRN	FIGURE:
DRAFTED	CMP	16
PROJECT	117-2201472	
DATE	06-03-21	

S:\CAD\BEAZER\WABASH\JUNE 2021\FIGURE 16_GROUNDWATER PLUME_06-03-21.DWG



EXPLANATION

MW-101	WATER TABLE WELL
P-103	NESTED PIEZOMETER
B-01	SOIL BORING
× OC-SB1	SOIL BORING (CITY OF OAK CREEK)
OC-GP1	GEOPROBE (CITY OF OAK CREEK)
	APPROXIMATE WABASH PARCEL BOUNDARY (VPLE 06-41-560068)
	APPROXIMATE CITY PARCEL BOUNDARY (VPLE # TBD)
	FORMER TAR PLANT STRUCTURES
	PAST REMEDIAL ACTIVITIES
	FORMER WASTEWATER TREATMENT PLANT STRUCTURES
	APPROXIMATE WETLAND BOUNDARY
	APPROXIMATE CITY UTILITY CORRIDOR PROPERTY BOUNDARY
670	SHALLOW WATER TABLE CONTOUR
E	ELECTRICAL
G	NATURAL GAS
RW	RAW WATER
SAN	SANITARY
SS	STORM SEWER
FO	FIBER OPTIC
	APPROXIMATE AREA OF GROUNDWATER THAT EXCEEDS ENFORCEMENT STANDARD

0 160 320

SCALE IN FEET

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY AND SITE FEATURES FROM LAND INFORMATION SERVICES, INC. - ENVIRONMENTAL SURVEY, 12/21/2001.
2. FORMER TAR PLANT STRUCTURES FROM THE SANBORN LIBRARY - EDR INQUIRY 2284158.1s, ©1950.
3. FORMER POND AND LAGOON LOCATIONS FROM 1937-1968 AERIAL PHOTOGRAPHY - COMPILED BY AERO-DATA CORPORATION, APRIL 2013.
4. FORMER WASTEWATER TREATMENT PLANT STRUCTURES FROM HARTMAN-STRASS, INC. - FILE NO. 72051-C-303, 12/1/1971.

TITLE: FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE
UTILITY MIGRATION PATHWAYS (ALTERNATIVES UT-1, UT-2, AND UT-3)

LOCATION: OAK CREEK, WISCONSIN

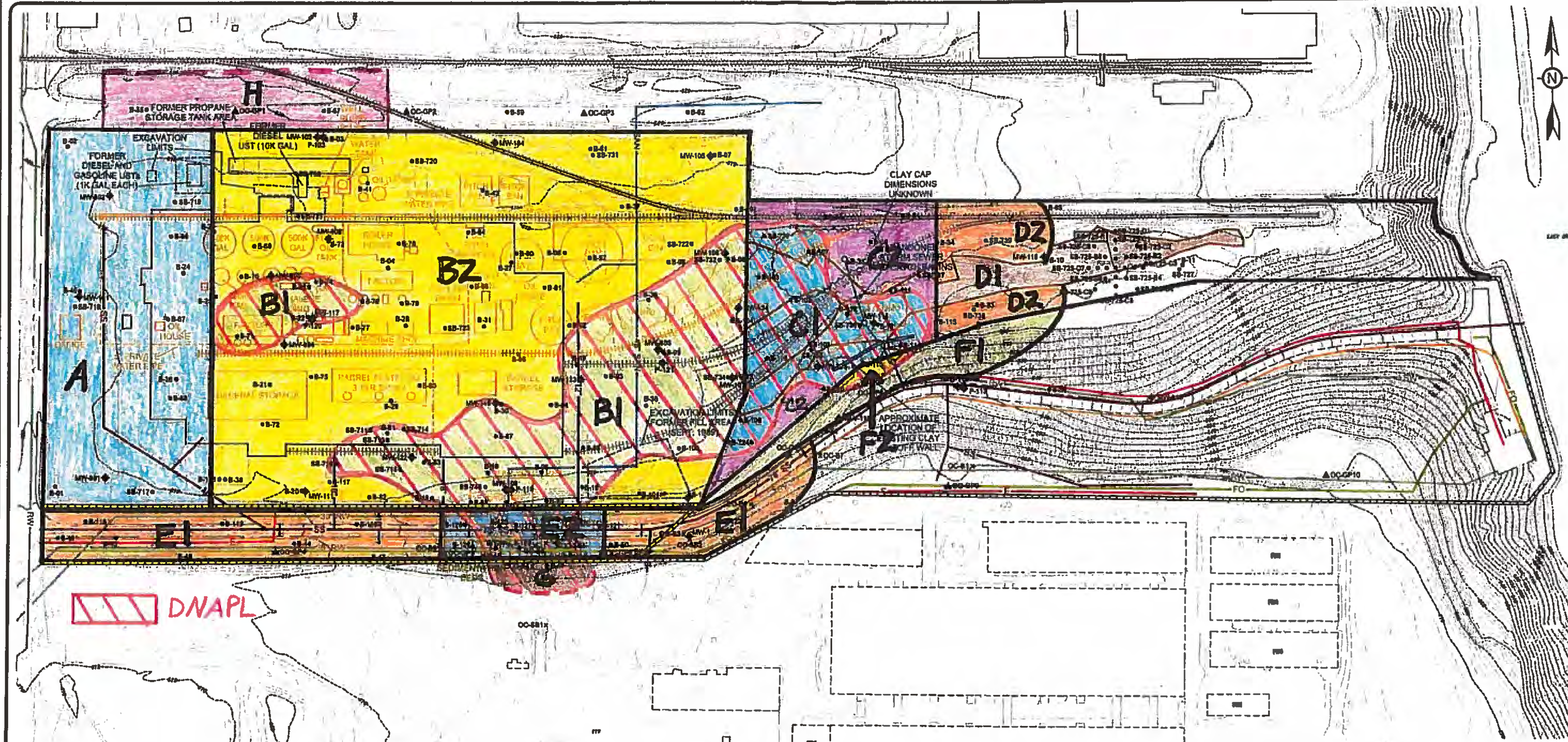
TETRA TECH

CHECKED	MRN	FIGURE:
DRAFTED	CMP	17
PROJECT	117-2201472	
DATE	06-03-21	

S:\CAD\BEAZER\WABASH\JUNE 2021\FIGURE 17 UTILITY MIGRATION PATHWAYS 06-03-21.DWG

Appendix A

DNR May 15, 2018 Matrix of Remedial Options



EXPLANATION

MW-101	WATER TABLE WELL
P-103	NESTED PIEZOMETER
B-01	SOIL BORING
× OC-SB1	SOIL BORING (CITY OF OAK CREEK)
▲ OC-GP1	GEOPROBE (CITY OF OAK CREEK)
— — —	APPROXIMATE WABASH PARCEL BOUNDARY (VPLE 06-41-560068)
- - - -	APPROXIMATE CITY PARCEL BOUNDARY (VPLE # TBD)
	FORMER TAR PLANT STRUCTURES
	PAST REMEDIAL ACTIVITIES
	FORMER WASTEWATER TREATMENT PLANT STRUCTURES
	APPROXIMATE WETLAND BOUNDARY
	APPROXIMATE CITY UTILITY CORRIDOR PROPERTY BOUNDARY
—E—	ELECTRICAL
—G—	NATURAL GAS
—RW—	RAW WATER
—SAN—	SANITARY
—SS—	STORM SEWER
—FO—	FIBER OPTIC

0 160 320
SCALE IN FEET

REFERENCE NOTES:

1. EXISTING TOPOGRAPHY AND SITE FEATURES FROM LAND INFORMATION SERVICES, INC. - ENVIRONMENTAL SURVEY, 12/21/2001.
2. FORMER TAR PLANT STRUCTURES FROM THE SANBORN LIBRARY - EDR INQUIRY 2284158.1s, ©1950.
3. FORMER POND AND LAGOON LOCATIONS FROM 1937-1968 AERIAL PHOTOGRAPHY - COMPILED BY AERO-DATA CORPORATION, APRIL 2013.
4. FORMER WASTEWATER TREATMENT PLANT STRUCTURES FROM HARTMAN-STRASS, INC. - FILE NO. 72051-C-303, 12/1/1971.

TITLE: FORMER KOPPERS TAR PLANT AND WABASH ALLOYS SITE
SITE LAYOUT

LOCATION: OAK CREEK, WISCONSIN

TETRA TECH

CHECKED	MRN	FIGURE:
DRAFTED	HJW	2
PROJECT	117-2201323	
DATE	11/7/14	

S:\CAD\BEAZER\WABASH\NEW COMBINED INVESTIGATION\SITE LAYOUT REVISED 11-7-2014.DWG

2018.05.14

Proposed Remedial Actions for Residual Tar

Area	Area Name	Description	Sub-Area	Option 1 Remedial Action (RA) Continuing Obligation (CO)	Option 2 Remedial Action (RA) Continuing Obligation (CO)	Option 3 Remedial Action (RA) Continuing Obligation (CO)	Option 4 Remedial Action (RA) Continuing Obligation (CO)	Option 5 Remedial Action (RA) Continuing Obligation (CO)	Option 6 Remedial Action (RA) Continuing Obligation (CO)	Option 7 Remedial Action (RA) Continuing Obligation (CO)	Option 8 Remedial Action (RA) Continuing Obligation (CO)
A	West	West of General Storage building		A - Option 1 RA: Excavate all impacted soil to remove on-site contamination. Collect confirmation samples at the base of excavations. Backfill excavations with clean soil. CO: None for soil.	A - Option 2 RA: 2 feet of clean soil cover to address soil impacts above direct contact RCLs. No DNAPL identified. CO: Residual soil contamination & cap maintenance plan	A - Option 3 RA: Soil excavation with on-site treatment to pre-approved clean-up levels and replacement of soil back into the excavation. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. CO: To Be Determined (TBD) – may need for residual soil contamination, cap maintenance plan, future construction will require a vapor assessment, groundwater contamination.	A - Option 4 RA: In-situ chemical treatment of impacted soil to pre-approved clean-up levels. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. CO: To Be Determined (TBD) – may need for residual soil contamination, cap maintenance plan, future construction will require a vapor assessment, groundwater contamination.	A - Option 5 RA: Excavate to 4 feet bgs. Backfill with clean soil. No DNAPL identified. CO: Residual soil contamination			
B	West-Central	West edge of General Storage building to west edge of wetlands	B1 With DNAPL	B1 - Option 1 RA: Excavate all impacted soil to remove on-site contamination. Collect confirmation samples at the base of excavations. This depth may be greater than 27 feet in some DNAPL areas. Backfill excavations with clean soil. CO: None for soil. TBD for groundwater	B1 - Option 2 RA: Excavation to 20 feet bgs or less if Naphthalene <= 5 ppm or BTEX <= 10 ppm. If 20 feet bgs is attained, perform in-situ stabilization (ISS) from 20-26 feet bgs. Backfill excavations with clean soil. CO: Residual soil contamination. Future construction will require a vapor assessment.	B1 - Option 3 RA: Soil excavation to 20 feet with on-site treatment to pre-approved clean-up levels and replacement of soil back into the excavation. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. CO: TBD – may be needed for residual soil contamination, cap maintenance plan, future construction will require a vapor assessment and possible sub-surface construction requirements, groundwater contamination.	B1 - Option 4 RA: In-situ chemical treatment of impacted soil to 20 feet bgs to pre-approved clean-up levels. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. CO: TBD – may be needed for residual soil contamination, cap maintenance plan, future construction will require a vapor assessment and possible sub-surface construction requirements, groundwater contamination.	B1 - Option 5 RA: Excavation to 12 feet bgs or less if Naphthalene <= 5 ppm or BTEX <= 10 ppm. If 12 feet bgs is attained, perform ISS from 12-18 feet bgs. Backfill excavation with clean soil. CO: TBD – may be needed for residual soil contamination, cap maintenance plan, future construction will require a vapor assessment and possible sub-surface construction requirements, groundwater contamination.			
			B2 Without DNAPL	B2 - Option 1 RA: Excavate all impacted soil to remove on-site contamination. Collect confirmation samples at the base of excavations. Backfill excavations with clean soil. CO: None for soil. TBD for groundwater	B2 - Option 2 RA: 2 feet of clean soil cover to address soil impacts above direct contact RCLs. No DNAPL identified. CO: Residual soil contamination, cap maintenance plan & future construction will require a vapor assessment.	B2 - Option 3 RA: Soil excavation with on-site treatment to pre-approved clean-up levels and replacement of soil back into the excavation. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. CO: TBD – may need for residual soil contamination, cap maintenance plan, future construction will require a vapor assessment, groundwater contamination.	B2 - Option 4 RA: In-situ chemical treatment of impacted soil to pre-approved clean-up levels. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. CO: TBD – may need for residual soil contamination, cap maintenance plan, future construction will require a vapor assessment, groundwater contamination.	B2 - Option 5 RA: Excavate to 4 feet bgs. Backfill with clean soil. No DNAPL identified. CO: Residual soil contamination			
C	West Wetlands	West edge of wetlands to B-115	C1 Wetlands or DNAPL areas within or adjacent to wetlands	C1 - Option 1 RA: Individual wetland permit required. Excavate all impacted material to remove on-site contamination. Collect confirmation samples at the base of excavations. Restoration of wetlands. CO: None for soil. TBD for groundwater Wetland mitigation credits may be needed.	C1 - Option 2 RA: Individual wetland permit required. Excavation to 12 feet bgs or less if Naphthalene <= 5 ppm or BTEX <= 10 ppm. Restoration of wetlands. CO: Site-specific – no future construction. Wetland mitigation credits may be needed	C1 - Option 3 RA: Individual wetland permit required. Excavate all impacted material to remove on-site contamination. Collect confirmation samples at the base of excavations. Fill wetlands with clean soil. CO: None for soil. TBD for groundwater. Wetland mitigation credits may be needed.	C1 - Option 4 RA: Individual wetland permit required. Excavation to 12 feet bgs or less if Naphthalene <= 5 ppm or BTEX <= 10 ppm. If 12 feet bgs is attained, perform ISS from 12-18 feet bgs. Fill wetlands with clean soil. CO: Residual soil contamination. Potentially allows future construction that will require a vapor assessment. Wetland mitigation credits may be needed.	C1 - Option 5 RA: Individual wetland permit required. Excavation to 12 feet with on-site treatment to pre-approved clean-up levels and replacement of material back into the excavation. Restoration of wetlands. CO: Site-specific -- no future construction. Wetland mitigation credits may be needed.	C1 - Option 6 RA: Individual wetland permit required. Excavation to 12 feet with on-site treatment to pre-approved clean-up levels and replacement of material back into the excavation. Fill wetlands with clean soil. CO: TBD – may need for residual soil contamination, future construction will require a vapor assessment, groundwater contamination. Wetland mitigation credits may be needed.	C1 - Option 7 RA: Individual wetland permit required. In-situ chemical treatment of impacted material to 12 feet bgs to pre-approved clean-up levels. Restoration of wetlands. CO: Site-specific -- no future construction. Wetland mitigation credits may be needed.	C1 - Option 8 RA: Individual wetland permit required. In-situ chemical treatment of impacted material to 12 feet bgs to pre-approved clean-up levels. Fill wetlands with clean soil. CO: TBD – may need for residual soil contamination, future construction will require a vapor assessment, groundwater contamination. Wetland mitigation credits may be needed.
			C2 Adjacent to the wetlands without DNAPL	C2 - Option 1 RA: Excavate all impacted soil to remove on-site contamination. Collect confirmation samples at the base of excavations. Backfill excavations with clean soil. CO: None for soil. To be determined for groundwater	C2 - Option 2 RA: Excavation to 12 feet bgs or less if Naphthalene <= 5 ppm or BTEX <= 10 ppm. If 12 feet bgs is attained, perform ISS from 12-18 feet bgs. Backfill excavation with clean soil. CO: Residual soil contamination. Future construction will require a vapor assessment.	C2 - Option 3 RA: Soil excavation to 12 feet with on-site treatment to pre-approved clean-up levels and replacement of soil back into the excavation. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. CO: TBD – may need for residual soil contamination, cap maintenance plan, future construction will require a vapor assessment, groundwater contamination.	C2 - Option 4 RA: In-situ chemical treatment of impacted soil to pre-approved clean-up levels. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. CO: TBD – may need for residual soil contamination, cap maintenance plan, future construction will require a vapor assessment, groundwater contamination.	C2 - Option 5 RA: 2 feet of clean soil cover to address soil impacts above direct contact RCLs. No DNAPL identified. CO: Residual soil contamination & cap maintenance plan	C2 - Option 6 RA: Excavate to 4 feet bgs. Backfill with clean soil. No DNAPL identified. CO: Residual soil contamination		
D	Eastern Narrows	East of B-115	D1 In the wetlands	D1 - Option 1 RA: No remedial action needed for tar, but action is needed for PCBs. CO: TBD. May include site-specific condition for no future construction.							
			D2 Adjacent to the wetlands	D2 - Option 1 RA: Excavate all impacted soil to remove on-site contamination. Collect confirmation samples at the base of excavations. Backfill excavations with clean soil. CO: None for soil. TBD for groundwater	D2 - Option 2 RA: 2 feet of clean soil cover in specified areas to address soil impacts above direct contact RCLs. No DNAPL identified. CO: Residual soil contamination & cap maintenance plan. Future construction will require a vapor assessment.	D2 - Option 3 RA: Soil excavation with on-site treatment to pre-approved clean-up levels and replacement of soil back into the excavation. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. CO: TBD – may need for residual soil contamination, cap maintenance plan, future construction will require a vapor assessment, groundwater contamination.	D2 - Option 4 RA: In-situ chemical treatment of impacted soil to pre-approved clean-up levels. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. CO: TBD – may need for residual soil contamination, cap maintenance plan, future construction will require a vapor assessment, groundwater contamination.	D2 - Option 5 RA: Excavate to 4 feet bgs. Backfill with clean soil. CO: Residual soil contamination			

Area	Area Name	Description	Sub-Area	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8
				Remedial Action (RA) Continuing Obligation (CO)	Remedial Action (RA) Continuing Obligation (CO)	Remedial Action (RA) Continuing Obligation (CO)	Remedial Action (RA) Continuing Obligation (CO)	Remedial Action (RA) Continuing Obligation (CO)	Remedial Action (RA) Continuing Obligation (CO)	Remedial Action (RA) Continuing Obligation (CO)	Remedial Action (RA) Continuing Obligation (CO)
E	Utility Corridor	Separate VPLE parcel owned by the City.	E1 Without DNAPL	E1 - Option 1 Interim RA: Excavate all impacted soil to remove contamination. Collect confirmation samples at the base of excavations. Backfill excavations with clean soil. Note: Must finish SI for off-site parcel & further evaluate southern extent of contamination across the utility corridor and onto the Dupont site.	E1 - Option 2 Interim RA: 2 feet of clean soil cover in specified areas to address soil impacts above direct contact RCLs. Note: Must finish SI for off-site parcel & further evaluate southern extent of contamination across the utility corridor and onto the Dupont site.	E1 - Option 3 Interim RA: Soil excavation with on-site treatment to pre-approved clean-up levels and replacement of soil back into the excavation. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. Note: Must finish SI for off-site parcel & further evaluate southern extent of contamination across the utility corridor and onto the Dupont site.	E1 - Option 4 Interim RA: In-situ chemical treatment of impacted soil to pre-approved clean-up levels. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. Note: Must finish SI for off-site parcel & further evaluate southern extent of contamination across the utility corridor and onto the Dupont site.	E1 - Option 5 Interim RA: Excavate to 4 feet bgs. Backfill with clean soil. Note: Must finish SI for off-site parcel & further evaluate southern extent of contamination across the utility corridor and onto the Dupont site.			
				CO: None for soil. TBD for groundwater.	CO: Residual soil contamination, cap maintenance plan & restricted access.	CO: TBD – may need for residual soil contamination, cap maintenance plan, future construction will require a vapor assessment, groundwater contamination.	CO: TBD – may need for residual soil contamination, cap maintenance plan, future construction will require a vapor assessment, groundwater contamination.	CO: Residual soil contamination			
			E2 With DNAPL, between OC-GPS and B-121	E2 - Option 1 Interim RA: Excavate all impacted soil to remove contamination. Collect confirmation samples at the base of excavations. Backfill excavations with clean soil. Note: Must finish SI for off-site parcel & further evaluate southern extent of contamination across the utility corridor and onto the Dupont site.	E2 - Option 2 Interim RA: 2 feet of clean soil cover to address soil impacts above direct contact RCLs. ISS at ingress and egress points within the DNAPL area & within the utility corridor itself. Note: Must finish SI for off-site parcel & further evaluate southern extent of contamination across the utility corridor and onto the Dupont site.	E2 - Option 3 Interim RA: Soil excavation with on-site treatment to pre-approved clean-up levels and replacement of soil back into the excavation. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. Note: Must finish SI for off-site parcel & further evaluate southern extent of contamination across the utility corridor and onto the Dupont site.	E2 - Option 4 Interim RA: In-situ chemical treatment of impacted soil to pre-approved clean-up levels. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. Note: Must finish SI for off-site parcel & further evaluate southern extent of contamination across the utility corridor and onto the Dupont site.	E2 - Option 5 Interim RA: Excavate to 4 feet bgs. Backfill with clean soil. ISS at ingress and egress points within the DNAPL area & within the utility corridor itself. Note: Must finish SI for off-site parcel & further evaluate southern extent of contamination across the utility corridor and onto the Dupont site.			
				CO: None for soil. TBD for groundwater.	CO: Residual soil contamination, cap maintenance plan, restricted access & future soil management activities for utility work will require off-site disposal.	CO: TBD – may need for residual soil contamination, cap maintenance plan, groundwater contamination, restricted access, future soil management activities for utility work will require off-site disposal.	CO: TBD – may need for residual soil contamination, cap maintenance plan, groundwater contamination, restricted access, future soil management activities for utility work will require off-site disposal.	CO: Residual soil contamination, restricted access & future soil management activities for utility work will require off-site disposal.			
F	Slope/ Swale	Off-site affected property Formerly owned by Koppers.	F1 Without DNAPL	F1 - Option 1 RA: Excavate all impacted soil to remove contamination. Collect confirmation samples at the base of excavations. Backfill excavations with clean soil.	F1 - Option 2 RA: 2 feet of clean soil cover in specified areas to address soil impacts above direct contact RCLs.	F1 - Option 3 RA: Soil excavation with on-site treatment to pre-approved clean-up levels and replacement of soil back into the excavation. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs.	F1 - Option 4 RA: In-situ chemical treatment of impacted soil to pre-approved clean-up levels. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs.	F1 - Option 5 RA: Excavate to 4 feet bgs. Backfill with clean soil.			
				CO: None for soil. TBD for groundwater.	CO: Residual soil contamination, cap maintenance plan & restricted access.	CO: TBD – may need for residual soil contamination, cap maintenance plan, future construction will require a vapor assessment, groundwater contamination.	CO: TBD – may need for residual soil contamination, cap maintenance plan, future construction will require a vapor assessment, groundwater contamination.	CO: Residual soil contamination			
			F2 With DNAPL	F2 - Option 1 Excavate all impacted soil to remove on-site contamination. Collect confirmation samples at the base of excavations. Backfill excavations with clean soil.	F2 - Option 2 RA: Soil excavation to 20 feet with on-site treatment to pre-approved clean-up levels and replacement of soil back into the excavation. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs.	F2 - Option 3 RA: Soil excavation to 20 feet with on-site treatment to pre-approved clean-up levels and replacement of soil back into the excavation. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs.	F2 - Option 4 RA: In-situ chemical treatment of impacted soil to 20 feet bgs to pre-approved clean-up levels. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs.				
				CO: None for soil. To be determined for groundwater.	CO: TBD – may be needed for residual soil contamination, cap maintenance plan, groundwater contamination.	CO: TBD – may be needed for residual soil contamination, cap maintenance plan, groundwater contamination.	CO: TBD – may be needed for residual soil contamination, cap maintenance plan, groundwater contamination.				
G	Dupont parcel with DNAPL	Off-site affected property – needs further delineation.		G - Option 1 Interim RA: Excavate all impacted soil to remove contamination. Collect confirmation samples at the base of excavations. Backfill excavations with clean soil. Note: Must finish SI for off-site parcel & further evaluate southern extent of contamination across the utility corridor and onto the Dupont site.	G - Option 2 Interim RA: Soil excavation to 20 feet with on-site treatment to pre-approved clean-up levels and replacement of soil back into the excavation. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. Note: Must finish SI for off-site parcel & further evaluate southern extent of contamination across the utility corridor and onto the Dupont site	G - Option 3 Interim RA: Soil excavation to 20 feet with on-site treatment to pre-approved clean-up levels and replacement of soil back into the excavation. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. Note: Must finish SI for off-site parcel & further evaluate southern extent of contamination across the utility corridor and onto the Dupont site.	G - Option 4 Interim RA: In-situ chemical treatment of impacted soil to 20 feet bgs to pre-approved clean-up levels. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. Note: Must finish SI for off-site parcel & further evaluate southern extent of contamination across the utility corridor and onto the Dupont site.	G1 - Option 5 Interim RA: Excavation to 12 feet bgs or less if Naphthalene <= 5 ppm or BTEX <= 10 ppm. If 12 feet bgs is attained, perform ISS from 12-18 feet bgs. Backfill excavation with clean soil. Note: Must finish SI for off-site parcel & further evaluate southern extent of contamination across the utility corridor and onto the Dupont site.			
				CO: None for soil. TBD for groundwater.	CO: TBD – may be needed for residual soil contamination, cap maintenance plan, groundwater contamination.	CO: TBD – may be needed for residual soil contamination, cap maintenance plan, groundwater contamination.	CO: TBD – may be needed for residual soil contamination, cap maintenance plan, groundwater contamination.	CO: Residual soil contamination. Future construction will require a vapor assessment.			
H	Depot Road and north	Off-site affected property – needs further delineation		H - Option 1 Interim RA: Excavate all impacted soil to remove on-site contamination. Collect confirmation samples at the base of excavations. Backfill excavations with clean soil. Note: Must finish SI for off-site parcel & further evaluate northern extent of contamination below and across Depot Road.	H - Option 2 Interim RA: 2 feet of clean soil cover to address soil impacts above direct contact RCLs. No DNAPL identified. Note: Must finish SI for off-site parcel & further evaluate northern extent of contamination below and across Depot Road.	H - Option 3 Interim RA: Soil excavation with on-site treatment to pre-approved clean-up levels and replacement of soil back into the excavation. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. Note: Must finish SI for off-site parcel & further evaluate northern extent of contamination below and across Depot Road.	H - Option 4 Interim RA: In-situ chemical treatment of impacted soil to pre-approved clean-up levels. 2 feet of clean soil cover to address soil impacts if concentrations from 0-4 feet bgs are above direct contact RCLs. Note: Must finish SI for off-site parcel & further evaluate northern extent of contamination below and across Depot Road.	H - Option 5 Interim RA: Excavate to 4 feet bgs. Backfill with clean soil. No DNAPL identified. Note: Must finish SI for off-site parcel & further evaluate northern extent of contamination below and across Depot Road.			
				CO: None for soil.	CO: Residual soil contamination & cap maintenance plan	CO: TBD – may need for residual soil contamination, cap maintenance plan, future construction will require a vapor assessment, groundwater contamination.	CO: TBD – may need for residual soil contamination, cap maintenance plan, future construction will require a vapor assessment, groundwater contamination.	CO: Residual soil contamination			

Note: Long-term groundwater monitoring to evaluate the effectiveness of the remedy will be required for any remedial action.

Appendix SW-1

Cost Estimate Alternative SW-1 – Site Wide Institutional Controls

Alternative SW-1
Site Wide Institutional Controls

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Legal & Administrative				
Legal & Administrative Services				$ 25,000
Total Capital Costs				$ 25,000
O&M COSTS				
O&M (cap inspection & repairs)	$ 1,000	YR		
30 Years NPV Annual Costs			30	$ 26,035
Total O&M Costs				**$ 26,035**
TOTAL ALTERNATIVE COST				**$ 51,035**
Average of Superfund Interest Rates for 2012-2021 (%)	0.94%			
30 year Net Present Value Multiplier	26.04			
Years	30			

Appendix S-1

Cost Estimate Alternative S-1 – Soil Barrier

Alternative S-1
Soil Barrier

Description		Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS					
Soil Barrier					
Mob/Demob		$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment		$ 30,000	LS	1	$ 30,000
Import General Fill for Drainage		$ 16	CY	5000	$ 80,000
Grading Subbase for Drainage		$ 2,500	Acre	21.2	$ 53,000
Imported Soil Characterization		$ 150	300 CY	230	$ 34,500
Furnish and Place Imported Soil		$ 21	CY	51,175	$ 1,074,675
Grade Soil for Dermal Protection Layer (18")		$ 4	CY	51,175	$ 204,700
Furnish and Place Imported Topsoil		$ 26	CY	17,050	$ 443,300
Grade Topsoil (6")		$ 3,000	Acre	21.2	$ 63,600
Seeding, Mulch and Erosion Control		$ 4,000	Acre	21.2	$ 84,800
Documentation Survey		$ 25,000	LS	1	$ 25,000
	SubTotal				$ 2,123,575
Engineering & Contingency		Percent			
Permitting & Design		5%			$ 106,179
Construction Oversight		5%			$ 106,179
Contingency		15%			$ 318,536
	SubTotal				$ 530,894
Total Capital Costs					**$ 2,654,469**
O&M COSTS					
O&M (cap inspection & repairs)		$ 1,000	YR		
30 Years NPV Annual Costs				30	$ 26,035
Total O&M Costs					**$ 26,035**
TOTAL ALTERNATIVE COST					**$ 2,680,504**

Average of Superfund Interest Rates for 2012-2021 (%)	0.94%
30 year Net Present Value Multiplier	26.04
Years	30

Appendix S-2

Cost Estimate Alternative S-2 – Impermeable Cover

Alternative S-2
Impermeable Cap

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Impermeable Cap				
Mob/Demob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	LS	1	$ 30,000
Import General Fill for Drainage	$ 16	CY	5000	$ 80,000
Grading Subbase for Drainage	$ 2,500	Acre	21.2	$ 53,000
Install Geomembrane	$ 2.50	SQ FT	921,150	$ 2,302,875
Imported Soil Characterization	$ 150	300 CY	230	$ 34,500
Furnish and Place Imported Soil	$ 21	CY	51,175	$ 1,074,675
Grade Soil for Dermal Protection Layer (18")	$ 4	CY	51,175	$ 204,700
Furnish and Place Imported Topsoil	$ 26	CY	17,050	$ 443,300
Grade Topsoil (6")	$ 3,000	Acre	21.2	$ 63,600
Seeding, Mulch and Erosion Control	$ 4,000	Acre	21.2	$ 84,800
Documentation Survey	$ 25,000	LS	1	$ 25,000
SubTotal				$ 4,426,450
Engineering & Contingency				
Permitting & Design (15%)				$ 663,968
Construction Oversight (7.5%)				$ 331,984
Contingency (15%)				$ 663,968
SubTotal				$ 1,659,919
Total Capital Costs				**$ 6,086,369**
O&M COSTS				
O&M (cap inspection & repairs)	$ 1,000	YR		
30 Years NPV Annual Costs			30	$ 26,035
Total O&M Costs				**$ 26,035**
TOTAL ALTERNATIVE COST				**$ 6,112,404**

Average of Superfund Interest Rates for 2012-2021 (%)	0.94%
30 year Net Present Value Multiplier	26.04
Years	30

Appendix S-3

Cost Estimate Alternative S-3 – Soil Excavation & Off-Site Disposal

Alternative S-3A

Excavation with Off-Site Landfill Disposal (All Soil)

Wabash Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Soil Excavation and Disposal				
Mob/DeMob	$ 10,000	LS	1	$ 10,000
Stormwater Control & Treatment	$ 10,000	Each	1	$ 10,000
Soil Excavation & Loading Shallow <8'	$ 7	CY	196,694	$ 1,376,860
Soil Excavation & Loading Deep >8'	$ 36	CY	130,829	$ 4,649,675
Groundwater Management	$ 28	CY	65,415	$ 1,798,903
Transportation & Off-Site Soil Disposal (Special Waste)	$ 70	CY	327,524	$ 22,926,649
Imported Soil Characterization	$ 150	300 CY	1092	$ 163,800
Furnish and Place Imported Backfill Soil	$ 21	CY	310,873	$ 6,528,331
Furnish and Place Imported Topsoil	$ 26	CY	16,651	$ 432,917
Seeding, Mulch and Erosion Control	$ 4,000	Acre	21	$ 82,565
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	1.3	$ 94,500
SubTotal				$ 38,074,200
Engineering & Contingency				
Permitting & Design	1%			$ 380,742
Construction Oversight	$ 10,000	Week	131	$ 1,310,094
Contingency	15%			$ 5,711,130
SubTotal				$ 7,401,966
Total Capital Costs				**$ 45,476,166**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 45,476,166**

Alternative S-3A
Excavation with Off-Site Landfill Disposal (All Soil)
Utility Corridor

Description	Unit Cost		Unit	Quantity	Extension	
CAPITAL COSTS						
Soil Excavation and Disposal						
Mob/DeMob	$	10,000	LS	1	$	10,000
Stormwater Control & Treatment	$	10,000	Each	1	$	10,000
Soil Excavation & Loading Shallow <8'	$	7	CY	33,036	$	231,249
Soil Excavation & Loading Deep >8'	$	36	CY	12,456	$	442,670
Groundwater Management	$	28	CY	6,228	$	171,264
Transportation & Off-Site Soil Disposal (Special Waste)	$	70	CY	45,491	$	3,184,378
Imported Soil Characterization	$	150	300 CY	152	$	22,800
Furnish and Place Imported Backfill Soil	$	21	CY	42,806	$	898,935
Furnish and Place Imported Topsoil	$	26	CY	2,685	$	69,802
Seeding, Mulch and Erosion Control	$	4,000	Acre	3	$	13,313
Wetland Mitigation (off-site credits or in-lieu fee)	$	75,000	Acre	0.0	$	-
SubTotal					$	5,054,410
Engineering & Contingency						
Permitting & Design		1%			$	50,544
Construction Oversight	$	10,000	Week	18	$	181,964
Contingency		15%			$	758,162
SubTotal					$	990,670
Total Capital Costs					**$**	**6,045,081**
O&M COSTS						
Total O&M Costs					$	-
TOTAL ALTERNATIVE COST					**$**	**6,045,081**

Alternative S-3A
Excavation with Off-Site Landfill Disposal (All Soil)
Depot Road

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Soil Excavation and Disposal				
Mob/DeMob	$ 10,000	LS	1	$ 10,000
Stormwater Control & Treatment	$ 10,000	Each	1	$ 10,000
Soil Excavation & Loading Shallow <8'	$ 7	CY	6,651	$ 46,556
Soil Excavation & Loading Deep >8'	$ 36	CY	311	$ 11,057
Groundwater Management	$ 28	CY	156	$ 4,278
Transportation & Off-Site Soil Disposal (Special Waste)	$ 70	CY	6,962	$ 487,335
Imported Soil Characterization	$ 150	300 CY	24	$ 3,600
Furnish and Place Imported Backfill Soil	$ 21	CY	6,131	$ 128,742
Furnish and Place Imported Topsoil	$ 26	CY	831	$ 21,615
Seeding, Mulch and Erosion Control	$ 4,000	Acre	1	$ 4,122
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 727,305
Engineering & Contingency				
Permitting & Design	8%			$ 54,548
Construction Oversight	$ 10,000	Week	3	$ 27,848
Contingency	15%			$ 109,096
SubTotal				$ 191,491
Total Capital Costs				**$ 918,796**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 918,796**

Alternative S-3A
Excavation with Off-Site Landfill Disposal (All Soil)
Former Dupont Parcel

Description		Unit Cost	Unit	Quantity		Extension
CAPITAL COSTS						
Soil Excavation and Disposal						
Mob/DeMob	$	10,000	LS	1	$	10,000
Stormwater Control & Treatment	$	10,000	Each	1	$	10,000
Soil Excavation & Loading Shallow <8'	$	7	CY	1,879	$	13,155
Soil Excavation & Loading Deep >8'	$	36	CY	281	$	9,988
Groundwater Management	$	28	CY	141	$	3,864
Transportation & Off-Site Soil Disposal (Special Waste)	$	70	CY	2,160	$	151,221
Imported Soil Characterization	$	150	300 CY	8	$	1,200
Furnish and Place Imported Backfill Soil	$	21	CY	1,955	$	41,048
Furnish and Place Imported Topsoil	$	26	CY	206	$	5,346
Seeding, Mulch and Erosion Control	$	4,000	Acre	0	$	1,020
Wetland Mitigation (off-site credits or in-lieu fee)	$	75,000	Acre	0.0	$	-
SubTotal					$	246,842
Engineering & Contingency						
Permitting & Design		15%			$	37,026
Construction Oversight	$	10,000	Week	1	$	8,641
Contingency		15%			$	37,026
SubTotal					$	82,694
Total Capital Costs					**$**	**329,536**
O&M COSTS						
Total O&M Costs					$	-
TOTAL ALTERNATIVE COST					**$**	**329,536**

Alternative S-3A
Excavation with Off-Site Landfill Disposal (All Soil)
All Parcels Combined

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Soil Excavation and Disposal				
Mob/DeMob	$ 10,000	LS	1	$ 10,000
Stormwater Control & Treatment	$ 10,000	Each	1	$ 10,000
Soil Excavation & Loading Shallow <8'	$ 7	CY	238,259.9	$ 1,667,819
Soil Excavation & Loading Deep >8'	$ 36	CY	143,877.0	$ 5,113,390
Groundwater Management	$ 28	CY	71,938.5	$ 1,978,309
Transportation & Off-Site Soil Disposal (Special Waste)	$ 70	CY	382,136.9	$ 26,749,582
Imported Soil Characterization	$ 150	300 CY	1274	$ 191,100
Furnish and Place Imported Backfill Soil	$ 21	CY	361,764.5	$ 7,597,055
Furnish and Place Imported Topsoil	$ 26	CY	20,372.4	$ 529,681
Seeding, Mulch and Erosion Control	$ 4,000	Acre	25.3	$ 101,020
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	1.3	$ 94,500
SubTotal				$ 44,042,457
Engineering & Contingency				
Permitting & Design	1%			$ 440,425
Construction Oversight	$ 10,000	Week	153	$ 1,528,548
Contingency	15%			$ 6,606,369
SubTotal				$ 8,575,341
Total Capital Costs				**$ 52,617,797**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 52,617,797**

Alternative S-3B

Excavation with Off-Site Landfill Disposal (DNAPL)

Wabash Parcel

Description		Unit Cost	Unit	Quantity		Extension
CAPITAL COSTS						
Soil Excavation and Disposal						
Mob/DeMob	$	10,000	LS	1	$	10,000
Stormwater Control & Treatment	$	10,000	Each	1	$	10,000
Soil Excavation & Loading Shallow <8'	$	7	CY	25,973	$	181,810
Non impacted Soil Excavation and Backfill	$	11	CY	27,797	$	305,763
Soil Excavation & Loading Deep >8'	$	4	CY	53,769	$	215,078
Groundwater Management	$	28	CY	26,885	$	739,330
Transportation & Off-Site Soil Disposal (Special Waste)	$	70	CY	79,742	$	5,581,966
Imported Soil Characterization	$	150	300 CY	266	$	39,900
Furnish and Place Imported Backfill Soil	$	21	CY	77,304	$	1,623,394
Furnish and Place Imported Topsoil	$	26	CY	2,438	$	63,386
Seeding, Mulch and Erosion Control	$	4,000	Acre	4	$	15,822
Wetland Mitigation (off-site credits or in-lieu fee)	$	75,000	Acre	1.3	$	94,500
SubTotal					$	8,880,948
Engineering & Contingency						
Permitting & Design		1%			$	111,012
Construction Oversight	$	10,000	Week	22	$	215,078
Contingency		15%			$	1,332,142
SubTotal					$	1,658,232
Total Capital Costs					**$**	**10,539,180**
O&M COSTS						
Total O&M Costs					$	-
TOTAL ALTERNATIVE COST					**$**	**10,539,180**

Alternative S-3B
Excavation with Off-Site Landfill Disposal (DNAPL)
Utility Corridor

Description		**Unit Cost**	**Unit**	**Quantity**		**Extension**
CAPITAL COSTS						
Soil Excavation and Disposal						
Mob/DeMob	$	10,000	LS	1	$	10,000
Stormwater Control & Treatment	$	10,000	Each	1	$	10,000
Soil Excavation & Loading Shallow <8'	$	7	CY	1,979	$	13,851
Non impacted Soil Excavation and Backfill	$	11	CY	0	$	-
Soil Excavation & Loading Deep >8'	$	4	CY	2,797	$	11,186
Groundwater Management	$	28	CY	1,398	$	38,453
Transportation & Off-Site Soil Disposal (Special Waste)	$	70	CY	4,775	$	334,268
Imported Soil Characterization	$	150	300 CY	16	$	2,400
Furnish and Place Imported Backfill Soil	$	21	CY	4,566	$	95,892
Furnish and Place Imported Topsoil	$	26	CY	209	$	5,434
Seeding, Mulch and Erosion Control	$	4,000	Acre	0.3	$	1,118
Wetland Mitigation (off-site credits or in-lieu fee)	$	75,000	Acre	0.0	$	-
SubTotal					$	522,601
Engineering & Contingency						
Permitting & Design		15%			$	78,390
Construction Oversight	$	10,000	Week	1	$	7,915
Contingency		15%			$	78,390
SubTotal					$	164,695
Total Capital Costs					**$**	**687,296**
O&M COSTS						
Total O&M Costs					$	-
TOTAL ALTERNATIVE COST					**$**	**687,296**

Alternative S-3B
Excavation with Off-Site Landfill Disposal (DNAPL)
Former Dupont Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Soil Excavation and Disposal				
Mob/DeMob	$ 10,000	LS	1	$ 10,000
Stormwater Control & Treatment	$ 10,000	Each	1	$ 10,000
Soil Excavation & Loading Shallow <8'	$ 7	CY	159	$ 1,113
Non impacted Soil Excavation and Backfill	$ 11	CY	0	$ -
Soil Excavation & Loading Deep >8'	$ 4	CY	125	$ 502
Groundwater Management	$ 28	CY	63	$ 1,725
Transportation & Off-Site Soil Disposal (Special Waste)	$ 70	CY	284	$ 19,911
Imported Soil Characterization	$ 150	300 CY	1	$ 150
Furnish and Place Imported Backfill Soil	$ 21	CY	79	$ 1,655
Furnish and Place Imported Topsoil	$ 26	CY	206	$ 5,346
Seeding, Mulch and Erosion Control	$ 4,000	Acre	0	$ 1,020
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 51,422
Engineering & Contingency				
Permitting & Design	20%			$ 10,284
Construction Oversight	$ 10,000	Week	1	$ 10,000
Contingency	15%			$ 7,713
SubTotal				$ 27,998
Total Capital Costs				**$ 79,420**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 79,420**

Alternative S-3B

Excavation with Off-Site Landfill Disposal (DNAPL)

All Parcels

Description	**Unit Cost**	**Unit**	**Quantity**	**Extension**
CAPITAL COSTS				
Soil Excavation and Disposal				
Mob/DeMob	$ 10,000	LS	1	$ 10,000
Stormwater Control & Treatment	$ 10,000	Each	1	$ 10,000
Soil Excavation Shallow <8'	$ 7	CY	28,111	$ 196,774
Non impacted Soil Excavation and Backfill	$ 11	CY	27,797	$ 305,763
Soil Loading Deep >8'	$ 4	CY	56,692	$ 226,766
Groundwater Management	$ 28	CY	28,346	$ 779,509
Transportation & Off-Site Soil Disposal (Special Waste)	$ 70	CY	84,802	$ 5,936,145
Imported Soil Characterization	$ 150	300 CY	283	$ 42,450
Furnish and Place Imported Backfill Soil	$ 21	CY	4,911	$ 103,133
Furnish and Place Imported Topsoil	$ 26	CY	77,719	$ 2,020,696
Seeding, Mulch and Erosion Control	$ 4,000	Acre	4	$ 17,959
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	1.3	$ 97,500
SubTotal				$ 9,746,695
Engineering & Contingency				
Permitting & Design	1%			$ 97,467
Construction Oversight	$ 10,000	Week	22	$ 223,628
Contingency	12%			$ 1,169,603
SubTotal				$ 1,490,699
Total Capital Costs				**$ 11,237,393**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 11,237,393**

Alternative S-3C
Excavation with Off-Site Landfill Disposal (DNAPL 6')
Wabash Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Soil Excavation and Disposal				
Mob/DeMob	$ 10,000	LS	1	$ 10,000
Stormwater Control & Treatment	$ 10,000	Each	1	$ 10,000
Soil Excavation & Loading Shallow <8'	$ 7	CY	16,221	$ 113,549
Soil Excavation & Loading Deep >8'	$ 4	CY	0	$ -
Groundwater Management	$ 28	CY	0	$ -
Transportation & Off-Site Soil Disposal (Special Waste)	$ 70	CY	16,221	$ 1,135,488
Imported Soil Characterization	$ 150	300 CY	55	$ 8,250
Furnish and Place Imported Backfill Soil	$ 21	CY	15,413	$ 323,664
Furnish and Place Imported Topsoil	$ 26	CY	809	$ 21,026
Seeding, Mulch and Erosion Control	$ 4,000	Acre	3	$ 12,089
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	1.3	$ 97,500
SubTotal				$ 1,731,566
Engineering & Contingency				
Permitting & Design	5%			$ 86,578
Construction Oversight	$ 10,000	Week	6	$ 64,885
Contingency	15%			$ 259,735
SubTotal				$ 411,198
Total Capital Costs				**$ 2,142,764**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 2,142,764**

Alternative S-3C
Excavation with Off-Site Landfill Disposal (DNAPL 6')
Utility Corridor

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Soil Excavation and Disposal				
Mob/DeMob	$ 10,000	LS	1	$ 10,000
Stormwater Control & Treatment	$ 10,000	Each	1	$ 10,000
Soil Excavation & Loading Shallow <8'	$ 7	CY	1,143	$ 7,999
Soil Excavation & Loading Deep >8'	$ 4	CY	0	$ -
Groundwater Management	$ 28	CY	0	$ -
Transportation & Off-Site Soil Disposal (Special Waste)	$ 70	CY	1,143	$ 79,992
Imported Soil Characterization	$ 150	300 CY	4	$ 600
Furnish and Place Imported Backfill Soil	$ 21	CY	1,104	$ 23,192
Furnish and Place Imported Topsoil	$ 26	CY	38	$ 997
Seeding, Mulch and Erosion Control	$ 4,000	Acre	0.3	$ 1,036
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 133,817
Engineering & Contingency				
Permitting & Design	20%			$ 26,763
Construction Oversight	$ 10,000	Week	1	$ 10,000
Contingency	15%			$ 20,072
SubTotal				$ 56,836
Total Capital Costs				**$ 190,652**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 190,652**

Alternative S-3C
Excavation with Off-Site Landfill Disposal (DNAPL 6')
Former Dupont Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Soil Excavation and Disposal				
Mob/DeMob	$ 10,000	LS	1	$ 10,000
Stormwater Control & Treatment	$ 10,000	Each	1	$ 10,000
Soil Excavation & Loading Shallow <8'	$ 7	CY	120	$ 837
Soil Excavation & Loading Deep >8'	$ 4	CY	0	$ -
Groundwater Management	$ 28	CY	0	$ -
Transportation & Off-Site Soil Disposal (Special Waste)	$ 70	CY	120	$ 8,374
Imported Soil Characterization	$ 150	300 CY	1	$ 150
Furnish and Place Imported Backfill Soil	$ 21	CY	110	$ 2,301
Furnish and Place Imported Topsoil	$ 26	CY	10	$ 261
Seeding, Mulch and Erosion Control	$ 4,000	Acre	0	$ 1,020
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 32,944
Engineering & Contingency				
Permitting & Design	20%			$ 6,589
Construction Oversight	$ 10,000	Week	1	$ 10,000
Contingency	15%			$ 4,942
SubTotal				$ 21,530
Total Capital Costs				**$ 54,474**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 54,474**

Alternative S-3C

Excavation with Off-Site Landfill Disposal (DNAPL 6')

All Parcels

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Soil Excavation and Disposal				
Mob/DeMob	$ 10,000	LS	1	$ 10,000
Stormwater Control & Treatment	$ 10,000	Each	1	$ 10,000
Soil Excavation & Loading Shallow <8'	$ 7	CY	17,483.6	$ 122,385
Soil Excavation & Loading Deep >8'	$ 4	CY	0.0	$ -
Groundwater Management	$ 28	CY	0.0	$ -
Transportation & Off-Site Soil Disposal (Special Waste)	$ 70	CY	17,483.6	$ 1,223,854
Imported Soil Characterization	$ 150	300 CY	60.0	$ 9,000
Furnish and Place Imported Backfill Soil	$ 21	CY	16,626.5	$ 349,157
Furnish and Place Imported Topsoil	$ 26	CY	857.1	$ 22,284
Seeding, Mulch and Erosion Control	$ 4,000	Acre	3.5	$ 14,145
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	1.3	$ 97,500
SubTotal				$ 1,858,326
Engineering & Contingency				
Permitting & Design	5%			$ 92,916
Construction Oversight	$ 10,000	Week	7	$ 69,935
Contingency	15%			$ 278,749
SubTotal				$ 441,600
Total Capital Costs				**$ 2,299,926**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 2,299,926**

Alternative S-3D

Excavation with Off-Site Landfill Disposal (Direct Contact Barrier)

Alternative S-1 Footprint

Description		Unit Cost	Unit	Quantity		Extension
CAPITAL COSTS						
Soil Excavation and Disposal						
Mob/DeMob	$	10,000	LS	1	$	10,000
Stormwater Control & Treatment	$	10,000	Each	1	$	10,000
Soil Excavation & Loading Shallow <8'	$	7	CY	134,831.0	$	943,817
Soil Excavation & Loading Deep >8'	$	36	CY	0.0	$	-
Groundwater Management	$	28	CY	0.0	$	-
Transportation & Off-Site Soil Disposal (Special \	$	70	CY	134,831.0	$	9,438,170
Imported Soil Characterization	$	150	300 CY	450	$	67,500
Furnish and Place Imported Backfill Soil	$	21	CY	117,977	$	2,477,517
Furnish and Place Imported Topsoil	$	26	CY	16,854.0	$	438,204
Seeding, Mulch and Erosion Control	$	4,000	Acre	21.0	$	84,000
Wetland Mitigation (off-site credits or in-lieu fee)	$	75,000	Acre	0.0	$	-
SubTotal					$	13,469,208
Engineering & Contingency						
Permitting & Design		1%			$	134,692
Construction Oversight	$	10,000	Week	54	$	539,324
Contingency		15%			$	2,020,381
SubTotal					$	2,694,397
Total Capital Costs					**$**	**16,163,605**
O&M COSTS						
O&M (cap inspection & repairs)	$	1,000	YR			
30 Years NPV Annual Costs				30	$	26,035
Total O&M Costs					**$**	**26,035**
TOTAL ALTERNATIVE COST					**$**	**16,189,641**

Average of Superfund Interest Rates for 2012-20	0.94%
30 year Net Present Value Multiplier	26.04
Years	30

Appendix S-4

Cost Estimate Alternative S-4 – Soil Excavation & Thermal Desorption

Alternative S-4A
Excavation with On-Site Thermal Desorption (All Soil)
Wabash Parcel

Description	**Unit Cost**	**Unit**	**Quantity**	**Extension**
CAPITAL COSTS				
Soil Excavation and Thermal Desorption				
Mob/DeMob	$ 20,000	LS	1	$ 20,000
Stormwater Control & Treatment	$ 25,000	Each	1	$ 25,000
Soil Excavation, Stockpile, Replace <8'	$ 11	CY	196,694	$ 2,163,636
Soil Excavation, Stockpile, Replace >8'	$ 47	CY	130,829	$ 6,114,963
Groundwater Management	$ 28	CY	65,415	$ 1,798,903
Soil Treatment	$ 51	CY	327,524	$ 16,559,121
Confirmation Sampling	$ 200	Ea	1,310	$ 262,019
Backfill Treated Soil	$ 5	CY	0	$ -
Furnish and Place Imported Topsoil	$ 26	CY	16,651	$ 432,917
Seeding, Mulch and Erosion Control	$ 4,000	Acre	21	$ 82,565
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	1.3	$ 94,500
SubTotal				$ 27,553,625
Engineering & Contingency				
Permitting & Design	2%			$ 551,072
Construction Oversight	$ 30,000	Week	293	$ 8,790,000
Contingency	30%			$ 8,266,087
SubTotal				$ 17,607,160
Total Capital Costs				**$ 45,160,785**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 45,160,785**

Alternative S-4A
Excavation with On-Site Thermal Desorption (All Soil)
Utility Corridor

Description		Unit Cost	Unit	Quantity		Extension
CAPITAL COSTS						
Soil Excavation and Thermal Desorption						
Mob/DeMob	$	20,000	LS	1	$	20,000
Stormwater Control & Treatment	$	25,000	Each	1	$	25,000
Soil Excavation, Stockpile, Replace <8'	$	11	CY	33,036	$	363,391
Soil Excavation, Stockpile, Replace >8'	$	47	CY	12,456	$	582,173
Groundwater Management	$	28	CY	6,228	$	171,264
Soil Treatment	$	92	CY	45,491	$	4,194,398
Confirmation Sampling	$	200	Ea	182	$	36,393
Backfill Treated Soil	$	5	CY	0	$	-
Furnish and Place Imported Topsoil	$	26	CY	2,685	$	69,802
Seeding, Mulch and Erosion Control	$	4,000	Acre	3	$	13,313
Wetland Mitigation (off-site credits or in-lieu fee)	$	75,000	Acre	0.0	$	-
SubTotal					$	5,475,734
Engineering & Contingency						
Permitting & Design		2%			$	109,515
Construction Oversight	$	30,000	Week	41	$	1,230,000
Contingency		30%			$	1,642,720
SubTotal					$	2,982,235
Total Capital Costs					**$**	**8,457,968**
O&M COSTS						
Total O&M Costs					$	-
TOTAL ALTERNATIVE COST					**$**	**8,457,968**

Alternative S-4A
Excavation with On-Site Thermal Desorption (All Soil)
Depot Road

Description	Unit Cost		Unit	Quantity	Extension	
CAPITAL COSTS						
Soil Excavation and Thermal Desorption						
Mob/DeMob	$	20,000	LS	1	$	20,000
Stormwater Control & Treatment	$	25,000	Each	1	$	25,000
Soil Excavation, Stockpile, Replace <8'	$	11	CY	6,651	$	73,159
Soil Excavation, Stockpile, Replace >8'	$	47	CY	311	$	14,541
Groundwater Management	$	28	CY	156	$	4,278
Soil Treatment	$	360	CY	6,962	$	2,505,221
Confirmation Sampling	$	200	Ea	28	$	5,570
Backfill Treated Soil	$	5	CY	0	$	-
Furnish and Place Imported Topsoil	$	26	CY	831	$	21,615
Seeding, Mulch and Erosion Control	$	4,000	Acre	1	$	4,122
Wetland Mitigation (off-site credits or in-lieu fee)	$	75,000	Acre	0	$	-
SubTotal					$	2,673,506
Engineering & Contingency						
Permitting & Design		2%			$	53,470
Construction Oversight	$	30,000	Week	7	$	210,000
Contingency		30%			$	802,052
SubTotal					$	1,065,522
Total Capital Costs					**$**	**3,739,028**
O&M COSTS						
Total O&M Costs					$	-
TOTAL ALTERNATIVE COST					**$**	**3,739,028**

Alternative S-4A
Excavation with On-Site Thermal Desorption (All Soil)
Former Dupont Parcel

Description	**Unit Cost**	**Unit**	**Quantity**	**Extension**
CAPITAL COSTS				
Soil Excavation and Thermal Desorption				
Mob/DeMob	$ 20,000	LS	1	$ 20,000
Stormwater Control & Treatment	$ 25,000	Each	1	$ 25,000
Soil Excavation, Stockpile, Replace <8'	$ 11	CY	1,879	$ 20,672
Soil Excavation, Stockpile, Replace >8'	$ 47	CY	281	$ 13,136
Groundwater Management	$ 28	CY	141	$ 3,864
Soil Treatment	$ 1,062	CY	2,160	$ 2,294,711
Confirmation Sampling	$ 200	Ea	9	$ 1,728
Backfill Treated Soil	$ 5	CY	0	$ -
Furnish and Place Imported Topsoil	$ 26	CY	206	$ 5,346
Seeding, Mulch and Erosion Control	$ 4,000	Acre	0.3	$ 1,020
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 2,385,477
Engineering & Contingency				
Permitting & Design	2%			$ 47,710
Construction Oversight	$ 30,000	Week	2	$ 60,000
Contingency	30%			$ 715,643
SubTotal				$ 823,353
Total Capital Costs				**$ 3,208,829**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 3,208,829**

Alternative S-4A

Excavation with On-Site Thermal Desorption (All Soil)

All Parcels Combined

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Soil Excavation and Thermal Desorption				
Mob/DeMob	$ 20,000	LS	1	$ 20,000
Stormwater Control & Treatment	$ 25,000	Each	1	$ 25,000
Soil Excavation, Stockpile, Replace <8'	$ 11	CY	238,260	$ 2,620,858
Soil Excavation, Stockpile, Replace >8'	$ 47	CY	143,877	$ 6,724,813
Groundwater Management	$ 28	CY	71,939	$ 1,978,309
Soil Treatment	$ 50	CY	382,137	$ 18,953,451
Confirmation Sampling	$ 200	Ea	1,529	$ 305,710
Backfill Treated Soil	$ 5	CY	0	$ -
Furnish and Place Imported Topsoil	$ 26	CY	20,372	$ 529,681
Seeding, Mulch and Erosion Control	$ 4,000	Acre	25	$ 101,020
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	1.3	$ 94,500
SubTotal				$ 31,353,342
Engineering & Contingency				
Permitting & Design	2%			$ 627,067
Construction Oversight	$ 30,000	Week	342	$ 10,260,000
Contingency	30%			$ 9,406,002
SubTotal				$ 20,293,069
Total Capital Costs				**$ 51,646,411**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 51,646,411**

Alternative S-4B

Excavation with On-Site Thermal Desorption (DNAPL)

Wabash Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Soil Excavation and Thermal Desorption				
Mob/DeMob	$ 20,000	LS	1	$ 20,000
Stormwater Control & Treatment	$ 25,000	Each	1	$ 25,000
Soil Excavation, Stockpile, Replace <8'	$ 11	CY	25,973	$ 285,702
Non impacted Soil Excavation and Backfill	$ 11	CY	27,797	$ 305,763
Soil Excavation, Stockpile, Replace >8'	$ 47	CY	53,769	$ 2,513,186
Groundwater Management	$ 28	CY	26,885	$ 739,330
Soil Treatment	$ 71	CY	79,742	$ 5,696,024
Confirmation Sampling	$ 200	Ea	16	$ 3,200
Backfill Treated Soil	$ 5	CY	4,566	$ 22,831
Furnish and Place Imported Topsoil	$ 26	CY	209	$ 5,434
Seeding, Mulch and Erosion Control	$ 4,000	Acre	4	$ 15,822
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	1.3	$ 94,500
SubTotal				$ 9,726,792
Engineering & Contingency				
Permitting & Design	2%			$ 194,536
Construction Oversight	$ 30,000	Week	72	$ 2,160,000
Contingency	30%			$ 2,918,037
SubTotal				$ 5,272,573
Total Capital Costs				**$ 14,999,365**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 14,999,365**

Alternative S-4B

Excavation with On-Site Thermal Desorption (DNAPL)

Utility Corridor

Description		Unit Cost	Unit	Quantity		Extension
CAPITAL COSTS						
Soil Excavation and Thermal Desorption						
Mob/DeMob	$	20,000	LS	1	$	20,000
Stormwater Control & Treatment	$	25,000	Each	1	$	25,000
Soil Excavation, Stockpile, Replace <8'	$	11	CY	1,979	$	21,765
Soil Excavation, Stockpile, Replace >8'	$	47	CY	2,797	$	130,713
Groundwater Management	$	28	CY	1,398	$	38,453
Soil Treatment	$	505	CY	4,775	$	2,409,354
Confirmation Sampling	$	200	Ea	16	$	3,200
Backfill Treated Soil	$	5	CY	4,566	$	22,831
Furnish and Place Imported Topsoil	$	26	CY	209	$	5,434
Seeding, Mulch and Erosion Control	$	4,000	Acre	0.3	$	1,118
Wetland Mitigation (off-site credits or in-lieu fee)	$	75,000	Acre	0.0	$	-
SubTotal					$	2,677,868
Engineering & Contingency						
Permitting & Design		2%			$	53,557
Construction Oversight	$	30,000	Week	5	$	150,000
Contingency		30%			$	803,360
SubTotal					$	1,006,918
Total Capital Costs					**$**	**3,684,786**
O&M COSTS						
Total O&M Costs					$	-
TOTAL ALTERNATIVE COST					**$**	**3,684,786**
TOTAL ALTERNATIVE COST					**$**	**-**

Alternative S-4B
Excavation with On-Site Thermal Desorption (DNAPL)
Former Dupont Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Soil Excavation and Thermal Desorption				
Mob/DeMob	$ 20,000	LS	1	$ 20,000
Stormwater Control & Treatment	$ 25,000	Each	1	$ 25,000
Soil Excavation, Stockpile, Replace <8'	$ 11	CY	159.0	$ 1,749
Soil Excavation, Stockpile, Replace >8'	$ 47	CY	125.5	$ 5,865
Groundwater Management	$ 28	CY	62.7	$ 1,725
Soil Treatment	$ 7,778	CY	284.4	$ 2,212,470
Confirmation Sampling	$ 200	Ea	1.0	$ 200
Backfill Treated Soil	$ 5	CY	78.8	$ 394
Furnish and Place Imported Topsoil	$ 26	CY	205.6	$ 5,346
Seeding, Mulch and Erosion Control	$ 4,000	Acre	0.3	$ 1,020
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 2,273,770
Engineering & Contingency				
Permitting & Design	2%			$ 45,475
Construction Oversight	$ 30,000	Week	1	$ 30,000
Contingency	30%			$ 682,131
SubTotal				$ 757,606
Total Capital Costs				**$ 3,031,376**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 3,031,376**

Alternative S-4B
Excavation with On-Site Thermal Desorption (DNAPL)
All Parcels

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Soil Excavation and Thermal Desorption				
Mob/DeMob	$ 20,000	LS	1	$ 20,000
Stormwater Control & Treatment	$ 25,000	Each	1	$ 25,000
Soil Excavation, Stockpile, Replace <8'	$ 11	CY	28,110.5	$ 309,216
Soil Excavation, Stockpile, Replace >8'	$ 47	CY	56,691.6	$ 2,649,763
Groundwater Management	$ 28	CY	28,345.8	$ 779,509
Soil Treatment	$ 70	CY	84,802.1	$ 5,917,849
Confirmation Sampling	$ 200	Ea	33.0	$ 6,600
Backfill Treated Soil	$ 5	CY	9,211.4	$ 46,057
Furnish and Place Imported Topsoil	$ 26	CY	623.6	$ 16,213
Seeding, Mulch and Erosion Control	$ 4,000	Acre	4.5	$ 17,959
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	1.3	$ 94,500
SubTotal				$ 9,882,667
Engineering & Contingency				
Permitting & Design	2%			$ 197,653
Construction Oversight	$ 30,000	Week	76	$ 2,280,000
Contingency	30%			$ 2,964,800
SubTotal				$ 5,442,453
Total Capital Costs				**$ 15,325,120**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 15,325,120**

Alternative S-4C
Excavation with On-Site Thermal Desorption (DNAPL 6')
Wabash Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Soil Excavation and Thermal Desorption				
Mob/DeMob	$ 20,000	LS	1	$ 20,000
Stormwater Control & Treatment	$ 25,000	Each	1	$ 25,000
Soil Excavation, Stockpile, Replace <8'	$ 11	CY	16,221.3	$ 178,434
Soil Excavation, Stockpile, Replace >8'	$ 47	CY	0.0	$ -
Groundwater Management	$ 28	CY	0.0	$ -
Soil Treatment	$ 179	CY	16,221.3	$ 2,911,164
Confirmation Sampling	$ 200	Ea	1.0	$ 200
Backfill Treated Soil	$ 5	CY	109.6	$ 548
Furnish and Place Imported Topsoil	$ 26	CY	10.0	$ 261
Seeding, Mulch and Erosion Control	$ 4,000	Acre	0.3	$ 1,020
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 3,136,627
Engineering & Contingency				
Permitting & Design	2%			$ 62,733
Construction Oversight	$ 30,000	Week	15	$ 450,000
Contingency	30%			$ 940,988
SubTotal				$ 1,453,721
Total Capital Costs				**$ 4,590,347**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 4,590,347**

Alternative S-4C
Excavation with On-Site Thermal Desorption (DNAPL 6')
Utility Corridor

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Soil Excavation and Thermal Desorption				
Mob/DeMob	$ 20,000	LS	1	$ 20,000
Stormwater Control & Treatment	$ 25,000	Each	1	$ 25,000
Soil Excavation, Stockpile, Replace <8'	$ 11	CY	1,143	$ 12,570
Soil Excavation, Stockpile, Replace >8'	$ 47	CY	0	$ -
Groundwater Management	$ 28	CY	0	$ -
Soil Treatment	$ 1,969	CY	1,143	$ 2,250,099
Confirmation Sampling	$ 200	Ea	4.0	$ 800
Backfill Treated Soil	$ 5	CY	1,104.4	$ 5,522
Furnish and Place Imported Topsoil	$ 26	CY	38.4	$ 997
Seeding, Mulch and Erosion Control	$ 4,000	Acre	0.3	$ 1,036
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 2,316,025
Engineering & Contingency				
Permitting & Design	2%			$ 46,320
Construction Oversight	$ 30,000	Week	2	$ 60,000
Contingency	30%			$ 694,807
SubTotal				$ 801,128
Total Capital Costs				**$ 3,117,153**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 3,117,153**
TOTAL ALTERNATIVE COST				**$ -**

Alternative S-4C
Excavation with On-Site Thermal Desorption (DNAPL 6')
Former Dupont Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Soil Excavation and Thermal Desorption				
Mob/DeMob	$ 20,000	LS	1	$ 20,000
Stormwater Control & Treatment	$ 25,000	Each	1	$ 25,000
Soil Excavation, Stockpile, Replace <8'	$ 11	CY	120	$ 1,316
Soil Excavation, Stockpile, Replace >8'	$ 47	CY	0	$ -
Groundwater Management	$ 28	CY	0	$ -
Soil Treatment	$ 18,434	CY	120	$ 2,205,245
Confirmation Sampling	$ 200	Ea	1	$ 200
Backfill Treated Soil	$ 5	CY	110	$ 548
Furnish and Place Imported Topsoil	$ 26	CY	10	$ 261
Seeding, Mulch and Erosion Control	$ 4,000	Acre	0.3	$ 1,020
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0	$ -
SubTotal				$ 2,253,589
Engineering & Contingency				
Permitting & Design	2%			$ 45,072
Construction Oversight	$ 30,000	Week	1	$ 30,000
Contingency	30%			$ 676,077
SubTotal				$ 751,149
Total Capital Costs				**$ 3,004,738**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 3,004,738**

Alternative S-4C
Excavation with On-Site Thermal Desorption (DNAPL 6')
All Parcels

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Soil Excavation and Thermal Desorption				
Mob/DeMob	$ 20,000	LS	1	$ 20,000
Stormwater Control & Treatment	$ 25,000	Each	1	$ 25,000
Soil Excavation, Stockpile, Replace <8'	$ 11	CY	17,483.6	$ 192,320
Soil Excavation, Stockpile, Replace >8'	$ 47	CY	0.0	$ -
Groundwater Management	$ 28	CY	0.0	$ -
Soil Treatment	$ 170	CY	17,483.6	$ 2,966,508
Confirmation Sampling	$ 200	Ea	6.0	$ 1,200
Backfill Treated Soil	$ 5	CY	1,323.6	$ 6,618
Furnish and Place Imported Topsoil	$ 26	CY	58.4	$ 1,519
Seeding, Mulch and Erosion Control	$ 4,000	Acre	0.8	$ 3,076
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 3,216,241
Engineering & Contingency				
Permitting & Design	2%			$ 64,325
Construction Oversight	$ 30,000	Week	16	$ 480,000
Contingency	30%			$ 964,872
SubTotal				$ 1,509,197
Total Capital Costs				**$ 4,725,438**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 4,725,438**

Appendix S-5

Cost Estimate Alternative S-5 – In-Situ Chemical Oxidation/Solidification

Alternative S-5A
In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (All Soil)
Wabash Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Bench Test for In Situ Mixing				
Collect Composite Soil Samples	$ 4,000	Event	1	$ 4,000
Soil Sample Laboratory Analyses	$ 3,000	Lot	1	$ 3,000
Technology Bench Test and Report	$ 20,000	Each	1	$ 20,000
SubTotal				$ 27,000
ISCO-ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing (Lang Tool/Auger) <8'	$ 20	CY	196,694	$ 3,933,884
Mechanical Mixing (Lang Tool/Auger) >8'	$ 37	CY	130,829	$ 4,840,685
Klosur-SP (4% by soil weight)	$ 2,400	Ton	11,802	$ 28,323,968
Portland cement (3% by soil weight)	$ 200	Ton	8,851	$ 1,770,248
Water Supply (25% of soil weight)	$ 0.01	Gal	29,488,916	$ 294,889
Confirmation Sampling (2,500 ft2)	$ 500	Ea	360	$ 179,827
Spoils Management	$ 5	CY	19,669	$ 98,347
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	1.3	$ 94,500
SubTotal				$ 39,596,349
Engineering & Contingency				
Permitting & Design	1%			$ 395,963
Construction Oversight	$ 10,000.00	Week	65	$ 650,000
Contingency	15%			$ 5,939,452
SubTotal				$ 6,985,416
Total Capital Costs				**$ 46,608,765**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 46,608,765**

Alternative S-5A
In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (All Soil)
Utility Corridor

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
ISCO-ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing (Lang Tool/Auger) <8'	$ 20	CY	33,036	$ 660,711
Mechanical Mixing (Lang Tool/Auger) >8'	$ 37	CY	12,456	$ 460,856
Klosur-SP (4% by soil weight)	$ 2,400	Ton	1,982	$ 4,757,120
Portland cement (3% by soil weight)	$ 200	Ton	1,487	$ 297,320
Water Supply (25% of Soil Weight)	$ 0.01	Gal	4,095,838	$ 40,958
Confirmation Sampling (2,500 ft2)	$ 500	Ea	58	$ 28,995
Spoils Management	$ 5	CY	3,304	$ 16,518
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 6,322,478
Engineering & Contingency				
Permitting & Design	2%			$ 126,450
Construction Oversight	$ 10,000.00	Week	9	$ 90,000
Contingency	15%			$ 948,372
SubTotal				$ 1,164,821
Total Capital Costs				**$ 7,487,299**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 7,487,299**

Alternative S-5A
In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (All Soil)
Depot Road

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
ISCO-ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing (Lang Tool/Auger) <8'	$ 20	CY	6,651	$ 133,016
Mechanical Mixing (Lang Tool/Auger) >8'	$ 37	CY	311	$ 11,511
Klosur-SP (4% by soil weight)	$ 2,400	Ton	399	$ 957,717
Portland cement (3% by soil weight)	$ 200	Ton	299	$ 59,857
Water Supply (25% of Soil Weight)	$ 0.01	Gal	626,824	$ 6,268
Confirmation Sampling (2,500 ft2)	$ 500	Ea	18	$ 8,979
Spoils Management	$ 5	CY	665	$ 3,325
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 1,240,674
Engineering & Contingency				
Permitting & Design	10%			$ 124,067
Construction Oversight	$ 10,000.00	Week	2	$ 20,000
Contingency	15%			$ 186,101
SubTotal				$ 330,169
Total Capital Costs				**$ 1,570,843**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 1,570,843**

Alternative S-5A
In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (All Soil)
Former Dupont Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
ISCO-ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing (Lang Tool/Auger) <8'	$ 20	CY	1,879	$ 37,585
Mechanical Mixing (Lang Tool/Auger) >8'	$ 37	CY	281	$ 10,398
Klosur-SP (4% by soil weight)	$ 2,400	Ton	113	$ 270,613
Portland cement (3% by soil weight)	$ 200	Ton	85	$ 16,913
Water Supply (25% of Soil Weight)	$ 0.01	Gal	194,504	$ 1,945
Confirmation Sampling (2,500 ft2)	$ 500	Ea	4	$ 2,221
Spoils Management	$ 5	CY	188	$ 940
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 400,616
Engineering & Contingency				
Permitting & Design	15%			$ 60,092
Construction Oversight	$ 10,000.00	Week	1	$ 10,000
Contingency	15%			$ 60,092
SubTotal				$ 130,185
Total Capital Costs				**$ 530,800**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 530,800**

Alternative S-5A
In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (All Soil)
All Parcels

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Bench Test for In Situ Mixing				
Collect Composite Soil Samples	$ 4,000	Event	1	$ 4,000
Soil Sample Laboratory Analyses	$ 3,000	Lot	1	$ 3,000
Technology Bench Test and Report	$ 20,000	Each	1	$ 20,000
SubTotal				$ 27,000
ISCO-ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing (Lang Tool/Auger) <8'	$ 20	CY	238,260	$ 4,765,197
Mechanical Mixing (Lang Tool/Auger) >8'	$ 37	CY	143,877	$ 5,323,450
Klosur-SP (4% by soil weight)	$ 2,400	Ton	14,296	$ 34,309,419
Portland cement (3% by soil weight)	$ 200	Ton	10,722	$ 2,144,339
Water Supply (25% of Soil Weight)	$ 0.01	Gal	34,406,082	$ 344,061
Confirmation Sampling (2,500 ft2)	$ 500	Ea	440	$ 220,021
Spoils Management	$ 5	CY	23,826	$ 119,130
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	1.3	$ 94,500
SubTotal				$ 47,380,117
Engineering & Contingency				
Permitting & Design	1%			$ 473,801
Construction Oversight	$ 10,000.00	Week	74	$ 740,000
Contingency	15%			$ 7,107,018
SubTotal				$ 8,320,819
Total Capital Costs				**$ 55,727,936**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 55,727,936**

Alternative S-5B
In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (DNAPL)
Wabash Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Bench Test for In Situ Mixing				
Collect Composite Soil Samples	$ 4,000	Event	1	$ 4,000
Soil Sample Laboratory Analyses	$ 3,000	Lot	1	$ 3,000
Technology Bench Test and Report	$ 20,000	Each	1	$ 20,000
SubTotal				$ 27,000
ISCO-ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing (Lang Tool/Auger) <8'	$ 20	CY	25,973	$ 519,458
Mechanical Mixing (Lang Tool/Auger) >8'	$ 37	CY	53,769	$ 1,989,471
Klosur-SP (8% by soil weight)	$ 2,400	Ton	3,117	$ 7,480,192
Portland cement - 3% by soil weight	$ 200	Ton	1,169	$ 233,756
Water Supply (25% of Soil Weight)	$ 0.01	Gal	7,179,685	$ 71,797
Confirmation Sampling	$ 200	Ea	104	$ 20,778
Spoils Management	$ 5	CY	2,597	$ 12,986
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	1.0	$ 75,000
SubTotal				$ 10,463,438
Engineering & Contingency				
Permitting & Design	2%			$ 209,269
Construction Oversight	$ 10,000.00	Week	20	$ 200,000
Contingency	15%			$ 1,569,516
SubTotal				$ 1,978,784
Total Capital Costs				**$ 12,469,223**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 12,469,223**

Alternative S-5B
In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (DNAPL)
Utility Corridor

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
ISCO-ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing (Lang Tool/Auger) <8'	$ 20	CY	1,979	$ 39,573
Mechanical Mixing (Lang Tool/Auger) >8'	$ 37	CY	2,797	$ 103,474
Klosur-SP (8% by soil weight)	$ 2,400	Ton	237	$ 569,856
Portland cement - 3% by soil weight	$ 200	Ton	89	$ 17,808
Water Supply (25% of Soil Weight)	$ 0.01	Gal	429,945	$ 4,299
Confirmation Sampling	$ 200	Ea	8	$ 1,583
Spoils Management	$ 5	CY	198	$ 989
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 797,583
Engineering & Contingency				
Permitting & Design	10%			$ 79,758
Construction Oversight	$ 10,000.00	Week	2	$ 20,000
Contingency	15%			$ 119,637
SubTotal				$ 219,396
Total Capital Costs				**$ 1,016,979**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 1,016,979**

Alternative S-5B
In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (DNAPL)
Former Dupont Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
ISCO-ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing (Lang Tool/Auger) <8'	$ 20	CY	159	$ 3,179
Mechanical Mixing (Lang Tool/Auger) >8'	$ 37	CY	125	$ 4,643
Klosur-SP (8% by soil weight)	$ 2,400	Ton	19	$ 45,781
Portland cement - 3% by soil weight	$ 200	Ton	7	$ 1,431
Water Supply (25% of Soil Weight)	$ 0.01	Gal	25,610	$ 256
Confirmation Sampling	$ 200	Ea	1	$ 127
Spoils Management	$ 5	CY	16	$ 79
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 115,497
Engineering & Contingency				
Permitting & Design	20%			$ 23,099
Construction Oversight	$ 10,000.00	Week	1	$ 10,000
Contingency	15%			$ 17,325
SubTotal				$ 50,424
Total Capital Costs				**$ 165,921**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 165,921**

Alternative S-5B

In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (DNAPL)

All Parcels

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Bench Test for In Situ Mixing				
Collect Composite Soil Samples	$ 4,000	Event	1	$ 4,000
Soil Sample Laboratory Analyses	$ 3,000	Lot	1	$ 3,000
Technology Bench Test and Report	$ 20,000	Each	1	$ 20,000
SubTotal				$ 27,000
ISCO-ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing (Lang Tool/Auger) <8'	$ 20	CY	28,111	$ 562,210
Mechanical Mixing (Lang Tool/Auger) >8'	$ 37	CY	56,692	$ 2,097,588
Klosur-SP (8% by soil weight)	$ 2,400	Ton	3,373	$ 8,095,829
Portland cement - 3% by soil weight	$ 200	Ton	1,265	$ 252,995
Water Supply (25% of Soil Weight)	$ 0.01	Gal	7,635,241	$ 76,352
Confirmation Sampling	$ 200	Ea	112	$ 22,488
Spoils Management	$ 5	CY	2,811	$ 14,055
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	1.0	$ 75,000
SubTotal				$ 11,256,518
Engineering & Contingency				
Permitting & Design	2%			$ 225,130
Construction Oversight	$ 10,000.00	Week	21	$ 210,000
Contingency	15%			$ 1,688,478
SubTotal				$ 2,123,608
Total Capital Costs				**$ 13,407,126**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 13,407,126**

Alternative S-5C
In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (DNAPL 6')
Wabash Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Bench Test for In Situ Mixing				
Collect Composite Soil Samples	$ 4,000	Event	1	$ 4,000
Soil Sample Laboratory Analyses	$ 3,000	Lot	1	$ 3,000
Technology Bench Test and Report	$ 20,000	Each	1	$ 20,000
SubTotal				$ 27,000
ISCO-ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing (Lang Tool/Auger) <8'	$ 20	CY	16,221	$ 324,425
Mechanical Mixing (Lang Tool/Auger) >8'	$ 37	CY	0	$ -
Klosur-SP (8% by soil weight)	$ 2,400	Ton	1,947	$ 4,671,723
Portland cement - 3% by soil weight	$ 200	Ton	730	$ 145,991
Water Supply (25% of Soil Weight)	$ 0.01	Gal	1,460,498	$ 14,605
Confirmation Sampling	$ 200	Ea	65	$ 12,977
Spoils Management	$ 5	CY	1,622	$ 8,111
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	1.0	$ 75,000
SubTotal				$ 5,312,832
Engineering & Contingency				
Permitting & Design	5%			$ 265,642
Construction Oversight	$ 10,000.00	Week	5	$ 50,000
Contingency	15%			$ 796,925
SubTotal				$ 1,112,566
Total Capital Costs				**$ 6,452,398**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 6,452,398**

Alternative S-5C

In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (DNAPL 6')

Utility Corridor

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
ISCO-ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing (Lang Tool/Auger) <8'	$ 20	CY	1,143	$ 22,855
Mechanical Mixing (20' deep barrier wall)	$ 37	CY	1,200	$ 44,400
Klosur-SP (8% by soil weight)	$ 2,400	Ton	137	$ 329,109
Portland cement - 3% by soil weight	$ 200	Ton	51	$ 10,285
Water Supply (25% of Soil Weight)	$ 0.01	Gal	210,931	$ 2,109
Confirmation Sampling	$ 200	Ea	5	$ 914
Spoils Management	$ 5	CY	114	$ 571
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 470,244
Engineering & Contingency				
Permitting & Design	5%			$ 23,512
Construction Oversight	$ 10,000.00	Week	2	$ 20,000
Contingency	15%			$ 70,537
SubTotal				$ 114,049
Total Capital Costs				**$ 584,292**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 584,292**

Alternative S-5C
In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (DNAPL 6')
Former Dupont Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
ISCO-ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing (Lang Tool/Auger) <8'	$ 20	CY	120	$ 2,393
Mechanical Mixing (Lang Tool/Auger) >8'	$ 37	CY	0	$ -
Klosur-SP (8% by soil weight)	$ 2,400	Ton	14	$ 34,453
Portland cement - 3% by soil weight	$ 200	Ton	5	$ 1,077
Water Supply (25% of Soil Weight)	$ 0.01	Gal	10,771	$ 108
Confirmation Sampling	$ 200	Ea	0.5	$ 96
Spoils Management	$ 5	CY	12	$ 60
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 98,186
Engineering & Contingency				
Permitting & Design	10%			$ 9,819
Construction Oversight	$ 10,000.00	Week	1	$ 10,000
Contingency	15%			$ 14,728
SubTotal				$ 34,546
Total Capital Costs				**$ 132,732**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 132,732**

Alternative S-5C
In-Situ Chemical Oxidation/Solidification (ISCO-ISS) (DNAPL 6')
All Parcels

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Bench Test for In Situ Mixing				
Collect Composite Soil Samples	$ 4,000	Event	1	$ 4,000
Soil Sample Laboratory Analyses	$ 3,000	Lot	1	$ 3,000
Technology Bench Test and Report	$ 20,000	Each	1	$ 20,000
SubTotal				$ 27,000
ISCO-ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing (Lang Tool/Auger) <8'	$ 20	CY	17,484	$ 349,673
Mechanical Mixing (20' deep barrier wall)	$ 37	CY	1,200	$ 44,400
Klosur-SP (8% by soil weight)	$ 2,400	Ton	2,098	$ 5,035,285
Portland cement - 3% by soil weight	$ 200	Ton	787	$ 157,353
Water Supply (25% of Soil Weight)	$ 0.01	Gal	1,682,200	$ 16,822
Confirmation Sampling	$ 200	Ea	70	$ 13,987
Spoils Management	$ 5	CY	1,748	$ 8,742
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	1	$ 75,000
SubTotal				$ 5,761,261
Engineering & Contingency				
Permitting & Design	5%			$ 288,063
Construction Oversight	$ 10,000.00	Week	6	$ 60,000
Contingency	15%			$ 864,189
SubTotal				$ 1,212,252
Total Capital Costs				**$ 7,000,514**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 7,000,514**

Appendix S-6

Cost Estimate Alternative S-6 – In-Situ Soil Stabilization/Solidification

Alternative S-6A
Solidification via In-Situ Soil Mixing (All Soil)
Wabash Parcel

Description	**Unit Cost**	**Unit**	**Quantity**	**Extension**
CAPITAL COSTS				
Bench Test for In Situ Mixing				
Collect Composite Soil Samples	$ 4,000	Event	1	$ 4,000
Soil Sample Laboratory Analyses	$ 3,000	Lot	1	$ 3,000
Technology Bench Test and Report	$ 15,000	Each	1	$ 15,000
SubTotal				$ 22,000
ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing (Lang Tool/Auger) <8'	$ 20	CY	196,694	$ 3,835,537
Mechanical Mixing (Lang Tool/Auger) >8'	$ 37	CY	130,829	$ 4,775,271
Portland cement - 10% by soil weight	$ 200	Ton	49,129	$ 9,825,707
Bentonite - 5% by soil weight	$ 100	Ton	24,564	$ 2,456,427
Water Supply (50% of Soil Weight)	$ 0.01	Gal	58,977,831	$ 589,778
Confirmation Sampling (2,500 ft2)	$ 500	Ea	360	$ 179,827
Spoils Management	$ 5	CY	65,505	$ 327,524
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	1.3	$ 94,500
SubTotal				$ 22,144,570
Engineering & Contingency				
Permitting & Design	1%			$ 221,446
Construction Oversight	$ 10,000.00	Week	65	$ 650,000
Contingency	15%			$ 3,321,686
SubTotal				$ 4,193,131
Total Capital Costs				**$ 26,359,702**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 26,359,702**

Alternative S-6A
Solidification via In-Situ Soil Mixing (All Soil)
Utility Corridor

Description	**Unit Cost**	**Unit**	**Quantity**	**Extension**
CAPITAL COSTS				
ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing ISCO (Lang Tool/Auger) <8'	$ 20	CY	33,036	$ 644,193
Mechanical Mixing ISCO (Lang Tool/Auger) >8'	$ 37	CY	12,456	$ 454,628
Portland cement - 10% by soil weight	$ 200	Ton	6,824	$ 1,364,733
Bentonite - 5% by soil weight	$ 100	Ton	3,412	$ 341,183
Water Supply (50% of Soil Weight)	$ 0.01	Gal	8,191,677	$ 81,917
Confirmation Sampling (2,500 ft2)	$ 500	Ea	58	$ 28,995
Spoils Management	$ 5	CY	9,098	$ 45,491
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 3,021,140
Engineering & Contingency				
Permitting & Design	2%			$ 60,423
Construction Oversight	$ 10,000.00	Week	9	$ 90,000
Contingency	15%			$ 6,824
SubTotal				$ 3,178,387
Total Capital Costs				**$ 3,223,878**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 3,223,878**

Alternative S-6A
Solidification via In-Situ Soil Mixing (All Soil)
Depot Road

Description	**Unit Cost**	**Unit**	**Quantity**	**Extension**
CAPITAL COSTS				
ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing ISCO (Lang Tool/Auger) <8'	$ 20	CY	6,651	$ 129,691
Mechanical Mixing ISCO (Lang Tool/Auger) >8'	$ 37	CY	311	$ 11,356
Portland cement - 10% by soil weight	$ 200	Ton	1,044	$ 208,858
Bentonite - 5% by soil weight	$ 100	Ton	522	$ 52,214
Water Supply (50% of Soil Weight)	$ 0.01	Gal	1,253,648	$ 12,536
Confirmation Sampling (2,500 ft2)	$ 500	Ea	18	$ 8,979
Spoils Management	$ 5	CY	1,392	$ 6,962
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 490,596
Engineering & Contingency				
Permitting & Design	10%			$ 49,060
Construction Oversight	$ 10,000.00	Week	2	$ 20,000
Contingency	15%			$ 73,589
SubTotal				$ 142,649
Total Capital Costs				**$ 633,245**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 633,245**

Alternative S-6A
Solidification via In-Situ Soil Mixing (All Soil)
Former Dupont Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing ISCO (Lang Tool/Auger) <8'	$ 20	CY	1,879	$ 36,646
Mechanical Mixing ISCO (Lang Tool/Auger) >8'	$ 37	CY	281	$ 10,258
Portland cement - 10% by soil weight	$ 200	Ton	324	$ 64,809
Bentonite - 5% by soil weight	$ 100	Ton	162	$ 16,202
Water Supply (50% of Soil Weight)	$ 0.01	Gal	389,009	$ 3,890
Confirmation Sampling (2,500 ft2)	$ 500	Ea	4	$ 2,221
Spoils Management	$ 5	CY	432	$ 2,160
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 196,186
Engineering & Contingency				
Permitting & Design	15%			$ 29,428
Construction Oversight	$ 10,000.00	Week	1	$ 10,000
Contingency	15%			$ 29,428
SubTotal				$ 68,856
Total Capital Costs				**$ 265,041**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 265,041**

Alternative S-6A
Solidification via In-Situ Soil Mixing (All Soil)
All Parcels

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Bench Test for In Situ Mixing				
Collect Composite Soil Samples	$ 4,000	Event	1	$ 4,000
Soil Sample Laboratory Analyses	$ 3,000	Lot	1	$ 3,000
Technology Bench Test and Report	$ 20,000	Each	1	$ 20,000
SubTotal				$ 27,000
ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing ISCO (Lang Tool/Auger) <8'	$ 20	CY	238,260	$ 4,646,067
Mechanical Mixing ISCO (Lang Tool/Auger) >8'	$ 37	CY	143,877	$ 5,251,512
Portland cement - 10% by soil weight	$ 200	Ton	57,321	$ 11,464,107
Bentonite - 5% by soil weight	$ 100	Ton	28,660	$ 2,866,027
Water Supply (50% of Soil Weight)	$ 0.01	Gal	68,812,165	$ 688,122
Confirmation Sampling (2,500 ft2)	$ 500	Ea	440	$ 220,021
Spoils Management	$ 5	CY	76,427	$ 382,137
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	1.3	$ 94,500
SubTotal				$ 25,672,492
Engineering & Contingency				
Permitting & Design	1%			$ 256,725
Construction Oversight	$ 10,000.00	Week	74	$ 740,000
Contingency	15%			$ 3,850,874
SubTotal				$ 4,847,599
Total Capital Costs				**$ 30,542,091**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 30,542,091**

Alternative S-6B
Solidification via In-Situ Soil Mixing (DNAPL)
Wabash Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Bench Test for In Situ Mixing				
Collect Composite Soil Samples	$ 4,000	Event	1	$ 4,000
Soil Sample Laboratory Analyses	$ 3,000	Lot	1	$ 3,000
Technology Bench Test and Report	$ 15,000	Each	1	$ 15,000
SubTotal				$ 22,000
ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing ISCO (Lang Tool/Auger) <8'	$ 20	CY	25,973	$ 506,471
Mechanical Mixing ISCO (Lang Tool/Auger) >8'	$ 37	CY	53,769	$ 1,962,586
Portland cement - 10% by soil weight	$ 200	Ton	11,961	$ 2,392,271
Bentonite - 5% by soil weight	$ 100	Ton	5,981	$ 598,068
Water Supply (50% of Soil Weight)	$ 0.01	Gal	14,359,370	$ 143,594
Sample Treated Soils	$ 200	Ea	319	$ 63,794
Spoils Management	$ 5	CY	15,948	$ 79,742
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.3	$ 22,500
SubTotal				$ 5,829,026
Engineering & Contingency				
Permitting & Design	2%			$ 116,581
Construction Oversight	$ 10,000.00	Week	20	$ 200,000
Contingency	15%			$ 874,354
SubTotal				$ 1,190,934
Total Capital Costs				**$ 7,041,961**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 7,041,961**

Alternative S-6B
Solidification via In-Situ Soil Mixing (DNAPL)
Utility Corridor

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing ISCO (Lang Tool/Auger) <8'	$ 20	CY	1,979	$ 38,584
Mechanical Mixing ISCO (Lang Tool/Auger) >8'	$ 37	CY	2,797	$ 102,076
Portland cement - 10% by soil weight	$ 200	Ton	716	$ 143,258
Bentonite - 5% by soil weight	$ 100	Ton	358	$ 35,814
Water Supply (50% of Soil Weight)	$ 0.01	Gal	859,891	$ 8,599
Sample Treated Soils	$ 200	Ea	19	$ 3,820
Spoils Management	$ 5	CY	955	$ 4,775
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.3	$ 22,500
SubTotal				$ 419,426
Engineering & Contingency				
Permitting & Design	10%			$ 41,943
Construction Oversight	$ 10,000.00	Week	2	$ 20,000
Contingency	15%			$ 62,914
SubTotal				$ 544,283
Total Capital Costs				**$ 549,058**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 549,058**

Alternative S-6B
Solidification via In-Situ Soil Mixing (DNAPL)
Former Dupont Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing ISCO (Lang Tool/Auger) <8'	$ 20	CY	159	$ 3,100
Mechanical Mixing ISCO (Lang Tool/Auger) >8'	$ 37	CY	125	$ 4,580
Portland cement - 10% by soil weight	$ 200	Ton	43	$ 8,533
Bentonite - 5% by soil weight	$ 100	Ton	21	$ 2,133
Water Supply (50% of Soil Weight)	$ 0.01	Gal	51,220	$ 512
Sample Treated Soils	$ 200	Ea	1	$ 228
Spoils Management	$ 5	CY	57	$ 284
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.3	$ 22,500
SubTotal				$ 101,871
Engineering & Contingency				
Permitting & Design	20%			$ 20,374
Construction Oversight	$ 10,000.00	Week	1	$ 10,000
Contingency	15%			$ 15,281
SubTotal				$ 45,655
Total Capital Costs				**$ 147,525**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 147,525**

Alternative S-6B
Solidification via In-Situ Soil Mixing (DNAPL)
All Parcels

Description	**Unit Cost**	**Unit**	**Quantity**	**Extension**
CAPITAL COSTS				
Bench Test for In Situ Mixing				
Collect Composite Soil Samples	$ 4,000	Event	1	$ 4,000
Soil Sample Laboratory Analyses	$ 3,000	Lot	1	$ 3,000
Technology Bench Test and Report	$ 20,000	Each	1	$ 20,000
SubTotal				$ 27,000
ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing ISCO (Lang Tool/Auger) <8'	$ 20	CY	28,111	$ 548,155
Mechanical Mixing ISCO (Lang Tool/Auger) >8'	$ 37	CY	56,692	$ 2,069,242
Portland cement - 10% by soil weight	$ 200	Ton	12,720	$ 2,544,062
Bentonite - 5% by soil weight	$ 100	Ton	6,360	$ 636,016
Water Supply (50% of Soil Weight)	$ 0.01	Gal	15,270,482	$ 152,705
Sample Treated Soils	$ 200	Ea	339	$ 67,842
Spoils Management	$ 5	CY	16,960	$ 84,802
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.3	$ 22,500
SubTotal				$ 6,185,323
Engineering & Contingency				
Permitting & Design	2%			$ 123,706
Construction Oversight	$ 10,000.00	Week	21	$ 210,000
Contingency	15%			$ 927,798
SubTotal				$ 1,261,505
Total Capital Costs				**$ 7,468,828**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 7,468,828**

Alternative S-6C
Solidification via In-Situ Soil Mixing (DNAPL 6')
Wabash Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Bench Test for In Situ Mixing				
Collect Composite Soil Samples	$ 4,000	Event	1	$ 4,000
Soil Sample Laboratory Analyses	$ 3,000	Lot	1	$ 3,000
Technology Bench Test and Report	$ 15,000	Each	1	$ 15,000
SubTotal				$ 22,000
ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing ISCO (Lang Tool/Auger) <8'	$ 20	CY	16,221	$ 316,315
Mechanical Mixing ISCO (Lang Tool/Auger) >8'	$ 37	CY	0	$ -
Portland cement - 10% by soil weight	$ 200	Ton	2,433	$ 486,638
Bentonite - 5% by soil weight	$ 100	Ton	1,217	$ 121,659
Water Supply (50% of Soil Weight)	$ 0.01	Gal	2,920,995	$ 29,210
Sample Treated Soils	$ 200	Ea	65	$ 12,977
Spoils Management	$ 5	CY	3,244	$ 16,221
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.3	$ 22,500
SubTotal				$ 1,065,520
Engineering & Contingency				
Permitting & Design	1%			$ 10,655
Construction Oversight	$ 10,000.00	Week	5	$ 50,000
Contingency	15%			$ 159,828
SubTotal				$ 220,483
Total Capital Costs				**$ 1,308,003**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 1,308,003**

Alternative S-6C
Solidification via In-Situ Soil Mixing (DNAPL 6')
Utility Corridor

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing ISCO (Lang Tool/Auger) <8'	$ 20	CY	1,143	$ 22,283
Mechanical Mixing ISCO (20' deep barrier wall)	$ 37	CY	1,200	$ 43,800
Portland cement - 10% by soil weight	$ 200	Ton	351	$ 70,282
Bentonite - 5% by soil weight	$ 100	Ton	176	$ 17,571
Water Supply (50% of Soil Weight)	$ 0.01	Gal	421,862	$ 4,219
Sample Treated Soils	$ 200	Ea	9	$ 1,874
Spoils Management	$ 5	CY	469	$ 2,343
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 222,372
Engineering & Contingency				
Permitting & Design	2%			$ 4,447
Construction Oversight	$ 10,000.00	Week	2	$ 20,000
Contingency	15%			$ 351
SubTotal				$ 24,799
Total Capital Costs				**$ 247,171**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 247,171**

Alternative S-6C
Solidification via In-Situ Soil Mixing (DNAPL 6')
Former Dupont Parcel

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing ISCO (Lang Tool/Auger) <8'	$ 20	CY	120	$ 2,333
Mechanical Mixing ISCO (Lang Tool/Auger) >8'	$ 37	CY	0	$ -
Portland cement - 10% by soil weight	$ 200	Ton	18	$ 3,589
Bentonite - 5% by soil weight	$ 100	Ton	9	$ 897
Water Supply (50% of Soil Weight)	$ 0.01	Gal	21,542	$ 215
Sample Treated Soils	$ 200	Ea	0	$ 96
Spoils Management	$ 5	CY	24	$ 120
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.0	$ -
SubTotal				$ 67,250
Engineering & Contingency				
Permitting & Design	15%			$ 10,087
Construction Oversight	$ 10,000.00	Week	1	$ 10,000
Contingency	15%			$ 10,087
SubTotal				$ 30,175
Total Capital Costs				**$ 97,425**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 97,425**

Alternative S-6C
Solidification via In-Situ Soil Mixing (DNAPL 6')
All Parcels

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Bench Test for In Situ Mixing				
Collect Composite Soil Samples	$ 4,000	Event	1	$ 4,000
Soil Sample Laboratory Analyses	$ 3,000	Lot	1	$ 3,000
Technology Bench Test and Report	$ 20,000	Each	1	$ 20,000
SubTotal				$ 27,000
ISS				
Mob/DeMob	$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment	$ 30,000	Each	1	$ 30,000
Mechanical Mixing ISCO (Lang Tool/Auger) <8'	$ 20	CY	17,484	$ 340,931
Mechanical Mixing ISCO (20' deep barrier wall)	$ 37	CY	1,200	$ 43,800
Portland cement - 10% by soil weight	$ 200	Ton	2,803	$ 560,509
Bentonite - 5% by soil weight	$ 100	Ton	1,401	$ 140,127
Water Supply (50% of Soil Weight)	$ 0.01	Gal	3,364,399	$ 33,644
Sample Treated Soils	$ 200	Ea	75	$ 14,947
Spoils Management	$ 5	CY	3,737	$ 18,684
Wetland Mitigation (off-site credits or in-lieu fee)	$ 75,000	Acre	0.3	$ 22,500
SubTotal				$ 1,235,141
Engineering & Contingency				
Permitting & Design	5%			$ 61,757
Construction Oversight	$ 10,000.00	Week	6	$ 60,000
Contingency	15%			$ 185,271
SubTotal				$ 307,028
Total Capital Costs				**$ 1,564,170**
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 1,564,170**

Appendix S-7

Cost Estimate Alternative S-7 – In-Situ Thermal Desorption

Alternative S-7A
In-Situ Thermal Desorption (ISTD) (All Soil)
Wabash Parcel

Description		Unit Cost	Unit	Quantity		Extension
CAPITAL COSTS						
ISTD						
Mob/DeMob	$	30,000	LS	1	$	30,000
Stormwater Control & Treatment	$	25,000	Each	1	$	25,000
ISTD (drilling/abandonment, electrical connect/usage, vapor treatment)	$	150	CY	666,026	$	99,903,900
Wetland Mitigation (off-site credits or in-lieu fee)	$	75,000	Acre	1.3	$	94,500
SubTotal					$	100,053,400
Engineering & Contingency						
Permitting & Design (included in above ISTD)		0%			$	-
Construction Oversight	$	2,000	Week	100	$	200,000
Contingency		15%			$	15,008,010
SubTotal					$	15,208,010
Total Capital Costs					**$**	**115,261,410**
O&M COSTS						
Total O&M Costs					$	-
TOTAL ALTERNATIVE COST					**$**	**115,261,410**

Alternative S-7B
In-Situ Thermal Desorption (ISTD) (DNAPL)
Wabash Parcel

Description		Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS					
ISTD					
Mob/DeMob		$ 30,000	LS	1	$ 30,000
Stormwater Control & Treatment		$ 25,000	Each	1	$ 25,000
ISTD (drilling/abandonment, electrical connect/usage, vapor treatment)		$ 150	CY	127,631	$ 19,144,650
Wetland Mitigation (off-site credits or in-lieu fee)		$ 75,000	Acre	0.3	$ 22,500
	SubTotal				$ 19,222,150
Engineering & Contingency					
Permitting & Design (included in above ISTD)		0%			$ -
Construction Oversight		$ 2,000	Week	50	$ 100,000
Contingency		15%			$ 2,883,323
	SubTotal				$ 2,983,323
Total Capital Costs					**$ 22,205,473**
O&M COSTS					
Total O&M Costs					$ -
TOTAL ALTERNATIVE COST					**$ 22,205,473**

Appendix GW-1

Cost Estimate Alternative GW-1 – Monitored Natural Attenuation (MNA)

Alternative GW-1
Monitored Plume Stability

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Well Installation/Repair				
Well Installation/Repair (shallow)	$ 7,500	LS	6	$ 45,000
Well Installation/Repair (deep)	$ 24,000	LS	2	$ 48,000
SubTotal				$ 93,000
Engineering & Contingency				
Permitting & Design (10%)				$ 9,300
Construction Oversight (7.5%)				$ 6,975
Contingency (15%)				$ 13,950
SubTotal				$ 30,225
Total Capital Costs				**$ 123,225**
O&M COSTS				
Annual Groundwater Sampling & Reporting	$ 30,000	YR	30	$ 781,060
Total O&M Costs				**$ 781,060**
TOTAL ALTERNATIVE COST				**$ 904,285**

Average of Superfund Interest Rates for 2012-2021 (%)	0.94%
30 year Net Present Value Multiplier	26.04
Years	30

Appendix GW-2

Cost Estimate Alternative GW-2 – In-Situ Treatment

Alternative GW-2
Funnel & Gate with In-Situ Treatment

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Funnel and Gate Construction				
Mob/DeMob	$ 75,000	LS	1	$ 75,000
Well Installation/Repair (4 shallow & 1 deep)	$ 30,000	LS	1	$ 30,000
Slurry Wall Construction (30" W x 1,000' L x 25' D)	$ 10.0	SQ FT	25,000	$ 250,000
Water Supply (50% of soil weight)	$ 0.01	Gal	500,200	$ 5,002
Disposal of Extra Excavated Material and Slurry (30%)	$ 70	Tons	1,000	$ 70,000
Treatment Gate Trench (6' wide x 200' long x 25' deep)	$ 20	CY	1,100	$ 22,000
Disposal of Trench Soil	$ 70	Tons	1,650	$ 115,500
Granular Trench Fill	$ 21	CY	1,100	$ 23,100
Sparge and Nutrient Addition System	$ 100,000	LS	1	$ 100,000
SubTotal				$ 690,602
Engineering & Contingency				
Permitting & Design (15%)				$ 103,590
Construction Oversight (7.5%)				$ 51,795
Contingency (15%)				$ 103,590
SubTotal				$ 258,976
Total Capital Costs				**$ 949,578**
O&M COSTS				
Annual O&M Treatment System (NPV)	$ 25,000	YR	30	$ 650,883
Annual Groundwater Sampling & Reporting	$ 30,000	YR	30	$ 781,060
Total O&M Costs				**$ 1,431,944**
TOTAL ALTERNATIVE COST				**$ 2,381,521**

Average of Superfund Interest Rates for 2012-2021 (%)	0.94%
30 year Net Present Value Multiplier	26.04
Years	30

Appendix GW-3

Cost Estimate Alternative GW-3 – Extraction with Treatment

Alternative GW-3
Groundwater Extraction & Treatment

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Collection Trench and Treatment System Construction				
Mob/DeMob	$ 50,000	LS	1	$ 50,000
Well Installation/Repair (4 shallow & 1 deep)	$ 30,000	LS	1	$ 30,000
Trench Construction (30" W x 1000' L x 25' D)	$ 20	CY	2,320	$ 46,400
Disposal of Trench Soil	$ 70	Tons	3,825	$ 267,750
Granular Trench Fill	$ 24	CY	2,550	$ 61,200
GAC Treatment System	$ 100,000	LS	1	$ 100,000
SubTotal				$ 555,350
Engineering & Contingency				
Permitting & Design (15%)				$ 83,303
Construction Oversight (7.5%)				$ 41,651
Contingency (15%)				$ 83,303
SubTotal				$ 208,256
Total Capital Costs				**$ 763,606**
O&M COSTS				
Annual O&M Treatment System (NPV)	$ 50,000	YR	30	$ 1,301,767
Annual Groundwater Sampling & Reporting	$ 30,000	LS	30	$ 781,060
Total O&M Costs				**$ 2,082,827**
TOTAL ALTERNATIVE COST				**$ 2,846,433**

Average of Superfund Interest Rates for 2012-2021 (%)	0.94%
30 year Net Present Value Multiplier	26.04
Years	30

Appendix GW-4

Cost Estimate Alternative GW-4 – Slurry Wall Containment with In-Situ Treatment Gate

Alternative GW-4
Containment with In-Situ Treatment

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Funnel and Gate Construction				
Mob/DeMob	$ 75,000	LS	1	$ 75,000
Well Installation/Repair (4 shallow & 1 deep)	$ 30,000	LS	1	$ 30,000
Slurry Wall Construction (30" W x 3,000' L x 25' D)	$ 10.0	SQ FT	75,000	$ 750,000
Water Supply (50% of soil weight)	$ 0.01	Gal	1,500,600	$ 15,006
Disposal of Extra Excavated Material and Slurry (30%)	$ 70	Tons	3,000	$ 210,000
Treatment Gate Trench (6' wide x 200' long x 25' deep)	$ 20	CY	1,100	$ 22,000
Disposal of Trench Soil	$ 70	Tons	1,650	$ 115,500
Granular Trench Fill	$ 21	CY	1,100	$ 23,100
Sparge and Nutrient Addition System	$ 100,000	LS	1	$ 100,000
SubTotal				$ 1,340,606
Engineering & Contingency				
Permitting & Design (15%)				$ 201,091
Construction Oversight (7.5%)				$ 100,545
Contingency (15%)				$ 201,091
SubTotal				$ 502,727
Total Capital Costs				**$ 1,843,333**
O&M COSTS				
Annual O&M Treatment System (NPV)	$ 25,000	YR	30	$ 650,883
Annual Groundwater Sampling & Reporting	$ 30,000	YR	30	$ 781,060
Total O&M Costs				**$ 1,431,944**
TOTAL ALTERNATIVE COST				**$ 3,275,277**

Average of Superfund Interest Rates for 2012-2021 (%)	0.94%
30 year Net Present Value Multiplier	26.04
Years	30

Appendix UT-1

Cost Estimate Alternative UT-1 – Trench Plug

Alternative UT-1
Trench Plug

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Trench Plug Construction				
Mobilization	$ 10,000	EA	1	$ 10,000
Inspection	$ 5,000	EA	1	$ 5,000
Injection from inside pipe in two locations	$ 60,000	LS	1	$ 60,000
Hydrovac Monitoring Sump Installation	$ 10,000	EA	2	$ 20,000
Shallow Monitoring Well Nest	$ 3,000	EA	2	$ 6,000
SubTotal				$ 101,000
Engineering & Contingency				
Permitting & Design	10%			$ 10,100
Construction Oversight	$ 1,000.00	Week	1	$ 7,575
Contingency	15%			$ 15,150
SubTotal				$ 32,825
Total Capital Costs				**$ 133,825**
O&M COSTS				
WL and DNAPL Measurement	$ 1,000	Event	34	$ 34,000
DNAPL Removal	$ 1,000	Event	30	$ 30,000
Total O&M Costs				$ 64,000.00
TOTAL ALTERNATIVE COST				**$ 197,825**

Appendix UT-2

Cost Estimate Alternative UT-2 – In-Situ Treatment

Alternative UT-2
In-Situ Treatment

Description		Unit Cost	Unit	Quantity		Extension
CAPITAL COSTS						
Trench Construction						
Pavement Removal (6' x 70')	$	10	SQ FT	420	$	4,200
Trench Excavation (6' W x 70' L x 20' D)	$	20	CY	325	$	6,500
Utility Shoring	$	40,000	LS	1	$	40,000
Disposal of Trench Soil	$	70	Tons	325	$	22,750
Granular Fill	$	30	CY	325	$	9,750
Pavement Replacement (6' x 70')	$	20	SQ FT	420	$	8,400
Sparge and Nutrient Addition System	$	75,000	LS	1	$	75,000
SubTotal					$	166,600
Engineering & Contingency						
Permitting & Design (15%)					$	24,990
Construction Oversight (7.5%)					$	12,495
Contingency (15%)					$	24,990
SubTotal					$	62,475
Total Capital Costs					**$**	**229,075**
O&M COSTS						
Annual O&M Treatment System (NPV)	$	25,000	YR	30	$	650,883
Total O&M Costs					**$**	**650,883**
TOTAL ALTERNATIVE COST					**$**	**879,958**

Average of Superfund Interest Rates for 2012-2021 (%)	0.94%
30 year Net Present Value Multiplier	26.04
Years	30

Appendix UT-3

Cost Estimate Alternative UT-3 – Extraction with Treatment

Alternative UT-3
Groundwater Extraction & Treatment

Description		Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS					
Trench Construction					
Pavement Removal (6' x 70')		$ 10	SQ FT	420	$ 4,200
Trench Excavation (6' W x 70' L x 20' D)		$ 20	CY	325	$ 6,500
Utility Shoring		$ 40,000	LS	1	$ 40,000
Disposal of Trench Soil		$ 70	Tons	325	$ 22,750
Granular Fill		$ 30	CY	325	$ 9,750
Pavement Replacement (6' x 70')		$ 20	SQ FT	420	$ 8,400
GAC Treatment System		$ 100,000	LS	1	$ 100,000
	SubTotal				$ 191,600
Engineering & Contingency					
Permitting & Design (15%)					$ 28,740
Construction Oversight (7.5%)					$ 14,370
Contingency (15%)					$ 28,740
	SubTotal				$ 71,850
Total Capital Costs					**$ 263,450**
O&M COSTS					
Annual O&M Treatment System (NPV)		$ 50,000	YR	30	$ 1,301,767
Total O&M Costs					**$ 1,301,767**
TOTAL ALTERNATIVE COST					**$ 1,565,217**

Average of Superfund Interest Rates for 2012-2021 (%)	0.94%
30 year Net Present Value Multiplier	26.04
Years	30

Appendix VI-1

Cost Estimate Alternative VI-1 – Institutional Controls

Alternative VI-1
Institutional Controls

Description	Unit Cost	Unit	Quantity	Extension
CAPITAL COSTS				
Legal & Administrative				
Legal & Administrative Services				$ 12,500
Total Capital Costs				$ 12,500
O&M COSTS				
Total O&M Costs				$ -
TOTAL ALTERNATIVE COST				**$ 12,500**