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Sent:	Wednesday, August 12, 2020 5:35 PM
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Subject:	Former WPS Green Bay, WI MGP - Revised PDI Work Plan
Attachments:	2020-08-12 Green Bay Upland PreDesign Investigation Work Plan Revision 1.pdf; 70712 Green Bay Upland PDIWP Rev 1 200812_RLSO.pdf

Ms. Rolfes,
On behalf of Frank Dombrowski, please find attached a letter response to USEPA comments received on May 29, 2020, on the Pre-Design Investigation Work Plan. The letter, which also incorporates Revision 1 of the work plan, is being submitted per the proposed schedule submitted by email on August 8, 2020. A second attachment of the revised work plan text has been provided in red-line strike-out to facilitate review of the document changes.

If you have any questions, please don't hesitate to contact Frank at (414) 221-2156 or reach out to me if an alternative method of file delivery is needed.

Kind regards
Staci Goetz

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August 12, 2020

Ms. Sarah Rolfes
Remedial Project Manager
United States Environmental Protection Agency
77 W. Jackson Boulevard
Chicago, Illinois 60604-3590

RE: Response to Comments and Transmittal of Pre-Design Investigation Work Plan Revision 1
Green Bay Former Manufactured Gas Plant
Green Bay, Wisconsin
Wisconsin Public Service Corporation
CERCLA Docket No. V-W-06-C-847, CERCLIS ID – WIN000509948

Dear Ms. Rolfes:

Wisconsin Public Service Corporation (WPSC) is providing this letter response to the United States Environmental Protection Agency (USEPA) comments received on May 29, 2020 on the Pre-Design Investigation Work Plan (PDI WP) for the Wisconsin Public Service Corporation (WPSC) Green Bay Manufactured Gas Plant (MGP) Site, dated March 16, 2020.

For ease of review, USEPA comments are presented below in italics, followed by responses developed for WEC Business Services, LLC (WBS). A revised Pre-Design Investigation Work Plan Revision 1 dated August 12, 2020 is also included.

GENERAL COMMENTS

1. *The PDI WP in its current form does not address all Site data gaps and two instances are noted below –*
    a. *Based on a review of Table 5 from the 2003 Remedial Action Documentation Report, thermally treated soil used as backfill within the excavation still has exceedances of screening levels.*

WPSC Response: The subject of this PDI and Early Removal Action is areas that have not yet been remediated. An RI Data Summary Memorandum will be submitted by September 18, 2020 that presents the evaluation of the data versus current Screening Levels (SL). The memorandum will also include discussion of risk including the thermally treated soil areas. Upon review of the RI Data Summary and focused risk assessment, the need for and scope of supplemental data collection for areas beyond the focus of the PDI and Early Removal Action will be discussed.

Note that soil borings SB-529 through SB-535 have been added to the attached work plan for the visual logging and collection of soil analytical data to support evaluation of soil exposure risk pathways. Geotechnical sample collection has also been included at select locations to inform the design for potential sheet pile wall or excavation shoring.

b. *The extent of subsurface NAPL in the area of the former MGP structures south of the Utility Court are not known. Based on a review of Table 12 from the 2003 Remedial Action Documentation Report, the side wall and bottom samples from the four excavation areas still have exceedances of screening levels. For example, Sample EW 2-4 (7 ft) has detections of benzene at 8,900 ppm, benzo(a)pyrene at 11,000 ppb, and naphthalene at 95,000 ppb all of which are above screening levels. Additionally, the statement on page 15 of the 2020 PDI WP that excavations did not proceed laterally or vertically to remove tar that occurred in clay fractures or "silt seams", indicates there may be NAPL that extends laterally from the excavation areas in silt seams. The extent of NAPL does not appear to be defined.*

WPSC Response: As provided in the response above, a discussion of risk will be presented as part of the RI Data Summary Memorandum. The Memorandum will include expanded cross-sections and documentation of approved 2015 Site Specific Work Plan (SSWP) investigation activities that we believe will demonstrate the extent of NAPL is defined laterally and vertically in the previously remediated area. In addition, the 2003 Remedial Action Work Plan which was approved by WDNR acknowledged some NAPL in clay fractures would remain on site and specifically states: *"Other outlying and possible deeper areas exist which indicate the presence of coal tar in clay fractures which are not targeted for excavation."*

2. *Additional soil borings are recommended along the land-side of the sheet pile wall installed as part of the 2003 soil removal action. Approximate suggested locations are shown as red rectangles on the annotated Figure 8, PDI Work Plan (Attachment 2). The purpose of the sample locations would be to see if NAPL exists at any depth behind the wall, either outside the 2003 removal action footprint, or underneath the footprint, or within if NAPL migrated to a more permeable layer.*

WPSC Response: Additional soil borings (SB-524 through SB-528) have been included in the PDI Work Plan as shown on the revised Figure 8. The proposed locations include area within the thermally treated backfill and adjacent to the sheet pile wall as recommended.

3. *A brief description of the site-specific geology and hydrogeology (where the water table is encountered) as well as prevailing groundwater conditions in an early section of the document would provide context for the vertical DPI soil data to be collected and for biotrap deployment. A cross-section through the northern portion of the site with lithology of existing borings would enhance the understanding of vertical soil sampling.*

WPSC Response: These comments have been incorporated within the text (Section 1.2 Site Geology and Hydrogeology) and cross-sections provided in the 2017 RI data summary package have been added to Appendix D.

SPECIFIC COMMENTS

1. *Executive Summary - Please clarify statement in second to last sentence of the first paragraph on page 5 that is in parentheses. It is unclear if borings will extend 20 feet into the clay or a total of 20 feet.*

WPSC Response: Borings will extend approximately 20 feet below ground surface and a minimum of 5-feet into the clay. The final depth of each boring will depend on the purpose of the boring as described in Section 3.3 of the PDI Work Plan. The abbreviation, bgs, has been expanded to below ground surface to provide further clarification.

2. *Executive Summary - The work plan states that the vertical and horizontal extent of delineation is complete if no oil coated or oil wetted observations are present. Consider including oil staining as visual evidence of source material impacts.*

WPSC Response: Oil staining will be noted per Standard Operating Procedures in Appendix B. If staining is observed in the absence of oil coated or oil wetted material that interval will be sampled as described in Section 3.3.2.

3. *Executive Summary - The last sentence of the first paragraph on page 5 indicates that if there is 4 feet of DNAPL-free sample, the boring will be terminated regardless of whether it has reached the top of the clay. All borings should extend into the clay at least 5 feet despite any absence of DNAPL in the overlying soils.*

WPSC Response: The sentence does not suggest the boring will be terminated, it states that the source material will be delineated if no oil-coated or oil-wetted observations are present for two consecutive sample intervals (i.e., a total interval of 4 feet having no observed source material). The preceding sentence in the paragraph states the borings will extend into the clay layer (approximately 20 feet below ground surface). The PDI Work Plan has been clarified to indicate borings will be advanced a minimum of 5-feet into the confining clay or to the proposed target depth.

4. *Executive Summary - Sample collection protocol does not include sampling of the native clay, when impacts are encountered. The TarGOST data is collected down to 20 ft and is expected to include impacts in native clay, however the vertical soil sampling terminates "within the 2-foot interval above the clay defining layer." Consider collecting soil samples into the top of the clay at 2-foot intervals until impacts are observed.*

WPSC Response: NAPL impacts in the native clay are not expected at most boring locations. As indicated on Figure 8, only one of the SSWP borings (SB-418E) encountered NAPL in the native clay. Previous sampling of the native clay indicates very low or non-detectable concentrations of total BTEX and total PAH in clay samples that do not contain visual observations of NAPL (see cross-sections from the 2017 RI data summary added to Appendix D). Based on previous sampling, NAPL in the native clay can be evaluated visually.

5. *Section 1.4 - Please include a brief summary of the sheet pile wall and shoreline excavation activities that were performed to the northeast of Area 3, as shown on Figure 4. This summary should highlight the depth and conditions that prompted this work.*

WPSC Response: A summary of the 2018 shoreline soil removal has been incorporated within Section 1.5.

6. *Section 2 - The first sentence in Section 2 suggests that sufficient data have been collected at the site to "estimate the extent of affected media." The purpose of this sentence is not clear, and it can be confusing to the reader as it is seemingly incongruent with the Work Plan Data Gap 1 (Section 2.2) which highlights that the extent of the horizontal and vertical extent of soil exceeding RGs has not been established in the north parking lot. As written this sentence is misleading, please modify or delete this sentence accordingly.*

WPSC Response: The purpose of this sentence, and the rest of this paragraph, is to establish that the existing data are sufficient to estimate the extent of affected media; however, additional data may be required to refine the limits of affected soil <u>for remedial design purposes</u>. Data Gap 1 has been updated to reference the limits of screening levels (SLs) rather than remediation goals. Proposed soil boring locations are shown on Figure 9 along with 10^{-5} residential risk exceedances for context.

7. *Section 2.2 - The objective of the soil boring investigations presented prior to section 2.2 is to delineate the extent of source material impacts as determined by visual observations. Section 2.2 seems to suggest the delineation is based on remediation*

goals which contradicts with information presented previously. Please remove reference to delineation based on remediation goals.

WPSC Response: Remediation Goals (RGs) have been changed to Screening Levels (SLs) throughout the document for clarification.

8. *Section 2.3 - Should Data Gap 3 be under a separate heading, as it is not related to utilities?*

WPSC Response: The subsurface location of MW-402R is confounded by utilities which have made the well undetectable by a metal detector; therefore, location of the well has been included as part of the utility data gap (subsurface survey) to identify the location of the well.

9. *Section 3.1.1 - This section indicates that the active parking lot may require partial or total closure. It is unclear if this closure is related to the investigation presented in this work plan, or as part of remedial activities. Please revise sentence to clarify.*

WPSC Response: Anticipated remedial activities will require partial or total closure of the parking lot during those activities.

10. *Section 3.3.1 - Have measurable thicknesses of LNAPL or DNAPL been observed in any monitoring wells at the site, either recently or in the past? Depending on the soil conditions observed during this work, is there any need to determine if these NAPL conditions represent something more than residual NAPL, or is it presumed that all NAPL (residual or otherwise) will be addressed as part of the remedial action?*

WPSC Response: Prior to 2003 Remedial Action, DNAPL was observed in MW-401AR, MW-402, MW-403, MW-404, and MW-411A. Since then, DNAPL observations have been reduced to only two wells (MW-405A and MW-401AR). The last and most recent observations from MW-402R were strong odors, but no observed NAPL. This information about NAPL observations in monitoring wells has been added to Section 1.4.3. The reduction in NAPL observations and stable groundwater concentrations indicate source removal was an effective remedy; and, there are no longer any indications of source material and instead indicates the presence of residual NAPL.

11. *Section 3.3.1 - Considering the presence of NAPL that has been detected in the fractured clay and the unknown nature of the source of these impacts, it is recommended that all borings be advanced into the top of this unit and not terminated prematurely should a 4-foot interval of unimpacted soil be observed.*

WPSC Response: See response to Specific Comment #1. Borings will extend approximately 20 feet below ground surface to a minimum of 5-feet into the clay.

12. *Section 3.3.1 - The text states that "TarGOST® laser induced fluorimeter response will be calibrated to the residual DNAPL prior to mobilization on site." Please provide additional detail on what is meant by this statement. Calibration of TarGOST to a site-specific NAPL condition is not normally done, but instead the instrument is calibrated to a standard reference emitter (RE) where readings are generated that are relative the that reference (in units of percent RE).*

WPSC Response: In initial conversations with Dakota Technologies, they had recommended submitting a pre-mobilization analysis of the site's NAPL to assure that TarGOST® would detect the site's NAPL. This calibration test has been removed following discussion with Dakota Technologies. Note that equivalent fluorescence technologies, such as an Optical Image Profiler – Hydraulic Profile Tool (OIP) operated by Cascade Remediation Services may be used to

evaluate the presence of DNAPL, pending availability of drilling/testing contractors. See response to comment 13 below for further discussion of fluorescence testing.

13. *Section 3.3.1 - Please provide additional information regarding the utilization of TarGOST, as the intended usage/role is not entirely clear. For example, will TarGOST profiles be generated in advance of the completion of DPT borings so that soil sample collection intervals can be targeted and a preliminary extent of DNAPL can be determined? Will the DPT borings then be used to confirm these extents and assess the LIF response thresholds that are indicative of DNAPL at the site? If TarGOST borings will be advanced ahead of DPT sampling and they will extend 5 feet into the top of the clay then the follow-on DPT borings may not all need to extend this deep, and perhaps at only a couple of select locations they could extend to the same depth to confirm the observed TarGOST responses here. With this confirmation the remaining DPT borings where impacts were not observed in this unit with TarGOST could be terminated at shallower depths based on where impacts were observed.*

WPSC Response: TarGOST® (or equivalent fluorescence technology) profiles will be generated first and then followed by completion of DPT borings. DPT borings will be co-located with NAPL fluorescence borings to ground truth fluorimeter response. NAPL fluorescence borings typically will be completed in advance of DPT borings, with an initial co-located DPT boring or two completed for visual confirmation of fluorescence profiles to aid with early interpretation. DPT borings will be advanced approximately 5 feet into clay. Visual observations and fluorescence that both support the presence of NAPL will be used to inform sampling per the described protocol; fluorescence alone will not be used to select sample intervals.

14. *The sequence of TarGOST and how it will be used in the field to guide sample collection and delineation decision making should be clearly outlined in the work plan.*

WPSC Response: Utilization and sequencing as described in the response to Specific Question #13 has been incorporated.

15. *Section 3.3.1 - Please include the spacing that will be utilized for the contingency borings and update Figure 8 to include potential locations.*

WPSC Response: Contingency boring locations will be determined based on visual results of the initial PDI borings. Step out borings will generally be placed equidistant between the PDI boring containing a visual result and a location previously investigated.

16. *Executive Summary, Section 3.4, and Table 1 - It is not clear if biotraps will be deployed only to assess the microbial population naturally present in the COPC-impacted groundwater (as described for data gap 4), or if stable isotope probing (using naphthalene) will be conducted (as described in Table 1). No mention of lab analyses such as CENSUS qPCR or QuantArray for assessing the diverse microbial population is made. If biotraps will only be used to label naphthalene and track its biodegradation into biomass and CO2, provide rationale how this would be used as a line of evidence for benzene and benzo(a)pyrene natural attenuation.*

WPSC Response: Stable isotope probing (SIP) is proposed as a screening tool to confirm that biodegradation of naphthalene is occurring within COPC impacted wells as an additional line of evidence that supports natural attenuation as a viable remedial option. The COPC impacted wells also exhibit detections of naphthalene at levels recommended by Microbial Insights, Inc. Microbial Insights does not currently offer SIP testing for benzo(a)pyrene; however, it is available for benzene and has been added to the PDI WP. Benzene and naphthalene are also expected to have more influence on natural attenuation clean up timelines than benzo(a)pyrene. Data gap 4 and corresponding text in Section 3.4 has been updated for clarity.

17. *Table 1- Footnote 5 includes a reference to sediment sampling. Please revise accordingly.*

WPSC Response: Comment has been incorporated.

18. *Figure 4 - In the legend Excavation Area 1 is repeated and Excavation Area 4 is omitted. Please revise as appropriate.*

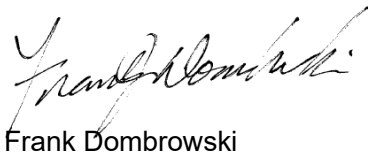
WPSC Response: Figure 4 has been revised accordingly.

19. *Figure 5 - The same symbol is noted for both the hand auger sampling and surface soil sampling location. Please review and change the symbol or the label accordingly.*

WPSC Response: "Surface soil sampling" location label has been removed from Figure 5.

If you have any questions, please don't hesitate to contact me at (414) 221-2156 or via email at frank.dombrowski@wecenergygroup.com.

Sincerely,



Frank Dombrowski
Principal Environmental Consultant
WEC Business Services – Environmental Dept.

Enclosures: Pre-Design Investigation Work Plan Revision 1

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Intended for
Wisconsin Public Service Corporation

Date
August 12, 2020

Project No.
70712

PRE-DESIGN INVESTIGATION WORK PLAN REVISION 1

FORMER GREEN BAY MANUFACTURED GAS PLANT SITE

RAMBOLL Bright ideas. Sustainable change.

PRE-DESIGN INVESTIGATION WORK PLAN REVISION 1
FORMER GREEN BAY MANUFACTURED GAS PLANT SITE

Project name	**Former Green Bay MGP**
Project no.	**70712**
Recipient	**Wisconsin Public Service Corporation**
Document Type	**Pre-Design Investigation Work Plan**
Revision	**1**
Date	**August 12, 2020**
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Table C Estimated Field Analysis Schedule

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APPENDICES

Appendix A Site Specific Work Plan Addendum – MW-402R Replacement Memorandum
Appendix B Relevant Multi-Site Operating Procedures
Appendix C Site-Specific Health and Safety Plan
Appendix D Remedial Investigation Data Summary Package – Select Figures and Tables
Appendix E Vendor Specifications & Protocols

ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CERCLA ("Superfund")	Comprehensive Environmental Response, Compensation, and Liability Act
City	City of Green Bay, Wisconsin
COPC	constituent of potential concern
CSM	Conceptual Site Model
CY	Cubic yards
Diggers	Wisconsin's Diggers Hotline
DNAPL	dense non-aqueous phase liquid
ES	Enforcement standard
FSP	Field Sampling Plan
FS	feasibility study
ft^3	cubic feet
GBGLC	Green Bay Gas Light Company
GPR	Ground penetrating radar
HASP	Health and Safety Plan
IBS	Integrys Business Support, LLC
IDW	investigation-derived waste
MMTD	medium temperature thermal desorption
MGP	manufactured gas plant
NAPL	non-aqueous phase liquid
NCP	National Contingency Plan
NFA	North Focus Area
NRT	Natural Resources Technology, Inc., formerly OBG, part of Ramboll, now Ramboll
OBG	O'Brien and Gere Engineers, Inc., part of Ramboll, now Ramboll
OSR	Off-Site Rule
OIP	Optical Image Profiler
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PDI	pre-design investigation
PID	photoionization detector
PPE	personal protective equipment
QC	quality control
QAPP	Quality Assurance Project Plan
RA	remedial action
RAF	Risk Assessment Framework
RD AOC	Administrative Settlement Agreement and Order on Consent for Remedial Design
RI	remedial investigation
ROD	Record of Decision
ROW	right-of-way
SAA	Superfund Alternative Approach
SFA	South Focus Area
SIP	Stable isotope probing
SLs	Screening Levels
SOP	standard operating procedure

USEPA	United States Environmental Protection Agency
WBS	WEC Business Group, LLC
WDNR	Wisconsin Department of Natural Resources
WPSC	Wisconsin Public Service Corporation

EXECUTIVE SUMMARY

Ramboll has prepared this Pre-Design Investigation (PDI) Work Plan on behalf of Wisconsin Public Service Corporation (WPSC) for the upland portion of the Green Bay Former Manufactured Gas Plant (MGP) located in Brown County, Wisconsin. The primary objective of the PDI Work Plan is to further delineate the horizontal and vertical extent of impacts within the upland near the WPSC Annex building. To proceed with design for an interim removal action and to the remedial investigation/feasibility study (RI/FS) phase, additional information is required to design the remedy for the upland portion of the site. This additional information will be obtained through implementation of this PDI work plan.

Site investigation and historic soil excavation activities were completed between 1994 and 2003 focused on identifying source areas, determining the presence of former MGP structures, and groundwater monitoring continues to be performed to determine plume stability. Investigations included soil borings, test pits, soil samples, sediment samples, and groundwater sampling from monitoring wells and piezometers. Groundwater sampling has continued through November 2019 to evaluate the effect of source removal/soil remediation activities on water quality and natural attenuation.

Previous remedial action (RA) was completed in 2003 within the upland site in the form of soil removal and treatment, engineering and institutional controls, and long-term monitoring areas with the goal of meeting established criteria for natural attenuation as a final groundwater remedy. Although source and contaminated material was removed as part of the 2003 soil remediation effort, residual impacts remain within the former MGP (Site).

Investigations completed under the Superfund Alternative Approach (SAA) program identified oil-wetted/oil-coated fill/soil above native clay in upland material adjacent to the Annex building and the East River in the north parking lot area. One boring had trace observations of residual dense non-aqueous phase liquid (DNAPL) just above the top of/in fractured native clay. Subsequent SAA early removal actions occurred adjacent to the former MGP in the East and Lower Fox Rivers in 2018 and 2019, removing residual DNAPL from channel sediments and native clay, and shoreline soils. This PDI Work Plan addressed the upland.

To further refine extent of residual upland soils impact, the following data gaps were identified to be addressed to facilitated development of the early action design:

- **Data Gap 1**: The horizontal and vertical extent of soil exceeding screening levels (SLs) adjacent to the WPSC Annex Building in the north parking lot is insufficient for design purposes.
- **Data Gap 2**: Information regarding locations of potential buried utilities and remnant MGP structures is insufficient and out of date for safe drilling of borings and early action design purposes.
- **Data Gap 3**: The location of MW-402R is unknown because it was paved over by the property owner in 2018.
- **Data Gap 4**: There is uncertainty regarding the potential for the microbial community to address COPCs to the SLs for groundwater in the upland.

Soil borings will be installed at locations where data gaps have been identified between a DNAPL-containing boring and a clean boring based on the previous investigation results. The vertical and horizontal extent evaluation will involve advancing soil borings for residual DNAPL visual and analytical observations. Soil borings will be augmented with TarGOST® or the Geoprobe® equivalent Optical Image Profiler (OIP) to evaluate the extent of DNAPL. Co-located soil borings and TarGOST® analysis are expected to be continuous, to define the presence/absence and vertical extent of affected soil at each boring location and extend into confining clay layer (approximately 20 feet below ground surface (bgs)). The borings will extend a minimum of 5 feet into clay or to the depth of 20 feet, whichever is achieved first. For the purpose of guiding PDI fieldwork, the vertical and horizontal extent of source material will be considered delineated if no oil-coated or oil-wetted observations are present for two consecutive sample intervals (e.g., 4-feet) of sample free from DNAPL or into top of clay.

Soil borings will be characterized for soil texture (grain size), visual indication of DNAPL, color, odor, bedding features, secondary porosity features (e.g. fractures), or notable inclusions (e.g. wood, peat). Subsurface soil samples will be collected from all delineation borings as follows:

- For borings that show no visual, olfactory, or PID indication of impacts, one sample within the 2-foot interval above the clay confining layer will be collected.
- For borings that indicate the presence of contamination (through visual, olfactory, or PID indication), a sample of impacted material will be collected. A second sample will also be collected below the interval(s) of potential MGP residuals, to document vertical extent. A third sample will be collected from within the 2-foot interval above the clay confining layer if not included in the other samples.

Additionally, a waste characterization soil sample will be collected for materials anticipated for excavation and off-site disposal, in order to document waste characteristics. This profile will be utilized for anticipated removal actions within 2020.

Positive indicators of the occurrence of natural attenuation have been presented in the SSWP. To further evaluate the potential for monitored natural attenuation within the groundwater, stable isotope probing biotraps will be deployed in groundwater monitoring wells exhibiting groundwater standard exceedances for benzene, naphthalene, and benzo(a)pyrene and will be naphthalene specific. Biotraps will be deployed at four monitoring wells in the vicinity of the former MGP structures. A replacement well will be installed for MW-402R which was previously paved over. Details regarding the installation of MW-402R are included in Appendix A and include utilization of ground penetrating radar (GPR) for delineation of the paved over well.

The PDI field activities will be scheduled following USEPA approval of the PDI Work Plan, and will be dependent upon weather conditions, execution of access agreements, utility constraints, and contractor availability. WPSC will inform USEPA of the proposed schedule for PDI field activities following USEPA's approval of the PDI Work Plan. Field activities are targeted to initiate within 30 days of USEPA's approval of the PDI Work Plan and are expected to occur for one week in Q2 2020. The Pre-Design Investigation Evaluation Report will be submitted to the USEPA 60 days following completion of field activities and receipt of all analytical results.

1. INTRODUCTION

Ramboll has prepared this Pre-Design Investigation (PDI) Work Plan on behalf of Wisconsin Public Service Corporation (WPSC) for the upland portion of the Green Bay Former Manufactured Gas Plant (MGP) located in Brown County, Wisconsin (Figure 1; Site). The sediment portion of the Site is being addressed separately. The Site is managed by WEC Business Services, LLC (WBS). The primary objective of the PDI Work Plan is to outline the additional data collection efforts necessary to meet the requirements of the Administrative Settlement Agreement and Order on Consent for Remedial Investigations and Feasibility Studies (AOC) and Statement of Work (SOW), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or "Superfund") Docket No. V-W-06-C-847, dated May 5, 2006 (USEPA, 2006). The AOC and SOW address six of WPSC former MGPs.

Under the AOC/SOW, a generic approach was developed to address the six WPSC Sites (the Multi-Site approach). The Multi-Site support documents, which can be modified to account for site-specific differences that may exist and were approved by the United States Environmental Protection Agency (USEPA) as of April 20, 2010 (or later) include:

- Quality Assurance Project Plan (QAPP)
- Health and Safety Plan (HASP)
- Generalized Conceptual Site Model (CSM)
- Risk Assessment Framework (RAF)
- Field Sampling Plan (FSP)
- Feasibility Study (FS) Support Documents

The PDI includes elements of the FS, as defined in the SOW and the USEPA-approved Multi-Site FS Support Documents. If necessary, site-specific modifications will be provided.

1.1 Overview

Following remedial actions (RA) completed at the site in 2003 under Wis. Admin NR 700 auspices, investigations completed under the Superfund Alternative Approach (SAA) program identified oil-wetted/oil-coated material above native clay adjacent to the Annex building and the East River in the north parking lot area. One boring had trace observations of residual DNAPL just above the top of/in fractured native clay. Subsequent SAA early removal actions occurred adjacent to the former MGP in the East and Lower Fox Rivers in 2018 and 2019, removing residual DNAPL from channel sediments and native clay, and shoreline soils. Residual DNAPL remaining in the upland area will also be addressed as an early removal action, consistent with an August 2019 EPA Memorandum and Section 300.430 of the National Contingency Plan (NCP).

August 23, 2019, EPA Office of Land and Emergency Management released Use of Early Actions at Superfund National Priorities List Sites and Sites with Superfund Alternative Approach Agreements Memorandum, which encourages consideration of early action as part of the overall strategy for site management. The memorandum states that actions should be taken at the point that sufficient information is available to support a response to mitigate risk or limit contaminant migration, which is consistent with Section 300.430(a)(l) of the National Contingency Plan. The objective of early actions is to achieve signification risk reduction, address immediate risks to

human health and the environment, to control migration of contamination or in support of property reuse. The response action is considered an "early action" because it is taken before completion before the remedial investigation/feasibility study (RI/FS) phase for the site or operable unit (OU) is complete.

To proceed to the RI/FS and further design for an early action at the former WPS Green Bay MGP, additional information is required to design the remedy for the upland portion of the site. This additional information will be obtained through implementation of this PDI work plan, which includes monitoring well installation (Appendix A) and soil boring installation (Appendix B) to be conducted under a site-specific Health and Safety Plan (Appendix C). The AOC contained several content requirements for the PDI Work Plan. The following is a list of those requirements along with the section of this PDI Work Plan that addresses them:

- An evaluation and summary of existing data and description of data gaps (Section 2).
- A detailed plan of PDI activities targeted at resolving identified data gaps. Among other elements, this plan will include data quality objectives, media to be sampled, contaminants or parameters for which sampling will be conducted, location, and number of samples anticipated (Sections 3.3, 3.4).
- Cross-references to quality assurance/quality control requirements.

1.2 Site Geology and Hydrogeology

Soils encountered during previous site investigations include lacustrine and glacial deposits intermixed with fill. Surface and near surface soils are dominated by fine sand, silt, clay, and fill. The fill is predominately a black ash/cinder mix that resembles fine to coarse sand and silt; it also includes wood, glass, brick, concrete, wire, and porcelain. Fill ranges between 4 and 12 feet thick and generally the thickness increases towards the north. Clay till is present beneath much of the Site, extending from approximately 4 feet bgs to at least 30 feet bgs. The clay till is, red to red-brown, firm to hard, and usually fractured with thin, sporadic silt and fine sand seams throughout. The depth to clay increases approaching the river.

The groundwater flow direction has been generally consistent throughout the course of the various investigation activities. The hydraulic conductivity of the near surface material is orders of magnitude higher than the clay as observed in groundwater monitoring wells and piezometers beginning as early as December 1994. Well measurements collected through 2014 indicate the water table generally occurs between two and seven feet bgs. Typically, the shallow water table contours indicate radial groundwater flow toward both rivers while groundwater levels in the piezometers indicates a flow towards the East River (to the east-northeast).

1.3 Site Description and Surrounding Land Use

The former Green Bay MGP property is located in Green Bay, Wisconsin, immediately east of the WPSC corporate offices. The former MGP property is approximately 4 acres in size, while the entire area owned by WPSC covers approximately 13 acres. The property is bounded by the Fox and East Rivers on the north, by North Jefferson Street on the west, by North Madison Street on the east, and by Elm Street on the south (Figure 2).

The former MGP facility is a currently used as a parking lot, is entirely paved, and is an upland setting (Figure 2). A river walk area, located on an easement to the City (City of Green Bay) occupies the area immediately adjacent to the Fox River/East River shoreline. The channel

sediments of the Lower Fox River/East River adjacent to the former MGP comprise the sediment portion of the site, which includes two recently remediated areas called the North Focus Area (NFA) and the South Focus Area (SFA), the locations of which are shown on Figure 1. In relation to the former MGP property, the WPSC General Office and Annex Buildings are located northwest, the WPSC corporate Division Office Building is located west, the KI Convention Center is located southwest, the Associated Bank Office Building is located south, and the Associated Bank Office Building parking areas adjoin the Site to the south and east, respectively (Figure 2).

The former Green Bay MGP property was owned by the Green Bay Gas Light Company (GBGLC) and began operating in 1871. In 1922, GBGLC merged with other utilities to form WPSC. The MGP property was used to convert coal and other hydrocarbon feed stock into gas for heating and lighting until the late 1940s when natural gas became readily available through pipelines.

The Green Bay MGP utilized the coal gas production method until carbureted water gas machines were installed in 1919 and 1922. The MGP operated until 1947. The facility was dismantled in 1950, except for one gas holder, which was dismantled in 1975 Previously existing MGP related structures are shown on Figure 3. Former MGP related structures of significance include:

- Boiler, relief, and condenser houses
- Two condenser tanks approximately 12 feet in diameter
- Three oil tanks approximately 15 feet in diameter
- A tar well approximately 50 feet in diameter
- Four gas holders ranging in diameter from approximately 40 to 140 feet, with capacities of 15,000 cubic feet (ft^3), 40,000 ft^3, 300,000 ft^3, and 1,000,000 ft^3
- Three purifiers approximately 20 feet in diameter

One feature that was not identified until later during investigation activities was a historic sewer line that was a potential conduit for contaminant migration between the former MGP operational area and the East River. This line is approximated on Figure 3 and was investigated during the latter part of the Phase II activities and remediated as part of the 2003 soil remediation activities illustrated on Figure 4.

1.4 Previous Investigations Summary

Site investigation and historic soil excavation activities were completed between 1994 and 2003 and groundwater monitoring has continued through November 2019 to assess conditions since soil remediation. Investigations have focused on identifying source areas, determining the presence of former MGP structures, and groundwater plume stability. Investigations included soil borings, test pits, soil samples, sediment samples, and groundwater sampling from monitoring wells and piezometers. Full bibliography of reports and summaries for the site prior to 2014 is addressed in the Completion Report dated June 2014 (Natural Resources Technology[1], June 2014). Soil, soil gas, and groundwater sampling locations are included on Figure 5, Figure 6, and Figure 7, respectively. Sediment investigations are not discussed in this report.

1.4.1 Phase II Investigations (1994 and 1996)

Phase II Investigations were completed in 1994 and 1996 to delineate MGP residuals in soil and groundwater. The Phase II investigations included nineteen soil borings (SB-401 to SB-419),

[1] Natural Resources Technology, Inc. (NRT) formerly OBG, part of Ramboll, now Ramboll.

fourteen groundwater monitoring wells (MW-401A to MW-414), and four piezometers (MW-401B, MW-405B, MW-409B, and MW-411B) in 1994 followed by seven soil borings (SB-420 to SB-426), four monitoring wells (MW-415A to MW-418), and one piezometer (MW-415B) in 1996. The investigations concluded that most MGP residuals occurred in shallow soils which included fill material with some evidence of MGP residuals within deeper clay fractures. Additional conclusions within the Phase II investigations include:

- Soil with elevated polycyclic aromatic hydrocarbon (PAH) concentrations was the focus of the 2003 soil remediation and the volume was approximately 780,000 ft^3 (28,900 yd^3), assuming a 6-foot average depth.
- Evidence of free phase MGP residual was noted in wells MW-401A/B, MW-404, and MW-411A. The presence of this material to a maximum depth of approximately 14 feet in piezometer MW-401B suggested limited vertical migration via clay fractures.
- BTEX and PAH concentrations in groundwater exceeded the NR 140 Enforcement Standard (ES) on the south part of the property and along the bank of the East River.
- Results from the piezometers indicate affected groundwater was present at depth only in well nest MW-401, located adjacent to the former condenser tanks and a gas holder.

Soil boring and groundwater monitoring well locations representative of post removal action conditions are shown on Figure 5 and Figure 7 respectively

1.4.2 Remedial Design Investigation (2002)

A focused remedial design investigation was completed in 2002 to obtain additional data for the 2003 soil remediation work as described in the Completion Report (NRT, June 2014). Completed activities included:

- Sample groundwater at all wells in August 2002 and at select wells in November 2002.
- Install additional piezometer MW-407B for further groundwater quality assessment.
- Install replacement piezometer MW-401BR (for MW-401B) because the August 2002 groundwater sampling results indicated the well integrity was possibly compromised.
- Complete geotechnical borings SBG-401 to SBG-403 along the East River for proposed sheet pile design. Geotechnical data was also collected from MW-401BR for design of proposed sheet pile along Elm Street.
- Install borings SB-427 to SB-431 in the former tar well, former purifier area, small gas holder, and area along the East River (to assess potential impacts from a former historic sewer line).

1.4.3 Post Remedial Action and Remedial Investigation (2003 to 2019)

Although source and contaminated material was removed as part of the 2003 soil remediation effort described in Section 1.5 and shown on Figure 4, affected soils remain within the former MGP Property. Appendix D includes select figures and tables summarizing screening level exceedances and monitoring data, previously transmitted to USEPA as an RI Data Summary Package in preparation for a RI kick-off meeting scheduled for February 2017, which did not occur.

Analytical results of investigation of soil undisturbed by the 2003 remediation effort are presented in Table 1 and Table 2 of Appendix D and indicate that seven PAHs are most prevalent in the site soils: Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene,

Benzo(a)pyrene, Dibenzo(a,h)anthracene, Indeno(1,2,3 cd)pyrene, and Naphthalene. The prevalent PAHs were the most common exceedances for either the residential or industrial RSLs in samples following the 2003 removal activities. Benzo(a)pyrene was the most prevalent PAH and it exceeded either the residential or industrial RSL in 21 of the 28 samples collected at excavation base or walls. Of these 21 benzo(a)pyrene results, five were collected between the surface and 3-feet below ground surface (bgs). In soils deeper than 3-feet bgs, the highest PAH concentrations were present on the edge of Excavation Area 4 and these frequently exceeded 10,000 µg/kg. Concentrations in the other excavation areas were neither as high nor as prevalent. Analytical results that exceed either the residential or industrial RSL for borings outside of the four excavation areas are predominantly less than 5-feet bgs. The only location at which benzene exceeded the industrial RSL was at a depth of 10-feet bgs at MW 401BR. Only one other benzene sample and two ethylbenzene samples exceeded the residential RSL; all other VOC results were below the RSLs. The results indicate widespread, generally low-level concentrations remained in soils across the site, especially for areas outside of the excavation areas.

Additional soil investigations toward RI/FS efforts were completed with seventeen hand auger borings (HA-401 through HA-417), twenty-one soil borings (SB-418 through SB-438), and thirteen soil borings for conversion to soil gas probes (SG-401 through SG-404, SS-405A/B, SG-406 through SG-412) completed between October 19 and 21, 2015. Surface and subsurface soil sampling was conducted as specified in Revision 2 of the Site-Specific Work Plan for Upland Areas (October 9, 2015). Several step-out borings (SB-418A through SB-418I, Figure 5) were completed to evaluate the horizontal extent of potential MGP residuals east of the Annex Building. As an extension of the step-out boring program initiated in October 2015, a second subsurface soil sampling event took place on February 8, 2016 to evaluate potential soil impacts adjacent to the east side Annex Building. Four Geoprobe® soil borings (SB-418J, SB-418K, SB-418L and SB-418M) were advanced to a depth of 15-ft below ground surface.

Laboratory reports on the soil samples collected for analysis indicated detected concentrations of contaminants of potential concern (COPC) including benzene, ethylbenzene, and naphthalene. Soil gas results collected in February 2016 from nearby soil vapor probes SG-401 and SG-402 (Figure 26, Appendix D) also included detections of MGP VI COPCs and an exceedance of the benzene industrial screening level at SG-401. Impacts were mostly in fill materials outside of the 2003 soil remediation excavation areas. Nonaqueous phase liquid (NAPL) was located in fill and fluvial materials immediately overlying the less permeable clay (Figure 8). Trace amounts of NAPL were found within vertical clay fractures.

Long-term groundwater monitoring has been conducted from the conclusion of the 2003 soil remediation to November 2019. Semi-annual groundwater monitoring was completed from September 2003 through September 2008, annual sampling was completed each May from 2009 to 2015, quarterly sampling of select wells was completed in 2015 and 2016, and semi-annual sampling of select wells was completed from 2017 to 2019. Sampling was completed to evaluate the effect of source removal/soil remediation activities on water quality and natural attenuation. Prior to the 2003 Remedial Action, DNAPL was observed in MW-401AR, MW-402, MW-403, MW-404, and MW-411A. Since then, DNAPL observations have been reduced to two wells (MW-405A and MW-401AR).

Appendix D presents a summary of groundwater contours, which have been stable during the period of monitoring, and concentration trends and plume extents for select parameters. Cross-Sections X, Y, and Z in the vicinity of the proposed PDI activities are provided in Appendix D.

1.5 Overview of Previous Remedial Action Activities

Previous RA was completed in 2003 within the upland site in the form of soil removal and treatment, engineering and institutional controls, and long-term monitoring in accordance with the approved Wis. Admin. Code NR 724 Remedial Work Plan (NRT 2003). Soil remediation was undertaken with the objective of removing significant soil impacts and source areas with the goal of meeting established criteria for natural attenuation as a final remedy. Areas to be addressed were based on the soil analytical results obtained between 1994 and 2002. The selected remedy was source area excavation with medium temperature thermal desorption (MMTD), a parking lot cap and cover soil in peripheral unpaved areas, and groundwater monitoring.

Excavation and decommissioning of former MGP structures and piping removed approximately 30,075 tons of soil and debris from four areas (Figure 4) that included the following:

- Area 1 - included the 300,000 ft^3 gas holder near Elm Street
- Area 2 – included the former tar well, oil tanks, purifiers, and small gas holders
- Area 3 – included the suspected discharge area of the former concrete channel to the river
- Area 4 – included an area along the East River bank near well MW-410 (elevated cyanide)

In addition, former MGP and sewer piping was also excavated and treated, and this included the former concrete channel between the tar well and Area 3. Sheet pile was installed along Elm Street and the East River to facilitate Areas 1 and 3 excavation and portions were cut off and left in place. Sheet pile installed north of Area 3 served as a barrier between soil remediation and the East River shoreline and remains in place.

The main purpose for excavation was to remove former MGP structures (pipes, channels, tar well, etc.) considered to be sources of the tar impacted material. Excavations did not proceed laterally or vertically to remove tar that occurred in clay fractures or silt seams. The extent of the excavation areas are shown on Figure 4 and a summary for each is below, along with the volume of material excavated and how it was treated or disposed.

Table A. Previous Removal Excavation Volumes and Disposal Summary

Site Area/ Feature	Depth Excavated ft. bgs (approx.)	Tons Excavated	Backfill Material	Final Disposal
Area 1	6 8 ft	3,484	Imported Sand; Treated Soil	Excess soil thermally treated and debris disposed at Hickory Meadows
Area 2 & Tar Well	16 22 ft tar well, 8 14 ft other	14,461	Treated Soil	
Area 3	8 12 ft	7,715	Treated Soil	
Area 4	7 ft	173	Treated Soil; Imported Gravel	

Cores advanced in 2017 along the south shoreline of the East River (between the Upland Area 3 excavation and the East River channel) indicated the presence of DNAPL in riverbank soil. Approximately, 170 linear feet of the shoreline soil adjacent to the sheet pile wall was excavated from the Upland Area 3 sheet pile wall to the rip-rap face (i.e., water's edge) to remove DNAPL as part of the South Focus Area Sediment Remedial Action completed in 2018. The shoreline

excavation extended approximately 20 linear feet river-ward from the upland sheet pile wall and was contiguous to the river channel sediment removal. The shoreline soil excavation depth was at least 8 feet bgs or a minimum of elevation of 577 feet NAVD 88 and extended deeper in three areas. Approximately, 1,245 cubic yards (CY) of clay soil was excavated as a part of the voluntary early removal action that completed to remove DNAPL observed during 2014 and 2017 investigation activities. The shoreline area was backfilled with clean fill to match pre-construction elevations.

1.6 Multi-Site Documents

WPSC enrolled six former MGP sites into the USEPA Superfund Alternatives Program in 2006. In an effort to promote a consistent methodology for investigating and evaluating these six sites, WPSC developed multi-site documents that outline general approaches and concepts, with the intent to streamline preparation of work plans and to minimize review times for future deliverables. In addition, the multi-site documents provide a consistent approach to investigate and assess all sites within the program. PDI field work will be carried out in accordance with relevant elements of these multi-site documents. Specifically, field documentation, sample collection, and sample handling will be conducted in accordance with standard operating procedures (SOP) defined in the *Multi-Site Field Sampling Plan (FSP)- Revision 4* (Integrys Business Support [IBS], 2008). SOPs relevant to the PDI field work are included in Appendix B. Similarly, laboratory analysis and data management will be managed in accordance with *Multi-Site Quality Assurance Project Plan (QAPP) - Revision 2* (IBS 2007b) and subsequent addenda.

The USEPA-approved *Multi-Site Health and Safety Plan - Revision 2* dated March 12, 2015 (Multi-Site HASP; IBS, 2007a), which was used to develop the HASP for the purposes of this PDI Work Plan. The Site-specific HASP is included as Appendix C. This plan will be modified based on additional site-specific information as the PDI and early action process progresses.

2. DATA GAP IDENTIFICATION

Sufficient investigation activities have been conducted during prior upland investigations, removal actions, and on-going long term monitoring to estimate the extent of affected media, determine risk for potential exposure, and develop and evaluate remedial alternatives. The extent of this PDI and the proposed early action is limited to the western portion of the north parking lot area of the Site. Additional data is required to facilitate development of the early action design and implementation. The following sections identify current data gaps needed to complete the early action. Proposed investigation to resolve these data gaps is presented in Section 3.

2.1 General

General data gaps related to overall fundamental design needs of the proposed remedy are presented below.

2.2 Remedial Areas

- **Data Gap 1:** The horizontal and vertical extent of soil exceeding screening levels (SLs) adjacent to the WPSC Annex Building in the north parking lot is insufficient for design purposes.

2.3 Utilities

- **Data Gap 2:** Information regarding locations of potential buried utilities and remnant MGP structures is insufficient and out of date for safe drilling of borings and RA design purposes.
- **Data Gap 3:** The location of MW-402R is unknown because it was paved over by the property owner in 2018.

2.4 Groundwater Monitored Natural Attenuation

- **Data Gap 4:** There is uncertainty regarding the potential for biodegradation of COPCs to SLs for groundwater in the upland via natural attenuation.

3. PRE-DESIGN INVESTIGATION SCOPE

This section details the scope of the PDI.

3.1 Administrative Considerations

Design and implementation of the USEPA-approved early action will be influenced by administrative and engineering considerations. Investigation work to address engineering considerations are identified in later subsections. This subsection presents the administrative elements that need to be better understood prior to proceeding with PDI and voluntary early action activities.

3.1.1 City of Green Bay, AT&T, and WPSC

The anticipated remedial activities within the Green Bay MGP Upland are focused on land owned by WPSC and active roadways owned by the City of Green Bay. The majority of the area subject to supplemental investigation and removal activities is currently utilized as an active parking lot for WPSC facilities which may require partial or total closure during removal action activities. North Jefferson Street, Utility Court, Elm Street, and North Madison Street are active roadways, which may require lane closure or traffic control during remedial activities. WPSC desires to minimize the magnitude of disturbance through use of administrative and construction scheduling methods. Accordingly, WPSC will meet with the City, City Engineering Department, public utilities, and AT&T (communication utility) to discuss the following considerations:

- Preferred traffic detour routes during upcoming right-of-way (ROW) work for the RA
- Requirements and accommodations for temporary shutdown, relocation, and/or bypass of utilities
- Information regarding utility dimensions, depths, and other details that may be required for shutdown, relocation, and/or bypass of utilities
- City standard or preferred offset distances for excavation adjacent to utilities and other infrastructure
- City standard or preferred specifications for replacing roadways, sidewalks, and other pavement improvements following the RA
- Other City standards or concerns associated with implementing the voluntary early action remedy

3.2 Utility Clearance and Topographic and Visual Surveys

This subsection summarizes information that is currently known about utilities at the Site and plans to obtain and update the information needed to support the PDI and voluntary early action activities.

3.2.1 Existing Utilities

Preliminary understanding of above ground and subsurface utilities was obtained during the 2003 removal actions. Existing underground utilities in the vicinity of the upland site, including storm water, sanitary, water, electric, communications, and gas, are depicted on Figure 2. The utilities in the vicinity of the north parking lot area include the following:

- **Sanitary and Storm:** The City of Green Bay and WPSC maintain public and private sanitary sewers and storm sewers within the site boundary. A storm sewer line runs north-south beneath the north parking lot sidewalk to an outfall at the shoreline. Storm sewer lines run beneath the north parking lot from the intersection of N Madison Street and Utility Court to intersect the sidewalk storm sewer near the WPSC Annex building. The surface water runoff in the area is collected in storm sewers located in the streets, sidewalks, and within the parking lots and is discharged via a storm sewer outfall into the East River.
- **Water and Electric:** The City of Green Bay and WPSC maintain the water and electric utilities in the vicinity of the Site. Underground electric lines run north-south beneath the north parking lot from Utility Court to the river walk easement with east-west intersecting lines and two lines located beneath the river walk. Overhead electric runs north-south from the intersection of Utility Court and N Madison Street to the shoreline. A water main runs east west beneath Utility Court.
- **Natural Gas** – WPSC maintains a natural gas line in the vicinity of the Site. A natural gas line run east-west beneath the Utility Court ROW, intersecting with the north-south line beneath the N Madison Street ROW. Additional natural gas lines run north to the Annex building and east to the shoreline.
- **Communications** – AT&T maintains a communication line located beneath Utility Court. Known communication lines are not identified within the north parking lot area of the Site.

3.2.2 Utility Clearance

Consideration was given to the known utilities when selecting the proposed investigation locations identified in Figure 8. Prior to initiation of any drilling or other intrusive work, underground and overhead utilities, including electric lines, gas lines, storm and sanitary sewers, and communication lines, will be identified. The process for conducting utility clearance is outlined below:

- Locate all investigation borings with flagging, survey stakes, and/or marking paint prior to the utility locate.
- Submit a request to Wisconsin's Diggers Hotline (Diggers), the utility one-call system, to initiate the utility-locating activities. Wisconsin state law requires that Diggers be notified at least three working days, and not more than 10 working days, before subsurface work is conducted.
- Subcontract a third-party utility location service to support identification of private subsurface utility infrastructure.
- Coordinate with participating utility-owning companies to locate and mark all respective subsurface utility lines within the Approximate Extent of Upland Site boundary presented on Figure 2.
- Precautions regarding safe distance from the overhead electrical lines will be reviewed and equipment offset distances flagged and marked, in accordance with the required clearances.
- Drilling and other intrusive activities will proceed with due caution for the top 10 feet of each investigation location.
- Proposed sampling locations identified on Figure 8 may be relocated to avoid subsurface and overhead utilities, as appropriate.

If offset borings are required beyond the boundary of the area on which utility clearance has been completed, a new request will be submitted to Diggers and work will not commence until the locates associated with the new request have been completed.

3.2.3 Survey

The following subsections describe the surveys to be conducted as part of the PDI.

3.2.3.1 Topographic, Boundary, and Utility Survey

To develop a suitable base map to support RI/FS and early action design, a Site survey will be completed by a licensed Wisconsin professional surveyor to update previously collected survey information. The surveyor will be responsible for providing an updated survey plat for the northern parking lot area of the Site including updates to the following as applicable:

- Property boundaries
- Surrounding streets/ROWs, structures, and driveway entrances
- Easements
- All above-ground and underground utilities, including utility poles and manholes, as identified during the Diggers and private utility locate process
- Existing Site features, including fences, fence gates, asphalt/concrete surfaces, monitoring wells, trees/brush, and grass areas
- The final location of all soil borings, wells, and other information necessary to document the location of PDI activities
- A Site topographic survey with 1-foot contours

All survey information will be completed in accordance with Multi-Site SOP SAS-02-02, using Wisconsin State Plane Central Zone as the horizontal datum and North American Vertical Datum of 1988 as the vertical datum. All survey information will be consistent with prior investigations and will be uploaded into Ramboll's database to produce accurate and updated figures for design and implementation of the RA.

3.3 WPSC Parking Lot Early Action

This subsection details the PDI activities that will be performed to support design for early action in the upland north parking lot area. Previous observations and plans to further define the extent of impacts are summarized below.

3.3.1 Locations, Visual Observations, and Field Delineation

Existing characterization of the source material areas is predominantly based on excavation samples from removal actions in 2003 and borings completed during the supplemental investigations which further delineated the extent of impacts within the upland. Previous removal areas and boring locations are shown on Figure 5.

Intermittent MGP residuals (classified in accordance with Multi-Site SOP SAS-05-02 Standard Descriptors – Visual Observations of NAPL) were observed in the northern portion of the site during investigation in 2015. Residuals were noted in SB-436 and SB-437 along the bank of the East River; SG-401, SB-418, SB-418A, and SB-418C through SB-418G between the Annex

building and the East River; and in historical boring SB-431-2002. Oil wetted/oil coated material was observed within the aforementioned locations above the native clay at various depths ranging from 1.7- to 12.8-ft bgs with the majority between 4- and 10-ft bgs. Staining, sheen, and/or oil-wetted NAPL was observed as fluid or viscous, malleable weathered material. Visual impacts were typically noted in conjunction with odors and elevated photoionization detector (PID) readings. Where NAPL residuals were highly weathered, olfactory or PID indications were at times absent. Trace amounts of NAPL were found within vertical clay fractures at SB-418E at a depth of 14.3- to 15.0-ft bgs.

To further refine extent of impact for early action, soil borings will be installed at locations where data gaps have been identified between a DNAPL-containing boring and a clean boring based on the previous investigation results. The vertical and horizontal extent evaluation will involve advancing soil borings for residual DNAPL visual and analytical observations. Soil borings will also be augmented with TarGOST® or equivalent technology such as Geoprobe Optical Image Profiler (OIP) that uses NAPL fluorescence to evaluate the extent of DNAPL. Proposed soil boring locations for early action refinement are shown on Figure 8. Proposed soil boring locations are shown on Figure 9 along with 10^{-5} residential risk exceedances for context.

Dakota Technologies or an equivalent NAPL fluorescence provider will be contracted by Ramboll to delineate the extent of DNAPL using NAPL fluorescence technology. Some site-specific materials (e.g. wood content, mineralogical content, source material origin processing) can impact emitter response accuracy; for this reason several visual observation borings (Figure 8) will be co-located to verify presence of source material and for collection of analytical samples. NAPL fluorescence borings will be advanced prior to the Geoprobe borings, with an initial co-located pair being collected to ground-truth emitter response. Intermittent ground-truthing may occur on an as needed basis to allow NAPL fluorescence observations to progress quickly and allow greater time for sample collection. Geoprobe borings will be located proximal to the NAPL fluorescence locations and depending on NAPL fluorescence response, step out borings may be performed to delineate the extent of the DNAPL plume. The colocation of NAPL fluorescence borings with Geoprobe borings will ground truth NAPL fluorescence response. Duplicate NAPL fluorescence borings will provide an estimate of reproducibility of the response. The output from the NAPL fluorescence investigation will include NAPL fluorescence logs and an electronic file that can be input into environmental visualization software (EVS) for interpolation of the DNAPL plume extent. NAPL fluorescence borings will be advanced a minimum of 5 feet into the confining clay layer (or to a depth of approximately 20 feet bgs, whichever is achieved first) to fully define vertical and horizontal extent of source material.

Soil borings are expected to be advanced using direct-push method. Unless otherwise noted, sampling will be continuous, to define the presence/absence and vertical extent of affected soil at each boring location and extend a minimum of 5-ft into confining clay layer or to a depth of 20-ft bgs, whichever is achieved first.

For the purpose of guiding PDI fieldwork, the vertical and horizontal extent of source material will be considered delineated if no oil-coated or oil-wetted observations are present for two consecutive sample intervals (e.g., 4-feet) of sample free from NAPL or into top of clay (whichever is deeper). For delineation of COPCs, the vertical and horizontal extent of non-source material will be considered delineated if analytical results for COPCs are below the industrial SLs.

If a field definition of the horizontal extents is not achieved after completing the initial borings, six contingent delineation step-out borings will be advanced to satisfy source material and/or non-source material delineation data gaps. Review of field visual observations will guide decisions about whether or not contingency borings be required. Contingency borings will generally be placed equidistant between PDI visual observation location and previously investigated sampling points.

All borings advanced as part of the PDI will be continuously logged, following Multi-Site SOP SAS-05-02, and will include a record of blow counts (as applicable), the presence of fill material, moisture content, photoionization detector readings, the nature of each geologic unit encountered, and visual and olfactory observations indicating the presence of NAPL (e.g., staining, oil-coated, or oil-wetted). Soil boring locations will be recorded in accordance with Multi-Site SOP SAS-03-03, and will be abandoned in accordance with the methods described in Multi-Site SOP SAS-05-05. Field equipment will be calibrated prior to use, as required by Multi-Site SOP SAS-02-01 from the Multi-Site FSP.

3.3.2 Soil Sampling, Analytical and Geotechnical Parameters

Soil borings will be characterized for soil texture (grain size), visual indication of DNAPL, color, odor, bedding features, secondary porosity features (e.g. fractures), or notable inclusions (e.g. wood, peat). Figure 8 conveys the analysis scheme for each proposed boring while Figure 9 presents each proposed boring location in the context of residential risk threshold of 10^{-5}. Subsurface soil samples will be collected from all delineation borings as follows:

- For borings that show no visual, olfactory, or PID indication of impacts, one sample within the 2-foot interval above the clay confining layer will be collected.
- For borings that indicate the presence of contamination (through visual, olfactory, or PID indication), a sample of impacted material will be collected. A second sample will also be collected below the interval(s) of potential MGP residuals, to document vertical extent. A third sample will be collected from within the 2-foot interval above the clay confining layer if not included in the other samples. Visual observations and fluorescence that both support the presence of NAPL will be used to inform sampling per the described protocol; fluorescence alone will not be used to select sample intervals.

Sampling criteria and estimated depths of sampling locations are detailed in Table 1 attached.

If no evidence of impacts is present in a boring, samples will be collected from selected intervals based on soil type and stratification to best represent soil in the boring. Where applicable, soil samples may also target intervals where impacts were observed in a neighboring soil boring(s). Logging guidance developed specifically for MGP investigations will be used to assist the field team in describing NAPL in borings is listed on below (Table B). If observations or field screening results suggest soil is impacted by a potentially unrelated source, it will be noted on the drilling logs.

Table B: Standard Descriptors for NAPL Observations

Descriptive Term	Standard Descriptors for Visual Observations of NAPL
No Visible Evidence	No visible evidence of oil on soil or sediment sample
Sheen	Any visible sheen in the water on soil or sediment particles or the core
Staining	Visible brown or black staining in soil or sediment; can be visible as mottling or in bands; typically associated with fine grained soil or sediment
Coating	Visible brown or black oil coating soil/sediment particles; typically associated with coarse grained soil or sediment (i.e. coarse sand, gravels, and cobbles).
Oil Wetted	Visible brown or black oil wetting the soil or sediment sample; oil appears as a liquid and is not held by soil or sediment grains

All soil samples collected for laboratory analysis will be analyzed for PAHs for in-filling of existing analytical data sets. Quality control (QC) samples will be collected as required by Multi-Site FSP SOP SAS-04-03. Samples will be labeled and packaged in accordance with Multi-Site FSP SOP SAS-03-01 and shipped using chain-of-custody procedures described in Multi-Site FSP SOP SAS-03-02. Equipment will be decontaminated after use in accordance with Multi-Site FSP SOP SAS-04-04.

Geotechnical laboratory analyses will be performed to inform the design for potential sheet pile wall or excavation shoring. Samples will be collected from locations shown on Figure 8. The analyses to be performed include: Particle-Size Distribution by ASTM D422-63, Moisture Content by ASTM D2216, Specific Gravity of Soils by ASTM D854, Bulk Density of Soils by ASTM D2937, and for cohesive soil (fine-grained soil only) - Atterberg Limits by ASTM D4318 and Unconfined Compressive Strength Test by ASTM D2166. An equivalent alternative analysis method may be considered.

3.4 Natural Attenuation Evaluation

Positive indicators of the occurrence of natural attenuation have been presented in the SSWP. To further evaluate the potential for monitored natural attenuation within the groundwater, stable isotope probing (SIP) biotraps supplied by Microbial Insights, Inc. (Microbial Insights) will be deployed in groundwater monitoring wells exhibiting groundwater standards exceedances for benzene, naphthalene, and benzo(a)pyrene according to the standards set by Microbial Insights Bio-Trap – Stable Isotope Probing Protocol. The biotrap analysis will be naphthalene and benzene specific. Biotraps will be deployed at four monitoring wells (MW-402R [or its replacement MW-402R2], MW-404, MW-403R, and MW-405A) in the vicinity of the former MGP structures. A replacement well will be installed for MW-402R and is further described in Appendix A.

Sampling protocol as described by Microbial Insights involves purging of monitoring wells including removal of any LNAPL prior to installation of biotraps may be necessary (Appendix E). Naphthalene and benzene testing must be completed independently. Biotraps are to be suspended within the monitoring well at the depth where significant contaminant concentration exists or at the middle of the saturated screened interval. Estimated depths at which biotraps will be suspended is included in the attached Table 1. Naphthalene biotraps will be placed first, following the typical 30-day incubation period, the biotrap samplers are removed from the wells the wells will be purged and the benzene traps will be deployed.

3.5 Waste Characterization

A waste characterization soil sample will be collected for materials anticipated for excavation and off-site disposal, in order to document waste characteristics to amend waste profile HML15-159 for disposal to Advanced Disposal Hickory Meadows Landfill, which was recertified February 14, 2020. This profile will be utilized for anticipated removal actions within 2020. The analytes for the waste characterization sample will be determined through consultation with potential disposal facility based on their permit requirements.

Waste characterization groundwater samples will not be needed for profiling and disposal purposes. WPSC has a waste profile with SET Environmental, Inc. for disposing liquid waste generated during routine groundwater sampling. This profile will also be relied upon for disposal of any liquid waste generated during decontamination of equipment and purging of wells during installation and removal of biotraps.

3.6 Investigation Derived Waste Management

All investigation-derived waste (IDW) generated during the PDI will be collected in properly labeled, 55 gallon drums or bulk containers (e.g. roll-off container lined with polyethylene sheeting for solids, fractionation tanks for liquids). IDW includes soil cuttings, decontamination pad and plastic sheeting, personal protective equipment (PPE), decontamination water, and pumped groundwater.

Drums and containers of material will be labeled as "PENDING ANALYSIS – INVESTIGATION-DERIVED WASTE" with a description of the source (e.g., soil cuttings, decontamination water, pumping test water, etc.) and temporarily stored, pending characterization and proper disposal. The containerized soils will be disposed of off-site, at a facility permitted to accept such material.

Disposal facilities will meet the requirements of the "Off-Site Rule" (OSR) (USEPA, 1993) for the disposal of IDW. Prior to undertaking any disposal, Ramboll will contact the OSR Coordinator at the facility to confirm the facility is in compliance.

3.7 Reporting

In accordance with the AOC, the information collected from the PDI investigation will be presented to USEPA in the PDI Evaluation Report.

3.8 Schedule

The PDI field activities will be scheduled following USEPA approval of the PDI Work Plan, and will be dependent upon weather conditions, execution of access agreements, utility constraints, and contractor availability. WPSC informed USEPA of the proposed schedule for PDI field activities in email correspondence August 6, 2020. Field activities are targeted to occur for approximately one week beginning August 24, 2020. A reference schedule is included below for duration of specific field activities. The Pre-Design Investigation Evaluation Report will be submitted to the USEPA 60 days following completion of field activities and receipt of all analytical results.

Table C: Estimated Field Analysis Schedule

Activity		Duration
Public Utility Locate		1 day
Private Utility Locate/Geophysical Investigation (GPRS Inc.)		1 day
DNAPL Fluorescence Delineation		3 days
Geoprobe: soil borings and monitoring well replacement		1 ½ days
Natural Attenuation Evaluation (2 deployments)	Installation	1 day
	Incubation	30 days
	Retrieval	1 day

4. REFERENCES

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TABLES

Table 1 - Sampling and Analysis Plan Summary

Pre-Design Investigation Work Plan
Former Green Bay MGP
Green Bay, WI

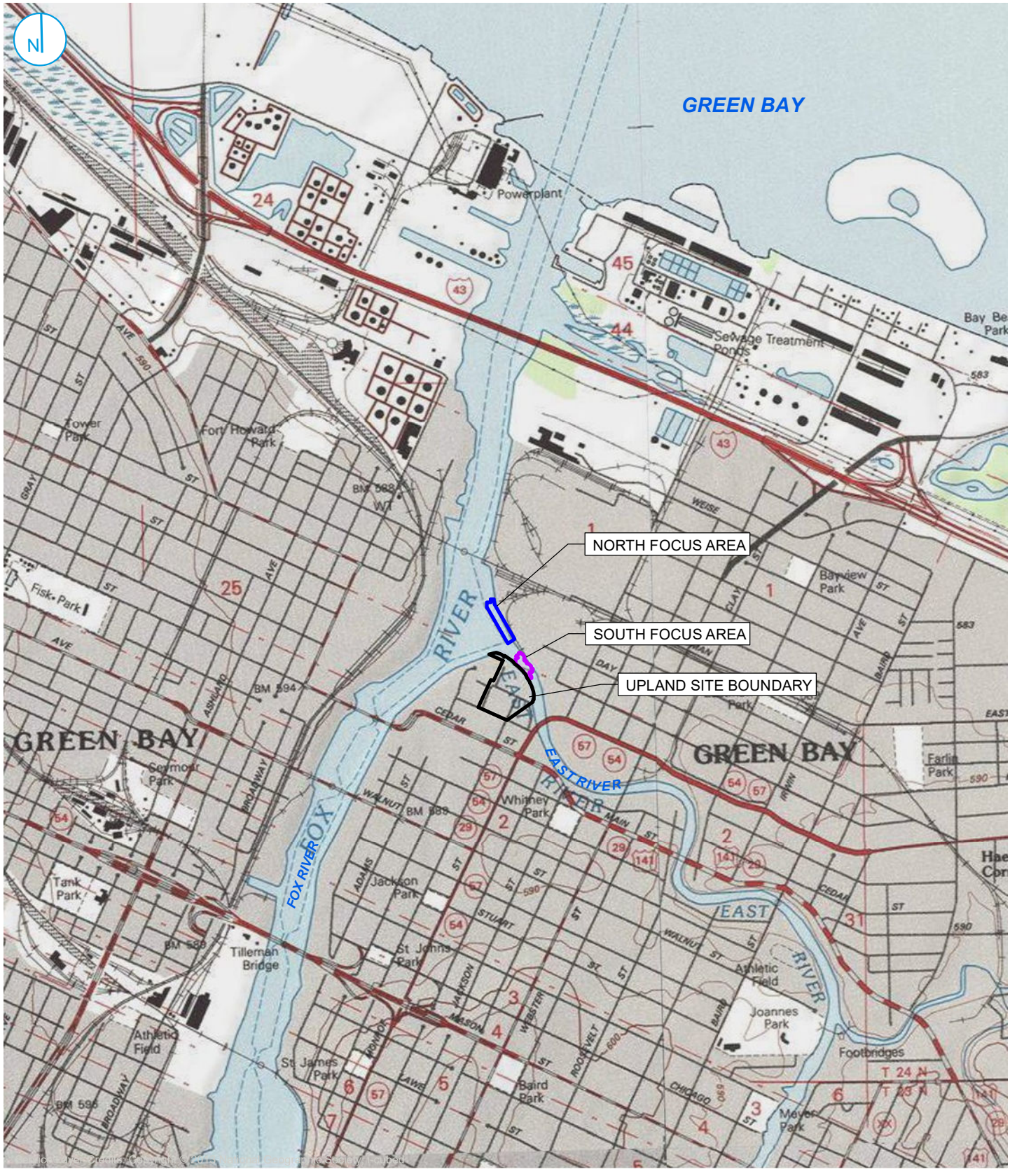
Sample Type	Sample Frequency	Sample Location	Estimated Sample Depth[1]	Estimated Number of Samples[2]	Parameter	Method	Laboratory	Field Duplicates (1 extra volume)[3]	MS/MSD (2 extra volumes)[4]	Equipment Blanks[5]	Total	Estimated No. of Containers	Container Type	Minimum Volume	Preservation (Cool All Samples to 4° ± 2°C Unless 'None' Indicated)	Holding Time from Sample Date
Discrete Samples																
Soil	If visual, olfactory, or PID indications of impacts: 1 within impacted interval(s), 1 immediately below impacted interval(s), 1 from bottom of boring. If no indication of impacts: 1 sample within 2-ft interval above clay	Visual observation and analytical locations	Field Determined	3 per boring	PAH	EPA 8270C SIM	Pace Analytical	6	3	3	75	75	4-oz Amber Glass	30 g	None	14 days
	1 per boring	geotechnical		1 per boring	ASTM D422-63, ASTM D2216, ASTM D854, ASTM D2937, ASTM D4318 and ASTM D2166		GESTRA	NA	NA	NA	5	5	gallon bags or undisturbed	gallon bags or undisturbed	None	None
Waste Characterization Samples (Soil Cuttings)																
Soil	Locations of visual, olfactory, or PID indications of impact	Composite	Composite	1	Protocol B	Various	Pace Analytical	NA	NA	NA	1	As required for analysis (check with landfill & laboratory)				
Natural Attenuation Parameters																
Groundwater	1 per monitoring well -requires separate deployments for benzene and naphthalene tests	MW-404	7.5'	2	Napthalene Benzene	Stable Isotope Probing	Microbial Insights	NA	NA	NA	8	NA	NA	NA	Samplers are to be kept cool (not frozen!) until deployment, then placed immediately on ice and shipped on ice next day delivery[7]	24-48 hours
		MW-402R(2)	7.5'	2												
		MW-403R	7.5'	2												
		MW-405A	7.5'	2												

[O: SJM 3/4/20, C: SLG 3/5/20, R: SLG 8/7/20]

Notes
NA = Not Applicable
PAH = Polycyclic aromatic hydrocarbon

1. Well screen midpoint in feet below groundsurface.
2. Number of samples estimated base on PDI WP requirements of one sample within anticipated impacted zone(s), 1 sample below zone(s). Anticipating impacts at all sampling locations.
3. Field duplicates will be collected at a frequency of 1 per 10 or fewer investigative samples.
4. Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples will be collected at a frequency of 1 per group of 20 or fewer. Additional volume will be determined by laboratory requirements.
5. Equipment blanks will be collected at a frequency of 1 per sampling day with non-dedicated sampling equipment.
6. Trip blanks will accompany each cooler containing VOC water samples, including equipment blanks.
7. Remove nylon thread upon retrieval from well then place in sealed double zippered bags. Immediately place on blue ice in cooler. If using regular ice, double bag ice.
8. Trip blanks are not required for this sampling plan.

FIGURES



KEY MAP

Map Scale: 1:1:24,000;
Map Center: 88°0'30"W 44°31'23"N

0 1,000 2,000 Feet

SITE LOCATION MAP

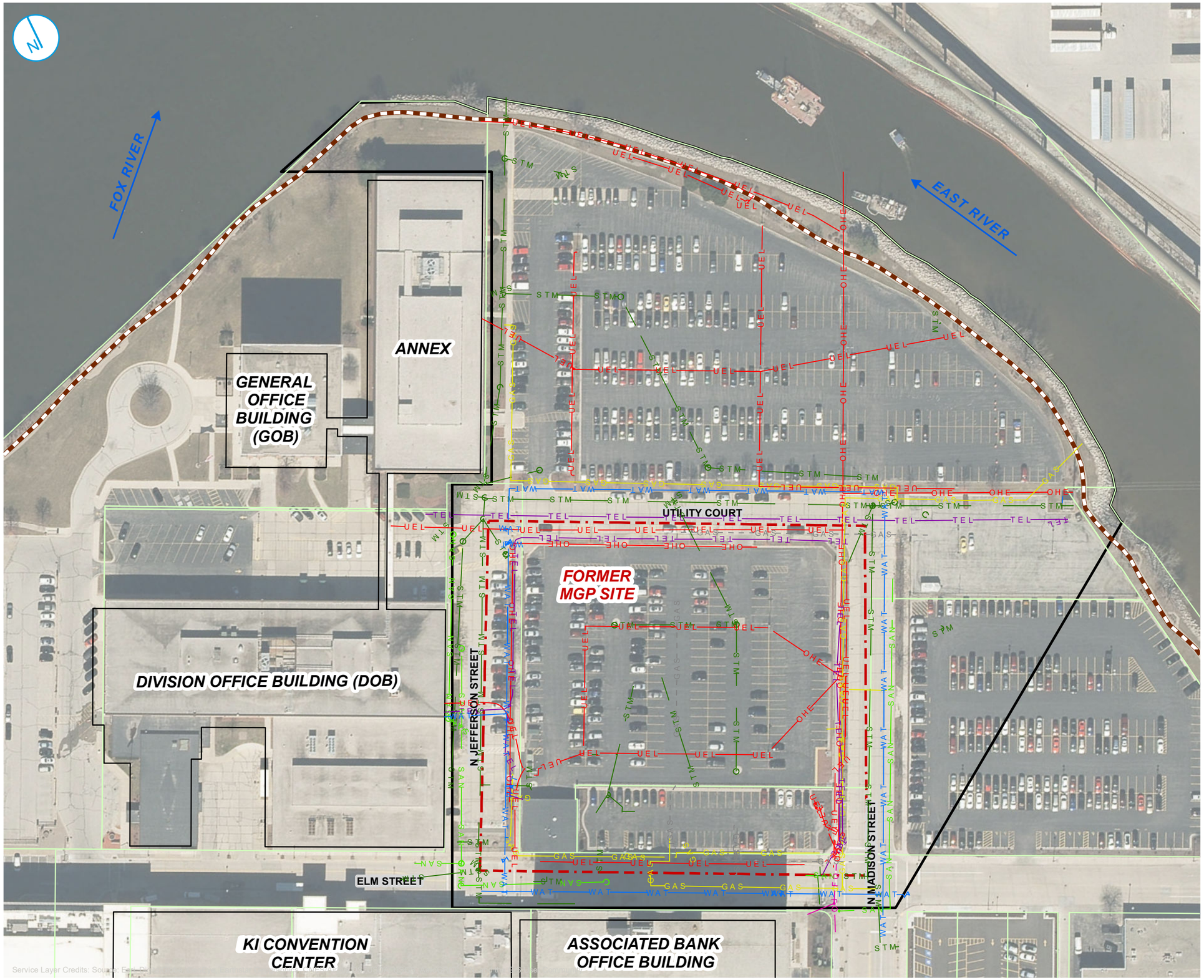
FIGURE 1

PRE-DESIGN INVESTIGATION WORK PLAN
FORMER GREEN BAY MANUFACTURED GAS PLANT
WISCONSIN PUBLIC SERVICE CORPORATION
CITY OF GREEN BAY, WISCONSIN

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

Y:\GIS\Projects\151\584\MXD\PDI_WP\Figure 2_Site Layout Surrounding Features Utilities.mxd



FO — FIBER OPTIC LINE
GAS — GAS LINE
SAN — SANITARY SEWER LINE
STM — STORM SEWER LINE
TEL — TELEPHONE LINE
WAT — WATER LINE
UEL — UNDERGROUND ELECTRIC LINE
OHE — OVERHEAD ELECTRIC LINE
GAS – – ABANDONED GAS LINE
CITY OF GREEN BAY RIVER WALK EASEMENT
BUILDING FOOTPRINT
RIVER FLOW DIRECTION
FORMER MGP SITE
UPLAND SITE BOUNDARY
PARCEL BOUNDARY

0 50 100 Feet

SITE LAYOUT, SURROUNDING FEATURES AND UTILITIES

PRE-DESIGN INVESTIGATION WORK PLAN
FORMER GREEN BAY MANUFACTURED GAS PLANT
WISCONSIN PUBLIC SERVICE CORPORATION
CITY OF GREEN BAY, WISCONSIN

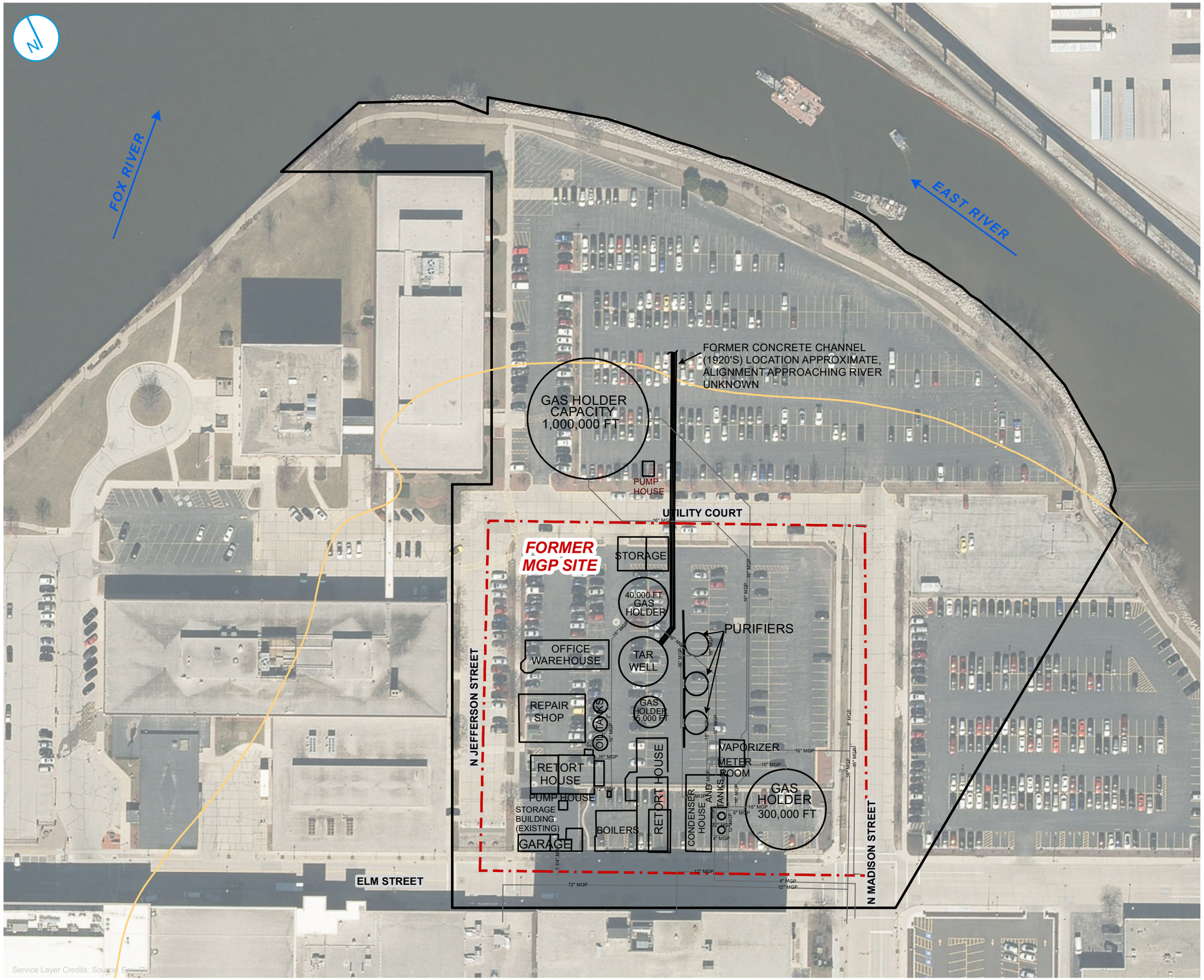
FIGURE 2

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

PROJECT: 169000XXXX | DATED: 2/25/2020 | DESIGNER: STOLZSD

Y:\GIS\Projects\15\1584\MXD\PDI_WP\Figure 3_Former MGP Structures.mxd



FORMER MGP STRUCTURE
APPROXIMATE SHORELINE (1835)
RIVER FLOW DIRECTION
FORMER MGP SITE
UPLAND SITE BOUNDARY

0 50 100
Feet

FORMER MGP STRUCTURES

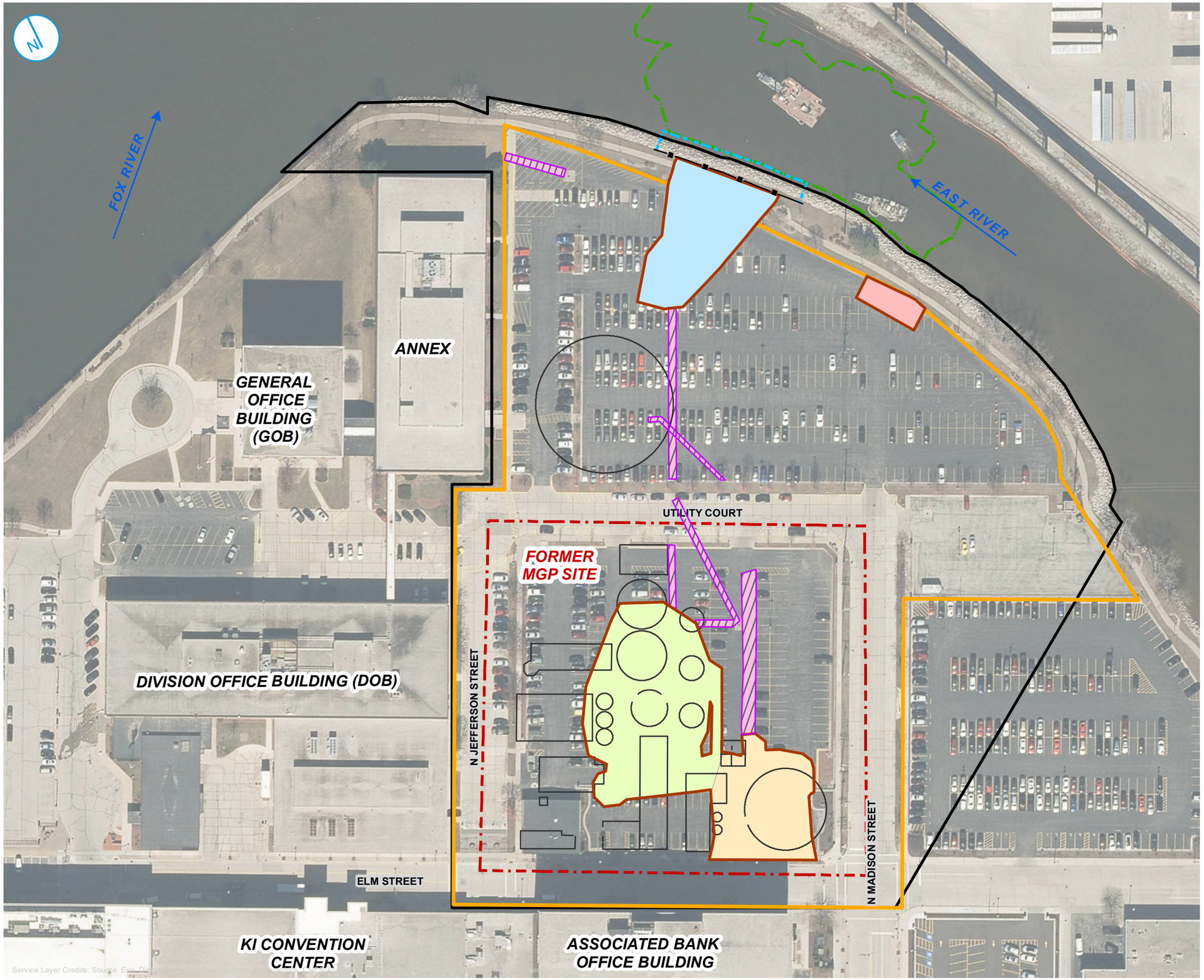
PRE-DESIGN INVESTIGATION WORK PLAN
FORMER GREEN BAY MANUFACTURED GAS PLANT
WISCONSIN PUBLIC SERVICE CORPORATION
CITY OF GREEN BAY, WISCONSIN

FIGURE 3

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

PROJECT: 169000XXXX | DATED: 2/25/2020 | DESIGNER: STOLZSD

C:\Users\galarnmc\OneDrive - Ramboll\Desktop\WAH_COVID\1584\MXD\PDI_WP\Figure 4_Previous Removal Areas.mxd



- SHEET PILE WALL
- SHORELINE EXCAVATION EXTENT (REMEDIAL ACTION COMPLETED IN 2018)
- FORMER STRUCTURE
- SOIL REMEDIATION EXCAVATION AREAS (2003)
- SOIL REMEDIATION MGP PIPING RUNS (2003)
- EXCAVATION AREA 1 (6-8 FT)
- EXCAVATION AREA 2 (8-14 FT)
- * TAR WELL (12-22 FT)
- EXCAVATION AREA 3 (8-12 FT)
- EXCAVATION AREA 4 (7 FT)
- EXCAVATED PIPING RUN
- CAP MAINTENANCE
- SOUTH FOCUS AREA (REMEDIAL ACTION COMPLETED IN 2018)
- RIVER FLOW DIRECTION
- FORMER MGP SITE
- UPLAND SITE BOUNDARY

0 50 100 Feet

PREVIOUS REMOVAL AREAS

PRE-DESIGN INVESTIGATION WORK PLAN
FORMER GREEN BAY MANUFACTURED GAS PLANT
WISCONSIN PUBLIC SERVICE CORPORATION
CITY OF GREEN BAY, WISCONSIN

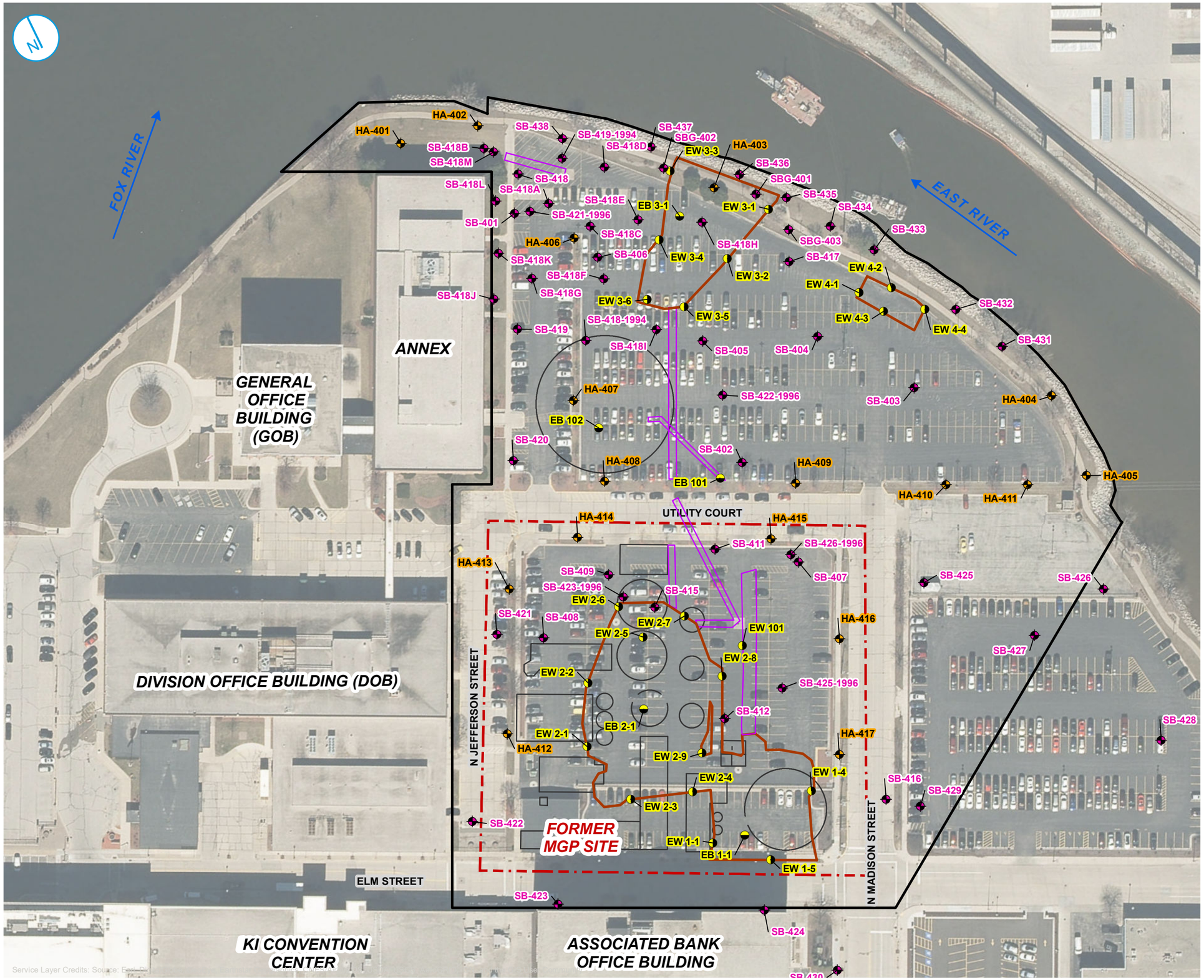
FIGURE 4

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

PROJECT: 169000XXXX | DATED: 3/16/2020 | DESIGNER: GALARNMC

Y:\GIS\Projects\151\15844\MXD\PDI_WP\Figure 5_Post Removal Soil Sample Locations.mxd



- EXCAVATION BASE SAMPLING LOCATION
- EXCAVATION WALL SAMPLING LOCATION
- HAND AUGER SAMPLING
- SOIL BORING LOCATION
- TEST PIT LOCATION
- FORMER STRUCTURE
- SOIL REMEDIATION EXCAVATION AREAS (2003)
- SOIL REMEDIATION MGP PIPING RUNS (2003)
- RIVER FLOW DIRECTION
- FORMER MGP SITE
- UPLAND SITE BOUNDARY

0 50 100 Feet

POST REMOVAL SOIL SAMPLE LOCATION MAP

PRE-DESIGN INVESTIGATION WORK PLAN
FORMER GREEN BAY MANUFACTURED GAS PLANT
WISCONSIN PUBLIC SERVICE CORPORATION
CITY OF GREEN BAY, WISCONSIN

FIGURE 5

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

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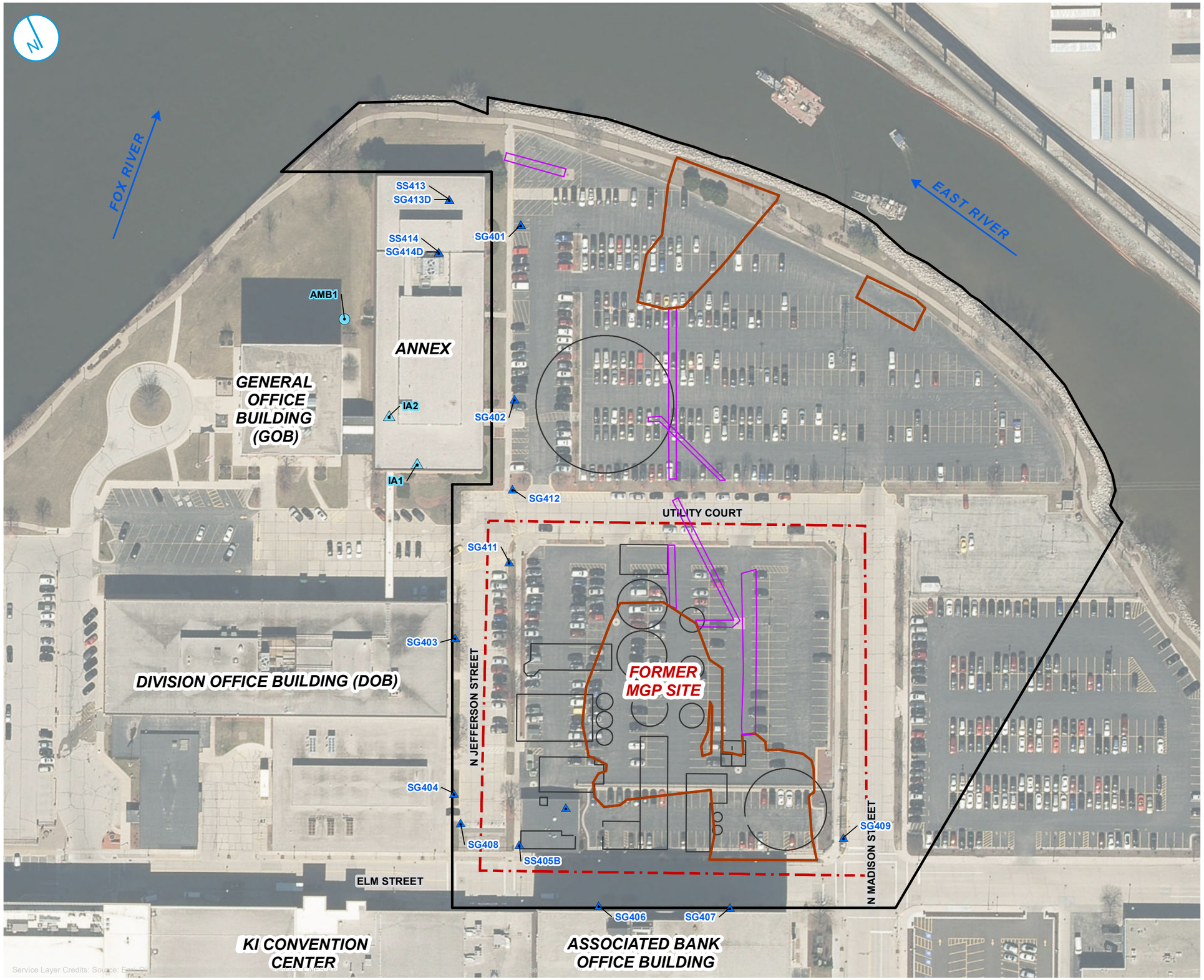


- AMBIENT AIR SAMPLING
- INDOOR AIR SAMPLING
- SOIL GAS SAMPLING LOCATION
- FORMER STRUCTURE
- SOIL REMEDIATION EXCAVATION AREAS (2003)
- SOIL REMEDIATION MGP PIPING RUNS (2003)
- RIVER FLOW DIRECTION
- FORMER MGP SITE
- UPLAND SITE BOUNDARY

0 50 100 Feet

PREVIOUSLY COLLECTED SOIL GAS MONITORING LOCATION MAP

PRE-DESIGN INVESTIGATION WORK PLAN
FORMER GREEN BAY MANUFACTURED GAS PLANT
WISCONSIN PUBLIC SERVICE CORPORATION
CITY OF GREEN BAY, WISCONSIN

FIGURE 6

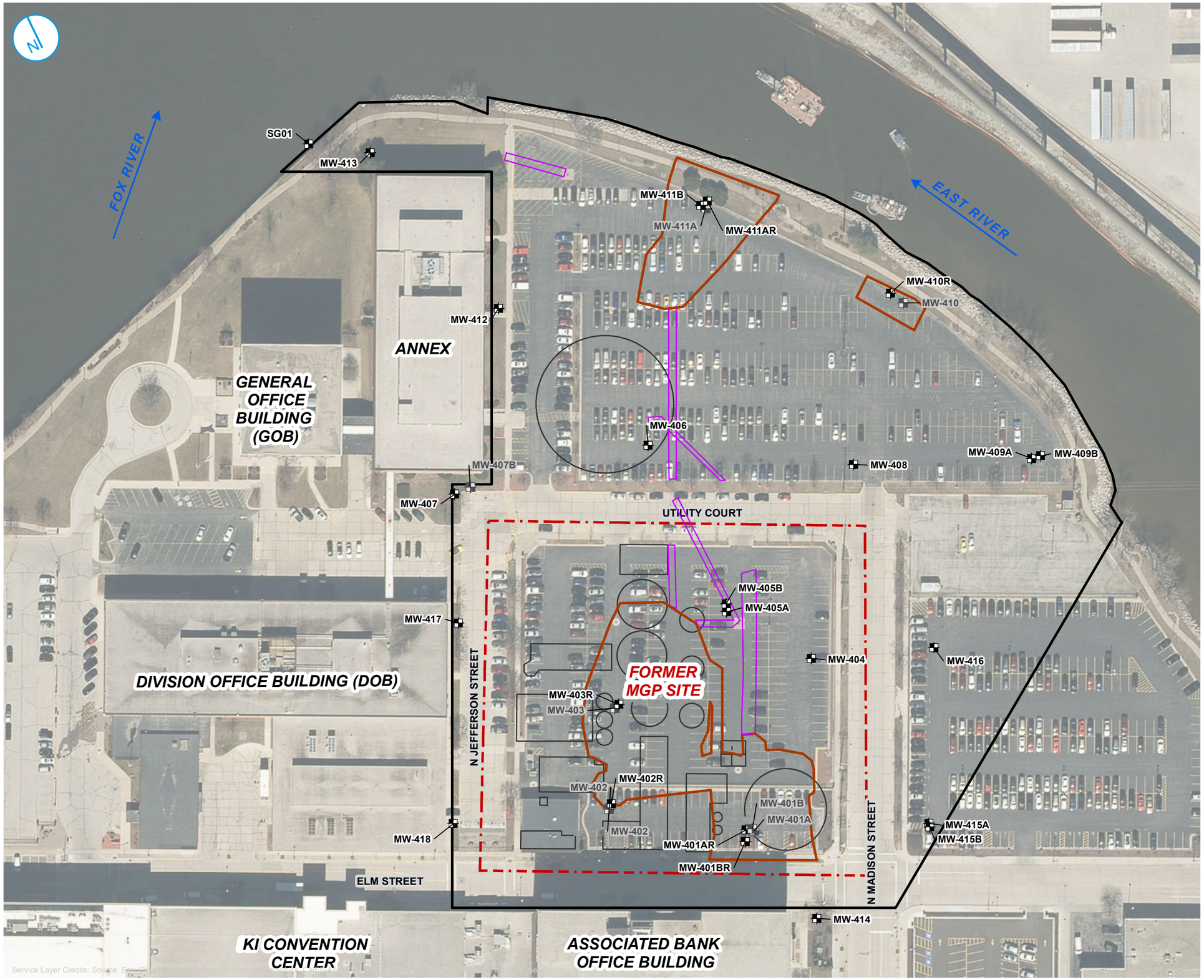
RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

Y:\GIS\Projects\151\1584\MXD\PDI_WP\Figure 6_Prev SG Monitoring Locations.mxd

PROJECT: 169000XXXX | DATED: 3/2/2020 | DESIGNER: STOLZSD

Y:\GIS\Projects\15\1584\MXD\PDI_WP\Figure 7_GW Monitoring Network.mxd



- MONITORING WELL LOCATION
- ABANDONDED MONITORING WELL LOCATION
- FORMER STRUCTURE
- SOIL REMEDIATION EXCAVATION AREAS (2003)
- SOIL REMEDIATION MGP PIPING RUNS (2003)
- RIVER FLOW DIRECTION
- FORMER MGP SITE
- UPLAND SITE BOUNDARY

0 50 100 Feet

GROUNDWATER MONITORING WELL NETWORK

PRE-DESIGN INVESTIGATION WORK PLAN
FORMER GREEN BAY MANUFACTURED GAS PLANT
WISCONSIN PUBLIC SERVICE CORPORATION
CITY OF GREEN BAY, WISCONSIN

FIGURE 7

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

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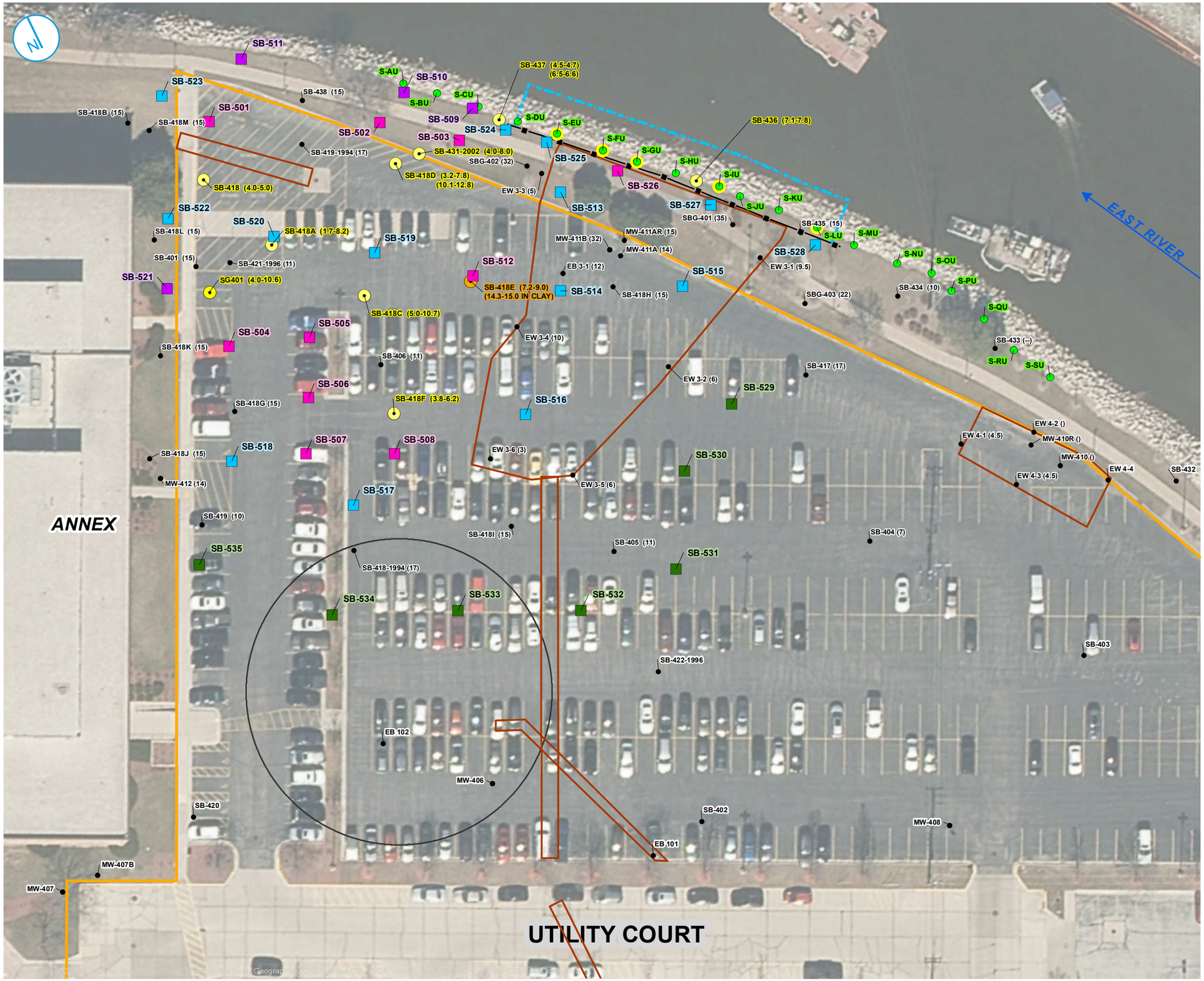
Y:\GIS\Projects\151\584\MXD\PDI_WP\Figure 8_NAPL Obs and Prop SB locs.mxd



PROPOSED LOCATION FOR FLUORESCENCE ONLY

PROPOSED LOCATION FOR VISUAL OBSERVATION, FLUORESCENCE, and GEOTECHNICAL PARAMETERS

PROPOSED LOCATION FOR VISUAL OBSERVATION & ANALYTICAL

PROPOSED LOCATION FOR VISUAL OBSERVATION & FLUORESCENCE

OIL WETTED-COATED MATERIAL ABOVE NATIVE CLAY

OIL WETTED-COATED MATERIAL ABOVE AND WITHIN NATIVE CLAY

SOIL BORING LOCATION

2017 VISUAL OBSERVATION LOCATION

2017 VISUAL OBSERVATION LOCATION WITH NAPL OBSERVATION IN UNCONSOLIDATED ABOVE CLAY

SHEET PILE WALL

SHORELINE EXCAVATION EXTENT (REMEDIAL ACTION COMPLETED IN 2018)

FORMER STRUCTURE

SOIL REMEDIATION EXCAVATION AREAS (2003)

RIVER FLOW DIRECTION

CAP MAINTENANCE AREA

SB418 (4.0-5.0) SAMPLE ID AND INTERMITTENT NAPL DEPTH IN FEET BELOW GROUND SURFACE

SB417 (17) SAMPLE ID AND TOTAL BORING DEPTH IN FEET BELOW GROUND SURFACE

0 22.5 45 Feet

NAPL OBSERVATION AND PROPOSED SOIL BORING LOCATION MAP

PRE-DESIGN INVESTIGATION WORK PLAN
FORMER GREEN BAY MANUFACTURED GAS PLANT
WISCONSIN PUBLIC SERVICE CORPORATION
CITY OF GREEN BAY, WISCONSIN

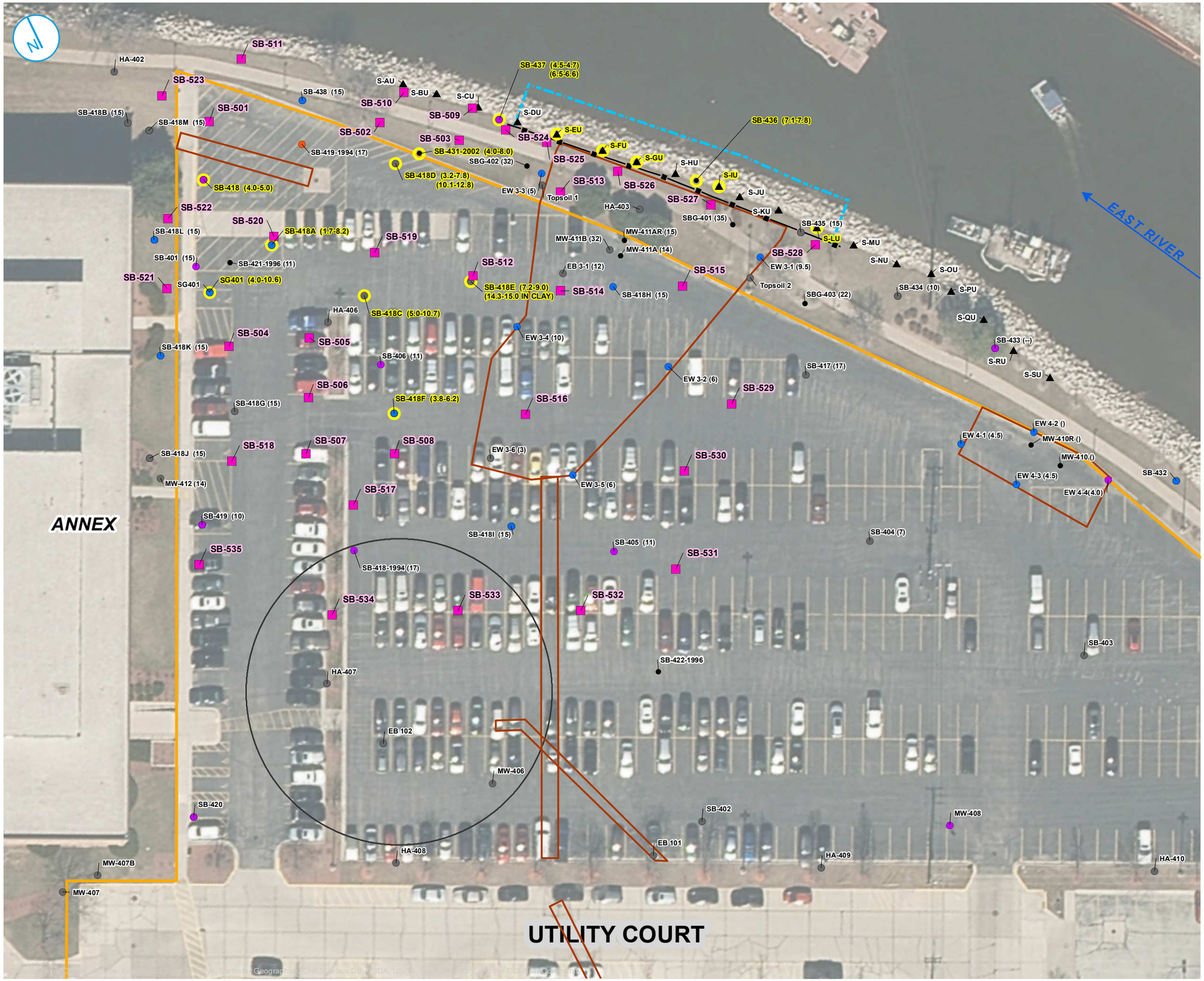
FIGURE 8

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

PROJECT: 169000XXXX | DATED: 8/7/2020 | DESIGNER: galarnmc

Y:\GIS\Projects\151\584\MXD\PDI_WP\Figure 9_10-5 Risk NAPL Obs and Prop SB locs.mxd



- PROPOSED SOIL BORING LOCATION
- LOCATION WITH CUMULATIVE CANCER RISK LESS THAN 10^{-5} AND A HAZARD QUOTION LESS THAN 1.0
- LOCATION WITH CUMULATIVE RISK EXCEEDANCE FOR SHALLOW SAMPLES (FROM 0 TO 4 FEET BELOW GROUND SURFACE INTERVAL)
- LOCATION WITH CUMULATIVE RISK EXCEEDANCE FOR DEEP SAMPLES (DEEPER THAN 4 FEET BELOW GROUND SURFACE)
- LOCATION WITH CUMULATIVE RISK EXCEEDANCE FOR BOTH SHALLOW AND DEEP SAMPLES
- OIL WETTED-COATED MATERIAL OBSERVATION
- SOIL BORING LOCATION
- 2017 VISUAL OBSERVATION LOCATION
- SHEET PILE WALL
- SHORELINE EXCAVATION EXTENT (REMEDIAL ACTION COMPLETED IN 2018)
- FORMER STRUCTURE
- SOIL REMEDIATION EXCAVATION AREAS (2003)
- RIVER FLOW DIRECTION
- CAP MAINTENANCE AREA
- **SB418 (4.0-5.0)** SAMPLE ID AND INTERMITTENT NAPL DEPTH IN FEET BELOW GROUND SURFACE
- **SB417 (17)** SAMPLE ID AND TOTAL BORING DEPTH IN FEET BELOW GROUND SURFACE

0 22.5 45 Feet

RISK ASSESSMENT, NAPL OBSERVATION, PROPOSED SOIL BORING LOCATION MAP

PRE-DESIGN INVESTIGATION WORK PLAN
FORMER GREEN BAY MANUFACTURED GAS PLANT
WISCONSIN PUBLIC SERVICE CORPORATION
CITY OF GREEN BAY, WISCONSIN

FIGURE 9

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

PROJECT: 169000XXXX | DATED: 8/7/2020 | DESIGNER: galarnmc

APPENDIX A
SITE SPECIFIC WORK PLAN ADDENDUM - MW-402R REPLACEMENT MEMORANDUM

RAMBOLL

ENVIRONMENT
& HEALTH

Mr. Frank Dombrowski
Principal Environmental Consultant
WEC Business Services, LLC

333 W. Everett Street, A231
Milwaukee, WI 53203
(via email)

RE: Pre-Design Investigation Work Plan
Green Bay Former Manufactured Gas Plant, Green Bay, Wisconsin
Wisconsin Public Service Corporation
CERCLA Docket No. V-W-06-C-847
Ramboll Project No. 70712

Date March 03, 2020

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
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Dear Mr. Dombrowski,

Ramboll is providing this Addendum No. 3, Revision 0 to the Site-Specific Work Plan (SSWP) Revision 2 (SSWP Rev2) dated October 2015 [Natural Resources Technology (NRT), 2015] for the Wisconsin Public Service Corporation (WPSC) Green Bay Former Manufactured Gas Plant (MGP) Site. The proposed Pre-Design Investigation (PDI) activities are to address data gaps on the upland portion of the site and replace a groundwater monitoring well (MW-402R) paved over in 2018. The approach is described below and in the Former Green Bay MGP PDI Work Plan (PDIWP) (Ramboll, 2020).

Summary

The SWPP Rev 2 (NRT 2015) notes exceedances of groundwater standards within the Former Green Bay MGP site. Although source and contaminated material was removed as part of the 2003 soil remediation effort, affected soils remain within the former MGP Property. Positive indicators of natural attenuation have been identified in supplemental remediation investigations between 2003 and 2018 and further investigation is warranted for development of the remedial investigation/feasibility study (RI/FS) and early action design.

Activities related to the PDIWP include further assessment of natural attenuation factors in four groundwater monitoring wells within the vicinity of the Former Green Bay MGP facility and previous soil excavation areas. One groundwater

monitoring well selected for further assessment of microbial communities is currently inaccessible due to being paved over in 2018. Ramboll proposes to fulfil the data gap as described in the PDIWP by locating and replacing monitoring well MW-402R by means of ground penetrating radar (GPR) followed by assessment of redevelopment or replacement of the well. Following reinstallation activities, routine groundwater sampling will continue at the well location in addition to initial assessment of the microbial communities by use of biotraps provided by Microbial Insights, Inc.

The data gaps and approach to addressing them are further described in the sections below and the PDIWP (Ramboll, 2020)

Current Data Gap(s)

Following a review of site data and recent observations, the following items were identified as data gaps that may warrant further investigation as part of the Former Green Bay MGP PDIWP.

Unknown Location of MW-402R

Long term groundwater monitoring activities have been ongoing at the Former Green Bay MGP site from previous investigations in 1994 to current supplemental investigation as of November 2019. Monitoring locations have included 31 unique monitoring wells within 15 well nests. Analytical sampling at the monitoring wells has been utilized to evaluate the effect of source removal/soil remediation activities on water quality and natural attenuation. Previous remedial action was completed in 2003 within the upland site in the form of soil removal and treatment, engineering and institutional controls, and long-term monitoring areas with the goal of meeting established criteria for natural attenuation as a final remedy.

The monitoring well located at MW-402R has been routinely sampled from September 2003 to May 2018. The monitoring well was scheduled for semi-annual sampling in November 2018 but was unable to be accessed due to repaving activities at the site by the property owner. Though access to the well was attempted, its exact location is unknown at this time making redevelopment or abandonment unattainable. In order to continue monitoring of groundwater at the location, the well will require redevelopment or reinstallation.

Groundwater Monitored Natural Attenuation

As described in by the PDIWP (Ramboll, 2020), positive indicators of the occurrence of natural attenuation have been presented in the SSWP. To further evaluate the potential for monitored natural attenuation within the groundwater, biotraps will be deployed to assess microbial communities. Biotraps will be deployed in groundwater monitoring wells exhibiting groundwater standards exceedances for benzene, naphthalene, and benzo(a)pyrene according to the standards set by Microbial Insights Bio-Trap – Stable Isotope Probing Protocol. The biotrap analysis will be naphthalene specific.

Biotraps will be deployed at four monitoring wells in the vicinity of the former MGP structures. Selected monitoring wells within the PDIWP include MW-402R which is inaccessible and unlocatable in its current state. The monitoring well is located within the bounds of the former MGP structure and at the extent of a soil remediation excavation area from the 2003 removal activities. Installation of the well will allow for analytical assessment of groundwater upgradient of the former excavation area.

Proposed Activity

As discussed above and included in the PDIWP, additional investigation is warranted to complete assessment of the natural attenuation potential of MGP-affected material at the Former Green Bay MGP site to support combined remedial investigation/feasibility study (RI/FS) and remedial design (RD) activities. The PDI activities and monitoring well installation will be performed in accordance with the Multi-Site Health and Safety Plan – Revision 1 (Integrys Business Support LLC (IBS), August 2007), the site-specific information included in the SSWP, Rev 1 (NRT, 2016), and the Multi-Site Field Sampling Plan (FSP) – Revision 4 (IBS, September 2008), except where noted.

Groundwater Monitoring Well Installation and Sampling

During prior investigations of the upland site and subsequent long term ground water monitoring activities, it has been observed that the groundwater data collected from monitoring well MW-402R has consistently exceeded the groundwater standard for benzene, naphthalene, manganese, with varied exceedances of benzo(a)pyrene, benzo(b)fluoranthene from time of initial development to the most recent monitoring event on May 30, 2018. Based on this historical data and proximity of the monitoring well to the 2003 excavation area, it is proposed that the monitoring well location continued to be utilized for assessment of natural attenuation potential and lateral extent of groundwater impacts.

The location of MW-402R may be obtained through use of ground penetrating radar (GPR) as part of a private utility locate performed by GPRS Inc. during PDI activities. The following equipment may be used as part of the investigation:

- 400 MHz ground penetrating radar (GPR) Antenna. The antenna is mounted in a stroller frame which rolls over the surface. GPR works by sending pulses of energy into a material and recording the strength and the time required for the return of the reflected signal. Reflections are produced when the energy pulses enter into a material with different electrical properties from the material it left. The strength of the reflection is determined by the contrast in signal speed between the two materials. The total depth achieved can be as much as 8’ or more with this antenna but can vary widely depending on the conductivity of the materials.
- 1600 MHz GPR Antenna. The total depth achieved can be as much as 18” or more with this antenna but can vary widely depending on the conductivity of the materials and other factors such as the spacing of the reinforcing.
- Electromagnetic Pipe Locator. The EM locator can passively detect the electromagnetic fields from live AC power or radio signals travelling along some conductive utilities. It can also be used in conjunction with a transmitter to connect directly to accessible, metallic pipes, risers, or tracer wires.

After successful location of the historical MW-402R, determination on redevelopment of the well, abandonment, or re-installation will be determined as feasible. Well installation will be completed in accordance with SAS-05-03 Well Installation (IBS, 2008) and NR 141 Groundwater Monitoring Well Requirements. Installation details are summarized as follows:

- The monitoring well will be constructed of 2-inch diameter polyvinyl chloride (PVC) material with a 0.01-inch screen slot size and screened across the groundwater table, to allow for seasonal fluctuations of the water table.

- The screen will be 10 feet in length with filter pack that will extend 2-feet above the top of screen and at least 0.5 feet below the bottom of the screen. Fine sand will then be placed above the filter pack sand.

The installed monitoring well will be developed following installation in accordance with the bailing and pumping methods described in USEPA-approved SOP SAS-05-04 Well Development and Section 4 of the Multi-Site FSP (IBS, 2008). Monitoring well development will continue until field parameters stabilize and at least five well volumes of water have been removed in accordance with USEPA-approved SOP SAS-08-03 Well-Volume Approach Groundwater Sampling (IBS, 2008). Purge water from well development will be managed on-site using the groundwater treatment system, consistent with ongoing practice for purge water from routine groundwater monitoring events.

Newly installed monitoring wells Mw402R2 will be sampled during the next scheduled semi-annual groundwater sampling round. Applicable duplicates, matrix spike/matrix spike duplicate (MS/MSD) for Quality Assurance/Quality Control (QA/QC) will be collected in accordance with the Multi Site Quality Assurance Project Plan (QAPP), Revision 2 (IBS 2007) and SOP SAS-04-03 Quality Control Samples (IBS, 2008). Sample analysis will be the same as presented in the SSWP Rev 2 (NRT, 2015).

Monitored Natural Attenuation Sampling

Sampling of the replaced groundwater monitoring well (MW-402R2) for monitored natural attenuation factors will continue with routine sampling. To further evaluate the potential for monitored natural attenuation, bioptraps supplied by Microbial Insights, Inc. will be deployed to assess the microbial community within the groundwater in the vicinity of MW-402R2. Sampling protocol will follow as described in Section 3.4 of the PDIWP and as described by Microbial Insights.

Data Evaluation

All samples collected will be sent to a commercial analytical laboratory under chain-of-custody procedures in accordance with SAS-03-01 Sample Identification, Labeling, Documentation and Packaging for Transport (IBS, 2007) and the Multi Site Quality Assurance Project Plan, Revision 1 (IBS, 2007). The analytical data collected during the proposed PDI activities will be combined with previous supplemental RI data and previous remedial action activities to develop a comprehensive data set. Data validation will be performed as described in Section 6.8 of the SSWP Rev 2 (NRT, 2015). Following validation and submittal to USEPA, results will also be transmitted to third party property owners in accordance with Wisconsin Administrative Code NR716.14(2).

Schedule

Pending USEPA approval, property access negotiations, utility locating, permitting approval, contractor availability and weather conditions, the proposed supplemental RI activities will be initiated by April 2020. The results of the additional assessment will be discussed with USEPA prior to their inclusion in the PDI Report.

Please contact the undersigned if you should have any questions regarding the content of this SSWP Addendum.

Yours sincerely

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References

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WEC Business Services, LLC. 2008. *Multi-Site Field Sampling Plan Former Manufactured Gas Plant Site - Revision 4WBS Multi-Site Field Sampling Plan Revision 4.* September.

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APPENDIX B
RELEVANT MULTI-SITE OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE NO. SAS-05-02

FIELD LOGGING AND CLASSIFICATION OF SOIL AND ROCKS Revision 1

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the guidelines for logging and classifying soil samples and rock cores during subsurface explorations as described in the Site-Specific Work Plan, or as otherwise specified, for the purposes of characterizing subsurface geologic conditions at a Site.

2.0 EQUIPMENT AND MATERIALS

General:

- Ruler or tape measure in 0.01-foot increments;
- Field logbook and field boring log forms;
- Pen(s) with waterproof, non-erasable ink;
- Camera;
- 5-gallon bucket and wire or nylon brushes, decontamination water, laboratory grade detergent (Alconox or similar), and paper towels;
- Aluminum foil or roll-plastic; and
- Personnel protective equipment, as appropriate, including nitrile gloves for handling impacted soil samples.

Soil Logging:

- Large sharp stainless-steel knife;
- Slim stainless-steel spatula or carpenter's 5-in-1 tool;
- Color chart;
- Comparative charts; and
- Pocket penetrometer.

Rock Coring and Logging:

- Core box(es);
- Hand lens; and
- Comparative charts.

3.0 HEALTH AND SAFETY

Potentially hazardous conditions relating to chemicals under investigation, equipment and tools in use, utility services in investigation areas, or certain work activities may exist on the site. Protocols are established in each site-specific Health & Safety Plan (HASP) based on corporate health and safety policies and manuals, past field experience, specific site conditions, and chemical hazards known or anticipated to be present from available site data. Before site operations begin, all employees, and subcontractor personnel will have read and understood the HASP and all revisions. Before work begins, all site project staff will sign an agreement and acknowledgment form indicating that they have read and fully understood the HASP and their individual responsibilities, and fully agree to abide by the provisions of the HASP.

4.0 GENERAL PROCEDURES

Geologic logging and material classification shall be conducted only by a trained logging technician (e.g. geologist, hydrogeologist, engineer, or environmental scientist). Field data and observations associated with field logging and material classification shall be documented during logging and for all drilling and sampling activities in accordance with SOP ENV-01-01, Field Documentation and Reporting, if not otherwise specified in this SOP. All field drilling activities should be recorded in a field logbook and/or on a field boring log form. In addition, tools and equipment used while logging boreholes shall be decontaminated between boring/probe locations and prior to each sampling event in accordance with the Quality Assurance Project Plan (QAPP).

5.0 LOGGING AND DOCUMENTATION PROCEDURES

The logging technician shall record all pertinent drilling information in the field logbook and/or on the field boring log form (Attachment A). At a minimum, the following technical information with respect to pre-sampling, drilling operations and observations, and sample recovery loss shall be recorded, if applicable:

- Project name and number;
- Location (well or boring/probe number) or other sample station identification, including a rough sketch;
- Name of the logging technician overseeing the drilling operations;
- Drill rig manufacturer and model;
- Drilling company name and city and state of origin;
- Driller and assistant(s) names;
- Drilling method(s) and fluids used to drill the borehole;
- Drilling fluid manufacturer;
- Drilling fluid gain or loss;
- Depth of drilling fluid loss;
- Water source (e.g. fire hydrant, faucet, municipality, etc.);
- Borehole diameter;
- Borehole start time and date;
- Borehole completion time and date;
- Sample type (e.g. split spoon, macrocore, etc.);
- Hammer weight/drop and blow counts;
- Sample recovery/loss and explanation of loss, if known;
- Drilling rates when applicable to lithology classification;
- Description of soil and/or rock classification and lithology;
- Lithologic changes and boundaries;
- Depth to water (first encountered [during drilling] and stabilized [upon completion of drilling]);
- Total borehole depth;
- Evidence of impact (e.g. staining, odors, free-phase product, etc.);
- Well materials, construction, and placement information (e.g. casing type and diameter, screen type and diameter, etc.);
- Sample identifications and depths for chemical and geotechnical samples;
- A description of any tests conducted in the borehole; and
- Problems with the drill rig or drilling process.

When rock coring is performed, the following information shall also be recorded:

- Top and bottom of cored interval;
- Core length;
- Coring rate in minutes per foot;
- Core breakage due to discontinuities (e.g. natural fractures versus coring-induced breaks);
- Total core breakage; and
- Number of breaks per foot.

6.0 SOIL SAMPLE CLASSIFICATION AND DESCRIPTIONS

6.1 Description of Hierarchy

The required order of terms is as follows:

1. Depth measured in tenths of a foot;
2. Soil color;
3. Major soil type (e.g. CLAY). This descriptor can include the secondary soil constituent as a modifier (e.g. silty CLAY);
4. Unified Soils Classification System (USCS) Group Symbol in parentheses (e.g. ML);
5. Evidence of environmental impacts, if encountered (e.g. free-phase product, staining, sheen, etc.);
6. Other soil components of the sample listed with the appropriate percent descriptor (i.e. “with”, “some” or “trace.”);
7. Consistency, relative density or degree of cementation;
8. Moisture and plasticity, if relevant; and
9. Miscellaneous (e.g. condition of sample, deposition, fractures, seams, bedding dip, bedding features, fossils, oxidation, drilling rate data when applicable for sample classification, etc.).

6.2 Color

The color descriptions will be consistent with the Munsell Soil Color Chart, Geological Society of America (GSA) Rock Color Chart, or as required by the Work Plan or otherwise specified. Write the Munsell color name with the Munsell color identification number in parenthesis following the color name. The major color

is listed first with any accessory color(s) thereafter (e.g. clay, yellowish gray (5Y 7/2) with pale green (5G 7/2) mottles). If descriptors are used for other soil components, the color designation follows each descriptor.

6.3 Soil Types

Soil descriptions and classification shall be conducted in accordance with the USCS (ASTM D2488-06). The order and presentation of the primary textural classification terms is as follows:

1. Major soil type (e.g. CLAY). This descriptor can include the secondary soil constituent as a modifier (gravelly, sandy, silty, or clayey). Nouns are unabbreviated (e.g. CLAY); "TOPSOIL" is an adequate single term for the naturally occurring organic soil found at the ground surface. In urban areas, "FILL" is used to denote previously disturbed soil, followed by a description of the major and minor soil components (e.g. "FILL, silty clay with some fine sand"). USCS Group Symbol follows the major soil component in parentheses.
2. Other soil components of the sample are listed in descending order of percentage using adjectives "with", "some" and "trace."
3. Using the Wentworth Scale in Attachment E, add size, sorting or angularity modifiers to granular material descriptions as appropriate.

6.4 Consistency and Relative Density

The relative density of cohesionless soils and the consistency of cohesive soils should be included in visual classifications. Attachments B and C can be used in describing the consistency of cohesive soils and the relative density of cohesionless soils, respectively.

A pocket penetrometer will be used to measure consistency of cohesive soils with the result recorded on the field boring log form. Attachment B includes information for determining soil consistency from penetrometer measurements.

6.4 Moisture Content

Moisture Content – Criteria for describing moisture content of soils are described in Attachment D.

6.5 Miscellaneous Descriptions

1. Structure – Some soils possess structural features (e.g. fissures, slickensides, or lenses) that if present, should be described.
2. Accessories or Inclusions – Elements such as rock fragments, fine roots, or nodules are included in the soil description following all other modifiers for the major components of the soil matrix. Any mineralogical or other significant components should be described, as well as man-made or apparently foreign constituents that indicate the presence and possible source of fill material.
3. Environmental Impacts – If monitoring instruments or visual observations indicate the potential presence of environmental impacts, it will be noted in detail. Additional information for describing specific types of impacts may be found in the Work Plan.

To provide consistency in logging soils, tables with additional guidelines for soil description are included in Attachment E.

7.0 ROCK CLASSIFICATION

7.1 Lithology and Texture

The logging technician should describe the lithology of the rock and its mineral composition. The geological name, such as granite, basalt, or sandstone, usually describes the rock's origin. The stratigraphic unit should be identified and assigned the local geological name, if appropriate. Stratigraphic age or period should be identified, if possible. Modifiers will be included to describe the rock texture, including grain size, sorting, packing, cementation, etc. (e.g. interlocking, cemented, or laminated-foliated).

7.2 Color

The color descriptions will be consistent with the Munsell Soil Color Chart, Geological Society of America (GSA) Rock Color Chart, or as required by the Work Plan or otherwise specified. Write the Munsell color name with the Munsell color identification number in parenthesis following the color name. The major color is listed first with any accessory colors thereafter. If secondary or tertiary descriptors are used, the color designation follows each descriptor.

7.3 Hardness

Terms used to describe hardness are described below. One common method to determine hardness is the Mohs Scale of Hardness, which is defined as follows:

Descriptive Term	Defining Characteristics
Very Hard	• Cannot be scratched with a knife. • Does not leave a groove on the rock surface when scratched.
Hard	• Difficult to scratch with a knife. • Leaves a faint groove with sharp edges.
Medium	• Can be scratched with a knife. • Leaves a well-defined groove with sharp edges.
Soft	• Easily scratched with a knife. • Leaves a deep groove with broken edges.
Very Soft	• Can be scratched with a fingernail.

7.4 Weathering

Terms used to describe weathering are described below (ASTM D 5434-03):

Descriptive Term	Defining Characteristics
Fresh	• Rock is unstained. • May be fractured, but discontinuities are not stained.
Slightly	• Rock is unstained. • Discontinuities show some staining on the surface, but discoloration does not penetrate rock mass.
Moderate	• Discontinuous surfaces are stained. • Discoloration may extend into rock mass along discontinuous surfaces.
High	• Individual rock fragments are thoroughly stained and can be crushed with pressure of a hammer. • Discontinuous surfaces are thoroughly stained and may crumble.
Severe	• Rock appears to consist of gravel-sized fragments in “soil” matrix. • Individual fragments are thoroughly discolored and can be broken with fingers.

7.5 Rock Matrix Descriptions

Grain size is a term that describes the fabric of the rock matrix. It is usually described as fine-grained, medium-grained or coarse-grained. The modified Wentworth scale should be used or as required by the Work Plan or otherwise specified.

A description of bedding (after Ingram, 1954) or fracture joint spacing should be provided according to the following:

Spacing	Bedding	Joints/Fractures
< 1 inch	Very thin	Very close
1 – 4 inches	Thin	Close
4 inches to 1 foot	Medium	Moderately close
1 foot to 4.5 feet	Thick	Wide
> 4.5 feet	Very Thick	Very Wide

Discontinuity descriptors are terms that describe number, depth, and type of natural discontinuities. They also describe density, orientation, staining, planarity, alteration, joint or fractural fillings and structural features.

8.0 ROCK CORE HANDLING

The following guidelines shall be followed for rock core handling:

1. Core samples must be placed into core boxes in the sequence of recovery, with the top of the core in the upper left corner of the box.
2. At the bottom of each core run, spacer blocks must be placed to separate the runs. The spacer should be indelibly labeled with the drilling depth to the bottom of the core run regardless of how much core was actually recovered from the run.
3. Spacer blocks should be placed in the core box and labeled appropriately to indicate zones of core loss, if known. Where core samples are removed for laboratory testing, blocks equal to the core length removed should be placed in the box. Note: If wooden core boxes are used, spacer blocks should be nailed securely in place.

4. The core boxes for each boring should be consecutively numbered from the top of the boring to the bottom.
5. The core boxes containing recovered rock cores should be photographed. One core box should be photographed at a time with the box lid framed in the picture to include information printed on the inside of the lid. Be sure to include a legible scale in the picture. Photographs are taken in the field most easily and efficiently with natural light and while the core is fresh.
6. When transporting a boxed core, the box should be moved only if the lid is closed and secured with tape or nails.

9.0 REFERENCES AND ADDITIONAL RESOURCES

ASTM International, 2007, D653-07b Terminology Relating to Soil, Rock, and Contained Fluids.

ASTM International, 1999, D1586-99 Standard Method for Penetration Test and Split-Barrel Sampling of Soils.

ASTM International, 2006, D2488-06 Practice for Description and Identification of Soils (Visual-Manual Procedure).

ASTM International, 2001, D4083-89R01E01 Practice for Description of Frozen Soils (Visual-Manual Procedure).

ASTM International, 2007, D4543-07 Practice for Preparing Rock Core Specimens and Determining Dimensional and Shape Tolerances.

ASTM International, 2002, D5079-02 (2006) Practice for Preserving and Transporting Rock Core Samples.

ASTM International, 2003, D5434-03 Guide for Field Logging of Subsurface Explorations of Soil and Rock.

ASTM International, 2000, D5715-00 (2006) Test Methods for Estimating the Degree of Humification of Peat and Other Organic Soils (Visual/Manual Method).

ASTM International, 2004, D6236-98 (2004) Guide for Coring and Logging Cement- or Lime-Stabilized Soil.

ASTM International, 2004, D7099-04 Terminology Relating to Frozen Soil and Rock.

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ATTACHMENT A
DRILLING LOG

Drilling Log

	Project Name	Project No.	Boring/Monitoring Well Number
	Site-Specific Coordinates	Ground Elevation	Page 1 of 1
	Total Depth (feet) / Hole Size (inches)	Driller (s)	
Drilling Rig		Drilling Company	
Date / To	Logged By:	Reviewed by:	Approved by:

Elevation (feet)	Depth (feet)	Description	Graphic Log	SAMPLING: Sample Type	Sample Interval	Blow Counts per 0.5'	N Value	Sample Recovery/Length (feet)	Penetro-meter (TSF)	PID Reading (PPM)	Remarks (▽ Depth to water while drilling; ▼ Depth to water after drilling)
	1 2 3 4 5 6 7 8 9 10 11 12 13										

ENVIRONMENTAL LOG COPY OF OSI 2003.GPJ BURNS_MO.GDT 8/30/07

ATTACHMENT B
CONSISTENCY OF COHESIVE SOILS

Author: T. Gilles **Q2R & Approval By:** C. Barry **Q3R & Approval By:** M. Kelley

CONSISTENCY OF COHESIVE SOILS

Consistency	Rule-of-Thumb	Blows Per Foot[1] (N value)[2]	Penetrometer (tons/ft^2)
Very Soft	Core (height = twice diameter) sags under own weight	0 – 1	0.0-0.25
Soft	Can be easily pinched in two between thumb and forefinger	2 – 4	0.26-0.49
Firm (Medium Stiff)	Can be imprinted easily with fingers	5 – 8	0.5-0.99
Stiff	Can be imprinted with considerable pressure from fingers	9 – 15	1.0-1.99
Very Stiff	Barely can be imprinted by pressure from fingers	16 – 30	2.0-3.99
Hard	Cannot be imprinted by fingers	> 30	4.0+

Notes:
1) Blows as measure with a 2-inch outer diameter (OD), 1 3/8-inch inner diameter (ID) sampler driven 1 foot by a 140-pound hammer falling 30 inches. See Standard Methods for Penetration Test and Split-Barrel Sampling of Soils, ASTM D1586-99.
2) N value is the sum of the blows from 6 inches to 12 inches and from 12 inches to 18 inches in the 2-foot sample.

ATTACHMENT C
RELATIVE DENSITY OF COHESIONLESS SOILS

RELATIVE DENSITY OF COHESIONLESS SOILS

Consistency	Rule-of-Thumb	Blows Per Foot (N value)[2]
Very Loose	Easily penetrated with a ½-inch diameter steel rod pushed by hand	0 - 4
Loose	Easily penetrated with a ½-inch diameter steel rod pushed by hand	4 - 10
Medium Dense	Easily penetrated with a ½-inch diameter steel rod driven with a 5-pound hammer	11 - 30
Dense	Penetrated a foot with a ½-inch diameter steel rod driven with a 5-pound hammer	31 - 50
Very Dense	Penetrated only a few inches with a ½-inch diameter steel rod driven with a 5-pound hammer	> 50

Notes:
1) Blows as measure with a 2-inch outer diameter (OD), 1 3/8-inch inner diameter (ID) sampler driven 1 foot by a 140-pound hammer falling 30 inches. See Standard Methods for Penetration Test and Split-Barrel Sampling of Soils, ASTM D1586-99.
2) N value is the sum of the blows from 6 inches to 12 inches and from 12 inches to 18 inches in the 2-foot sample.

ATTACHMENT D
CRITERIA FOR ESTIMATING MOISTURE CONTENT OF SOILS

Author: T. Gilles **Q2R & Approval By:** C. Barry **Q3R & Approval By:** M. Kelley

CRITERIA FOR ESTIMATING MOSITURE CONTENT OF SOILS

Adapted from USACE EM 1110-1-1804 and ASTM D 2488-06

Term	Description of Relative Moisture
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp, no visible water
Wet	Fine grained: well above optimum water content Coarse grained: visible free water
Saturated	Water is dripping from sample, usually encountered below water table

ATTACHMENT E
STANDARD SOIL DESCRIPTORS

Author: T. Gilles **Q2R & Approval By:** C. Barry **Q3R & Approval By:** M. Kelley

STANDARD SOIL DESCRIPTORS

Grain Size Terminology		
Soil Type		**Diameter**
Boulders		12-inches or greater
Cobbles		3- to 12 inches
Gravel	Coarse	0.75-inch to 3 inches
	Fine	0.19-inch to 0.75-inch
Sand	Very Coarse	1 mm to 2 mm
	Coarse	0.5 mm to 1 mm
	Medium	0.25 mm to 0.5 mm
	Fine	0.06 mm to 0.25 mm
Silt		0.004 mm to 0.06 mm
Clay		Less than 0.004 mm

Notes:
1) mm = millimeter
2) Based on Wentworth Grain Size Scale for Sediment (Wentworth 1922).
3) This terminology can also be used to describe clast size in rock cores.

Estimated Plasticity for Silt and Clay Content		
Thread Diameter (inches)	**Plasticity Index (PI)**	**Identification**
1/4	0	Silt
1/8	5 – 10	Clayey Silt
1/16	10 – 20	Clay and Silt
1/32	20 – 40	Silty Clay
1/64	40	Clay

Relative Proportions of Components	
Descriptive Term	**Percent**
Trace	1 – 10
Little	11 – 20
Some	21 – 30
And	30 – 50

Adapted from ASTM D2488-06

STANDARD DESCRIPTORS – VISUAL OBSERVATIONS OF NAPL

Descriptive Term	Definition
No Visible Evidence	No visible evidence of oil on soil or sediment sample
Sheen	Any visible sheen in the water on soil or sediment particles or the core
Staining	Visible brown or black staining in soil or sediment; can be visible as mottling or in bands; typically associated with fine-grained soil or sediment
Coating	Visible brown or black oil coating soil or sediment particles; typically associated with coarse-grained soil or sediment such as coarse sand, gravels, and cobbles.
Oil Wetted	Visible brown or black oil wetting the soil or sediment sample; oil appears as a liquid and is not held by soil or sediment grains

STANDARD OPERATING PROCEDURE NO. SAS-02-01

EQUIPMENT CALIBRATION, OPERATION, AND MAINTENANCE Revision 1

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the guidelines for controls, calibration, and maintenance of measurement and testing equipment to be used for obtaining samples for chemical analyses, for measuring field parameters, and for testing various parameter/characteristics. The purpose of this SOP is to ensure the validity of field measurement data generated during field activities as required in the Work Plan or as otherwise specified.

2.0 EQUIPMENT AND MATERIALS

- Measurement and testing equipment ;
- Equipment/instrumentation-specific operation manuals;
- Equipment/instrumentation-specific cases, battery chargers, and attachments; and
- Calibration standards (e.g. standard gas(es), calibration fluids, pH standards, etc.).

3.0 HEALTH AND SAFETY

Potentially hazardous conditions relating to chemicals under investigation, equipment and tools in use, utility services in investigation areas, or certain work activities may exist on the site. Protocols are established in each site-specific Health & Safety Plan (HASP) based on corporate health and safety policies and manuals, past field experience, specific site conditions, and chemical hazards known or anticipated to be present from available site data. Before site operations begin, all employees, and subcontractor personnel will have read and understood the HASP and all revisions. Before work begins, all site project staff will sign an agreement and acknowledgment form indicating that they have read and fully understood the HASP and their individual responsibilities, and fully agree to abide by the provisions of the HASP.

4.0 EXECUTION

4.1 General

Field measurements are used to verify sampling procedures, assist in sample selection, and evaluate field conditions. A variety of equipment/instrumentation may be utilized to obtain the field measurements required to satisfy and document project goals outlined in Work Plans or otherwise specified. Therefore, instrument operators must be thoroughly familiar with the operation of measuring instruments. Users will complete the appropriate training and be certified, if required, before using the instrument in the field.

All purchased equipment/instrumentation will be uniquely and permanently identified (model/serial number, equipment inventory number, etc.). All rental equipment/instrumentation will have their unique identification number and rental company name recorded in the field logbook and/or on the appropriate field form. Manufacturer's guides/operation manuals will be kept with the instrument or a designated area on the Site, as appropriate. The Site Manager or designee will obtain, identify, and control all equipment/instrumentation to be used during the project.

4.2 Calibration

Measuring equipment/instrumentation must be calibrated before initial use as recommended in the manufacturer's guide/operation manual. Equipment/instrumentation shall be re-calibrated following 1) the manufacturer's recommended calibration frequency, 2) long periods between uses, 3) readings observed above or below the range of the instrument, and/or 4) signs or evidence of equipment malfunction. Calibration and re-calibration activities will be recorded in the field logbook and/or on the appropriate field form and will include the following information:

- Date and time of calibration or re-calibration;
- Equipment/instrumentation manufacturer, make, and model;
- Equipment/instrumentation serial or unique inventory number;
- Method of calibration (may reference procedures outlined in the guide/instrument manual);
- Calibration standard(s) used; and
- Deviations, if any, from the manufacturer's recommended procedure(s) or calibration frequency.

Rental equipment/instrumentation will be calibrated prior to delivery by the rental company and will be accompanied by a certified calibration sheet. Calibration sheets from the rental company will be attached to the appropriate field form and/or filed at the Site by the Site Manager or designee. If rental equipment/instrumentation is maintained onsite for an extended period follow the re-calibration guidelines listed above.

4.3 Calibration Checks

Calibration checks should be completed at a minimum of twice per day (prior to equipment use, unless just calibrated, and at the completion of equipment use). A calibration check should be performed on rental equipment upon arrival and as stated above. Manufacturer's instructions will be followed for correct method(s) and frequency, if greater than twice per day, for checking equipment/instrumentation calibration. Calibration check activities will be recorded in the field logbook and/or on the appropriate field form and will include the following information:

- Date and time of calibration check;
- Equipment/instrumentation manufacturer, make, and model;
- Equipment/instrumentation serial or unique inventory number;
- Rental company name, if applicable;
- Method of calibration check (may reference procedures outlined in the guide/instrument manual);
- Calibration check standard(s) used; and
- Deviations, if any, from the manufacturer's recommended procedure(s) or calibration check frequency.

If calibration check fails according to manufacturer standards, the equipment/instrumentation shall be re-calibrated as described in Section 4.2 above.

4.4 Operation

Manufacturer's instructions will be followed for correct method(s) of operation. Equipment malfunctions and deviations, if any, from the manufacturer's recommended method(s) of operation will be documented in the field logbook and/or on the appropriate field form. Readings obtained from each instrument shall be recorded in the field logbook or on the appropriate field form.

4.5 Maintenance

Equipment/instrumentation will be maintained in accordance with the manufacturer's recommendations. Equipment/instrumentation that malfunctions or is scheduled for routine maintenance will be clearly labeled to prevent its continued use until repairs/maintenance is completed. The Site Manager or her/his designee will be responsible for ensuring that malfunctioning equipment is identified, marked for repair, repaired either in-house or by an outside company in accordance with manufacturer guidelines, checked following repair, and returned to service. The Site Manager or her/his designee will maintain an equipment log, which contains the following:

- Equipment/instrumentation manufacturer, make, and model;
- Equipment/instrumentation rental company, if applicable;
- Equipment/instrumentation serial or unique inventory number;
- Recommended calibration frequency;
- Recommended calibration check frequency;
- Recommended maintenance frequency, as appropriate;
- Status (in service, not in use, or out of service for repair/maintenance);
- Dates of status changes (e.g. date returned to service); and
- Inspection and maintenance/repair dates.

5.0 REFERENCE

USEPA, April 2007, Guidance for Preparing Standard Operating Procedures (SOPs), EPA/600/B-07/001

STANDARD OPERATING PROCEDURE NO. SAS-03-03

SAMPLE LOCATION IDENTIFICATION AND CONTROL Revision 2

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the guidelines for the identification of sample locations and field measurements of topographic features, water levels, geophysical parameters, and physical dimensions frequently required during groundwater, hazardous waste, and related field investigation activities. The scope of such measurements depends on the purpose of the field investigation. Samples collected from each sampling location will have a unique sample identified in accordance with ENV-03-01.

All sampling locations shall be uniquely identified and depicted on an accurate drawing or a topographic or other site map, or be referenced in such a manner that their location(s) are established and reproducible. A sample location must be identified by a coordinate system or other appropriate procedures which would enable an independent investigator, to collect samples from reproducible locations. Repetitive sampling might be performed, for example, to monitor the progress of a remedial program, to check for suspected erroneous results from an initial sampling, or to check the reproducibility of results.

2.0 EQUIPMENT AND MATERIALS

- Site map;
- Surveying equipment;
- Measuring tape;
- Field notebooks/logs; and
- Handheld GPS unit.

3.0 SAMPLE LOCATION IDENTIFICATION

Locations for collection of samples are assigned alphanumeric codes which are used to coordinate laboratory data tracking and graphic depiction of sample locations on drawings and figures. Samples collected from each sampling location will have a unique sample identified in accordance with ENV-03-01. Each sample location is issued a unique numeric code that corresponds to a specific map location on a plan view of a site and vicinity. An alpha-code (letter) is used to describe the type of sampling activity performed at the specific numeric location. The following alpha codes will be used:

Air	AS	Air Sparging Point
	GP	Gas Probe
	GM	Gas Monitoring Well
	SV	Soil Vapor Probe
	VE	Soil Vapor Extraction Well
Material	AC	Asbestos Containing Material
	LS	Lead Wipe Sample
Sediment	SD	Sediment
Soil	SB	Soil Boring
	SS	Surface Soil
	TP	Test Pit
	EB	Excavation Base
	EW	Excavation Well
Water	MW	Groundwater Monitoring Well
	PZ	Piezometer
	PW	Potable Water Well
	RW	Recovery Well
	TW	Temporary Monitoring Well
	SW	Surface Water
	SG	Surface Water Staff Gauge

A typical series of alpha numeric codes for a site might include test pit locations TP01 through TP12; borings SB01, SB02, SB03; monitoring wells MW01, MW02, MW03, etc.

Each sample location will have only one alphanumeric code. A borehole drilled for the purpose of installing a monitoring well will be identified as MW01. There should not be a location SB01 for soil sample location identification and MW01 for groundwater sample location identification.

Note that soil borings performed for the purpose of collecting a groundwater grab sample (e.g. through screened auger, open borehole, Geoprobe®, Hydro-Punch®, etc.) are identified as soil borings, not monitoring wells. These types of sampling locations may be further identified on site figures with a clarifying suffix (GW), such as SB01(GW). The site map legend will explain the meaning of all symbols used to identify sampling points.

If previous work has been performed at a site, the alphanumeric code should continue with previous successive numbers. If there is any potential for conflict with existing sample number identifiers, the proposed sample number should begin with series 101, 1001, or other appropriate system. Dashes should be eliminated from sample number identifiers, such as SB101 should be used instead of SB-101.

4.0 SURVEYED LOCATIONS

Survey control should be performed following monitoring well and borehole installations by a surveyor licensed in the state of the project site. Vertical elevations to the top of each new well casing will be established within ± 0.01 foot. Ground surface elevations at each well and borehole location should be established within ± 0.01 foot. Elevations should be referenced to the North American Vertical Datum of 1988 (NAVD 88). Alternative systems may be used on a project-specific basis, with appropriate reference documentation in the master project file and final reports.

Lateral locations based on an established grid system will be determined for each sampling location. Lateral locations should be calculated to within ± 1-foot. The site map should include at minimum sampling locations, structure boundaries, property boundaries, nearby surface water, site grid system origin according

to either a state plane coordinate system or latitude and longitude, bar scale, and a north arrow. Specific state reporting and mapping requirements should be checked prior to final plan development.

In conducting vertical surveys, the following procedures should be used or should be referenced in subcontractor service agreements with licensed surveyor:

- When practical, level circuits will close on a bench mark other than starting bench mark;
- Readings should be recorded to the closest 0.01 foot using a calibrated rod;
- Foresight and backsight distances should be reasonably balanced;
- Rod levels should be used;
- No side shot should be used; and
- Benchmarks should be traceable to USGS benchmarks.

Field staff and contractors will record all field data collected during survey activities in accordance with SOP SAS-01-01 for incorporation into site data reports, maps, tables, etc.

5.0 TRIANGULATION

Triangulation shall be used if a registered surveyor is not contracted. This method encompasses distance measurement from sampling points relative to two and sometimes three known points. Distance measurements should be accurate to within ±1 foot allowing for sag in the measuring tape and other inaccuracies. Measuring to two known points is typically adequate for rough measurements made with a pocket transit and 100-foot tape; however, measuring to three known points reduces potential error. Distance measurements should be made relative to distinctive features having a probable life span in excess of 10 years. Examples include the following:

- Power pole located on north side of plant entrance #1 driveway;
- SE corner of plant building 2 located at 111 Survey Circle; or
- NW corner of retaining wall running north-south along Bass Creek.

Unacceptable triangulation points include fence posts, trees, temporary stakes or markers etc., unless these features are to be located within 15 days by survey.

When locating sampling points, decide which site features will be important to illustrate on a site map in the report. If appropriate, also locate areas of known or suspected spills and manholes which may represent migration pathways. Establish relative locations of these and other pertinent site features by triangulation.

The client should be consulted regarding the existence of plant drawings or other surveyed maps which accurately show the relative location of major site features. The field notebook should record information describing the drawing (e.g., who it was prepared by, date, drawing number, etc.) and describe the points on the drawing being used for triangulation purposes.

If only one site feature is convenient for triangulation, the remaining two reference points can be established by running a line toward a more distant site feature, which can be easily located later, and the recorded distance from a defined point along that line.

6.0 GLOBAL POSITIONING SYSTEM (GPS)

Global Positioning System (GPS) is an appropriate method to determine the location of site investigation features in limited circumstances, and is solely at the discretion of the project manager.

There are significant accuracy limitations with GPS which limits the effectiveness of this technology in the role of sample location. For sites where accuracy less than ± 10 feet is acceptable, or surveying is impractical, a handheld GPS (Garmin) is a suitable sample location method. Garmin GPS is not suitable for sites requiring a higher degree of accuracy. For sites where accuracy less than ± 1 meter (~ 3 feet) is acceptable, or surveying is impractical, a Geo XH GPS is a suitable sample location method. For sites where accuracy less than ± 1foot is acceptable a licensed survey should be contracted (see section 4.0 Surveyed Locations).

However, at a minimum the recording of GPS coordinates, with any of these devices, is encouraged for all sites where monitoring wells or other permanent features may be obscured by snow, vegetation, or other obstructions. In such cases, GPS may assist in locating the monitoring well, etc..**7.0 REFERENCES**

ASTM International, 2002, D5906-02 Guide for Measuring Horizontal Positioning During Measurements of Surface Water Depths.

USEPA, 2001, Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM), Region 4, Enforcement and Investigations Branch, SESD, Athens, Georgia, www.epa.gov/region4/sesd/eisopqam/eisopqam.html.

USEPA, April 2007, Guidance for Preparing Standard Operating Procedures (SOPs), EPA/60/B-07/001.

Zilkoski, David B., J.H. Richards, and G.M. Young , 1992, Results of the General Adjustment of the North American Vertical Datum of 1988, American Congress on Surveying and Mapping, Surveying and Land Information Systems, Vol. 52, No. 3, 1992, pp.133-149.

STANDARD OPERATING PROCEDURE
NO. SAS-05-05

BOREHOLE AND WELL ABANDONMENT
Revision 3

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the guidelines for borehole and well abandonment. When boreholes and wells are no longer needed to complete project goals and objectives, they must be properly abandoned to prevent them from acting as a conduit for migration of contaminants from the ground surface to the water table or between transmissive zones.

2.0 EQUIPMENT AND MATERIALS

Equipment and materials may vary based on borehole and well accessibility and depth and well construction. Field personnel should use the equipment and materials required by the Site-Specific Work Plan or otherwise specified for the project. All non-disposable equipment shall be decontaminated before and after introduction into borehole or well. Equipment Decontamination should be performed in accordance with SOP SAS-04-05 and/or requirements of the Site-Specific Work Plan.

3.0 HEALTH AND SAFETY

Potentially hazardous conditions relating to chemicals under investigation, equipment and tools in use, utility services in investigation areas, or certain work activities may exist on the site. Protocols are established in each site-specific Health & Safety Plan (HASP) based on corporate health and safety policies and manuals, past field experience, specific site conditions, and chemical hazards known or anticipated to be present from available site data. Before site operations begin, all employees, and subcontractor personnel will have read and understood the HASP and all revisions. Before work begins, all site project staff will sign an agreement and acknowledgment form indicating that they have read and fully understood the HASP and their individual responsibilities, and fully agree to abide by the provisions of the HASP.

4.0 CONSIDERATIONS

Borehole and well abandonment procedures should meet applicable regulatory agency requirements. Well abandonment procedures are dependent upon several factors which include:

- Geologic data availability
- Aquifer formation (creviced consolidated)
- Aquifer formation (non-creviced consolidated)
- Aquifer formation (unconsolidated)
- More than one water bearing formation

In addition, licensing and/or certification of the driller is typically required however licensing requirements vary by state. A trained supervising technician (e.g. geologist, hydrogeologist, engineer, or environmental scientist) should be present during well abandonment to document the activities. The supervising technician should complete and submit a well abandonment form, as required, to the appropriate regulatory agency. Attachment A contains the Illinois Department of Public Health Water Well Sealing Form as an example. If wells are abandoned in other states, the relevant forms and procedures shall be implemented.

5.0 EXECUTION

Unless otherwise specified in the Site-Specific Work Plan, either of the following guidelines shall be followed.

5.1 Overdrilling Well Abandonment Method

One well abandonment method is to completely remove the well casing and screen from the borehole. This may be accomplished by auguring with a hollow-stem auger over the well casing (overdrilling) down to the bottom of the borehole, thereby removing the grout, bentonite seal, and filter pack from the hole. The well casing shall then be removed from the borehole with the drill rig. The remaining borehole and boreholes not utilized for the construction of a monitoring well, will be subsequently backfilled with the appropriate backfill material. The backfill material (e.g. bentonite, Portland cement, etc) shall be placed into the borehole from the bottom to the top by pressure grouting with the positive displacement method (tremie method) to within 30 inches of the ground surface. The annular space shall be filled with bentonite chips, grout, or granules to at least 30 inches bgs unless land use requires a design modification to use native material (gravel, soil, etc.) or material in adjacent areas (asphalt, concrete, etc.) to bring the former well location to grade. If the area has

heavy traffic and/or construction use, the location will be barricaded until the plug has cured or concrete plug recessed below ground surface will be used to maintain the surface seal. This abandonment method can typically be accomplished on small-diameter wells (4-inches or less in diameter).

On large-diameter wells (diameter greater than 4-inches) with little to no grout, a drill stem with a tapered wedge assembly or solid-stem auger should be used to ream out the borehole and extract the well materials. Wells that are badly corroded and/or have thickly grouted annular space have a tendency to twist and/or break off in the borehole. Should this occur, the well would be grouted with the remaining casing left in the borehole. In this case, the well and borehole shall be pressure grouted by placing a tremie pipe in bottom of the well casing, which will be the well screen or bottom sump area below the well screen. The pressurized grout will be forced out through the well screen into the filter pack and up the inside of the well casing sealing holes and breaks that are present. The tremie pipe shall be retracted slowly as the grout fills the casing. The annular space shall be filled with bentonite chips, grout, or granules to at least 30 inches bgs. The well casing shall then be cut off at least 30 inches below. Native material (gravel, soil, etc.) or material in adjacent areas (asphalt, concrete, etc.) may be used to bring the former well location to grade. If the casing has been broken off below the surface, the grout shall be tremied to within 30 inches of the ground surface and then finished similar to the surrounding features.

Brittle polyvinyl chloride (PVC) well casings may be more difficult to remove from the borehole than stainless-steel casings. If the PVC well casing breaks during removal, the borehole shall be cleaned out by using a drag bit or roller cone bit with the wet rotary method to grind the casing into small cuttings that will be flushed out of the borehole by the drilling fluid. Another method is to use a solid-stem auger with a carbide auger head to grind the PVC casing into small cuttings that will be brought to the surface by the rotating flights. After the casing materials have been removed from the borehole, the borehole shall be cleaned out and pressure grouted with the approved grouting materials. As previously stated, the borehole shall be finished with a concrete surface plug or site-specific surface restoration material with adequate surface protection, unless otherwise directed or required by the Site-Specific Work Plan.

5.2 In-Place Well Abandonment Method

5.2.1 Cement Grout - The in-place monitoring well or borehole abandonment method completely fills the monitoring well or borehole with concrete, cement grout, or a low permeability material such as bentonite. When using concrete or cement grout the monitoring well or borehole shall be pressure grouted by placing a tremie pipe in bottom of the well casing, which will be the well screen or bottom sump area below the well screen. The pressurized grout will be forced out through the well screen into the filter pack and up the inside of the well casing sealing holes and breaks that are present. The tremie pipe shall be retracted slowly as the grout fills the casing. The well casing shall then be cut off at least 24 inches below ground surface. Native material (gravel, soil, etc.) or material in adjacent areas (asphalt, concrete, etc.) may be used to bring the former well location to grade.

When grout is used for abandonment care should be taken in coarser-grained aquifers or where wells are nested close together as grout can travel or migrate in sand and gravel aquifers. Each well location should be evaluated to see if grout migration may be a concern. If grout migration is a concern, a thicker grout should be mixed or use of bentonite pellets or chips should be used in place of grout if possible.

5.2.2 Dry Bentonite - When granular bentonite, bentonite pellets or bentonite chips are used to abandon the monitoring well or boreholes the following guidelines shall be followed.

- Granular bentonite should be used only when the borehole or well is less than 25 ft deep and when there is no standing water above the filter pack.
- Bentonite chips no greater than 3/8 inch in diameter or bentonite pellets should be used for abandonment of boreholes or monitoring wells less than 50 ft deep and the depth of standing water is less than 50 ft.

Granular bentonite, bentonite chips or bentonite pellets should be placed slowly into the monitoring well or borehole to be sure they reach the bottom of the well to prevent bridging in the well. When the material has risen to the top of the well casing or borehole clean water shall be poured into the well to hydrate the bentonite material. The well casing shall then be cut off at least 24 inches below ground surface. Native material (gravel, soil, etc.) or material in adjacent areas (asphalt, concrete, etc.) may be used to bring the former well location to grade.

6.0 REFERENCES AND ADDITIONAL RESOURCES

ASTM International, 2005, D5299-99 (2005) Standard Guide for Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities.

USEPA, 2001, Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, Region 4, Enforcement and Investigations Branch, SESD, Athens, Georgia.

USEPA, April 2007, Guidance for Preparing Standard Operating Procedures (SOPs), EPA/600/B-07/001.

Illinois Administrative Code, Title 77: Public Health Chapter I: Water and Sewage Part 920 Illinois Water Well Construction Code Section 920.120 Abandoned Wells

Wisconsin Administrative Code, Chapter NR 141.25, Abandonment Procedures, March 2011

ATTACHMENT A
BOREHOLE / WELL ABANDONMENT FORM

BOREHOLE / WELL ABANDONMENT FIELD FORM

PROJECT INFORMATION

Site: _____ Client: _____

Project Number: _____ Task #: _____ Start Date: _____ Time: _____

Field Personnel: _____ Finish Date: _____ Time: _____

GENERAL INFORMATION

Ownership (Controlling Party): _____

Street Address: _____

City: _____

County: _____

State: _____ Zip: _____

Township: _____ Range: _____ Section: _____

_____ 1/4 of the _____ 1/4 of the _____ 1/4

If Known, Latitude: _____ Longitude: _____

If Known*, Northing: _____ Easting: _____

*Coordinate System: _____

Reason for Abandonment:

Permit Number (If applicable): _____

BOREHOLE / WELL INFORMATION

Borehole / Well ID: _____ Unique Well ID:

Installation Date: _____

☐ Borehole
☐ Monitoring Well
☐ Water Well
☐ Other (specify): _____

Attach Well Completion Report, if available

Construction Type:

☐ Drilled ☐ Driven (Sandpoint)
☐ Other (specify): _____

Formation Type:

☐ Unconsolidated Materials ☐ Bedrock

Borehole/Well Details:

Borehole Diameter: _____ Inches

Total Borehole Depth: _____ FT BGS

Casing Diameter: _____ Inches ☐ Not Applicable

Total Casing Depth: _____ FT BGS ☐ Not Applicable

Depth to Water: FT BGS ☐ Not Encountered

SEALING INFORMATION

Pump & Piping Removed? ☐ Yes ☐ No ☐ Not Applicable

Liner(s) Removed? ☐ Yes ☐ No ☐ Not Applicable

Screen Removed? ☐ Yes ☐ No ☐ Not Applicable

Entire Casing Removed? ☐ Yes ☐ No* ☐ Not Applicable

**If No, Upper 2 feet Removed?* ☐ Yes ☐ No

Method of Sealing Material Placement:

☐ Conductor Pipe - Gravity ☐ Tremie Pipe - Pumped

☐ Screened & Poured ☐ Other (specify): _____

Sealing Material Rose to Surface? ☐ Yes ☐ No

Material Settled After 24 Hours? ☐ Yes* ☐ No

*If Yes, Was Hole Re-Topped? ☐ Yes ☐ No

Sealing Material Used	From	To	Volume/Quantity
	Surface		

SEALING WORK PERFORMED BY

Individual's Name: _____ License Number:

Company Name: _____

Street Address: _____

City: _____ State: _____ Zip: _____

BOREHOLE / WELL ABANDONMENT FIELD FORM

PROJECT INFORMATION

Site: _____ Client: _____

Project Number: _____ Task #: _____ Start Date: _____ Time: _____

Field Personnel: _____ Finish Date: _____ Time: _____

GENERAL INFORMATION

Ownership (Controlling Party): _____

Street Address: _____

City: _____

County: _____

State: _____ Zip: _____

Township: _____ Range: _____ Section: _____

_____ 1/4 of the _____ 1/4 of the _____ 1/4

If Known, Latitude: _____ Longitude: _____

If Known*, Northing: _____ Easting: _____

*Coordinate System: _____

Reason for Abandonment:

Permit Number (If applicable): _____

BOREHOLE / WELL INFORMATION

Borehole / Well ID: _____ Unique Well ID:

Installation Date: _____

☐ Borehole
☐ Monitoring Well
☐ Water Well
☐ Other (specify): _____

Attach Well Completion Report, if available

Construction Type:

☐ Drilled ☐ Driven (Sandpoint)
☐ Other (specify): _____

Formation Type:

☐ Unconsolidated Materials ☐ Bedrock

Borehole/Well Details:

Borehole Diameter: _____ Inches

Total Borehole Depth: _____ FT BGS

Casing Diameter: _____ Inches ☐ Not Applicable

Total Casing Depth: _____ FT BGS ☐ Not Applicable

Depth to Water: FT BGS ☐ Not Encountered

SEALING INFORMATION

Pump & Piping Removed? ☐ Yes ☐ No ☐ Not Applicable

Liner(s) Removed? ☐ Yes ☐ No ☐ Not Applicable

Screen Removed? ☐ Yes ☐ No ☐ Not Applicable

Entire Casing Removed? ☐ Yes ☐ No* ☐ Not Applicable

**If No, Upper 2 feet Removed?* ☐ Yes ☐ No

Method of Sealing Material Placement:

☐ Conductor Pipe - Gravity ☐ Tremie Pipe - Pumped

☐ Screened & Poured ☐ Other (specify): _____

Sealing Material Rose to Surface? ☐ Yes ☐ No

Material Settled After 24 Hours? ☐ Yes* ☐ No

*If Yes, Was Hole Re-Topped? ☐ Yes ☐ No

Sealing Material Used	From	To	Volume/Quantity
	Surface		

SEALING WORK PERFORMED BY

Individual's Name: _____ License Number:

Company Name: _____

Street Address: _____

City: _____ State: _____ Zip: _____

APPENDIX C
SITE-SPECIFIC HEALTH AND SAFETY PLAN

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SECTION A HEALTH AND SAFETY PLAN

SUMMARY

A copy of this Health and Safety Plan (HASP) will be maintained on-site during field activities and updated as deemed necessary by the Project Manager.

SITE INFORMATION

Wisconsin Public Service Building

700 N. Adams St.

Green Bay, Wisconsin 54303

Former Green Bay Manufactured Gas Plant Removal Action

HOSPITAL INFORMATION

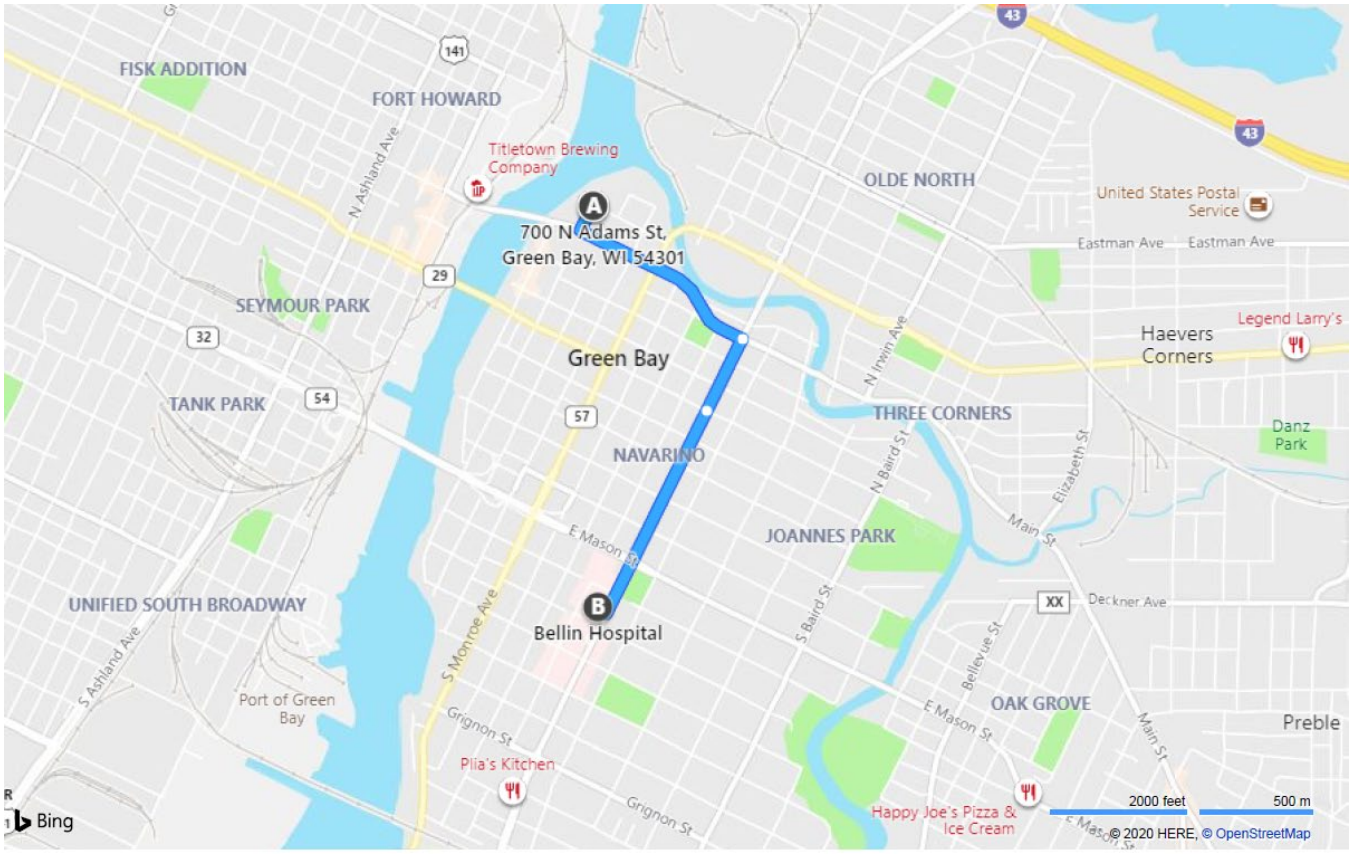
Bellin Hospital

744 S Webster Ave

Green Bay, Wisconsin 54301

Phone: (920) 433-3500

ROUTE TO HOSPITAL MAP



Total travel estimate: 1.5 miles – about 6 minutes

HOSPITAL ROUTE

1. Head southwest on N Adams St toward US-141 / Main St - 417 ft
2. Turn left onto US-141 / Main St -0.6 mi
3. Turn right onto N Webster Ave - 0.2 mi
4. Road name changes to S Webster Ave - 0.6 mi
5. Turn right and follow the Emergency Room signs

Emergency Contact List		
	Agency Name and Address (if applicable)	**Contact Number(s)**
Fire Dept:	Green Bay Fire Department	911 / 920-448-3280
Police:	Green Bay Police Department	911 / 920-448-3200
Sheriff:	Brown County Sheriff's Department	911 / 920-448-4219
Local Utilities:	Diggers Hotline (WI),	877.500.9592 (emergency only) 800.242.8511
Ramboll PM:	Staci Goetz	Office - 414.335.3563
Ambulance	911	911
Hospital	Bellin Hospital 744 S Webster Ave Green Bay, Wisconsin 54301	Emergency – 911 Hospital – (920) 433-3500

DESCRIPTION OF SITE

The 14-acre Wisconsin Public Service Corp. site is located in Green Bay, Wis. Currently; the site is used as Wisconsin Public Service Corporation (WPSC) corporate offices and as an employee parking lot. It is on the south bank of the East River near the confluence of the Fox River. WPSC owned and operated the gas plant from the 1871 to 1947 in an area that was historically industrial. Processes included coal carbonization and carbureted water gas.

ACTIVITIES

In preparation for an early removal action in the upland portion of the site, a pre-design investigation will be conducted in the parking lot and grass adjacent to the East River Trail and East River. Specific activities anticipated for Ramboll include the following:

- Utility clearance
  - Geophysical clearance of private subsurface utilities and identification of potential underground obstructions
  - Public utility clearance prior to any subsurface investigation activities
- Direct push technology drilling
  - Borings will be advanced 10-15 feet below ground surface
  - Collection, processing, and shipping of samples for laboratory analysis
- Groundwater sampling
  - Preservation of water samples with ice, hydrochloric acid, nitric acid, sulfuric acid, and/or sodium hydroxide

HEALTH AND SAFETY MONITORING

A hand-held photoionization detector (PID) is required during intrusive activities.

EQUIPMENT, PRESERVATIVES, CALIBRATION MATERIAL, DECONTAMINATION CHEMICALS

Safety Data Sheets (SDS) for listed materials are in Appendix A

- Air Monitoring Equipment – with lithium ion battery
- Field Chemicals including bug repellent spray or cream and sun screen

- First Aid Kit including eye wash sterile solution, rapid aid instant cold pack, PVP iodine scrub solution, burn spray, hydrocortisone cream 1%, neomycin antibiotic ointment, antiseptic spray
- Equipment decontamination with Alconox
- PID calibration gases isobutylene
- UltraRae PID calibration gas benzene
- Hydrochloric acid, nitric acid, sulfuric acid and/or sodium hydroxide for preservation of contact water
- Compressed gases

HEALTH/SAFETY HAZARDS ON AND ADJACENT TO WATER

Chemical / Material/Physical Hazard	Media	Maximum Concentration	Routes of Exposure
PAH compounds	soil	1,219 mg/kg	Inhalation, ingestion, skin/eye contact.
NAPL	soil	NA	Inhalation, ingestion, skin/eye contact.
Heavy equipment	NA	NA	Struck-by, caught between
Traffic	NA	NA	Struck-by
Working on/near water	NA	NA	Drowning

PROTECTIVE EQUIPMENT/INSTRUMENTS

In general, personal protective equipment (PPE) will be used as specified on Table 1 for the anticipated project tasks. Respirators (1/2 or full face) with appropriate organic vapor cartridges shall be available for use. Site personnel must have medical clearance and up to date fit testing and training to wear a respirator. The health and safety manager and/or the project manager may require additional PPE based on field conditions or additional data collection.

SAFETY EQUIPMENT

Fire extinguishers and first aid kits will be located in field vehicles and/or the field office.

DISTRACTED DRIVING PROHIBITIONS

Wisconsin Vehicle Code 346.89 now includes clauses that prohibit drivers from using a hand-held mobile device to answer, send, or compose a text message.

The use of cellular phones for conversation should be reserved as a non-driving activity or limited with the following guidelines:

- The priority during cell phone use is safe driving. Never allow a phone conversation to distract you from concentrating on driving.
- Always follow restrictions and bans for the state and municipality you're traveling in; the following link has a summary of State laws http://www.ghsa.org/html/stateinfo/laws/cellphone_laws.html.
- Do not answer a call if it is unsafe to do so.
- Use a headset while driving, or pull over to use a handheld phone. Ramboll will provide a hands-free accessory of Ramboll's choosing, for your cell phone if the accessory did not come with your cell phone.

- Keep conversations short and suspend the call in serious circumstances (e.g., heavy traffic, stop-and-go traffic, maneuvering around hazards, severe weather conditions).
- Avoid placing calls while moving; use speed dialing when making calls and plan calls before driving is started. When dialing manually without the speed-dialing feature, dial only when the vehicle is stationary.
- When receiving a call, inform the caller that you are driving and will suspend/end the call without notice if traffic conditions become hazardous in any way. If possible, ask a passenger to make the call for you or at least dial the number for you.
- If you are talking while driving, keep your head up, your eyes on the road, and frequently check the side and rearview mirrors.

REPORTING

Report all cell phone near-misses and accidents on the Ramboll Accident/Near-Miss Reporting Form intranet site:

https://obrienandgere.sharepoint.com/near-miss/SitePages/Submit%20a%20Near%20Miss%20Report.aspx

PPE Required	Site Recon/Field Mobilization	Utility Clearance Oversight	Drilling Oversight	Groundwater Bio-Trap Sampling
Steel-Toed Boots (Rubber)		Av	Av	Av
Steel-Toed Boots (Leather)	X	X	X	X
Hard Hat		Av	X	X
Safety Glasses/Goggles	X	X	X	X
Gloves-Inner (Nitrile)	Av	Av	X	X
Gloves-Outer (Nitrile)			Av	
High Visibility Vest	X	X	X	X
Personal Flotation Device		Av	Av	
Tyvek Coverall			Av	Av
PID			Av	Av
Respirator			Av	Av
Hearing Protection			X	X

Key:

X = PPE Required
Av = Have available at work site
Glove types may be altered based on field conditions to include Vinyl, Neoprene, and/or Latex
"Other" required or to be available PPE will be identified for each task in the Site-Specific Work Plan.
(a) Refer to Appendix B for the Air Monitoring and Respirator Use Flow Chart

FIELD HEALTH & SAFETY PLAN REVIEW

I HEREBY CERTIFY THAT I HAVE READ AND UNDERSTOOD ALL HEALTH AND SAFETY PROCEDURES AS STATED HEREIN:

Name and Affiliation (printed)	Signature	Date

Client:		**Project No.:**	
Project Name:		**Today's Date:**	
Project Location:			
Conducted By:			
Meeting Topic:			

Name	Signature	Company Name

Safety Meeting Topics (be specific)

KEEP COPIES OF ALL TOOLBOX MEETING MINUTES WITH PROJECT RECORDS

SECTION B - HEALTH AND SAFETY PLAN
1 OVERVIEW

1.1 Purpose and Scope

This document describes the health and safety procedures and requirements for the installation of borings/wells, test pit excavations, sampling of soil (surface and subsurface), groundwater, surface water and sediment and subsurface structure review (from ground surface). This document is intended to serve as a Multi-Site Health and Safety Plan (HASP) to try to ensure that the fieldwork performed by Ramboll is done in compliance with applicable federal, state, and local occupational safety and health regulations. Subcontractors shall be made aware of the requirements of this plan; however, subcontractors need to have their own plan for the health and safety of their own employees and for following applicable federal, state, and local regulations.

In compliance with HAZWOPER, a comprehensive work plan will be developed for each site to evaluate the logistics and resources needed to reach work objectives for site operations. The work plan will identify key individuals and their responsibilities, site activities, methods for accomplishing the objectives (sampling plans), and normal operating procedures. Site-specific work plan(s) will be available on location at the site.

1.2 Health and Safety Plan Modification Procedures

Due to varying site conditions or encountering unanticipated hazards, it may be necessary to revise the health and safety plan. Necessary plan changes that call for more stringent procedures or a higher level of personal protective equipment (PPE) may be made at any time by the Health and Safety Manager, Project Manager (PM) or Task Leader in cooperation with the Project Health and Safety Officer (PHSO). The PM should be notified at the soonest available opportunity.

Plan changes that would make safety procedures or PPE requirements less stringent may be made only upon approval of the HSM and PM.HSM). Plan changes must be put in writing and communicated to field personnel.

2 KEY PERSONNEL/IDENTIFICATION OF H&S PERSONNEL

2.1 KEY PERSONNEL

Responsibilities for health and safety compliance issues associated with hazardous waste operations are primarily vested in the project organization, with support from appropriate health and safety professionals on Ramboll's technical and administrative staffs.

2.2 SITE-SPECIFIC HEALTH AND SAFETY PERSONNEL AND ORGANIZATIONAL RESPONSIBILITY

2.2.1 Corporate Health and Safety Manager

The Corporate Health and Safety Manager (HSM) acts as a technical resource to Ramboll offices on health and safety matters. This person is responsible for ensuring that Ramboll health and safety programs comply with applicable federal, state, and local statutes for safety and health protection; executive orders; operating orders; permits and regulations; and company policies and procedures. The HSM is also responsible for review and approval of site-specific Health and Safety Plans, serves in a consultation capacity to the technical staff on health and safety-related issues, and has the authority to conduct health and safety audits.

2.2.2 Project Manager

The Project Manager (PM) is accountable for health and safety compliance on his or her projects. The PM is responsible for the technical and financial execution of the project, and has the authority to commit resources, adopt program policies and procedures, and approve expenditures and subcontracts. The PM will try to ensure that adequate resources are budgeted and available to implement a sound health and safety program and that appropriate technical resources are brought in to support the health and safety needs of the project. The PM will try to ensure that health and safety is a high priority in planning fieldwork and/or lab studies, and that adequate resources are available to develop and implement an appropriate project specific health and safety plan.

2.2.3 Project Health and Safety Officer

The Project Health and Safety Officer (PHSO) is responsible for developing and implementing the project or Site-Specific Health and Safety Plan. In the event a PHSO has not been identified for a specific project, the PM will assume those responsibilities. The PM is ultimately responsible for health and safety for the project. It is the responsibility of the PM to report any unsafe conditions reported by the project staff to the HSMHSM and to work cooperatively to mitigate unsafe conditions. The PHSO will also try to ensure compliance with health and safety requirements presented in this Plan. The PM will serve as the PHSO unless site-specific hazards are identified create the need for assignment of a PHSO to the project. To meet these responsibilities, the PM/PHSO may:

- Act as a health and safety consultant to the project field staff
- Provide site-specific training to staff assigned to work at the site
- Review and confirm any changes in personal protective clothing or respiratory protection requirements
- Indicate that specific health and safety precautions be taken before personnel enter a site
- Restrict access to the site or a portion thereof
- Perform necessary personnel review
- Stop work when the health or safety of project personnel are jeopardized and order the immediate evacuation of personnel from any area of the site
- Recommend personnel to obtain immediate medical attention if necessary
- Provide health and safety briefings to site visitors

- Enforce the requirements stated in the Corporate Health and Safety Manual and the project- or Site-Specific Health and Safety Plan

2.2.4 Field Team Members

Ramboll personnel must know, understand, and comply with the requirements of this Plan developed for their projects. Field personnel will:

- Read and understand applicable health and safety plans
- Perform work safely
- Be aware of and alert for signs and symptoms of work-related injuries and illnesses
- Promptly report any unsafe conditions that may occur on site to the PHSO, PM, and/or HSM

2.2.5 Subcontractors

Subcontractors have primary responsibility for the health and safety of their own employees. However, Ramboll is stipulated by OSHA standards (e.g., 29 CFR 1910.120) to provide information to its subcontractors on known or potential workplace hazards, as well as the methods proposed to manage the identified hazards.

It is currently OSHA policy to issue citations to prime contractors in the event that their subcontractor is found to be out of compliance with regulatory requirements. Ramboll may incur civil penalties as a result of non-compliance with regulatory requirements by its subcontractors and/or injuries or illnesses incurred by the subcontractor's staff. Personal injury suits have been successfully brought against prime contractors in instances where a subcontractor's employee has demonstrated that the lack of health and safety oversight on the part of a prime contractor played a role in his or her sustaining an injury or illness.

Ramboll intends to manage its subcontractors to protect the health and well-being of Ramboll staff. Ramboll's objective is to manage subcontractors in a way that limits Ramboll's and our client's liabilities related to subcontractor performance, including management of health and safety issues. To achieve this objective, a reasonable level of subcontractor surveillance, with respect to health and safety issues is recommended.

When indicated by Ramboll, the subcontractor must review project-specific health and safety information and hazards, and develop and implement a health and safety plan. This plan must comply with applicable health and safety regulations and any project-specific requirements that Ramboll has specified. The subcontractor must provide Ramboll with a copy of this plan before the start of work. Ramboll acceptance of the subcontractor's plan does not mean that Ramboll concurs with the adequacy of the plan for protection of the health and safety of the subcontractor's employees. That responsibility rests solely with the subcontractor. Ramboll's review of subcontractor health and safety plans will be for the purposes of: 1) assessing potential health and safety impacts to Ramboll personnel and 2) meeting Ramboll legal responsibilities as a prime contractor. Any deficiencies in the subcontractor's plan or inconsistencies in proposed work practices between Ramboll and its subcontractor should be identified. If appropriate, these deficiencies or differences should be resolved before the work begins.

2.3 COMMUNICATION

Field staff and subcontractors are both permitted to call 911 in an emergency situation. As part of preparing the Site-Specific Health and Safety Plan, 911 services will be verified for each site location. Assuming the PM is not on-site, the field staff should contact the PM as soon as possible regarding the on-site situation. It is then up to the discretion of the PM if necessary to contact the Client.

3 TASK/OPERATION SAFETY AND HEALTH RISK ANALYSIS

3.1 HISTORICAL OVERVIEW OF SITE

A historical overview of the site along with details of the project description is provided in the project Work Plan. Specific protocols for sampling, sample handling and storage, chain-of-custody, and laboratory and field analyses to be performed are described in Ramboll's SOPs. Quality assurance/quality control (QA/QC) procedures are structured in accordance with applicable technical standards, regulations, and guidance.

3.2 RISK ANALYSIS-GENERAL

Personnel in the vicinity of the drilling, excavation, and sampling operations are not only subject to the hazards of direct exposure to contaminants, but also to dangers posed by machinery operation. In addition, stresses due to working in protective clothing may be encountered. Physical, chemical, and biological hazards are present to some degree at most job sites.

3.2.1 Heat/Cold Stress

Thermal Stress– Heat

At times Ramboll personnel need to work in hot and humid weather conditions, when temperatures and or humidity create a heat index which may be dangerous to work in. Field personnel must dress appropriately for the weather conditions and drink fluids to stay hydrated. In addition, more frequent breaks to cool down should be taken when temperatures and the heat index are high. Site personnel should take breaks as often as necessary to prevent the conditions listed below. It is also very important that field staff work together (i.e.," buddy system") so that they can observe each other for signs of heat stress. The table below calculates the heat index and provides a guide to potentially dangerous working conditions.

IMPORTANT: Since heat index values were devised for shady, light wind conditions, exposure to full sunshine can increase heat index values by up to 15°F. Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

Heat Stress

The site safety officer (SSO) shall identify the extent to which heat stress observation and measures are needed based on the guidance provided in this section. The stress of working in a hot environment can cause a variety of illnesses including heat exhaustion or heat stroke; the latter can be fatal. Persona protective equipment (PPE) (i.e., Environmental Protection Agency (EPA) Level C protection [respirators]) can increase heat stress significantly. To reduce or prevent heat stress, frequent rest periods and beverage consumption to replace body fluids and salts is recommended. It should be noted that heat stress can occur in people wearing regular, permeable work clothing.

Quantitative physiological observation for heat stress may be conducted. Physiological observation for heat stress includes heart rate as a primary indicator and oral temperature as a secondary indicator. The frequency of observation depends on the ambient temperature and the level of protection used on site. To identify the initial review frequency, after a work period of moderate exertion, use the table below (source, NIOSH/OSHA/USCG/EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities):

Adjusted Temperature*	Level D	Level C
90 °F or above	After 45 minutes	After 15 minutes
87.5 to 90 °F	After 60 minutes	After 30 minutes
82.5 to 87.5 °F	After 90 minutes	After 60 minutes
77.5 to 82.5 °F	After 120 minutes	After 90 minutes
72.5 to 77.5 °F	After 150 minutes	After 120 minutes

°F – Degrees Fahrenheit

*Adjusted air temperature (°F) = observed temp + (0.13 x percent sunshine)

Observed temp = air temperature measured with bulb shielded from radiant heat.

Percent sunshine = the time sun is not covered by clouds thick enough to produce a shadow (100 percent = no cloud cover and a sharp, distinct shadow; 0 percent = no shadows).

Heart rate: Count the radial pulse during a 30-second period as early as possible in the rest period. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle one-third and keep the rest period the same. If the heart rate exceeds the 110 beats per minute at the next rest period, shorten the following work cycle by another one-third and also observe oral temperature.

Oral temperature: Use a clinical thermometer (3 minutes under the tongue), temperature strip or ear thermometer to measure the temperature at the end of the work period (before drinking). If the temperature exceeds 99.6 F, shorten the next work cycle by one-third without changing the rest period. If the temperature exceeds 99.6 F at the beginning of the next rest period, shorten the following work cycle by one-third. DO NOT allow a field team member to wear EPA Level C protection when the measured temperature exceeds 100.6 F.

Personnel will pay particular attention to the information in this section in order to recognize the symptoms of heat stress and the appropriate action to take upon recognition. Even though physiological observation is not generally necessary, it is essential that personnel understand the significance of heat stress and its recognition.

Symptoms that indicate heat exhaustion are:

- Clammy skin
- Weakness, fatigue
- Lightheadedness
- Confusion
- Slurred speech
- Fainting
- Rapid pulse
- Nausea (vomiting)

If these conditions are noted, the following steps should be taken:

- Remove the victim to a cool and uncontaminated area
- Remove protective clothing
- Give water to drink, if conscious.

Symptoms that indicate heat stroke include:

- Staggering gait
- Mental confusion
- Hot skin, high temp (yet may feel chilled)
- Convulsions
- Unconsciousness
- Incoherent, delirious

If heat stroke conditions are noted, immediately perform the following steps:

- Remove victim to a cool, uncontaminated area
- Cool the victim with water, compresses and/or rapid fanning
- Give water to drink, if conscious
- Transport the victim to the designated medical facility for further cooling and observation of body functions. HEAT STROKE IS A MEDICAL EMERGENCY!

Sunburns are another hazard of performing outdoor work. If hard hats are not necessary, team members should consider a brimmed hat and possibly neck flaps. Many weather reports now include an ultraviolet index to aid in the determination to apply sunscreen. When using sunscreen it is important to get one with a sun protection factor of about 30. Apply the sunscreen at least 30 minutes prior to going outdoors and reapply during the day. The SSO is responsible for ensuring that sunscreen is brought to the site and available for use.

It is also important to stay hydrated by drinking water and sports drinks with electrolytes to replenish salts lost through perspiration. Avoid caffeinated drinks when trying to stay hydrated because caffeine is a diuretic which is counter-productive to hydration.

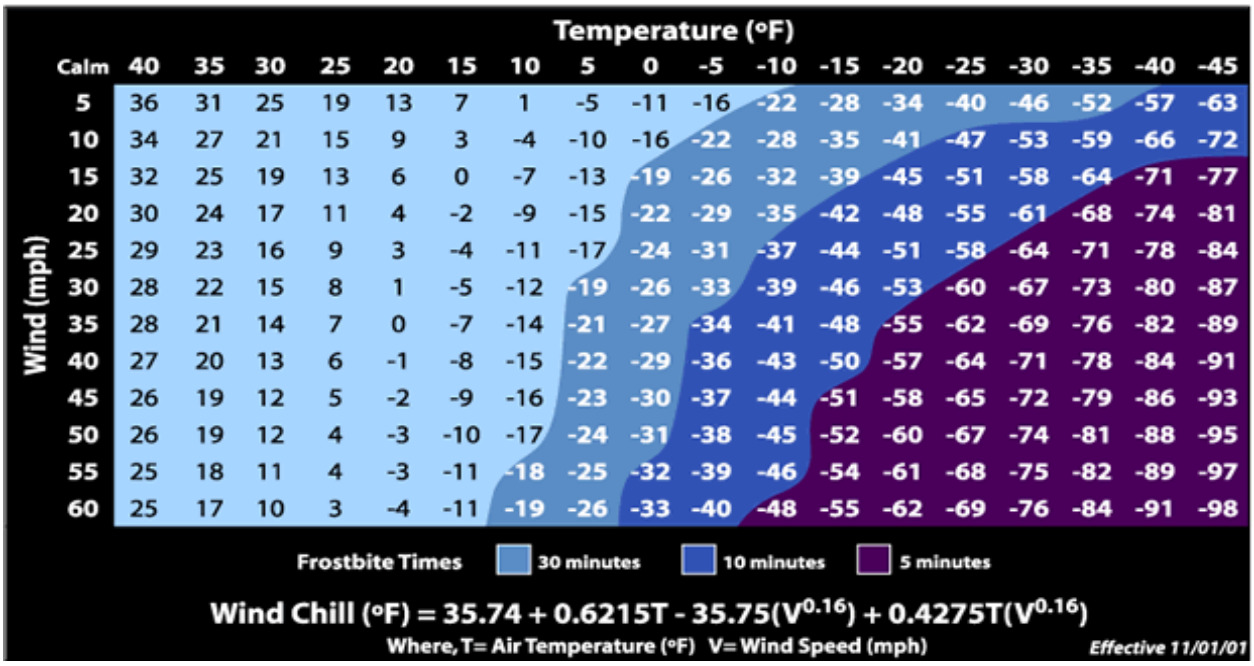
Thermal Stress - Cold

On days with low temperature, high winds, and humidity, anyone can suffer from the extreme cold. Severe cold exposure can be life threatening. Several factors increase the harmful effects of cold: being very young or very old, wet clothing, having wounds or fractures, smoking, drinking alcoholic beverages, fatigue, emotional stress, and certain diseases and medications.

Cold weather injuries may be local or systemic. Local cold weather injuries include chilblains (chronic injury of the skin and peripheral capillary circulation) and frostbite. Frostbite occurs in three progressive stages: frostnip, superficial frostbite, and deep frostbite. Systemic cold injuries, due to hypothermia, affect the entire body system. Hypothermia is caused by exposure to cold and is aggravated by moisture, cold winds, fatigue, hunger, and inadequate clothing or shelter. Precautionary measures that will be taken include the following:

- Providing field shelters or windscreens
- Observing temperature and wind speed to identify appropriate cold stress personal safety measures
- Adjusting work schedule based on weather conditions and temperature
- Providing insulated clothing for field workers
- Adhering strictly to the buddy system so that workers can assess cold stress symptoms in their co-workers
- Providing chemical hand and feet warmers
- Employees should also take common sense precautionary measures in regards to traveling in cold weather:
  - When driving, keep as full a tank of gas as possible, so the car can be run for warmth if needed
  - Carry cold weather gear (boots, gloves, hats, blankets) when traveling to stay warm in the event of an emergency
  - Keep cell phones charged

The following table provides temperature, wind, and wind chill relationships:



Field personnel must be cognizant of wind chill factors and take necessary precautions to prevent frostbite. The following are work/warm-up guidelines for working in cold temperatures and with associated wind chill factors. Please note these are only guidelines and field personnel should take warm-up breaks as often as necessary to prevent cold stress situations.

THRESHOLD LIMIT VALUES WORK/WARM-UP SCHEDULE FOR FOUR-HOUR SHIFT*

Air Temperature Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
° C (approx)	° F (approx)	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26° to -28°	-15° to -19°	(Norm breaks) 1		(Norm breaks) 1		75 min.	2	55 min.	3	40 min.	4
-29° to -31°	-20° to -24°	(Norm breaks) 1		75 min.	2	55 min.	3	40 min.	4	30 min.	5
-32° to -34°	-25° to -29°	75 min.	2	55 min.	3	40 min.	4	30 min.	5		
-35° to -37°	-30° to -34°	55 min.	3	40 min.	4	30 min.	5				
-38° to -39°	-35° to -39°	40 min.	4	30 min.	5						
-40° to -42°	-40° to -44°	30 min.	5								
-43° to below	-45° & below	Non-emergency work should cease									

Non-emergency work should cease (5 mph Wind)

Non-emergency work should cease (10 mph Wind)

Non-emergency work should cease (15 mph Wind)

Non-emergency work should cease (20 mph Wind)

*Source: Adapted from Threshold Limit Values (TLV) and Biological Exposure Indices (BEI) booklet: published by ACGIH, Cincinnati, Ohio, 2008

Frostbite Monitoring: Frostbite is a potentially crippling condition that can occur when inadequately protected skin or body parts are subjected to freezing weather. Team members should continually be alert for signs of frostbite in coworkers and bring it to the attention of the site safety officer (SSO). A cold feeling, pain, and numbness precede the onset of frostbite. Frostbite usually appears as gray or white waxy spots on skin. Areas most susceptible are nose, ears, and cheeks. The following steps should be taken to avoid frostbite:

- Dress warmly (avoid cotton, wear polypropylene, wool, Gore-Tex, or other moisture wicking materials instead)
- Wear at least three layers of clothing. An inner layer of wool, silk, or synthetic to wick moisture away from the body. A middle layer of wool or synthetic to provide insulation even when wet. An outer wind and rain protection layer that allows some ventilation to prevent overheating.
- Wear a hat or hood. Up to 40% of body heat can be lost when the head is left exposed.
- Keep boots and gloves loose fitting
- Stay dry; carry extra clothing
- Avoid touching cold metal with bare hands
- Avoid spilling cold fuel, alcohol, or other liquids that freeze below 32 °F on your body or clothing

If a person suffers frostbite, get them to a hospital as soon as possible. If transport to a hospital is not immediately available, get the person to a warm shelter and immediately perform the following:

- Cover exposed areas with additional clothing while still exposed to the elements
- Wrap the person in blankets or a sleeping bag
- Give the person warm drinks (no liquor)
- Undress the frozen part and submerge the frozen part in a tub of warm water (102 °F to 105 °F), or put the frostbitten person in a large tub of warm water, if available, and stir the water.
- Warm with skin to skin contact, such as placing warm hands on frozen nose or ears, but do not rub
- Get the person to a hospital as soon as possible

Do not allow the following to occur:

- Do not rub the frozen part
- Do not give the person liquor
- Do not allow the person to walk on thawed feet
- Do not let the person smoke
- Do not break any blisters that may form
- Do not let the thawed part freeze again
- Do not warm the frozen part in front of a source of dry heat (e.g., open fire or oven)

Hypothermia Monitoring: Hypothermia is a lowering of the body's temperature due to exposure to cold or cool temperatures. Team members should continually be alert for signs of hypothermia in co-workers and bring it to the attention of the SSO. Most cases of hypothermia occur at temperatures between 30 °F and 50 °F. If not properly treated, hypothermia can cause death. Safety equipment for hypothermia should include a synthetic sleeping bag and a hypothermia thermometer. HYPOTHERMIA IS A MEDICAL EMERGENCY! Transport to a hospital as soon as possible, even if victim appears to be recovering.

To prevent hypothermia:

- Eat well prior to exposure.
- Dress warmly (avoid cotton, wear polypropylene, wool, Gore-Tex, or other moisture wicking materials instead).
- Avoid becoming wet due to sweating, rain or snow, or falling in water.

Early signs of hypothermia may include:

- Violent shivering.
- Slurred speech.
- Decrease in coordination.
- Confusion, inability to answer simple questions.
- Unusually irritable behavior.
- Strange behavior.
- Tendency to drop or lose clothing or equipment.

As hypothermia progresses into more serious stages, victims typically:

- Develop trouble seeing clearly.
- Become sleepy and numb.
- Move with difficulty.
- Eventually become unconscious if not properly cared for.

The following actions should be taken to treat a hypothermia victim:

- Get the victim to a warm, dry shelter as soon as possible
- Remove any wet or cold garments and dry the person thoroughly
- Wrap the victim in blankets, sleeping bags, or dry clothing to prevent more heat loss
- If a warm area is not available:
- Build a shelter and put the victim in the warmest, driest area available
  - » Remove any wet or cold garments
  - » Have one or more persons remove their clothing and lay next to the victim, providing skin to skin contact
- Wrap the victim and rescuers in dry warm blankets, sleeping bags, or clothing
- When the victim becomes conscious, place warm objects along the victim's sides to warm vital areas.
- When the victim is able to swallow easily, provide warm, sweetened drinks and food (preferably candy or sweetened food)
- Do not give the victim alcohol or allow smoking
- Do not rub the victim's skin

Keep checking the victim and give additional assistance as needed

3.2.2 Slips, Trips, and Falls

The most common hazards that will be encountered on a jobsite will be slips, trips, and falls. Common sense will be used to avoid these hazards. When working on slippery surfaces, tasks will be planned to decrease the risk of slipping. Slippery surfaces will be avoided, work and travel will not be hurried, and good housekeeping will be

maintained. It is not advisable to walk and talk on a cell phone at a job site, if possible. It is also not advisable to text while walking on a job site. Personnel must vigilantly observe where they are working and walking to avoid slips, trips, and falls.

3.2.3 Vehicular Traffic

Another common hazard that will be encountered at many sites will be vehicle traffic, including cars, trucks, drilling rigs and heavy machinery. When it is necessary to move a vehicle, site drivers must be mindful that pedestrians are present on site. If appropriate, site personnel on foot may guide site drivers while moving vehicles to alert and protect non-site personnel. Site personnel on foot must avoid standing in blind spots or in high traffic areas, be aware of vehicle locations, and make eye contact with site drivers if crossing the path of vehicles is necessary. Site personnel on foot must vigilantly observe where they are working and walking to avoid being struck by vehicles which, for one reason or another, are moving. Finally, when working in high traffic areas (e.g., on the edge or in the middle of city streets, heavily used parking areas) site personnel should use the following equipment and procedures:

- Place the vehicle between site personnel and oncoming traffic.
- Place a "Worker" sign at least 75-100 feet behind the vehicle and one 75 feet in front of the vehicle.
- Place two large orange cones between each of the "Worker" signs and the vehicle.
- Place the portable yellow strobe light on top of the vehicle and turn it on.
- Wear the high-visibility safety vests with reflective tape.
- Try to keep equipment and personnel within the width of the vehicle.

Work performed in rail yards or along railroad tracks poses an additional hazard. Numerous incidents have occurred when working between or alongside rail lines and have resulted in serious injury or death. Therefore, the following rules should be followed when working near rail lines:

- It is best to not walk or step on a railroad track; tracks can be slick and injury due to slipping off a track is possible.
- It is best to not run over tracks - Walk; tripping injuries can occur when running over the tracks which can result in serious head injuries.
- It is best to not stand between the tracks; when necessary, walk across the railroad tracks and stand to one side or the other of a rail line.
- Wear a hard hat, eye protection, steel-toed boots, and an orange reflective vest for personal protection.

In addition to these rules, whenever work is done near railroad tracks or in a railroad right-of-way, the railroad company must be contacted and a flagman requested to observe work activities. No work will be done without a railroad flagman being present unless the railroad company expressly permits it.

3.2.4 Hunting Season

It is possible field activities will be conducted during hunting seasons and may pose a risk to site workers. The hunting season dates will be reviewed prior to conducting field activities in non-urban areas. During hunting season, site workers will wear at least 50% of the outer clothing above the waist in 100% blaze orange (faded blaze orange is not acceptable) to alert potential hunters to their presence. If site work is performed in densely vegetated locations, site personnel may post signs along access locations to indicate their presence.

3.2.5 Exposure to Excessive Noise

Overexposure to noise can result in hearing loss. If it is difficult to hear normal speech when the speaker is 3 to 4 feet from the listener, and that condition is present for more than four hours a day, it will be assumed that the

noise level exceeds 85 decibels (dBA) and appropriate hearing protection will be used. The disposable "ear plug" type hearing protectors are recommended.

3.2.6 Chemical Hazards

PPE requirements are stated in Personnel Protection Section 5 of this Plan. Material Safety Data Sheets (MSDSs) for suspected contaminants present at a site are contained in Appendix A.

3.2.7 Biological Hazards

During warm weather months, potential biological hazards include venomous insects, snakebites, and poisonous plants. Appropriate safety measures, such as the use of insect repellent (with DEET) and probing of possible nesting areas, will be taken to prevent exposure to biological hazards.

Ticks are common in wooded and heavily vegetated areas in spring summer, and fall in the Midwest. The deer tick, also known as a bear tick or a blacklegged tick, is much smaller than the wood tick. Adults are about 1/8 inch long and reddish-brown in color. They live in the woods and are common along trails. Deer ticks crawl, rather than jump, so are most likely to come into contact with humans as they brush against low-lying vegetation.

Wood ticks are a type of hard tick. Male wood ticks have mottled gray backs. Females have gray coloration behind their heads. They are found in both grassy and wooded areas. Both wood ticks and deer ticks can occasionally cause illness in their hosts. The deer tick can sometimes carry Lyme disease, a serious illness which can cause a rash, fever, tiredness, and flu-like symptoms. Wood ticks can carry Rocky Mountain spotted fever, a rare but sometimes serious illness that causes a rash and severe flu-like symptoms. At the end of the day personnel should do a self-review for ticks to remove them. Pulling them off with tweezers works the best. Grab the tick as close to the skin as possible and pull upward with a slow steady pressure. Try not to leave the head or any mouth parts of a tick imbedded in the skin as it can transmit diseases.

Poison ivy, poison oak, and poison sumac release oil (urushiol) when the leaf or other plant parts are bruised, damaged, or burned. When the oil gets on the skin an allergic reaction, referred to as contact dermatitis, occurs in most exposed people as an itchy red rash with bumps or blisters. When exposed to 50 micrograms of urushiol, an amount that is less than one grain of table salt, 80 to 90 percent of adults will develop a rash. The rash, depending upon where it occurs and how broadly it is spread, may significantly impede or prevent a person from working. Although over-the-counter topical medications may relieve symptoms for most people, immediate medical attention may be recommended for severe reactions. Long sleeves and pants will provide protection from contact with poisonous plants and insects. Field personnel should familiarize themselves with poison ivy, poison oak, and poison sumac. Care should be taken to avoid contact with poisonous plants.

3.2.8 Thunderstorms and Rain

Drilling/excavation and sampling activities during electrical storms poses a hazard of electrocution by a lightning strike, and adverse working conditions, as well as high winds tipping the drill rig. Drilling/ excavation and sampling activities will stop and the drilling rig mast will be lowered at the approach of a thunderstorm. Drilling activities during rainstorms can cause not only slippery conditions but also excess friction on cathead pulleys. This can cause dangerous conditions during drive sampling operations. Therefore, drive sampling operations will cease and, depending on the PHSO's assessment, drilling may be halted.

When drilling or using excavating equipment, if lightning is seen or thunder is heard, regardless of the distance, drilling and excavation operations must be temporarily shut down. If possible, the mast on the rig should be lowered and connection with the drill pipe in the ground broken. Operations may not resume until threat from lightning is over, which is at least 30 minutes after the last observed lightning or thunder. Lightning strikes are possible up to 10-miles from an obvious storm front. It is recommended to check local radar images to identify if other storms are following the one that shut operations down before resuming drilling.

3.3 RISK ANALYSIS-TASK-BY-TASK

Table 1. Anticipated Task Hazards

Table 1. Anticipated Task Hazards

	Hazards													
					Physical									
	Chemical	Biological	Explosive	General Safety	Heat	Cold	Traffic	Noise	Slips, Trips, Falls	Heavy Equipment	Underground	Overhead Power	Trench Excavation	
Site reconnaissance/field mobilization	X	X	X	X	X	X	X	X	X	X	X		X	
Well and borehole drilling	X	X	X	X	X	X	X	X	X	X	X	X	X	
Monitoring well development	X	X		X	X	X	X		X					
Groundwater level measurements	X	X		X	X	X	X		X					
Groundwater and soil sampling	X	X		X	X	X	X		X					X
Test pits and excavation	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Surface water and sediment sampling	X	X		X	X	X	X	X	X	X			X	
Sampling solid material, wipe sampling, surface sampling	X	X		X	X	X	X	X	X	X	X	X	X	
Sampling through ice	X	X		X		X	X	X	X	X			X	

3.3.1 Well and Borehole Drilling

In addition to the possibility of contact with the above listed chemicals, physical hazards associated with well and borehole drilling includes:

- Snapping cables
- Brush and equipment fires
- Being hit by equipment
- Being caught in rotating tools
- Falling objects

- Exposure to excessive noise
- Contact with energized electrical lines

3.3.2 Air Rotary Drilling

This type of drilling, in addition to the above listed hazards, may also expose field personnel to blowing dust and high-pressure airlines.

3.3.3 Groundwater, Seep, Soil, and Pipe Sampling

Collection of these samples presents inhalation and, direct skin contact hazards with the substances listed in Appendix A.

3.3.4 Drilling/Excavation near Overhead Electrical Lines

Drilling or excavation activities near overhead electrical lines present a serious electrocution hazard. Safe work distance must be maintained. This distance is a function of the humidity and the voltage present. Should work in the proximity of overhead lines be indicated, a reasonable clearance will be identified based on OSHA standards as follows:

- Lines rated 50kV or below - usual clearance between the lines and any part of the crane or load shall be 10 feet. (1926.550(a)(15)(i))
- Lines rated over 50 kV - usual clearance between the lines and any part of the crane or load shall be 10 feet plus 0.4 inch for each 1 kV over 50 kV, or twice the length of the line insulator, but should not ever be less than 10 feet (CFR 1926.550(a)(15)(ii)).
- Safe working distances are as follows:
  - Power line 51,000 to 138,000 volts - work at least 11 feet away
  - Power line more than 230,000 volts - work at least 13 feet away
  - Power line ≥500,000 volts - work at least 18 feet away

Note that humid or wet conditions (rain) are conducive to potential arcing from power lines to the piece of equipment. It is not advisable to work near power lines during humid or wet conditions.

3.3.5 Drilling/Excavation near Underground Electrical/Utility Lines

Buried electrical/utility lines present a hidden danger while drilling/excavating. The subcontractor will be responsible for contacting the local underground utility locator service (call 811 nationally for state one call system); however, it is the responsibility of the Ramboll PM or PHSO to try to ensure that the subcontractor has contacted the appropriate locator service to try to ensure that site activities can be completed in accordance with the schedule. The locator service will mark underground lines to try to ensure safe working conditions. Drilling/excavation will not occur until the site is properly marked. Drilling/excavation will not occur within three feet of any marked utility.

3.3.6 Test Pits and Excavation

Test pits and excavations pose a serious threat of injury resulting from falls or excavation wall collapses. During excavation or digging activities an exclusion work zone will be established around excavating machinery. Bystanders and on-lookers will be prohibited from entering this work zone while the excavating machinery is in operation. The work zone will be large enough so that the excavating machinery (e.g., trackhoe) can rotate 360-degree without extending out of the work zone. After the excavation is completed it should either be backfilled immediately or the entire excavation will be encircled with a physical barrier (e.g., barricades, orange excavation fencing), which will limit access to the excavation and decrease the likelihood of injury resulting from falls. Any excavation greater than four feet deep will NOT be entered unless the walls of the excavation have been reinforced to prevent wall collapse. Entry into any excavation greater than four feet deep will constitute a confined space entry procedure. Therefore, no excavation entrance is allowed.

A photoionization detector (PID) may be used to observe air quality in the breathing zone of the work area for volatile organic compound (VOC) vapor levels and in an excavation (See Section 7 of this plan) if VOCs are anticipated to be present. Prior to Contractor Personnel entering any excavations to install piping or any other equipment, the PID will be lowered into the excavation to identify air quality in the excavation. Depending on the potential hazards present additional air monitoring may include, oxygen levels, lower explosives limit, sulfide, carbon monoxide, and cyanide. Confined spaces will not be entered.

3.3.7 Operations on Surface Waters

The procedures specified in this subsection are designed to protect Ramboll staff when conducting work activities involving water craft vessels on surface waters. Governmental laws and regulations regarding onshore waters are under the jurisdiction of the Unites States Coast Guard (USCG) and the state regulatory agency and its regulations will be adhered to. It is Ramboll's standard practice to work in pairs, deviations will be addressed in site-specific work plans.

3.3.7.1 Scope and Applicability

The procedures specified in this subsection apply to work activities involving surface waters (including sediment sampling). The highest ranking Ramboll staff member (e.g., Project Manager, Field Task Leader) at the work site is responsible for implementing this plan. The work activities will not be initiated prior to receiving approval from the PM.

- Work activities can be conducted in "open water" or "ice" conditions.
- Each Ramboll staff person at the site is responsible for following these procedures.

3.3.7.2 Water Craft

The following procedures will be observed when Ramboll staff conducts work activities in "open water" conditions in a water craft vessels (including drill rigs mounted on barges):

- Work will not be initiated prior to meeting approval from the PM.
- Work activities conducted on surface waters will be conducted in accordance with the requirements of the USCG and the appropriate state agency. This includes and operable fire extinguisher and navigation lights. An emergency flare kit is mandatory on waters of the Great Lakes and is recommended for other waters; ensure the flare kit is not expired.
- Personal Flotation Devices (PFD) that is USCG approved must be worn at all times when on surface waters. The PFD must be properly securely fastened. There should be one adult size PFD (wearable style) for every person on the water craft.
- One "throwable" flotation device with attached line must be on board.
- Distribute weight evenly across the beam of the watercraft.
- Only allow one person to stand at a time in a small watercraft vessel.
- Do not exceed manufacture's capacity plate load limits.
- Attach a lanyard or safety line which can be tied to the sampling personnel when water surface conditions are rough. This will enable easier retrieval of the person should he/she fall over the side of the water craft.
- Check running condition of the outboard motor prior to launching (e.g., ample supply of fuel/oil mix, fuel line condition, integrity of the propeller, extra sheer pins for the propeller, if appropriate).
- Equipment to have on board include oars, anchor with line (at least100 foot line on inland waters) and mooring lines of adequate length.
- Wear work gloves when using equipment that could injure hands.
- Wear hard hat if overhead hazards exist (e.g., A-Frame, use of long coring devices).

- Secure overboard equipment to vessel.
- Use proper lifting techniques when retrieving heavy equipment.

3.3.7.3 Shallow Water

Site-Specific Work Plan and the site reconnaissance will evaluate the best approach to sampling in shallow water. If wading is necessary, work activities in shallow water along the shore line shall consider the following hazards:

- Use waders to minimize exposure to water, sediment contaminant exposure and heat loss.
- Add a statement that PFD is needed when X feet from shore… RHW shared Brennan has this in their work plans for reference
- Proceed carefully – water currents and falling can cause the waders to fill creating a very serious condition. In addition to wearing a PFD, a safety line should be tethered to the person walking in water currents.
- Fatigue can occur more rapidly from walking through the water.

3.3.7.4 Sampling Through Ice

Collection of samples through frozen rivers/lakes presents the difficulties of working on ice. Precautions for slips, trips, and falls will be observed. Ice thickness will be at at least 9-inches thick before work activities will commence.

The following procedures will be observed when Ramboll staff conducts work activities on "ice" conditions:

- Work activities will not be initiated prior to meeting approval from the Environmental Health & Safety Manager (EHSM).
- Know the ice (e.g., thickness) and proceed with extreme caution. Ice thickness at least should be 18 to 24 inches (when conducting drilling operations) and reviewed for integrity. Check ice thickness regularly when traversing across ice to see if adequate support exists. Be especially cautious when approaching pressure cracks, areas of open water or areas of rivers where water velocity may be higher.
- Wear PFDs while aboard any water craft.
- Warm weather causes ice thinning and potential for slipping (drilling holes on thinning ice can cause flooding of ice surface and can accelerate ice thinning and breakage).
- Equipment may need to be hauled between work stations (use sleds).
- Fatigue can occur from walking and drilling holes.

Based on water currents, water temperature and the amount of clothing worn by Ramboll staff, the threat of being swept downstream or drowning is possible. Extreme caution must be used when conducting these types of work activities. If a Ramboll staff employee should fall into the water, the employee will be retrieved and necessary precautions shall be taken to in effort to see to the safety and wellbeing of that individual. Work activities will be immediately suspended and the person brought to shore. Wet clothing shall be removed and the person shall be dried and dressed in a set of dry clothes. If the possibility of hypothermia exists, seek medical attention immediately.

Persons sampling contaminated or potentially contaminated materials should wear the same PPE as listed for monitoring well sampling. The recommended PPE will be carried along on the sediment sampling water craft. PPE can add to heat stress during warm conditions and can cause decreased mobility dexterity.

3.3.7.5 Subcontractors

It is the responsibility of the PM to require subcontractors assisting in the work activities, to adhere to state and federal governmental laws and regulations related to onshore and inland waters. Any refusal on behalf of the subcontractor will mandate shutdown of the project.

4 PERSONNEL TRAINING REQUIREMENTS

4.1 GENERAL

Ramboll and subcontractor employees performing field work on this project should have appropriate safety training as specified in the OSHA Standards, particularly the HAZWOPER Standard 29CFR1910.120. Ramboll personnel performing fieldwork on this project must meet the necessary general training requirements. Subcontractors are responsible for supplying Ramboll's PM with written statements stating that their project personnel meet the necessary general training requirements.

4.2 SITE-SPECIFIC

Site-specific hazard and hazard management information is contained in this health and safety plan. Ramboll personnel will be provided with a copy of this plan prior to the beginning of fieldwork. Each person will be need to "sign off" that they have read, understood, and will follow the procedures set forth in the plan.

4.3 INFORMATIONAL BRIEFINGS

It is the responsibility of each Ramboll staff member in charge field operations to keep their crew members appraised of site conditions relative to health and safety, and of any approved modifications to the plan. This will be accomplished through ongoing daily "tailgate" safety meetings. Ramboll personnel are should to report injuries, illnesses, and unsafe conditions to their immediate supervisor. The supervisor will then report in writing any such accidents to the HSM, PM and PHSO within 24 hours of occurrence.

5 PERSONAL PROTECTIVE EQUIPMENT

Listed in the health and safety plan summary at the very beginning of this plan are hazardous substances that have been found or are suspected to be present at the site. Hazardous substances may be found in air, soil, sediment, surface water and/or groundwater. Common routes of exposure include inhalation, ingestion, and absorption. Proper PPE should be worn when applicable.

5.1 DRILLING/EXCAVATION/INSTALLATION OF WELLS

Persons handling contaminated or potentially contaminated equipment, soils, sediment, or groundwater must wear the following PPE:

- Long sleeve coveralls (light or heavy weights subject to ambient temperature)
- Bib style rain pants where wet operations exist
- Nitrile gloves
- Vinyl gloves for sample handling
- Safety glasses with side-shields (SHOULD BE WORN AT ALL TIMES)
- Hard hat (SHOULD BE WORN AT ALL TIMES)
- Steel-toed boots (SHOULD BE WORN AT ALL TIMES)
- Reflective orange vest (as needed)
- Hearing protection (as needed – see note below)

NOTE: Guidance on the requirements of ear protection is as follows: if you must raise your voice to converse with persons three feet away from you, you are probably being overexposed to noise. This roughly equates to being exposed to over 85 dbs of noise for greater than a 4 hour period. In these instances, the wearing of hearing protection is recommended. The muff or "EAR" type disposable earplugs will suffice.

5.2 GROUND/SURFACE WATER AND SOIL/SEDIMENT SAMPLING

Persons sampling contaminated or potentially contaminated materials, soil, sediment, or water must wear the following PPE:

- Long sleeve coveralls (light or heavy weights subject to ambient temperature)
- Bib style rain pants where wet operations exist
- Nitrile gloves
- Vinyl gloves for sample handling
- Safety glasses with side-shields
- Steel-toed boots
- Hearing protection (as needed)

Persons whose skin or inner clothing comes in contact with contaminated soils or liquids should remove such clothing, shower or clean as appropriate, then re-suit for continued work activities.

NOTE: Outer gloves should be changed or decontaminated between samples if contact to the sample occurs. This will preserve sample integrity.

6 MEDICAL SURVEILLANCE REQUIREMENTS

The hazardous substances known or suspected to be present at the site are not known to produce injury or illness that would not be detected by the medical examination specified in the Ramboll Standard Practices Manual, Section 6, Health and Safety, Number 06-10. The medical monitoring program established in this section of the Standard Practices Manual complies with OSHA guidelines regarding and necessitating medical monitoring in the work place.

7 FREQUENCY AND TYPES OF AIR MONITORING/SAMPLING

7.1 SITE AIR MONITORING

A PID and possibly a combustible gas indicator (CGI) may be used to measure air contaminant concentrations in the breathing and work zones if indicated in the Health and Safety Plan Summary. Readings are to be recorded on the logs and in the project logbook. The PID will be calibrated per the air monitoring action plan below. If a CGI is also used to detect combustible conditions at the work site, the monitoring will also follow the plan below.

7.2 SAMPLING AIR MONITORING

A PID may be used to measure air VOC concentrations at the well head or soil sample location during sampling or drilling operations if indicated in the Health and Safety Plan Summary. If measurements are collected, they should be recorded in the project logbook. These measurements may be used to upgrade or change PPE requirements and/or the methods of performing the work. The PID will be calibrated at the start of each day of use. Air monitoring should follow the action plan below.

7.3 AIR MONITORING ACTION PLAN

A PID will be calibrated and checked at least three times per day: 1) before work activities begin; 2) during lunch break or approximately half way through the working day; and 3) following work activities at the end of the day. These calibration checks will be used to try to ensure accuracy of VOC readings. Calibration procedures will follow those outlined in the PID manual and Ramboll's SOPs and typically use isobutylene as the calibration gas.

The PID will be used to observe air quality in the breathing zone of the work area for the presence of VOC vapor levels if indicated in the Health and Safety Plan Summary. Prior to Contractor Personnel entering any excavations to install piping or any other equipment, the PID will be lowered into the excavation to identify air quality in the excavation. Confined spaces will not be entered. Besides using the PID to observe VOC vapors in the breathing zone, an oxygen meter and/or a CGM may also be used. The oxygen meter may be used to measure percent oxygen in any excavation and the CGM may be used to measure the explosive limit. Calibration of the combustible gas meter is necessary based on use to promote accuracy.

The VOCs "action level" for unknown contaminants is considered when a reading is sustained on the PID when the PID is held at a constant height, whether in the excavation or the breathing zone. If specific compounds are known to exist at the site (i.e benzene, vinyl chloride trichloroethene) actions levels will be set for the specific compound present or if several compounds are present the most conservative action level will be used. Use of either full-face or half-face respirators utilizing Organic Vapor cartridge filters will be needed to reach the VOC action level. Additionally, further air quality monitoring will be necessary to try to ensure that the PID readings do not exceed the upper limit. This will be done by the recommendation of the Ramboll PHSO who will identify specific modifications to work practices and PPE requirements. Draeger tubes or a compound specific meter may be used to identify specific compounds present onsite. If it is concluded that a specific compound is not present the PID screening action level may be changed for the specific compound present. In addition, if engineering measures at the site (i.e. ventilation, moving upwind, use of foam or other cover) mitigates the PID readings to below the action levels than respirators will not be necessary. Refer to Appendix C for the respirator use flow chart.

If the upper limit is achieved, activities on the site will immediately stop. The Ramboll PM will be contacted prior to taking any further action on the site, unless a situation exists which needs immediate action. Options such as nitrogen purging will be considered based on the most current information available.

It should be noted that action levels are identified by the contaminants present (if known). For example the action level for known petroleum contaminants (gasoline or diesel fuel) may be as indicated in the preceding paragraph. However, if chlorinated solvents are suspected to be present with much lower threshold limit values than petroleum contaminants then the action levels would be adjusted to lower values.

8 SITE CONTROL MEASURES

8.1 BUDDY SYSTEM

Each worker will maintain visual contact with another worker. The buddy system will try to ensure against an employee becoming stressed with a co-worker being aware of his or her condition. Workers should watch out for each other while working close to potential chemical and physical hazards. For example, work in the exclusion zone should be scheduled so that no employee works alone in this zone at any time.

8.2 SAFE WORK PRACTICES

To prevent accidental ingestion of chemical contaminants, the following rules must be compiled with when working within the exclusion/contamination reduction zones, and when taking or handling samples.

- No eating, drinking, or smoking is allowed at work locations.
- No fires are allowed at work locations unless approved by the Project Health and Safety Officer on a site-specific, task-specific basis. If fires or propane torches are used, fires will be maintained away from potential ignition sources and site personnel will not leave the fire unattended and a fire extinguisher will be immediately available.
- Ramboll and contractor personnel must wash their hands, arms, face, and neck immediately after leaving the exclusion/contamination reduction zones. This must also be done after taking samples and prior to eating, drinking, smoking, or using the restroom.

8.3 WORK ZONE DEFINITION

Work crews, whether drilling, excavating, or performing other activities, must prevent the uncontrolled movement of contaminated or potentially contaminated soil, water, PPE, and equipment. Soil and water removed from its natural setting should be considered contaminated unless proven otherwise by chemical analysis or specifically known to be clean material in which verification sampling is occurring. This is also the case for PPE and equipment which either must be decontaminated or disposed. Work crews will prevent migration of contaminated materials by establishing work zones and decontamination procedures. Work zones will be delineated. Only persons certified as having the necessary training and medical qualifications will be allowed in the Exclusion Zone (EZ) or Contamination Reduction Zone (CRZ). The following describes the zones to be established during drilling or excavation:

- Exclusion Zone – An EZ will be established surrounding the drilling or excavation site, if necessary and is the area where contamination does exist or could occur. The EZ will comprise an area of at least as large as a circle having a diameter equivalent to one half the mast height of the drilling equipment or arm of excavating equipment. The size and shape of the EZ will be identified by the PHSO. No personnel will be permitted in the EZ unless they are in full compliance with the site health and safety plan.
- Contamination Reduction Zone - This is the transition area between the exclusion zone and the support zone. It is the area where the decontamination of equipment and personnel takes place. Its purpose is to keep the support zone free of contamination.
- Support Zone: The support zone is the area free of contamination. People wear normal work clothes in this area. The personnel in this zone are responsible for organizing off-site emergency response teams in the event of an emergency.

8.4 DAILY START-UP AND SHUTDOWN PROCEDURES

The following protocols will be followed daily prior to the start of work activities:

- The PHSO will review site conditions to determine if modifications of the work and safety plans are needed.

- Personnel will be briefed and updated at the daily tailgate safety meeting on any new safety procedures based on the previous day's findings and the planned work activity for that day.
- Safety equipment will be checked for proper function.
- The PHSO will try to ensure that the hospital route map and first aid equipment are readily available.
- The PHSO will initiate appropriate observation.

The following protocol will be followed at the end of daily operations and before breaks:

- Personnel will proceed through appropriate decontamination procedures and facilities.
- The work site will be left clean. Drums will be properly labeled and staged.
- All PPE must be removed prior to eating, drinking, smoking, or using the restroom.
- Equipment will be decontaminated and properly stored.

8.5 EQUIPMENT

Drilling rigs and heavy equipment should be reviewed at the start of each day to detect equipment problems. Particular attention should be paid to cables and hydraulic lines. Examine them for evidence of stretching, fraying and cracking. The fuel system and hydraulic system should be in good repair (free from leaks) to avoid the potential for fire or explosion. Kill switches should be tested and functioning properly. The drill rig and heavy equipment should be equipped with or have stationed in the area two 20-pound type BC fire extinguishers.

8.6 DRILLING/EXCAVATION AREA

The drilling/excavation area should be located away from overhead electrical lines. The location of buried water, storm and sanitary sewer, electrical, telephone, and gas utility lines must be identified and marked by the authorized personnel. Slope of terrain, stability of embankments, soil load bearing ability, etc. should be evaluated in selection of the drilling/excavation locations.

In addition, a “competent person” as defined by CFR 1926.650 (b) must be designated for excavation safety at the site:

- Competent person means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them

The designated competent person has the abilities described above either through onsite experience, classroom training or the combination of both.

9 DECONTAMINATION PLAN

9.1 DECONTAMINATION PROCEDURES

Personal decontamination will be accomplished by using good personal hygiene. Personal contamination should not occur if the protection methods specified in this plan are used. However, the following procedures must be complied with to try to ensure that contamination does not remain on equipment, sample containers, or in contact with personnel.

- While in the EZ clean gross contamination off equipment by scraping or brushing. Collect contaminated soil with the drill cuttings and transport the cuttings in an appropriate manner to the staging area on site (e.g., placed in DOT approved 55-gallon drums).
- If steam cleaning of equipment is necessary it will occur at the designated area on site. If capture of decontamination water is necessary, it will be placed in DOT approved 55-gallon drums.
- After equipment and sample container decontamination is accomplished, drilling crewmembers must remove PPE before leaving the CRZ. PPE must be removed in a step-wise fashion to prevent contamination of work clothing, as follows:
- Remove contaminated soil from work boots and remove protective clothing for decontamination or disposal. If disposable PPE is used, it should be placed in an open top drum designated for that purpose. A lid should be placed on the drum after usage. Drummed material will be labeled identifying contents and the date filled.
- Remove and wash outer gloves and hard hat. Place disposable gloves in a collection bag.
- The use of respiratory protection is not anticipated. If a respirator must be used or otherwise removed from its containers, wash it down and take it with you as you exit the CRZ.
- Final daily decontamination will be reviewed by the PHSO to ensure that no contaminated articles are accessible to the public. Therefore, disposable PPE and other miscellaneous garbage will be stored in a drum with a secured lid.

After leaving the CRZ, and before eating, drinking, smoking, or using the restroom, personnel must wash their hands, arms, face, and neck. In addition, personnel should take a full-body shower at the end of the workday. A full-body shower includes the use of a wash cloth to scrub the skin.

9.2 WASTE STORAGE AND DISPOSAL

Since soil and water removed from its natural setting is considered potentially contaminated, these materials will be stored and disposed of according to the guidelines established in the Work Plan for the site. If no guidelines have been established in the work plan for storage and disposal of these investigative wastes, the procedures outlined in Ramboll Standard Practices Manual, Section 6, Health and Safety, Number 06-07.

Waste container contents and identification will be made in the field log for future reference. The number of containers will be counted and assessed for the amount of content present in each (1/2 full, full). All Containers will be distinctly labeled using a paint pen or marker. The drum labels with have at least the following information:

- Company name
- Date contents added to drum
- Contents of drum (soil, water, PPE)
- Well or soil boring identification (MW-1 or SB-1)

10 EMERGENCY ACTION PLAN

10.1 MEDICAL EMERGENCIES

In the event of a medical emergency, the following procedures should be used.

1. If serious injury or life-threatening condition exists, call 911. Clearly describe the location, injury, and conditions to the dispatcher. Designate a person to show emergency responders to the injured person(s).
2. Call the project manager.
3. Implement steps to prevent the reoccurrence of the accident.

10.2 CHEMICAL EMERGENCIES

1. If serious injury or life-threatening condition exists, call 911. Clearly describe the location, injury, and conditions to the dispatcher.
2. Evacuate other on-site personnel to a safe place in an upwind direction until it is safe for work to resume.
3. Call the PM.
4. If necessary contact clean-up contractor.
5. If release requires contacting government agencies the PM makes the appropriate calls (PM also contacts Client).

10.3 GENERAL EMERGENCIES

In the case of fire (other than a managed pre-approved fire, discussed in Section 8.2), flood, explosion, spills, severe weather, tank or pipe punctures, or other hazard, work shall be halted and if applicable, 911 called. On-site personnel will immediately be evacuated to a safe place.

10.4 ACCIDENT REPORTS AND FOLLOW UP

Accidents, including those that do not result in injury or illness, are to be reported verbally to the PHSO or the PM immediately, with written documentation within 24 hours of their occurrence. The report form is included as Appendix B. The policy specified in the Ramboll Standard Practices Manual, Section 6, Health and Safety, Number 06-12 regarding notification of the HSM, PHSO or PM will be followed.

11 CONFINED SPACE ENTRY PROCEDURES

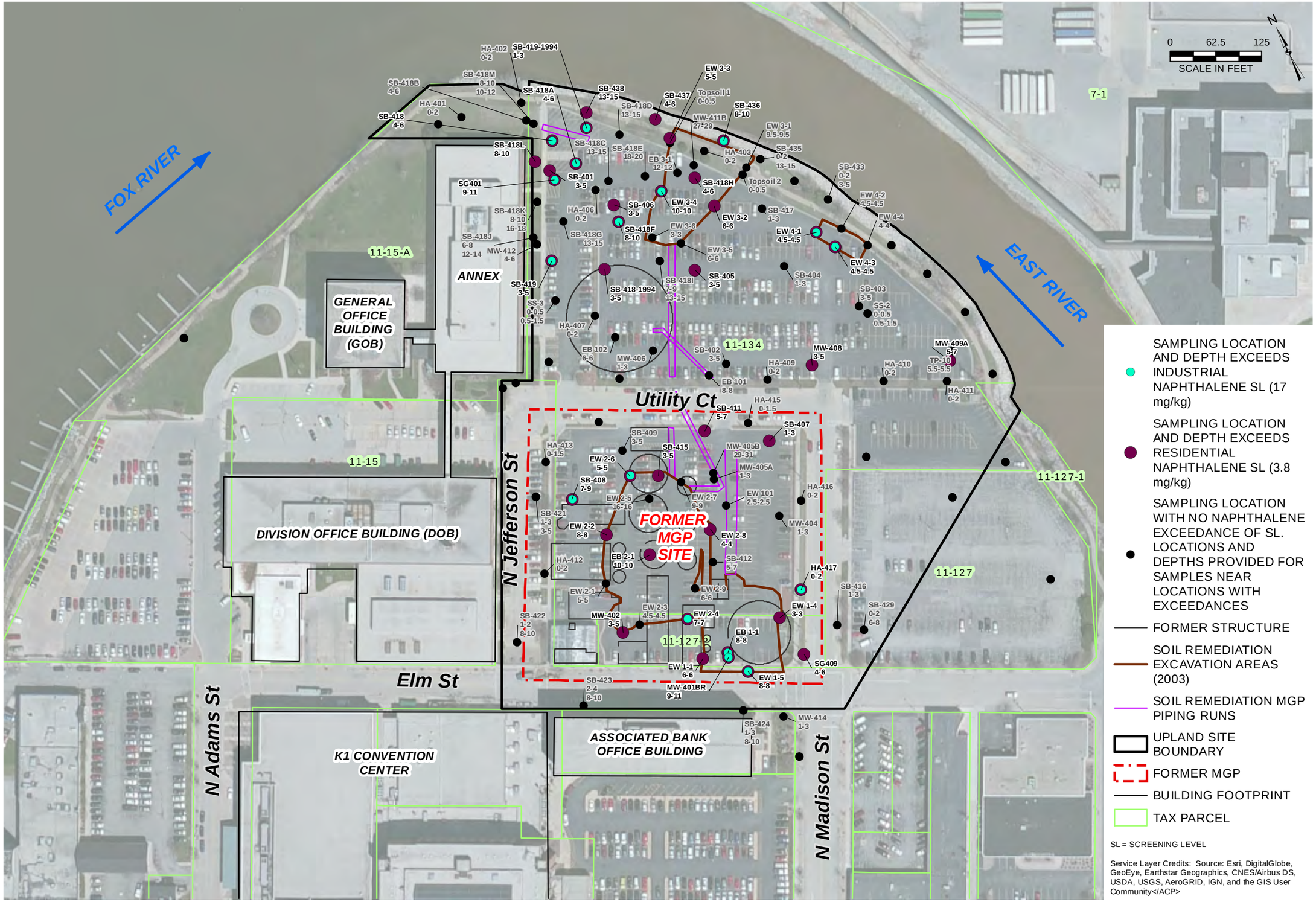
No confined spaces (or the need to enter a confined space) are anticipated at the site; however, should such an issue arise (or become anticipated at a particular site), it will be addressed in the site specific work plan. Only properly trained individuals may enter or be an attendant for confined space entry and only after a confined space permit has been completed.

12 SPILL CONTAINMENT PROGRAM

No potential spill situations are anticipated on the site; however, if there is an accidental release of potentially hazardous materials or waste (e.g., spilled purge water or soil cuttings, ruptured hydraulic line), site personnel will:

- Contact the HSM, Project Health and Safety Officer and Project Manager
- Contain the spill, if it is possible and it can be done safely
- Initiate cleanup
- Report the spill to the proper authorities if the reportable quantity has been exceeded for a particular compound

APPENDIX D
REMEDIAL INVESTIGATION DATA SUMMARY PACKAGE – SELECT FIGURES AND TABLES



SAMPLING LOCATION AND DEPTH EXCEEDS INDUSTRIAL NAPHTHALENE SL (17 mg/kg)

SAMPLING LOCATION AND DEPTH EXCEEDS RESIDENTIAL NAPHTHALENE SL (3.8 mg/kg)

SAMPLING LOCATION WITH NO NAPHTHALENE EXCEEDANCE OF SL. LOCATIONS AND DEPTHS PROVIDED FOR SAMPLES NEAR LOCATIONS WITH EXCEEDANCES

FORMER STRUCTURE

SOIL REMEDIATION EXCAVATION AREAS (2003)

SOIL REMEDIATION MGP PIPING RUNS

UPLAND SITE BOUNDARY

FORMER MGP

BUILDING FOOTPRINT

TAX PARCEL

SL = SCREENING LEVEL

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community</ACP>

DRAWN BY/DATE: SDS 10/12/16
REVIEWED BY/DATE: PRB 10/-/16
APPROVED BY/DATE: BGH 10/-/16

POST REMEDIATION NAPHTHALENE RESULTS - SOIL

REMEDIAL INVESTIGATION REPORT
FORMER GREEN BAY MANUFACTURED GAS PLANT SITE
WISCONSIN PUBLIC SERVICE CORPORATION
CITY OF GREEN BAY, WISCONSIN

DRAFT

PROJECT NO: 1584/16.3

FIGURE NO: 12

Natural Resource Technology

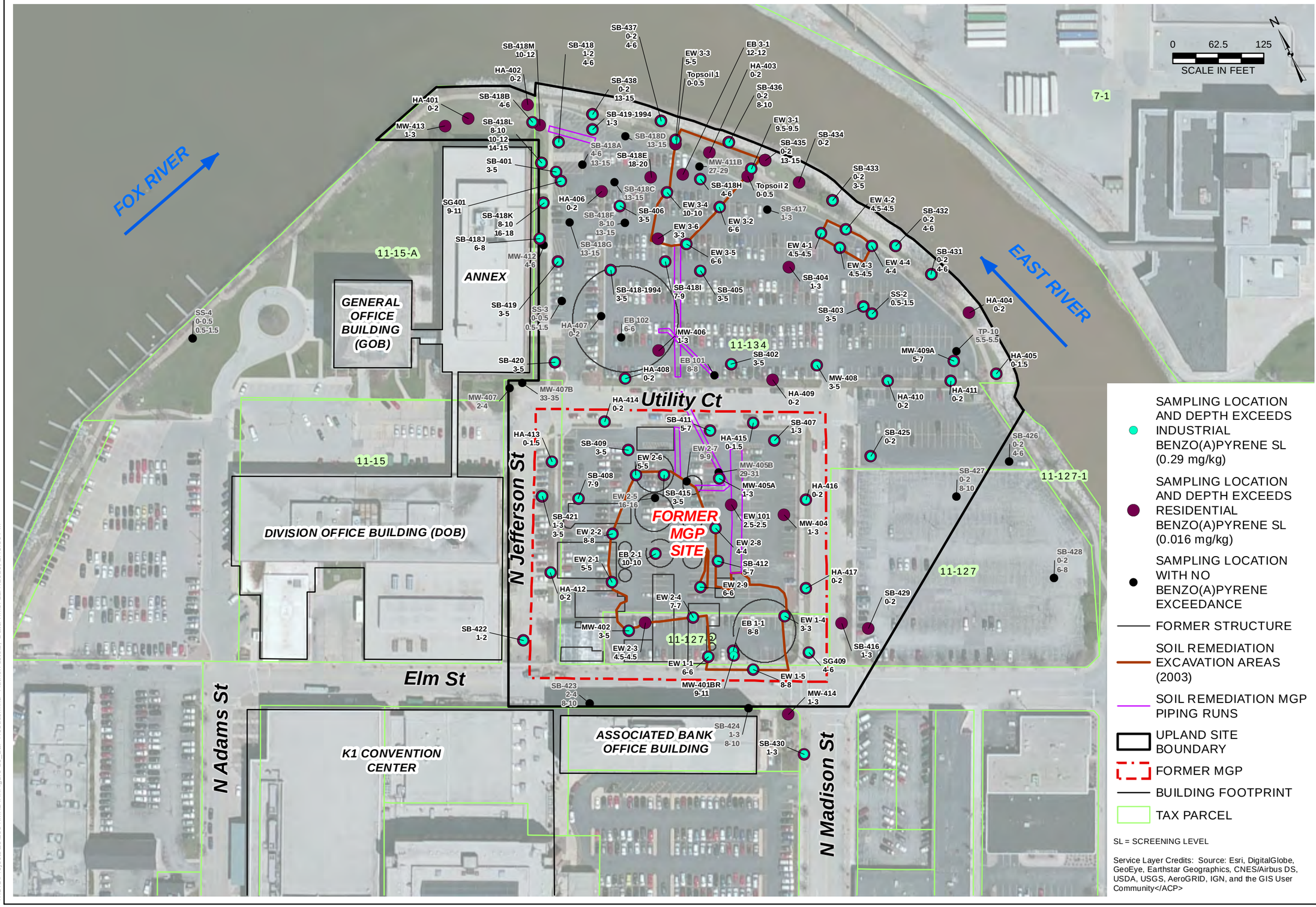
Y:\GIS\Projects\15\1584\MXD\R\Figure 12_Naphthalene Results.mxd Author: sstolz Date/Time: 12/7/2016, 2:36:10 PM

POST SOIL REMEDIATION BENZO(A)PYRENE RESULTS - SOIL

REMEDIAL INVESTIGATION REPORT
FORMER GREEN BAY MANUFACTURED GAS PLANT SITE
WISCONSIN PUBLIC SERVICE CORPORATION
CITY OF GREEN BAY, WISCONSIN

DRAWN BY/DATE: SDS 10/12/16
REVIEWED BY/DATE: PRB 10/--/16
APPROVED BY/DATE: BGH 10/--/16

DRAFT



SAMPLING LOCATION AND DEPTH EXCEEDS INDUSTRIAL BENZO(A)PYRENE SL (0.29 mg/kg)

SAMPLING LOCATION AND DEPTH EXCEEDS RESIDENTIAL BENZO(A)PYRENE SL (0.016 mg/kg)

SAMPLING LOCATION WITH NO BENZO(A)PYRENE EXCEEDANCE

FORMER STRUCTURE

SOIL REMEDIATION EXCAVATION AREAS (2003)

SOIL REMEDIATION MGP PIPING RUNS

UPLAND SITE BOUNDARY

FORMER MGP

BUILDING FOOTPRINT

TAX PARCEL

SL = SCREENING LEVEL

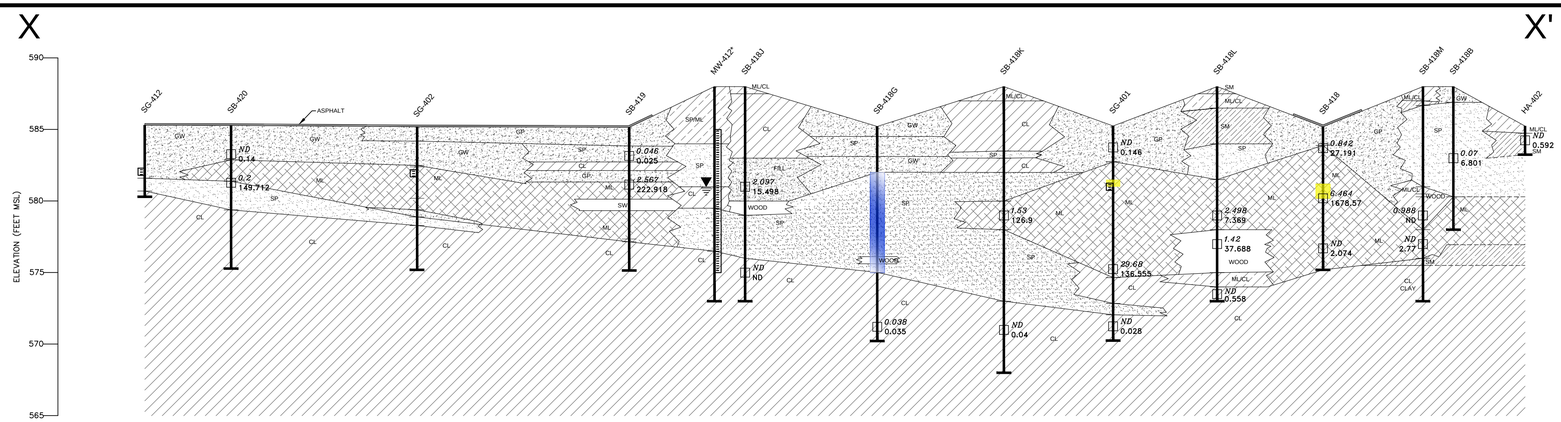
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community</ACP>

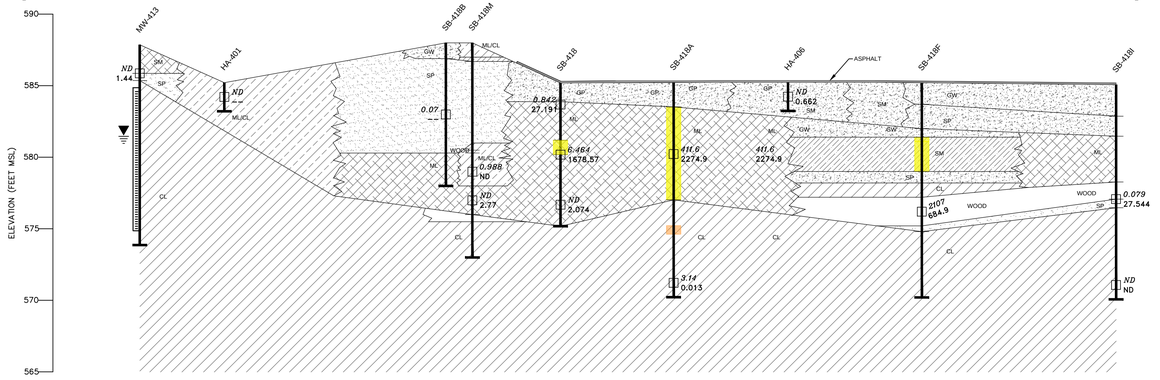
PROJECT NO: 1584/16.3

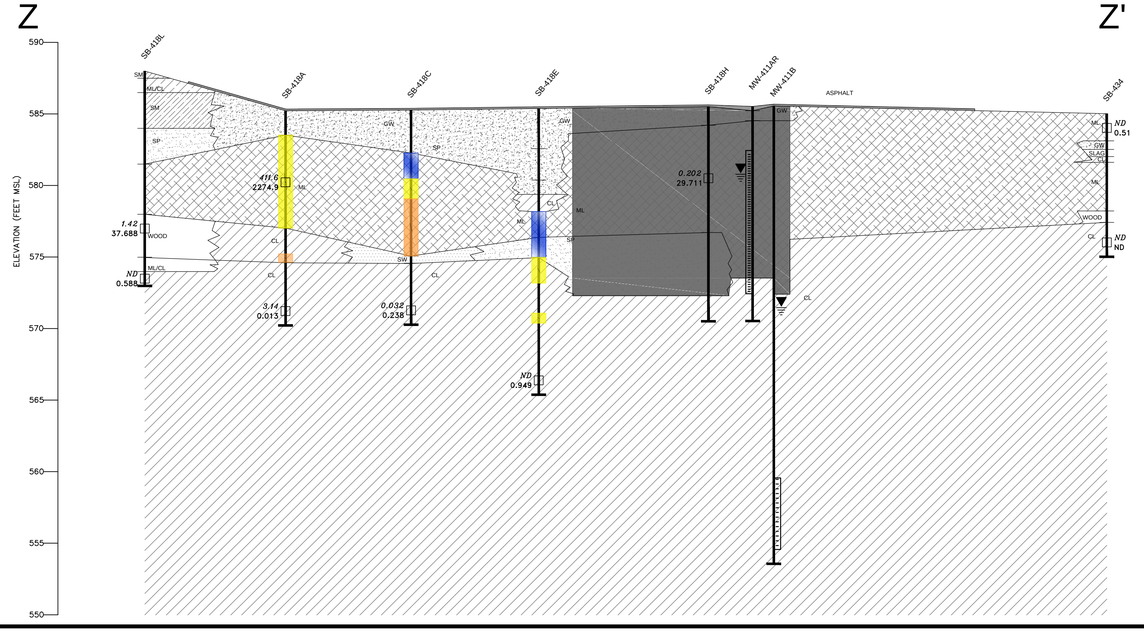
FIGURE NO: 13

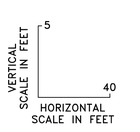
Natural Resource Technology

Y:\GIS\Projects\15\1584\MXD\RI\Figure 13_BaP Results.mxd Author: sstolz; Date/Time: 12/7/2016, 2:48:36 PM









- POORLY SORTED SAND
- WELL SORTED SAND
- SILTY SAND
- SANDS/GRAVELS
- SANDY CLAY
- SILTY CLAY
- SILT
- ASPHALT
- CLAY
- THERMALLY TREATED FILL
- SCREENED INTERVAL
- WATER LEVEL ELEVATION AUGUST 2016

BTEX BENZENE, TOLUENE, ETHYLBENZENE, AND XYLENES

PAH POLYNUCLEAR AROMATIC HYDROCARBONS

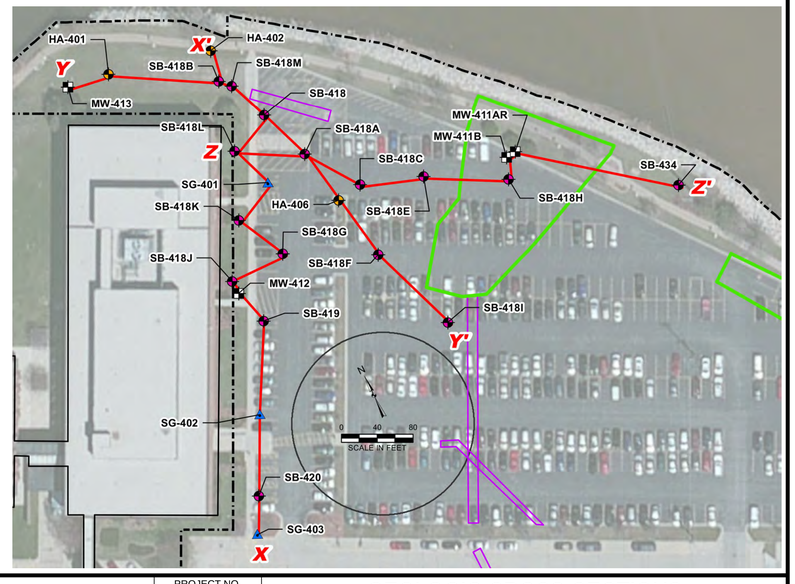
□ TOTAL BTEX (mg/kg)
TOTAL PAH (mg/kg)

mg/kg MILLIGRAMS PER KILOGRAM

NAPL IMPACTS:

- SHEEN
- STAINING
- OIL COATING / OIL WETTING

NOTES:
1. CROSS SECTION REPRESENTS A GENERALIZED INTERPRETATION OF SURFACE ELEVATIONS AND SUBSURFACE CONDITIONS. STRATUM LINES ARE BASED ON INTERPOLATION BETWEEN BORINGS AND MAY NOT REPRESENT ACTUAL SUBSURFACE CONDITIONS. FOR A DETAILED DESCRIPTION OF INDIVIDUAL BORINGS, REFER TO SOIL BORING LOGS.
2. FORMER STRUCTURES SHOWN WHERE BASE WAS FIELD CONFIRMED BY INVESTIGATION.
3. BTEX INCLUDES: BENZENE, ETHYLBENZENE, TOLUENE, XYLENES (124-TMB AND 135-TMB IF ANALYZED)



NATURAL RESOURCE TECHNOLOGY

PROJECT NO. 1584/19.0	GEOLOGIC CROSS-SECTIONS	
DRAWN BY: RJB 10/26/16	FORMER GREEN BAY MANUFACTURED GAS PLANT SITE WISCONSIN PUBLIC SERVICE CORPORATION GREEN BAY, WISCONSIN	
CHECKED BY: PRB DRAFT		
APPROVED BY: BGH DRAFT	DRAWING NO: 1584-190-D02	SHEET NO. 2
	REFERENCE: .	

Dec 14, 2016 12:54pm PLOTTED BY: acowrse SAVED BY: acowrse
Y:\ACADdata\Projects\15\1584 Gr Bay\19-0\1584-190-D02.dwg Sheet
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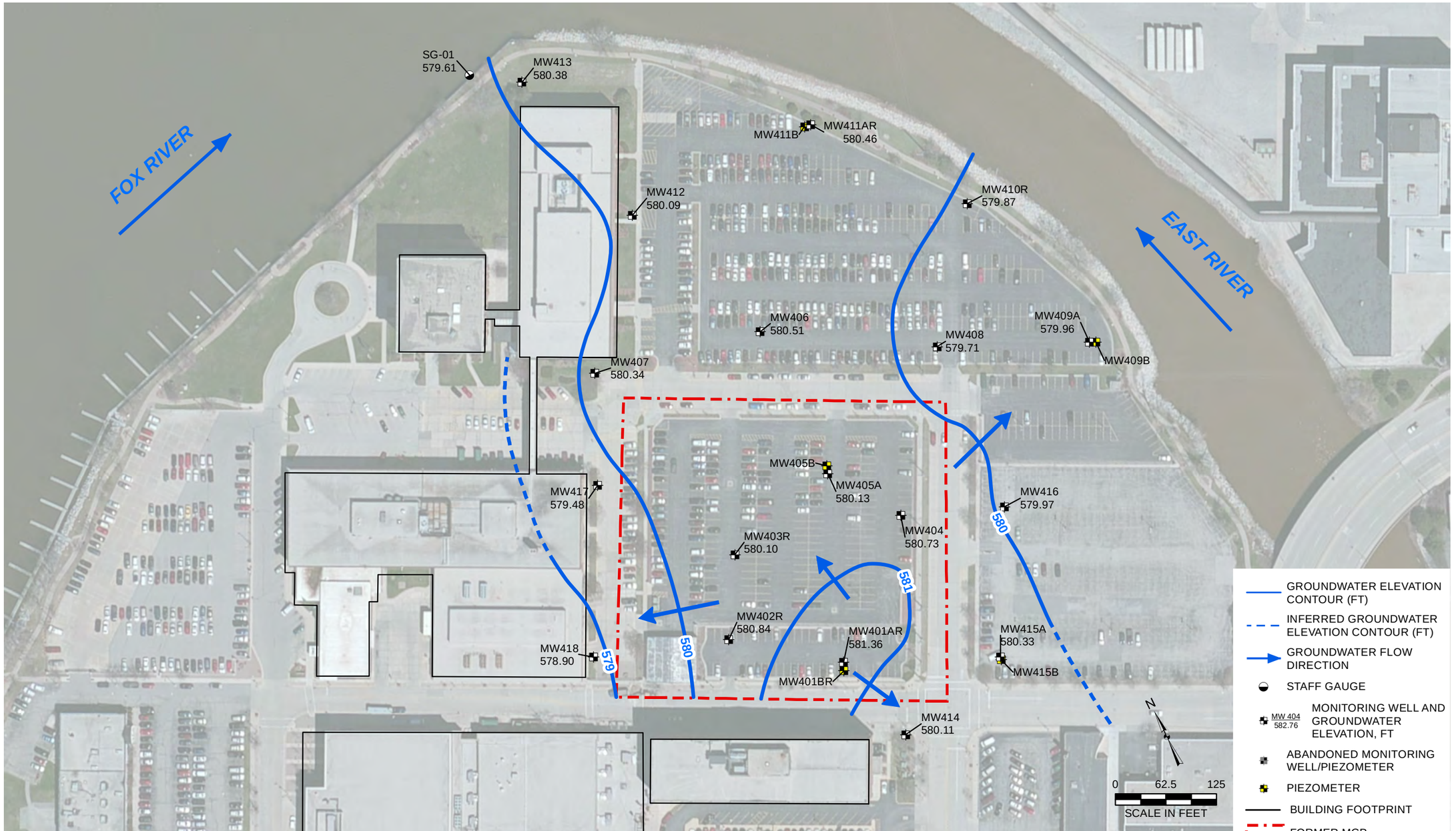
XREFS:



NM NOT MEASURED

SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GI USER COMMUNITY

SOURCE NOTE:
1. THIS DRAWING WAS DEVELOPED FROM DRAWINGS PROVIDED BY WPSC: "GENERAL LOCATION OF MACHINERY-TANKS-AND CONNECTING MAIN PIPES", DRAWING DD1691, REVISIONS THROUGH 1949; "GENERAL PLAN OF GAS PLANT PROPERTY AT GREEN BAY, WISCONSIN", DWG. NO. 10-50006, REVISIONS THROUGH MARCH 1966; "GENERAL PLAN OF GAS PLANT PROPERTY AT GREEN BAY, WISCONSIN", DWG. NO. 10-50004-S1, REVISIONS THROUGH APRIL 1970.
2. EDI ENGINEERING AND SCIENCE (JANUARY 1986) AND SANBORN MAPS. STREET WIDTHS AND LOCATIONS ARE APPROXIMATE BUT SOIL BORING ARE SPATIALLY ACCURATE PER WPSC SURVEY DECEMBER, 1994 AND JULY 1996.
3. SURVEY FROM WPSC COMPLETED NOVEMBER 2002.
4. PROPOSED PARKING IMPROVEMENTS PROVIDED BY PERFORMA, DE PERE, WISCONSIN, PROJECT # 03017, DIGITAL FILE C1-2.DWG, DRAWING DATED 02/14/03. REFER TO PERFORMA DRAWINGS FOR ADDITIONAL DIMENSIONS AND INFORMATION.
5. REPLACEMENT WELLS (MW-401AR, MW-402R, MW-403R, MW-410R AND MW-411AR) AND CATCH BASINS CB-1 THROUGH CB-7 FROM SURVEY BY WPSC JULY 2003.

ELEVATIONS IN PARENTHESIS WERE NOT USED FOR CONTOURS

NOTES:
1. ELEVATIONS OF NEIGHBORING WELLS SUGGEST THE WATER ELEVATION AT MW411AR IS ANOMOLOUS
2. STAFF GAUGE LOCATION IS APPROXIMATE

DRAWN BY/DATE: SDS 10/25/16
REVIEWED BY/DATE: PRB 10/25/16
APPROVED BY/DATE: BGH

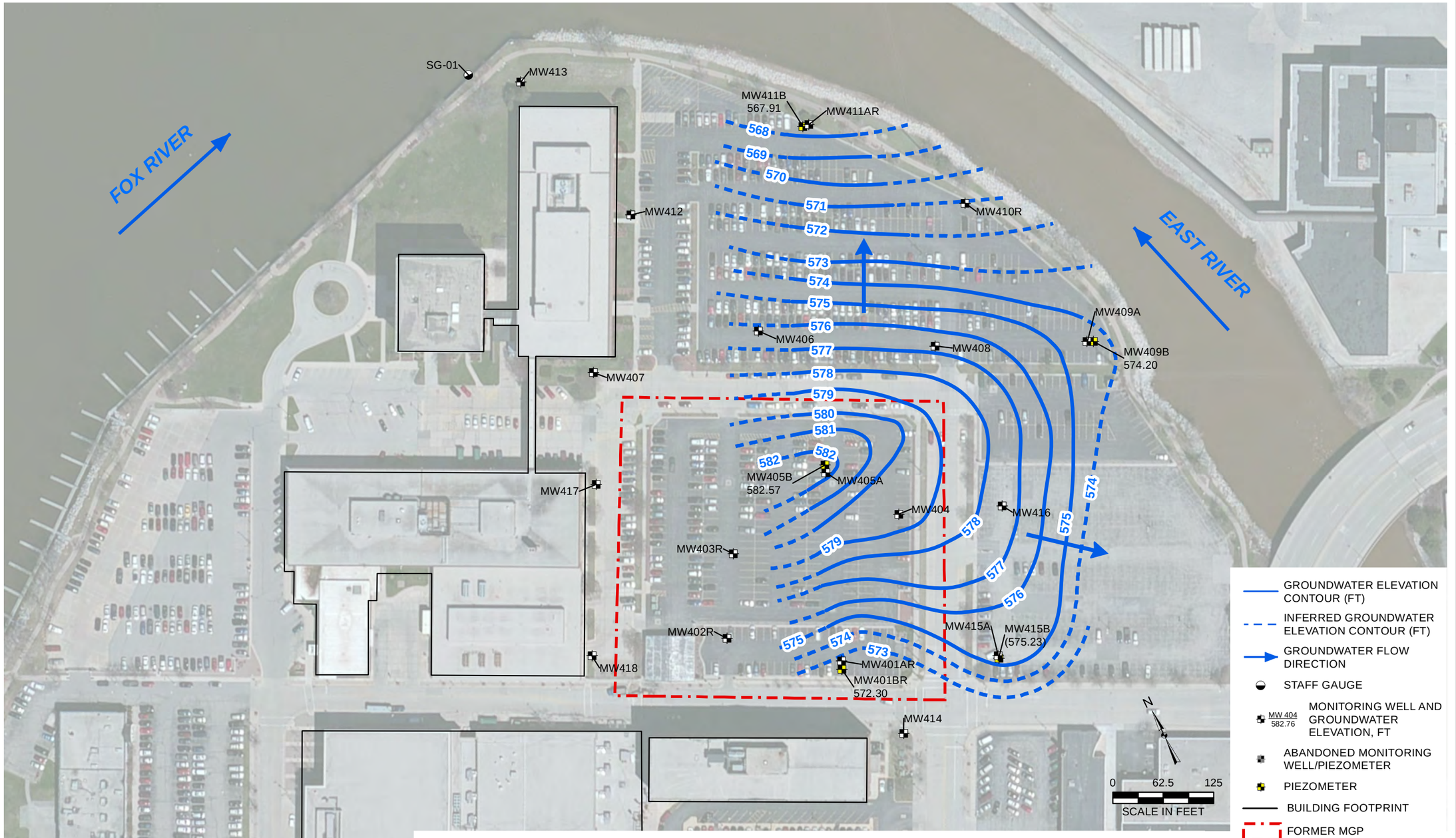
WATER TABLE CONTOURS - NOVEMBER 2015

REMEDIAL INVESTIGATION REPORT
FORMER GREEN BAY MANUFACTURED GAS PLANT SITE
WISCONSIN PUBLIC SERVICE CORPORATION
CITY OF GREEN BAY, WISCONSIN

PROJECT NO: 1584/19

FIGURE NO: 15

NATURAL RESOURCE TECHNOLOGY



GROUNDWATER ELEVATION CONTOUR (FT)

INFERRED GROUNDWATER ELEVATION CONTOUR (FT)

GROUNDWATER FLOW DIRECTION

STAFF GAUGE

MW 404 / 582.76 — MONITORING WELL AND GROUNDWATER ELEVATION, FT

ABANDONED MONITORING WELL/PIEZOMETER

PIEZOMETER

BUILDING FOOTPRINT

FORMER MGP

NM NOT MEASURED

SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GI USER COMMUNITY

SOURCE NOTE:
1. THIS DRAWING WAS DEVELOPED FROM DRAWINGS PROVIDED BY WPSC: "GENERAL LOCATION OF MACHINERY-TANKS-AND CONNECTING MAIN PIPES", DRAWING DD1691, REVISIONS THROUGH 1949; "GENERAL PLAN OF GAS PLANT PROPERTY AT GREEN BAY, WISCONSIN", DWG. NO. 10-50006, REVISIONS THROUGH MARCH 1966; "GENERAL PLAN OF GAS PLANT PROPERTY AT GREEN BAY, WISCONSIN", DWG. NO. 10-50004-S1, REVISIONS THROUGH APRIL 1970.
2. EDI ENGINEERING AND SCIENCE (JANUARY 1986) AND SANBORN MAPS. STREET WIDTHS AND LOCATIONS ARE APPROXIMATE BUT SOIL BORING ARE SPATIALLY ACCURATE PER WPSC SURVEY DECEMBER, 1994 AND JULY 1996.
3. SURVEY FROM WPSC COMPLETED NOVEMBER 2002.
4. PROPOSED PARKING IMPROVEMENTS PROVIDED BY PERFORMA, DE PERE, WISCONSIN, PROJECT # 03017, DIGITAL FILE C1-2.DWG, DRAWING DATED 02/14/03. REFER TO PERFORMA DRAWINGS FOR ADDITIONAL DIMENSIONS AND INFORMATION.
5. REPLACEMENT WELLS (MW-401AR, MW-402R, MW-403R, MW-410R AND MW-411AR) AND CATCH BASINS CB-1 THROUGH CB-7 FROM SURVEY BY WPSC JULY 2003.

ELEVATIONS IN PARENTHESIS WERE NOT USED FOR CONTOURS

NOTES:
1. ELEVATIONS OF NEIGHBORING WELLS SUGGEST THE WATER ELEVATION AT MW411AR IS ANOMOLOUS
2. STAFF GAUGE LOCATION IS APPROXIMATE

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REVIEWED BY/DATE: PRB 10/25/16
APPROVED BY/DATE: BGH

POTENTIOMETRIC CONTOURS - NOVEMBER 2015

REMEDIAL INVESTIGATION REPORT
FORMER GREEN BAY MANUFACTURED GAS PLANT SITE
WISCONSIN PUBLIC SERVICE CORPORATION
CITY OF GREEN BAY, WISCONSIN

PROJECT NO: 1584/19

FIGURE NO: 19

Natural Resource Technology

SHALLOW GROUNDWATER BENZENE RESULTS

REMEDIAL INVESTIGATION REPORT
FORMER GREEN BAY MANUFACTURED GAS PLANT SITE
WISCONSIN PUBLIC SERVICE CORPORATION
CITY OF GREEN BAY, WISCONSIN

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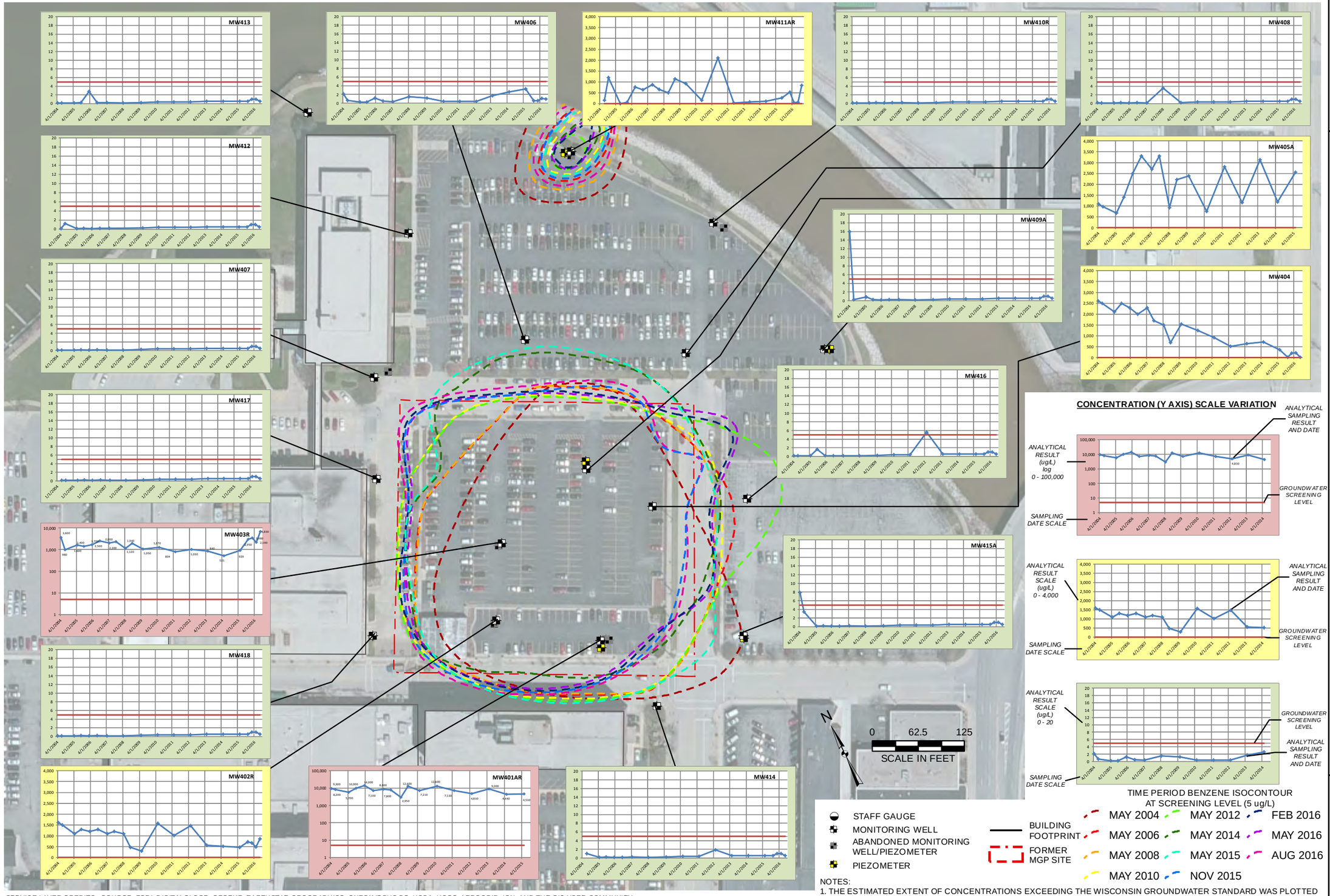
DRAWN BY/DATE: SDS 10/26/16
REVIEWED BY/DATE: PRB 10/26/16
APPROVED BY/DATE:

PROJECT NO: 1584/19

FIGURE NO: 23

Natural Resource Technology



CONCENTRATION (Y AXIS) SCALE VARIATION

STAFF GAUGE
MONITORING WELL
ABANDONED MONITORING WELL/PIEZOMETER
PIEZOMETER

BUILDING FOOTPRINT
FORMER MGP SITE

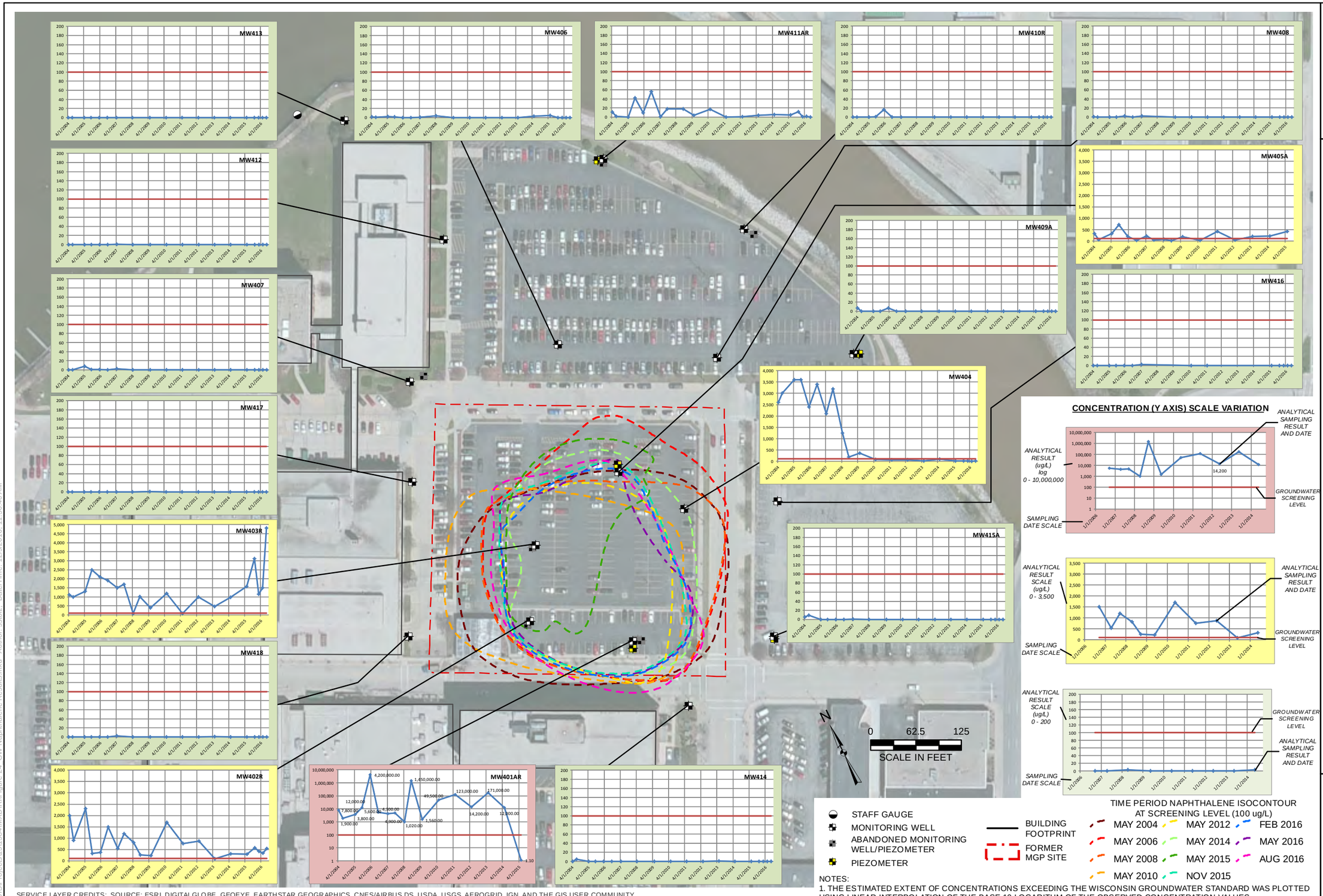
TIME PERIOD BENZENE ISOCONTOUR AT SCREENING LEVEL (5 ug/L)

MAY 2004 MAY 2012 FEB 2016
MAY 2006 MAY 2014 MAY 2016
MAY 2008 MAY 2015 AUG 2016
MAY 2010 NOV 2015

NOTES:
1. THE ESTIMATED EXTENT OF CONCENTRATIONS EXCEEDING THE WISCONSIN GROUNDWATER STANDARD WAS PLOTTED USING LINEAR INTERPOLATION OF THE BASE 10 LOGARITHM OF THE OBSERVED CONCENTRATION VALUES.

SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Y:\GIS\Projects\15\1584\MXD\R1\Figure 23_GW Benzene_Results.mxd Author: sstolz Date/Time: 12/9/2016, 11:52:36 AM



STAFF GAUGE
MONITORING WELL
ABANDONED MONITORING WELL/PIEZOMETER
PIEZOMETER
BUILDING FOOTPRINT
FORMER MGP SITE

TIME PERIOD NAPHTHALENE ISOCONTOUR AT SCREENING LEVEL (100 ug/L)

MAY 2004
MAY 2006
MAY 2008
MAY 2010
MAY 2012
MAY 2014
MAY 2015
NOV 2015
FEB 2016
MAY 2016
AUG 2016

NOTES:
1. THE ESTIMATED EXTENT OF CONCENTRATIONS EXCEEDING THE WISCONSIN GROUNDWATER STANDARD WAS PLOTTED USING LINEAR INTERPOLATION OF THE BASE 10 LOGARITHM OF THE OBSERVED CONCENTRATION VALUES.

SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

DRAWN BY/DATE: SDS 10/26/16
REVIEWED BY/DATE: PRB 10/26/16
APPROVED BY/DATE:

SHALLOW GROUNDWATER NAPHTHALENE RESULTS

REMEDIAL INVESTIGATION REPORT
FORMER GREEN BAY MANUFACTURED GAS PLANT SITE
WISCONSIN PUBLIC SERVICE CORPORATION
CITY OF GREEN BAY, WISCONSIN

DRAFT

PROJECT NO: 1584/19

FIGURE NO: 24

Natural Resource Technology

SHALLOW GROUNDWATER BENZO(a)PYRENE RESULTS

REMEDIAL INVESTIGATION REPORT
FORMER GREEN BAY MANUFACTURED GAS PLANT SITE
WISCONSIN PUBLIC SERVICE CORPORATION
CITY OF GREEN BAY, WISCONSIN

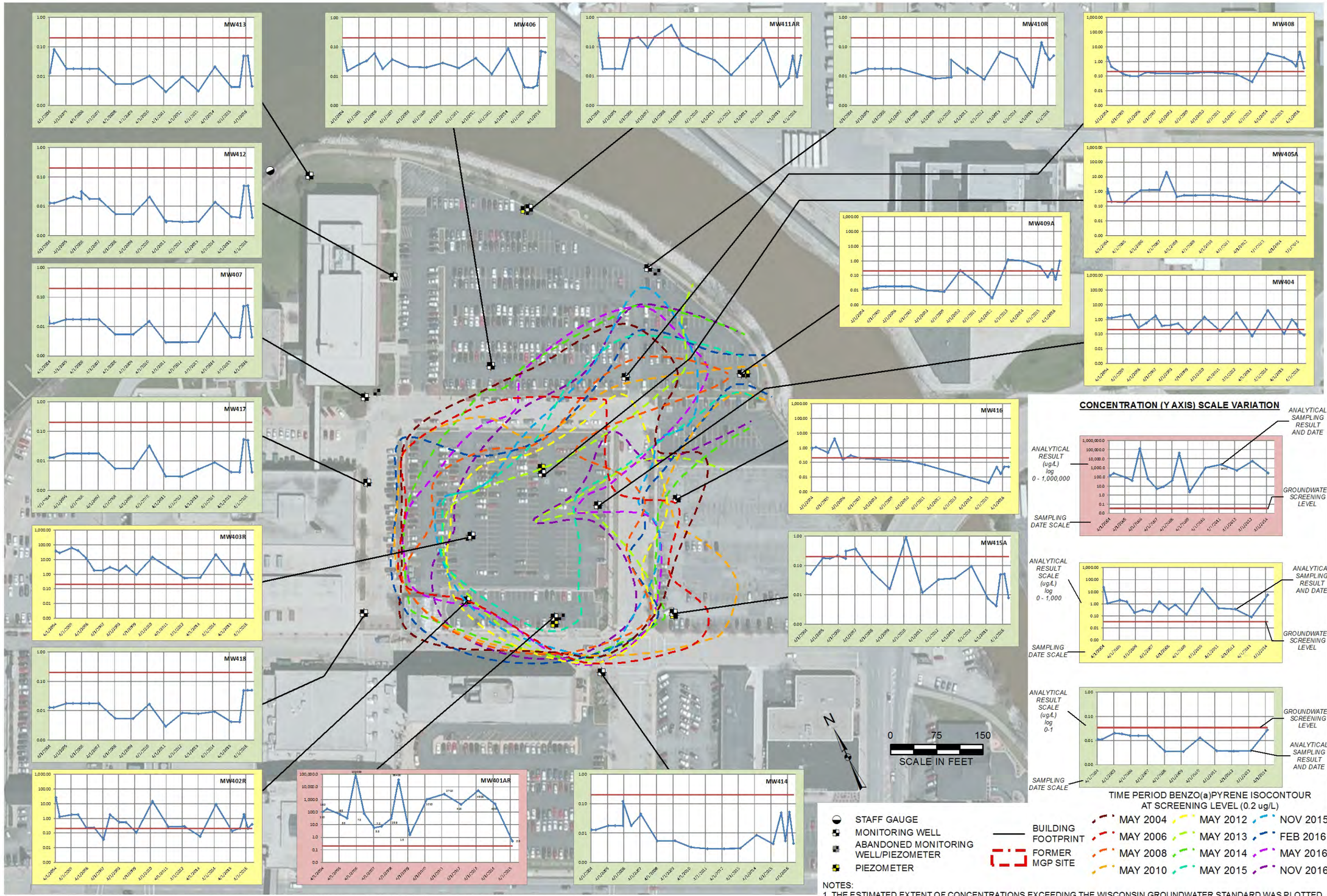
DRAWN BY/DATE: SDS 10/26/16
REVIEWED BY/DATE: PRB 10/26/16
APPROVED BY/DATE:

DRAFT

PROJECT NO: 1584/19

FIGURE NO: 25

Natural Resource Technology



CONCENTRATION (Y AXIS) SCALE VARIATION

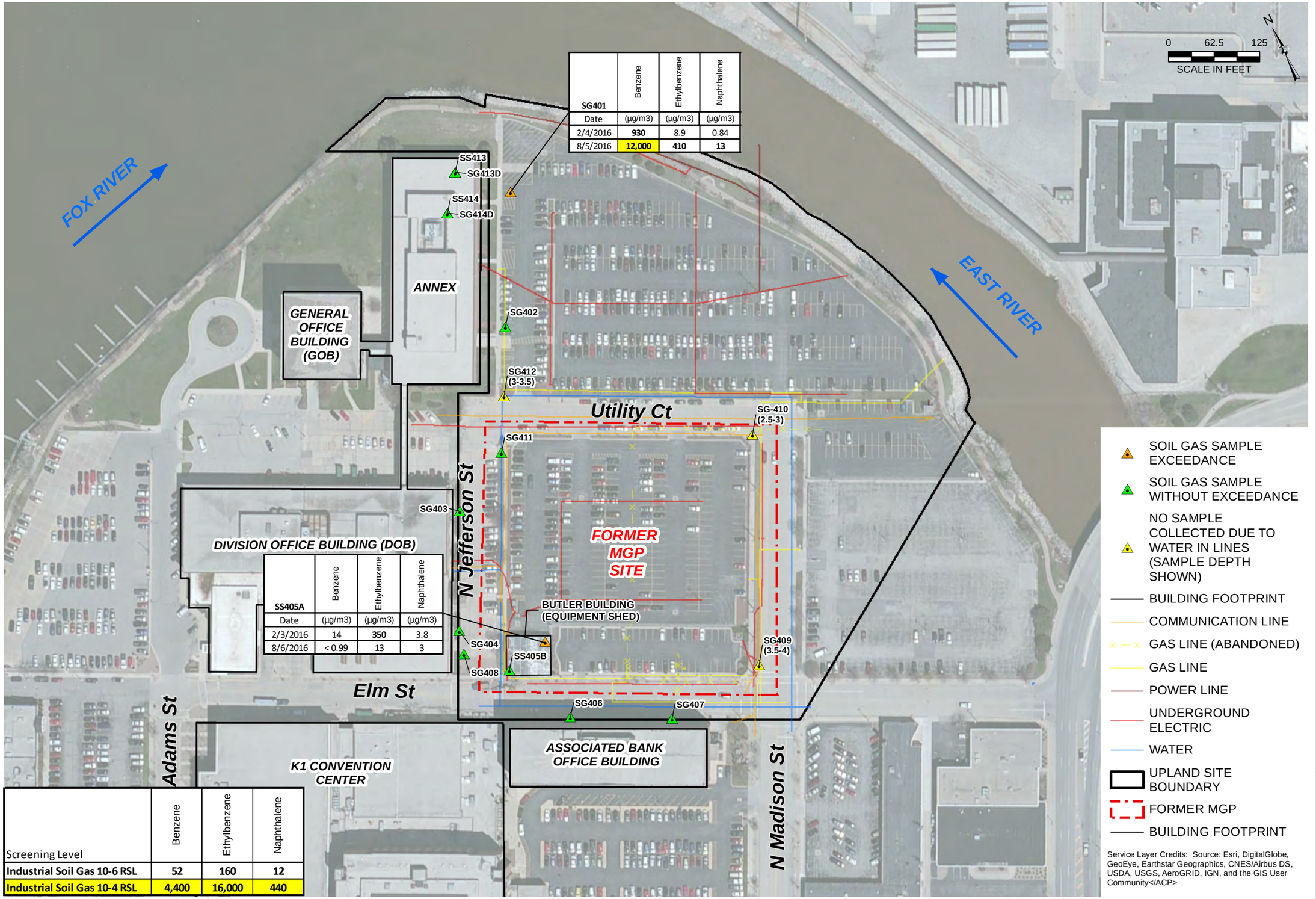
TIME PERIOD BENZO(a)PYRENE ISOCONTOUR AT SCREENING LEVEL (0.2 ug/L)

- MAY 2004
- MAY 2006
- MAY 2008
- MAY 2010
- MAY 2012
- MAY 2013
- MAY 2014
- MAY 2015
- NOV 2015
- FEB 2016
- MAY 2016
- NOV 2016

- STAFF GAUGE
- MONITORING WELL
- ABANDONED MONITORING WELL/PIEZOMETER
- PIEZOMETER
- BUILDING FOOTPRINT
- FORMER MGP SITE

NOTES:
1. THE ESTIMATED EXTENT OF CONCENTRATIONS EXCEEDING THE WISCONSIN GROUNDWATER STANDARD WAS PLOTTED USING LINEAR INTERPOLATION OF THE BASE 10 LOGARITHM OF THE OBSERVED CONCENTRATION VALUES.

SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY



SG401	Benzene	Ethylbenzene	Naphthalene
Date	(µg/m3)	(µg/m3)	(µg/m3)
2/4/2016	**930**	8.9	0.84
8/5/2016	**12,000**	**410**	**13**

SS405A	Benzene	Ethylbenzene	Naphthalene
Date	(µg/m3)	(µg/m3)	(µg/m3)
2/3/2016	14	**350**	3.8
8/6/2016	< 0.99	13	3

Screening Level	Benzene	Ethylbenzene	Naphthalene
Industrial Soil Gas 10-6 RSL	**52**	**160**	**12**
Industrial Soil Gas 10-4 RSL	**4,400**	**16,000**	**440**

- SOIL GAS SAMPLE EXCEEDANCE
- SOIL GAS SAMPLE WITHOUT EXCEEDANCE
- NO SAMPLE COLLECTED DUE TO WATER IN LINES (SAMPLE DEPTH SHOWN)
- BUILDING FOOTPRINT
- COMMUNICATION LINE
- GAS LINE (ABANDONED)
- GAS LINE
- POWER LINE
- UNDERGROUND ELECTRIC
- WATER
- UPLAND SITE BOUNDARY
- FORMER MGP
- BUILDING FOOTPRINT

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community</ACP>

DRAWN BY/DATE: SDS 10/25/16
REVIEWED BY/DATE: PRB 10/25/16
APPROVED BY/DATE: BGH

SOIL GAS RESULTS

REMEDIAL INVESTIGATION REPORT
FORMER GREEN BAY MANUFACTURED GAS PLANT SITE
WISCONSIN PUBLIC SERVICE CORPORATION
CITY OF GREEN BAY, WISCONSIN

DRAFT

PROJECT NO: 1584/19

FIGURE NO: 26

Natural Resource Technology

Table 1. Summary of Planned and Completed Activities
Wisconsin Public Service Corp. - Former Green Bay Manufactured Gas Plant Site
700 North Adams St., Green Bay, Wisconsin
USEPA WIN000509948 / WDNR BRRTS#02-05-000254

DRAFT

Planned (SSWP)	Additional	Completed	Comments/Deviations
Soil			
22 surface soil samples		October 2015	-Several borings were extended deeper around SB-418. SB422 moved for fiber optic line.
15 soil borings		October 2015	
	Additional Step-Out Borings	October 2015	-9 step-out borings to delineate DNAPL observed above native clay till
Groundwater			
Well Network resurvey		August 2016	
Well Network Repairs, as needed		August 2016	
Quarterly GW Sampling	Additional December 2016	Nov, 2015: Feb, 2016: May, 2016: Aug, 2016: Dec, 2016	-Recommend dropping cyanide, arsenic, cadmium, and lead from future analysis
NAPL Thickness Measurements		same as above	
Slug Testing		May 2016	
Soil Gas			
11 soil gas/2 sub-slab probes		Feb, 2016: Aug, 2016	-SG408 moved due to fiber optic, SG411/412 moved due to site use and active utility work. 3 of the utility corridor probes could not be sampled due to water in lines, they are very shallow so the utility lines can't be sampled with vapor probes. There are no buildings in those directions and groundwater is defined; therefore, no futher activities are necessary to evaluate current risk from VI.
	Supplemental VI Soil Borings	February 2016	-4 additional borings between Annex Building and SB-418 area.
	Supplemental VI Sampling: 2 indoor air and 3 nested sub-slab	Aug, 2016: Dec, 2016	-Proposed sub-slab location SG-415 could not be installed due to excessive thickness ~ 18 inches of concrete below the slab. No exceedances of Industrial 10-6 for either round, no further evaluation is required.

Table 2. Soil Summary Statistics - Samples Exceeding Screening Levels

Remedial Investigation Report
WBS/WPSC - Former Green Bay MGP Site
700 North Adams St., Green Bay, Wisconsin
USEPA WIN000509948 / WDNR BRRTS#02-05-000254

DRAFT

Parameter (mg/kg)	Samples Analyzed	Samples Exceeding the MDL	Minimum (mg/kg)	Maximum (mg/kg)	Residential Soil SL (mg/kg)	Samples Exceeding Residential SL	Industrial Soil SL (mg/kg)	Samples Exceeding Industrial SL	Soil Csat/Ceiling SL (mg/kg)	Samples Exceeding Csat/Ceiling SL
Benzene, Toluene, Ethylbenzene and Xylene (BTEX)										
Benzene	149	49	0.0285	23.1	1.2	9	5.1	3	1820	0
Ethylbenzene	149	56	0.0291	841	5.8	8	25	5	480	2
Xylenes, Total	149	52	0.017	866	260	2	260	2	260	2
Volatile Organic Compounds (VOCs)										
1,2,4-Trimethylbenzene	90	20	0.0611	287	58	3	219	1	219	1
Polynuclear Aromatic Hydrocarbons (PAHs)										
1-Methylnaphthalene	120	75	0.0095	365	18	8	73	3	394	0
2-Methylnaphthalene	120	78	0.0097	515	240	1	3000	0	NS	0
Benzo(a)anthracene	154	116	0.0038	74	0.16	80	2.9	32	NS	0
Benzo(a)pyrene	154	112	0.0076	56.9	0.016	103	0.29	73	NS	0
Benzo(b)fluoranthene	154	104	0.0035	65	0.16	74	2.9	26	NS	0
Benzo(k)fluoranthene	154	107	0.0068	86	1.6	36	29	5	NS	0
Chrysene	154	114	0.0086	100	16	8	290	0	NS	0
Dibenz(a,h)anthracene	154	62	0.0074	22	0.016	55	0.29	29	NS	0
Indeno(1,2,3-cd)pyrene	154	99	0.0065	45	0.16	69	2.9	20	NS	0
Naphthalene	154	111	0.0099	1170	3.8	39	17	17	NS	0
Metals										
Lead, Total	117	115	1.6	7900	400	4	800	4	NS	0
Mercury, Total	117	110	0.0029	93.6	23	1	350	0	NS	0
Thallium, Total	6	1	1.4	1.4	0.78	1	12	0	NS	0
Cyanide										
Cyanide, Total	122	83	0.122	1500	78	6	1200	1	NS	0

[O:ECK 10/11/2016][CYN:ECK 10/13/16][U:ECK 1/6/17]

MDL = method detection limit
SL = Screening Level
mg/kg = milligrams per kilogram
Csat - Soil saturation limit

SLs used on this table were presented in the Multi-Site Risk Assessment Framework Addendum Revision 5 (Exponent, July 2016).

Natural Resource Technology

Table 3. Groundwater Summary Statistics - Samples Exceeding Screening Levels

Remedial Investigation Report
WBS/WPSC - Former Green Bay MGP Site
700 North Adams St., Green Bay, Wisconsin
USEPA WIN000509948 / WDNR BRRTS#02-05-000254

DRAFT

					Groundwater SL								Industrial Groundwater Vapor SLs							
					Samples		Wells - All Sampling Events			Wells - Last 4 Sampling Events [1]			Samples		Wells - All Sampling Events			Wells - Last 4 Sampling Events [1]		
Parameter (µg/l)	Samples Analyzed	Samples Exceeding the MDL	Minimum (µg/l)	Maximum (µg/l)	Groundwater SL (µg/l)	Samples Exceeding Groundwater SL	Wells Sampled	Wells Exceeding the Groundwater SL	Deep Wells Exceeding the GW SL	Wells Sampled	Wells Exceeding the Groundwater SL	Deep Wells Exceeding the GW SL	Industrial GW Vapor SL (µg/l)	Samples Exceeding Industrial GW Vapor SL	Wells Sampled	Wells Exceeding the Industrial GW Vapor SL	Deep Wells Exceeding the Industrial GW Vapor SL	Wells Sampled	Wells Exceeding the Industrial GW Vapor SL	Deep Wells Exceeding the Industrial GW Vapor SL
Benzene, Toluene, Ethylbenzene and Xylene (BTEX)													**Benzene, Toluene, Ethylbenzene and Xylene (BTEX)**							
Benzene	537	220	0.17	14,000	5	155	30	23	2	21	4	0	6.9	151	30	19	4	21	4	0
Ethylbenzene	537	171	0.48	1,700	700	10	30	5	1	21	0	0	15	136	30	12	2	21	4	0
Toluene	537	150	0.36	6,700	800	13	30	3	1	21	0	0	81,000	0	30	0	0	21	0	0
Xylenes, m + p	537	132	1.1	3,100	NS	--	30	--	--	21	--	--	1,500	6	--	2	1	21	0	0
Xylene, o	537	155	0.43	2,000	NS	--	30	--	--	21	--	--	2,100	0	--	0	0	21	0	0
Xylenes, Total	537	157	0.43	5,100	2,000	10	24	1	0	21	0	0	1,600	14	30	1	1	21	0	0
Volatile Organic Compounds (VOCs)													**Volatile Organic Compounds (VOCs)**							
1,2,4-Trimethylbenzene	453	130	0.54	860	NS	--	30	--	--	--	--	--	120	62	30	9	1	--	0	0
1,3,5-Trimethylbenzene	453	75	0.41	270	NS	--	30	--	--	--	--	--	120	8	30	3	1	--	0	0
Trimethylbenzenes, Total	453	130	0.5	1,130	480	9	24	5	0	0	0	0	NS	--	24	--	--	--	--	--
Methyl-tert-butyl-ether	406	10	7.2	18	60	0	0	0	0	0	0	0	2,000	0	0	0	0	0	0	0
Naphthalene (VOC)	13	9	0.74	14,000	100	6	13	6	1	0	0	0	20	7	13	7	1	0	0	0
Polynuclear Aromatic Hydrocarbons (PAHs)													**Polynuclear Aromatic Hydrocarbons (PAHs)**							
1-Methylnaphthalene	505	357	0.0031	940,000	NS	--	--	--	--	--	--	--	NS	--	--	--	--	--	--	--
2-Methylnaphthalene	505	316	0.0027	1,000,000	NS	--	--	--	--	--	--	--	NS	--	--	--	--	--	--	--
Acenaphthene	505	265	0.0046	36,000	NS	--	--	--	--	--	--	--	NS	--	--	--	--	--	--	--
Acenaphthylene	505	315	0.0039	200,000	NS	--	--	--	--	--	--	--	NS	--	--	--	--	--	--	--
Anthracene	505	331	0.0047	180,000	3,000	6	30	2		21	0	0	NS	--	30	--	--	21	--	--
Benzo(a)anthracene	528	289	0.0041	130,000	NS	--	--	--	--	--	--	--	NS	--	--	--	--	--	--	--
Benzo(a)pyrene	528	294	0.003	100,000	0.2	110	30	20	9	21	6	2	NS	--	30	--	--	21	--	--
Benzo(b)fluoranthene	528	343	0.0034	51,000	0.2	129	30	20	10	21	8	3	NS	--	30	--	--	21	--	--
Benzo(g,h,i)perylene	505	267	0.004	43,000	250	5	30	2	1	21	0	0	NS	--	30	--	--	21	--	--
Benzo(k)fluoranthene	528	331	0.0051	60,000	NS	--	--	--	--	--	--	--	NS	--	--	--	--	--	--	--
Chrysene	528	323	0.0035	120,000	0.2	134	30	21		21	6	3	NS	--	30	--	--	21	--	--
Dibenz(a,h)anthracene	528	158	0.0039	13,000	NS	--	--	--	--	--	--	--	NS	--	--	--	--	--	--	--
Fluoranthene	528	390	0.005	200,000	400	8	30	2	1	21	0	0	NS	--	30	--	--	21	--	--
Fluorene	505	260	0.0041	170,000	400	10	30	4	1	21	0	0	NS	--	30	--	--	21	--	--
Indeno(1,2,3-cd)pyrene	528	260	0.0041	33,000	NS	--	--	--	--	--	--	--	NS	--	--	--	--	--	--	--
Naphthalene (PAH)	528	446	0.0062	4,200,000	100	98	30	11	1	21	2	0	20	118	30	14	2	21	2	0
Phenanthrene	505	372	0.0076	400,000	3,000	6	30	2	1	21	0	0	NS	--	30	--	--	21	--	--
Pyrene	528	396	0.0058	240,000	250	11	30	3	1	21	0	0	NS	--	30	--	--	21	--	--
Metals													**Metals**							
Arsenic, Dissolved	259	191	0.22	95.9	10	26	28	7	0	21	0	0	NS	--	28	--	--	21	--	--
Cadmium, Dissolved	254	91	0.05	17	5	3	28	2	1	21	0	0	NS	--	28	--	--	21	--	--
Iron, Dissolved	343	288	5.5	85,900	NS	--	--	--	--	--	--	--	NS	--	--	--	--	--	--	--
Lead, Dissolved	245	115	0.1	157	15	2	28	2	1	21	1	0	NS	--	28	--	--	21	--	--
Manganese, Dissolved	343	341	0.68	4,200	300	177	28	23	4	21	14	1	NS	--	28	--	--	21	--	--

Table 3. Groundwater Summary Statistics - Samples Exceeding Screening Levels

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700 North Adams St., Green Bay, Wisconsin
USEPA WIN000509948 / WDNR BRRTS#02-05-000254

DRAFT

					Groundwater SL								Industrial Groundwater Vapor SLs							
					Samples		Wells - All Sampling Events			Wells - Last 4 Sampling Events [1]			Samples		Wells - All Sampling Events			Wells - Last 4 Sampling Events [1]		
Parameter (µg/l)	Samples Analyzed	Samples Exceeding the MDL	Minimum (µg/l)	Maximum (µg/l)	Groundwater SL (µg/l)	Samples Exceeding Groundwater SL	Wells Sampled	Wells Exceeding the Groundwater SL	Deep Wells Exceeding the GW SL	Wells Sampled	Wells Exceeding the Groundwater SL	Deep Wells Exceeding the GW SL	Industrial GW Vapor SL (µg/l)	Samples Exceeding Industrial GW Vapor SL	Wells Sampled	Wells Exceeding the Industrial GW Vapor SL	Deep Wells Exceeding the Industrial GW Vapor SL	Wells Sampled	Wells Exceeding the Industrial GW Vapor SL	Deep Wells Exceeding the Industrial GW Vapor SL
							Cyanide								Cyanide					
Cyanide, Amenable	28	27	13	13,000	200	11	25	11	0	0	0	0	NS	--	25	--	--	--	--	--
Cyanide, Available	145	65	0.58	77	200	0	24	0	0	21	0	0	NS	--	24	--	--	21	--	--
Cyanide, Available (PbCO3 Preserved)	53	41	0.49	253	200	2	24	2	0	0	0	0	NS	--	24	--	--	--	--	--
Cyanide, Total	31	29	3	13,000	200	18	25	12	0	0	0	0	NS	--	25	--	--	--	--	--
Cyanide, Weak Acid Dissociable	31	27	3	540	200	4	25	3	0	0	0	0	NS	--	25	--	--	--	--	--

[O:ECK 10/26/16][U:ECK 12/12/16][U:ECK 1/6/17]

Notes
MDL = method detection limit
SL = Screening Level
µg/l = micrograms per liter
SLs used on this table were presented in the Multi-Site Risk Assessment Framework Addendum Revision 5 (Exponent, July 2016). The groundwater SL presented is the more conservative of the State and MCL values presented in the RAF Addendum Revision 5.
SLs used on this table are 10-6 risk value.
1. Last four (4) sampling events for this report are Nov2015, Feb2016, May2016 and Aug2016.
-- = not applicable as there is not a standard to compare to

Table 4: Summary Statistics of Soil Gas Analytical Results Compared to Industrial Criteria

Remedial Investigation Report
WBS/WPSC - Former Green Bay MGP Site
700 North Adams St., Green Bay, Wisconsin
USEPA WIN000509948 / WDNR BRRTS#02-05-000254

DRAFT

					Industrial			
					10-4		10-6	
Parameter (µg/m3)	Samples Analyzed	Samples Exceeding the MDL	Minimum (µg/m3)	Maximum (µg/m3)	Industrial Soil Gas 10-4 RSL:	Samples Exceeding Industrial Soil Gas 10-4 RSL:	Industrial Soil Gas 10-6 RSL:	Samples Exceeding Industrial Soil Gas 10-6 RSL:
Volatile Organic Compounds (VOCs)								
1,2,4-Trimethylbenzene	24	21	1.9	380	1,000	0	1,000	0
Benzene	24	11	1.2	12,000	4,400	1	52	2
Ethylbenzene	24	20	1.9	410	16,000	0	160	2
Naphthalene	24	23	0.48	13	440	0	12	1
Toluene	24	22	1.4	4,400	730,000	0	730,000	0
Xylenes, Total	24	22	5.3	1,400	15,000	0	15,000	0
Inorganic Compounds & Metals								
Carbon Dioxide	24	22	0.06	29	NS	0	NS	0
Methane	24	3	0.27	23	NS	0	NS	0
Oxygen	24	24	2.61	17	NS	0	NS	0

[O:ECK 10/14/16][U:ECK 10/25/16][U:ECK 11/3/16]

Notes:

µg/m3 = micrograms per cubic meter air

MDL = Method Detection Limit

RSL = Regional Screening Level

RSLs used on this table were presented in the Multi-Site Risk Assessment Framework Addendum Revision 5 (Exponent, July 2016).

Table 5: Summary Statistics of Indoor Air and Ambiant Air Analytical Results Compared to Industrial Criteria

Remedial Investigation Report
WBS/WPSC - Former Green Bay MGP Site
700 North Adams St., Green Bay, Wisconsin
USEPA WIN000509948 / WDNR BRRTS#02-05-000254

DRAFT

					Industrial	
Parameter (µg/m3)	**Samples Analyzed**	**Samples Exceeding the MDL**	**Minimum (µg/m3)**	**Maximum (µg/m3)**	**Indoor Air, Industrial RSL:**	**Samples Exceeding Indoor Air, Industrial RSL:**
Volatile Organic Compounds (VOCs)						
1,2,4-Trimethylbenzene	9	0	0	0	31	0
Benzene	9	0	0	0	2	0
Ethylbenzene	9	0	0	0	5	0
Naphthalene	9	2	0.35	0.35	0	0
Toluene	9	8	1.7	1.9	22,000	0
Xylenes, Total	9	0	0	0	440	0
Inorganic Compounds & Metals						
Carbon Dioxide	9	0	0	0	NS	0
Methane	9	0	0	0	NS	0
Oxygen	9	6	15.1	17.7	NS	0

[O:ECK 10/14/16][U:ECK 10/258/16][U:ECK 11/3/16][U:ECK 1/6/17]

Notes:

No Exceedances

µg/m3 = micrograms per cubic meter air

MDL = Method Detection Limit

RSL = Regional Screening Level

RSLs used on this table were presented in the Multi-Site Risk Assessment Framework Addendum Revision 5 (Exponent, July 2016).

RSLs used on this table are 10-6 risk value.

APPENDIX E
VENDOR SPECIFICATIONS & PROTOCOLS

Bio-Trap – Stable Isotope Probing Protocol

Sampling Instructions

Handling:

- Bio-Trap Samplers used for Stable Isotope Probing (SIP) are baited with ^{13}C-labeled contaminant of interest (e.g. benzene, MTBE, chlorobenzene) adsorbed onto the powder activated carbon (PAC). Controlled laboratory conditions show only minimal loss of contaminant due to volatilization. However, special considerations must be taken into account when handling SIP Bio-Trap Samplers in order to reduce the risk of volatilization.
- SIP Bio-Trap Samplers are shipped out chilled, on blue ice, and it is essential that they should be kept cool (not frozen) until deployment.
- When retrieving the Bio-Trap Samplers that have been deployed in the field, they should immediately be placed on ice and shipped on ice for next day delivery. These steps will ensure the most accurate results.
- Although the contaminant is absorbed onto the beads, caution should be used in handling these Bio-Trap Samplers because the contaminant compounds are associated with possible health and safety risks.

Note: Clean latex gloves (or similar) should be used at all times when handling the Bio-Trap Samplers.

Storage:

It is important to minimize the amount of time that Bio-Trap Samplers are stored prior to being installed in the field. The physical properties of the Bio-Trap Samplers that make them an ideal medium for collecting microbes also increase the chances of microbial or chemical contamination. Bio-Trap Samplers need to remain sealed and refrigerated (not frozen) until they can be installed in the field.

Installation:

- Prior to installing Bio-Trap Sampler, the monitoring well may need to be purged if it has not been sampled in a while. If purging is necessary, MI recommends that three well volumes be removed to ensure contact with formation water and reduce well bore effect.
- Attach the Bio-Trap Sampler's nylon loop (provided) to a nylon line (not provided) and suspend Bio-Trap Sampler at a depth where significant contaminant concentrations exist. If no data are available on the vertical distribution of contaminants, then suspend the Bio-Trap Sampler in the middle of the saturated screened interval.
- If large fluctuations in the water level are anticipated during the period of incubation, the Bio-Trap Sampler should be suspended from a float (contact MI for further details). Be sure not to suspend the bio-trap in the NAPL zone.
- Once installed, incubation times can vary depending upon the scope of the project. A typical Stable Isotope Probing (SIP) study incubation period is 30 days but is project dependant. Please contact us if you have questions regarding the optimum deployment period for your samples.

Retrieval:

- Open the monitoring well and pull up the Bio-Trap Sampler. Cut and remove the braided nylon line used to suspend the Bio-Trap Sampler.
- Transfer the recovered Bio-Trap Sampler to labeled (well number and date) zippered bags, seal and then double bag in a larger (one-gallon) zippered bag, immediately place on blue ice in a cooler.
- Repeat above for all the Bio-Trap Samplers from the site.
- A chain of custody (COC) form must be included with each shipment of samples.
- In order to minimize the potential effect of these samplers on the monitoring well, MI recommends purging three well volumes from the test well following the retrieval of the SIP Bio-Trap Samplers.

Hold time for this analysis is 24-48 hours.

Shipping Instructions

Packaging Samples:

1. Samples should be shipped in a cooler with ice or blue ice for next day delivery. If regular ice is used, the ice should be double bagged.
2. A chain of custody form must be included with each shipment of samples. Access our chain of custody at www.microbe.com.

Shipment for Weekday Delivery:

Samples for weekday delivery should be shipped to:

Sample Custodian
Microbial Insights, Inc.
10515 Research Drive
Knoxville, TN 37932
(865) 573-8188

Shipment for Saturday Delivery:

Coolers to be delivered on Saturday **must be shipped via FedEx** to our FedEx Drop Location (FedEx will not accept shipments from any other carriers). To ensure proper handling the following steps must be taken:

1. FedEx shipping label should be marked under (6) Special Handling, check Hold Saturday.
2. The cooler must be taped with FedEx SATURDAY tape.
3. The shipping label must be filled out with the Drop Location address below. Our laboratory name must be on the address label.

4. You MUST ***notify by email*** customerservice@microbe.com with the tracking number of the package on Friday (prior to 4pm Eastern Time) to arrange for Saturday pickup. Please make sure you write "Saturday Delivery" in the subject line of the message. Without proper labeling and the tracking number, there is no guarantee that the samples will be collected.

Samples for Saturday delivery should be shipped to:

Microbial Insights, Inc.
FedEx Drop Location
10601 Murdock Drive
Knoxville, TN 37932
(865) 573-8188

Notes:

- **Stable Isotope Probing (SIP) may preclude subsequent Compound Specific Isotope Analysis (CSIA) in the study well for a period of time. CSIA can be performed prior to SIP or at another location.**

Intended for
Wisconsin Public Service Corporation

Date
~~March 16~~August 12, 2020

Project No.
70712

~~PRE-DESIGN INVESTIGATION WORK PLAN~~PRE-DESIGN INVESTIGATION WORK PLAN REVISION 1

~~FORMER GREEN BAY MGP SITE~~FORMER GREEN BAY MANUFACTURED GAS PLANT SITE

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~~PRE-DESIGN INVESTIGATION WORK PLAN~~PRE-DESIGN INVESTIGATION WORK PLAN REVISION 1
~~FORMER GREEN BAY MGP SITE~~FORMER GREEN BAY MANUFACTURED GAS PLANT SITE

Project name	**Former Green Bay MGP**
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Table B Standard Descriptors for NAPL Observations
Table C Estimated Field Analysis Schedule

TABLES (ATTACHED)

Table 1 Sampling and Analysis Plan

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Figure 1 Site Location Map
Figure 2 Site Layout, Surrounding Features, and Utilities
Figure 3 Former MGP Structures
Figure 4 Previous Removal Areas
Figure 5 Post Removal Soil Sample Location Map
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Figure 8 NAPL Observation and Proposed Soil Boring Location Map
Figure 9 Risk Assessment, NAPL Observation, Proposed Soil Boring Location Map

APPENDICES

Appendix A Site Specific Work Plan Addendum – MW-402R Replacement Memorandum
Appendix B Relevant Multi-Site Operating Procedures
Appendix C Site-Specific Health and Safety Plan
Appendix D Remedial Investigation Data Summary Package – Select Figures and Tables
Appendix E Vendor Specifications & Protocols

ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CERCLA ("Superfund")	Comprehensive Environmental Response, Compensation, and Liability Act
City	City of Green Bay, Wisconsin
COPC	constituent of potential concern
CSM	Conceptual Site Model
CY	Cubic yards
Diggers	Wisconsin's Diggers Hotline
DNAPL	dense non-aqueous phase liquid
ES	Enforcement standard
FSP	Field Sampling Plan
FS	feasibility study
ft^3	cubic feet
GBGLC	Green Bay Gas Light Company
GPR	Ground penetrating radar
HASP	Health and Safety Plan
IBS	Integrys Business Support, LLC
IDW	investigation-derived waste
MMTD	medium temperature thermal desorption
MGP	manufactured gas plant
NAPL	non-aqueous phase liquid
NCP	National Contingency Plan
NFA	North Focus Area
NRT	Natural Resources Technology, Inc., formerly OBG, part of Ramboll, now Ramboll
OBG	O'Brien and Gere Engineers, Inc., part of Ramboll, now Ramboll
OSR	Off-Site Rule
OIP	Optical Image Profiler
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PDI	pre-design investigation
PID	photoionization detector
PPE	personal protective equipment
QC	quality control
QAPP	Quality Assurance Project Plan
RA	remedial action
RAF	Risk Assessment Framework
RD AOC	Administrative Settlement Agreement and Order on Consent for Remedial Design
~~RG~~	~~remediation goal~~
RI	remedial investigation
ROD	Record of Decision
ROW	right-of-way
SAA	Superfund Alternative Approach
SFA	South Focus Area
SIP	Stable isotope probing
SLs	Screening Levels

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SOP	standard operating procedure
USEPA	United States Environmental Protection Agency
WBS	WEC Business Group, LLC
WDNR	Wisconsin Department of Natural Resources
WPSC	Wisconsin Public Service Corporation

EXECUTIVE SUMMARY

Ramboll has prepared this Pre-Design Investigation (PDI) Work Plan on behalf of Wisconsin Public Service Corporation (WPSC) for the upland portion of the Green Bay Former Manufactured Gas Plant (MGP) located in Brown County, Wisconsin. The primary objective of the PDI Work Plan is to further delineate the horizontal and vertical extent of impacts within the upland near the WPSC Annex building. To proceed with design for an interim removal action and to the remedial investigation/feasibility study (RI/FS) phase, additional information is required to design the remedy for the upland portion of the site. This additional information will be obtained through implementation of this PDI work plan.

Site investigation and historic soil excavation activities were completed between 1994 and 2003 focused on identifying source areas, determining the presence of former MGP structures, and groundwater monitoring continues to be performed to determine plume stability. Investigations included soil borings, test pits, soil samples, sediment samples, and groundwater sampling from monitoring wells and piezometers. Groundwater sampling has continued through November 2019 to evaluate the effect of source removal/soil remediation activities on water quality and natural attenuation.

Previous remedial action (RA) was completed in 2003 within the upland site in the form of soil removal and treatment, engineering and institutional controls, and long-term monitoring areas with the goal of meeting established criteria for natural attenuation as a final groundwater remedy. Although source and contaminated material was removed as part of the 2003 soil remediation effort, residual impacts remain within the former MGP (Site).

Investigations completed under the Superfund Alternative Approach (SAA) program identified oil-wetted/oil-coated fill/soil above native clay in upland material adjacent to the Annex building and the East River in the north parking lot area. One boring had trace observations of residual dense non-aqueous phase liquid (DNAPL) just above the top of/in fractured native clay. Subsequent SAA early removal actions occurred adjacent to the former MGP in the East and Lower Fox Rivers in 2018 and 2019, removing residual DNAPL from channel sediments and native clay, and shoreline soils. This PDI Work Plan addressed the upland.

To further refine extent of residual upland soils impact, the following data gaps were identified to be addressed to facilitated development of the early action design:

- **Data Gap 1**: The horizontal and vertical extent of soil exceeding screening levels (SLs) ~~remediation goals (RGs)~~ adjacent to the WPSC Annex Building in the north parking lot is insufficient for design purposes.
- **Data Gap 2**: Information regarding locations of potential buried utilities and remnant MGP structures is insufficient and out of date for safe drilling of borings and early action design purposes.
- **Data Gap 3**: The location of MW-402R~~2~~ is unknown because it was paved over by the property owner in 2018.
- **Data Gap 4**: There is uncertainty regarding the potential for the microbial community to address COPCs to the SLs ~~RGs~~ for groundwater in the upland.

Soil borings will be installed at locations where data gaps have been identified between a DNAPL-containing boring and a clean boring based on the previous investigation results. The vertical and horizontal extent evaluation will involve advancing soil borings for residual DNAPL visual and analytical observations. Soil borings will ~~also~~ be augmented with TarGOST® or the Geoprobe® equivalent Optical Image Profiler (OIP) to evaluate the extent of DNAPL. Co-located ~~S~~soil borings and TarGOST® analysis are expected to be continuous, to define the presence/absence and vertical extent of affected soil at each boring location and extend into confining clay layer (approximately 20 feet ~~bgs~~below ground surface (bgs)). The borings will extend a minimum of 5 feet into clay or to the depth of 20 feet, whichever is achieved first. For the purpose of guiding PDI fieldwork, the vertical and horizontal extent of source material will be considered delineated if no oil-coated or oil-wetted observations are present for two consecutive sample intervals (e.g., 4-feet) of sample free from DNAPL or into top of clay.

Soil borings will be characterized for soil texture (grain size), visual indication of DNAPL, color, odor, bedding features, secondary porosity features (e.g. fractures), or notable inclusions (e.g. wood, peat). Subsurface soil samples will be collected from all delineation borings as follows:

- For borings that show no visual, olfactory, or PID indication of impacts, one sample within the 2-foot interval above the clay ~~defining~~ confining layer will be collected.
- For borings that indicate the presence of contamination (through visual, olfactory, or PID indication), a sample of impacted material will be collected. A second sample will also be collected below the interval(s) of potential MGP residuals, to document vertical extent. A third sample will be collected from within the 2-foot interval above the clay ~~defining~~ confining layer if not included in the other samples.

Additionally, a waste characterization soil sample will be collected for materials anticipated for excavation and off-site disposal, in order to document waste characteristics. This profile will be utilized for anticipated removal actions within 2020.

Positive indicators of the occurrence of natural attenuation have been presented in the SSWP. To further evaluate the potential for monitored natural attenuation within the groundwater, stable isotope probing biotraps~~.~~ will be deployed ~~to assess microbial communities. Biotraps will be deployed~~ in groundwater monitoring wells exhibiting groundwater standard~~s~~ exceedances for benzene, naphthalene, and benzo(a)pyrene and will be naphthalene specific. Biotraps will be deployed at four monitoring wells in the vicinity of the former MGP structures. A replacement well will be installed for MW-402R which was previously paved over. Details regarding the installation of MW-402R are included in Appendix A and include utilization of ground penetrating radar (GPR) for delineation of the paved over well.

The PDI field activities will be scheduled following USEPA approval of the PDI Work Plan, and will be dependent upon weather conditions, execution of access agreements, utility constraints, and contractor availability. WPSC will inform USEPA of the proposed schedule for PDI field activities following USEPA's approval of the PDI Work Plan. Field activities are targeted to initiate within 30 days of USEPA's approval of the PDI Work Plan and are expected to occur for one week in Q2 2020. The Pre-Design Investigation Evaluation Report will be submitted to the USEPA 60 days following completion of field activities and receipt of all analytical results.

Commented [A1]: confining

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1. INTRODUCTION

Ramboll has prepared this Pre-Design Investigation (PDI) Work Plan on behalf of Wisconsin Public Service Corporation (WPSC) for the upland portion of the Green Bay Former Manufactured Gas Plant (MGP) located in Brown County, Wisconsin (Figure 1; Site). The sediment portion of the Site is being addressed separately. The Site is managed by WEC Business Services, LLC (WBS). The primary objective of the PDI Work Plan is to outline the additional data collection efforts necessary to meet the requirements of the Administrative Settlement Agreement and Order on Consent for Remedial Investigations and Feasibility Studies (AOC) and Statement of Work (SOW), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or "Superfund") Docket No. V-W-06-C-847, dated May 5, 2006 (USEPA, 2006). The AOC and SOW address six of WPSC former MGPs.

Under the AOC/SOW, a generic approach was developed to address the six WPSC Sites (the Multi-Site approach). The Multi-Site support documents, which can be modified to account for site-specific differences that may exist and were approved by the United States Environmental Protection Agency (USEPA) as of April 20, 2010 (or later) include:

- Quality Assurance Project Plan (QAPP)
- Health and Safety Plan (HASP)
- Generalized Conceptual Site Model (CSM)
- Risk Assessment Framework (RAF)
- Field Sampling Plan (FSP)
- Feasibility Study (FS) Support Documents

The PDI includes elements of the FS, as defined in the SOW and the USEPA-approved Multi-Site FS Support Documents. If necessary, site-specific modifications will be provided.

1.1 Overview

Following remedial actions (RA) completed at the site in 2003 under Wis. Admin NR 700 auspices, investigations completed under the Superfund Alternative Approach (SAA) program identified oil-wetted/oil-coated material above native clay adjacent to the Annex building and the East River in the north parking lot area. One boring had trace observations of residual DNAPL just above the top of/in fractured native clay. Subsequent SAA early removal actions occurred adjacent to the former MGP in the East and Lower Fox Rivers in 2018 and 2019, removing residual DNAPL from channel sediments and native clay, and shoreline soils. Residual DNAPL remaining in the upland area will also be addressed as an early removal action, consistent with an August 2019 EPA Memorandum and Section 300.430 of the National Contingency Plan (NCP).

August 23, 2019, EPA Office of Land and Emergency Management released Use of Early Actions at Superfund National Priorities List Sites and Sites with Superfund Alternative Approach Agreements Memorandum, which encourages consideration of early action as part of the overall strategy for site management. The memorandum states that actions should be taken at the point that sufficient information is available to support a response to mitigate risk or limit contaminant migration, which is consistent with Section 300.430(a)(l) of the National Contingency Plan. The objective of early actions is to achieve signification risk reduction, address immediate risks to

human health and the environment, to control migration of contamination or in support of property reuse. The response action is considered an "early action" because it is taken before completion before the remedial investigation/feasibility study (RI/FS) phase for the site or operable unit (OU) is complete.

To proceed to the RI/FS and further design for an early action at the former WPS Green Bay MGP, additional information is required to design the remedy for the upland portion of the site. This additional information will be obtained through implementation of this PDI work plan, which includes monitoring well installation (Appendix A) and soil boring installation (Appendix B) to be conducted under a site-specific Health and Safety Plan (Appendix C). The AOC contained several content requirements for the PDI Work Plan. The following is a list of those requirements along with the section of this PDI Work Plan that addresses them:

- An evaluation and summary of existing data and description of data gaps (Section 2).
- A detailed plan of PDI activities targeted at resolving identified data gaps. Among other elements, this plan will include data quality objectives, media to be sampled, contaminants or parameters for which sampling will be conducted, location, and number of samples anticipated (Sections 3.3, 3.4).
- Cross-references to quality assurance/quality control requirements.

1.2 Site Geology and Hydrogeology

Soils encountered during previous site investigations include lacustrine and glacial deposits intermixed with fill. Surface and near surface soils are dominated by fine sand, silt, clay, and fill. The fill is predominately a black ash/cinder mix that resembles fine to coarse sand and silt; it also includes wood, glass, brick, concrete, wire, and porcelain. Fill ranges between 4 and 12 feet thick and generally the thickness increases towards the north. Clay till is present beneath much of the Site, extending from approximately 4 feet bgs to at least 30 feet bgs. The clay till is, red to red-brown, firm to hard, and usually fractured with thin, sporadic silt and fine sand seams throughout. The depth to clay increases approaching the river.

The groundwater flow direction has been generally consistent throughout the course of the various investigation activities. The hydraulic conductivity of the near surface material is orders of magnitude higher than the clay as observed in groundwater monitoring wells and piezometers beginning as early as December 1994. Well measurements collected through 2014 indicate the water table generally occurs between two and seven feet bgs. Typically, the shallow water table contours indicate radial groundwater flow toward both rivers while groundwater levels in the piezometers indicates a flow towards the East River (to the east-northeast).

~~1.2~~1.3 Site Description and Surrounding Land Use

The former Green Bay MGP property is located in Green Bay, Wisconsin, immediately east of the WPSC corporate offices. The former MGP property is approximately 4 acres in size, while the entire area owned by WPSC covers approximately 13 acres. The property is bounded by the Fox and East Rivers on the north, by North Jefferson Street on the west, by North Madison Street on the east, and by Elm Street on the south (Figure 2).

The former MGP facility is a currently used as a parking lot, is entirely paved, and is an upland setting (Figure 2). A river walk area, located on an easement to the City (City of Green Bay) occupies the area immediately adjacent to the Fox River/East River shoreline. The channel

sediments of the Lower Fox River/East River adjacent to the former MGP comprise the sediment portion of the site, which includes two recently remediated areas called the North Focus Area (NFA) and the South Focus Area (SFA), the locations of which are shown on Figure 1. In relation to the former MGP property, the WPSC General Office and Annex Buildings are located northwest, the WPSC corporate Division Office Building is located west, the KI Convention Center is located southwest, the Associated Bank Office Building is located south, and the Associated Bank Office Building parking areas adjoin the Site to the south and east, respectively (Figure 2).

The former Green Bay MGP property was owned by the Green Bay Gas Light Company (GBGLC) and began operating in 1871. In 1922, GBGLC merged with other utilities to form WPSC. The MGP property was used to convert coal and other hydrocarbon feed stock into gas for heating and lighting until the late 1940s when natural gas became readily available through pipelines.

The Green Bay MGP utilized the coal gas production method until carbureted water gas machines were installed in 1919 and 1922. The MGP operated until 1947. The facility was dismantled in 1950, except for one gas holder, which was dismantled in 1975 Previously existing MGP related structures are shown on Figure 3. Former MGP related structures of significance include:

- Boiler, relief, and condenser houses
- Two condenser tanks approximately 12 feet in diameter
- Three oil tanks approximately 15 feet in diameter
- A tar well approximately 50 feet in diameter
- Four gas holders ranging in diameter from approximately 40 to 140 feet, with capacities of 15,000 cubic feet (ft^3), 40,000 ft^3, 300,000 ft^3, and 1,000,000 ft^3
- Three purifiers approximately 20 feet in diameter

One feature that was not identified until later during investigation activities was a historic sewer line that was a potential conduit for contaminant migration between the former MGP operational area and the East River. This line is approximated on Figure 3 and was investigated during the latter part of the Phase II activities and remediated as part of the 2003 soil remediation activities illustrated on Figure 4.

~~1.3~~1.4 Previous Investigations Summary

Site investigation and historic soil excavation activities were completed between 1994 and 2003 and groundwater monitoring has continued through November 2019 to assess conditions since soil remediation. Investigations have focused on identifying source areas, determining the presence of former MGP structures, and groundwater plume stability. Investigations included soil borings, test pits, soil samples, sediment samples, and groundwater sampling from monitoring wells and piezometers. Full bibliography of reports and summaries for the site prior to 2014 is addressed in the Completion Report dated June 2014 (Natural Resources Technology[1], June 2014). Soil, soil gas, and groundwater sampling locations are included on Figure 5, Figure 6, and Figure 7, respectively. Sediment investigations are not discussed in this report.

~~1.3.1~~1.4.1 Phase II Investigations (1994 and 1996)

Phase II Investigations were completed in 1994 and 1996 to delineate MGP residuals in soil and groundwater. The Phase II investigations included nineteen soil borings (SB-401 to SB-419),

[1] Natural Resources Technology, Inc. (NRT) formerly OBG, part of Ramboll, now Ramboll.

fourteen groundwater monitoring wells (MW-401A to MW-414), and four piezometers (MW-401B, MW-405B, MW-409B, and MW-411B) in 1994 followed by seven soil borings (SB-420 to SB-426), four monitoring wells (MW-415A to MW-418), and one piezometer (MW-415B) in 1996. The investigations concluded that most MGP residuals occurred in shallow soils which included fill material with some evidence of MGP residuals within deeper clay fractures. Additional conclusions within the Phase II investigations include:

- Soil with elevated polycyclic aromatic hydrocarbon (PAH) concentrations was the focus of the 2003 soil remediation and the volume was approximately 780,000 ft^3 (28,900 yd^3), assuming a 6-foot average depth.
- Evidence of free phase MGP residual was noted in wells MW-401A/B, MW-404, and MW-411A. The presence of this material to a maximum depth of approximately 14 feet in piezometer MW-401B suggested limited vertical migration via clay fractures.
- BTEX and PAH concentrations in groundwater exceeded the NR 140 Enforcement Standard (ES) on the south part of the property and along the bank of the East River.
- Results from the piezometers indicate affected groundwater was present at depth only in well nest MW-401, located adjacent to the former condenser tanks and a gas holder.

Soil boring and groundwater monitoring well locations representative of post removal action conditions are shown on Figure 5 and Figure 7 respectively~~.~~

~~1.3.2~~1.4.2 Remedial Design Investigation (2002)

A focused remedial design investigation was completed in 2002 to obtain additional data for the 2003 soil remediation work as described in the Completion Report (NRT, June 2014). Completed activities included:

- Sample groundwater at all wells in August 2002 and at select wells in November 2002.
- Install additional piezometer MW-407B for further groundwater quality assessment.
- Install replacement piezometer MW-401BR (for MW-401B) because the August 2002 groundwater sampling results indicated the well integrity was possibly compromised.
- Complete geotechnical borings SBG-401 to SBG-403 along the East River for proposed sheet pile design. Geotechnical data was also collected from MW-401BR for design of proposed sheet pile along Elm Street.
- Install borings SB-427 to SB-431 in the former tar well, former purifier area, small gas holder, and area along the East River (to assess potential impacts from a former historic sewer line).

~~1.3.3~~1.4.3 Post Remedial Action and Remedial Investigation (2003 to 201~~7~~9)

Although source and contaminated material was removed as part of the 2003 soil remediation effort described in Section 1.~~4~~5 and shown on Figure 4, affected soils remain within the former MGP Property. Appendix D includes select figures and tables summarizing screening level exceedances and monitoring data, previously transmitted to USEPA as an RI Data Summary Package in preparation for a RI kick-off meeting scheduled for February 2017, which did not occur.

Analytical results of investigation of soil undisturbed by the 2003 remediation effort are presented in Table 1 and Table 2 of Appendix D and indicate that seven PAHs are most prevalent in the site soils: Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene,

Benzo(a)pyrene, Dibenzo(a,h)anthracene, Indeno(1,2,3 cd)pyrene, and Naphthalene. The prevalent PAHs were the most common exceedances for either the residential or industrial RSLs in samples following the 2003 removal activities. Benzo(a)pyrene was the most prevalent PAH and it exceeded either the residential or industrial RSL in 21 of the 28 samples collected at excavation base or walls. Of these 21 benzo(a)pyrene results, five were collected between the surface and 3-feet below ground surface (bgs). In soils deeper than 3-feet bgs, the highest PAH concentrations were present on the edge of Excavation Area 4 and these frequently exceeded 10,000 µg/kg. Concentrations in the other excavation areas were neither as high nor as prevalent. Analytical results that exceed either the residential or industrial RSL for borings outside of the four excavation areas are predominantly less than 5-feet bgs. The only location at which benzene exceeded the industrial RSL was at a depth of 10-feet bgs at MW 401BR. Only one other benzene sample and two ethylbenzene samples exceeded the residential RSL; all other VOC results were below the RSLs. The results indicate widespread, generally low-level concentrations remained in soils across the site, especially for areas outside of the excavation areas.

Additional soil investigations toward RI/FS efforts were completed with seventeen hand auger borings (HA-401 through HA-417), twenty-one soil borings (SB-418 through SB-438), and thirteen soil borings for conversion to soil gas probes (SG-401 through SG-404, SS-405A/B, SG-406 through SG-412) completed between October 19 and 21, 2015. Surface and subsurface soil sampling was conducted as specified in Revision 2 of the Site-Specific Work Plan for Upland Areas (October 9, 2015). Several step-out borings (SB-418A through SB-418I, Figure 5) were completed to evaluate the horizontal extent of potential MGP residuals east of the Annex Building. As an extension of the step-out boring program initiated in October 2015, a second subsurface soil sampling event took place on February 8, 2016 to evaluate potential soil impacts adjacent to the east side Annex Building. Four Geoprobe® soil borings (SB-418J, SB-418K, SB-418L and SB-418M) were advanced to a depth of 15-ft below ground surface.

Laboratory reports on the soil samples collected for analysis indicated detected concentrations of contaminants of potential concern (COPC) including benzene, ethylbenzene, and naphthalene. Soil gas results collected in February 2016 from nearby soil vapor probes SG-401 and SG-402 (Figure 26, Appendix D) also included detections of MGP VI COPCs and an exceedance of the benzene industrial screening level at SG-401. Impacts were mostly in fill materials outside of the 2003 soil remediation excavation areas. Nonaqueous phase liquid (NAPL) was located in fill and fluvial materials immediately overlying the less permeable clay (Figure 8). Trace amounts of NAPL were found within vertical clay fractures.

Long-term groundwater monitoring has been conducted from the conclusion of the 2003 soil remediation to November 2019. Semi-annual groundwater monitoring was completed from September 2003 through September 2008, annual sampling was completed each May from 2009 to 2015, quarterly sampling of select wells was completed in 2015 and 2016, and semi-annual sampling of select wells was completed from 2017 to 2019. Sampling was completed to evaluate the effect of source removal/soil remediation activities on water quality and natural attenuation. Prior to the 2003 Remedial Action, DNAPL was observed in MW-401AR, MW-402, MW-403, MW-404, and MW-411A. Since then, DNAPL observations have been reduced to two wells~~was observed in~~ (MW-405A and MW-401AR)~~ in November 2019~~.

Appendix D presents a summary of groundwater contours, which have been stable during the period of monitoring, and concentration trends and plume extents for select parameters. Cross-Sections X, Y, and Z in the vicinity of the proposed PDI activities are provided in Appendix D.

~~1.4~~1.5 Overview of Previous Remedial Action Activities

Previous RA was completed in 2003 within the upland site in the form of soil removal and treatment, engineering and institutional controls, and long-term monitoring in accordance with the approved Wis. Admin. Code NR 724 Remedial Work Plan (NRT 2003). Soil remediation was undertaken with the objective of removing significant soil impacts and source areas with the goal of meeting established criteria for natural attenuation as a final remedy. Areas to be addressed were based on the soil analytical results obtained between 1994 and 2002. The selected remedy was source area excavation with medium temperature thermal desorption (MMTD), a parking lot cap and cover soil in peripheral unpaved areas, and groundwater monitoring.

Excavation and decommissioning of former MGP structures and piping removed approximately 30,075 tons of soil and debris from four areas (Figure 4) that included the following:

- Area 1 - included the 300,000 ft^3 gas holder near Elm Street
- Area 2 – included the former tar well, oil tanks, purifiers, and small gas holders
- Area 3 – included the suspected discharge area of the former concrete channel to the river
- Area 4 – included an area along the East River bank near well MW-410 (elevated cyanide)

In addition, former MGP and sewer piping was also excavated and treated, and this included the former concrete channel between the tar well and Area 3. Sheet pile was installed along Elm Street and the East River to facilitate Areas 1 and 3 excavation and portions were cut off and left in place. Sheet pile installed north of Area 3 served as a barrier between soil remediation and the East River shoreline and remains in place.

The main purpose for excavation was to remove former MGP structures (pipes, channels, tar well, etc.) considered to be sources of the tar impacted material. Excavations did not proceed laterally or vertically to remove tar that occurred in clay fractures or silt seams. The extent of the excavation areas are shown on Figure 4 and a summary for each is below, along with the volume of material excavated and how it was treated or disposed.

Table A. Previous Removal Excavation Volumes and Disposal Summary

Site Area/ Feature	Depth Excavated ft. bgs (approx.)	Tons Excavated	Backfill Material	Final Disposal
Area 1	6 8 ft	3,484	Imported Sand; Treated Soil	Excess soil thermally treated and debris disposed at Hickory Meadows
Area 2 & Tar Well	16 22 ft tar well, 8 14 ft other	14,461	Treated Soil	
Area 3	8 12 ft	7,715	Treated Soil	
Area 4	7 ft	173	Treated Soil; Imported Gravel	

Cores advanced in 2017 along the south shoreline of the East River (between the Upland Area 3 excavation and the ~~water~~East River channel) indicated the presence of DNAPL in riverbank soil. Approximately, 170 linear feet of the shoreline soil adjacent to the sheet pile wall was excavated from the Upland Area 3 sheet pile wall to the rip-rap face (i.e., water's edge) to remove DNAPL as part of the South Focus Area Sediment Remedial Action completed in 2018. The shoreline

excavation extended approximately 20 linear feet river-ward from the upland sheet pile wall and ~~.~~was contiguous to the river channel sediment removal. The shoreline soil excavation depth was at least 8 feet bgs or a minimum of elevation of 577 feet NAVD 88 ~~throughout the shoreline area.~~and ~~Excavation~~ extended deeper ~~than elevation 577 feet~~ in three areas. ~~to remove DNAPL observed during 2017 investigation activities. The shoreline excavation extended approximately 20 linear feet river-ward from the upland sheet pile wall.~~ Approximately, 1,245 cubic yards (CY) of ~~material~~clay soil was excavated as a part of ~~shoreline soil~~the voluntary early removal action that completed to remove DNAPL observed during 2014 and 2017 investigation activities~~.~~. The shoreline area was backfilled with clean fill to match pre-construction elevations.

~~1.5~~1.6 Multi-Site Documents

WPSC enrolled six former MGP sites into the USEPA Superfund Alternatives Program in 2006. In an effort to promote a consistent methodology for investigating and evaluating these six sites, WPSC developed multi-site documents that outline general approaches and concepts, with the intent to streamline preparation of work plans and to minimize review times for future deliverables. In addition, the multi-site documents provide a consistent approach to investigate and assess all sites within the program. PDI field work will be carried out in accordance with relevant elements of these multi-site documents. Specifically, field documentation, sample collection, and sample handling will be conducted in accordance with standard operating procedures (SOP) defined in the *Multi-Site Field Sampling Plan (FSP)- Revision 4* (Integrys Business Support [IBS], 2008). SOPs relevant to the PDI field work are included in Appendix B. Similarly, laboratory analysis and data management will be managed in accordance with *Multi-Site Quality Assurance Project Plan (QAPP) - Revision 2* (IBS 2007b) and subsequent addenda.

The USEPA-approved *Multi-Site Health and Safety Plan - Revision 2* dated March 12, 2015 (Multi-Site HASP; IBS, 2007a), which was used to develop the HASP for the purposes of this PDI Work Plan. The Site-specific HASP is included as Appendix C. This plan will be modified based on additional site-specific information as the PDI and early action process progresses.

2. DATA GAP IDENTIFICATION

Sufficient investigation activities have been conducted during prior upland investigations, removal actions, and on-going long term monitoring to estimate the extent of affected media, determine risk for potential exposure, and develop and evaluate remedial alternatives. The extent of this PDI and the proposed early action is limited to the western portion of the north parking lot area of the Site. Additional data is required to facilitate development of the early action design and implementation. The following sections identify current data gaps needed to complete the early action. Proposed investigation to resolve these data gaps is presented in Section 3.

2.1 General

General data gaps related to overall fundamental design needs of the proposed remedy are presented below.

2.2 Remedial Areas

- **Data Gap 1:** The horizontal and vertical extent of soil exceeding screening levels (SLs) ~~remediation goals (RGs)~~ adjacent to the WPSC Annex Building in the north parking lot is insufficient for design purposes.

Commented [A3]: change to SLs

2.3 Utilities

- **Data Gap 2:** Information regarding locations of potential buried utilities and remnant MGP structures is insufficient and out of date for safe drilling of borings and RA design purposes.
- **Data Gap 3:** The location of MW-402R~~2~~ is unknown because it was paved over by the property owner in 2018.

2.4 Groundwater Monitored Natural Attenuation

- **Data Gap 4:** There is uncertainty regarding the potential for biodegradation of COPCs to SLs for groundwater in the upland via natural attenuation. ~~the microbial community to address COPCs to the RGs for groundwater in the upland.~~

3. PRE-DESIGN INVESTIGATION SCOPE

This section details the scope of the PDI.

3.1 Administrative Considerations

Design and implementation of the USEPA-approved early action will be influenced by administrative and engineering considerations. Investigation work to address engineering considerations are identified in later subsections. This subsection presents the administrative elements that need to be better understood prior to proceeding with PDI and voluntary early action activities.

3.1.1 City of Green Bay, AT&T, and WPSC

The anticipated remedial activities within the Green Bay MGP Upland are focused on land owned by WPSC and active roadways owned by the City of Green Bay. The majority of the area subject to supplemental investigation and removal activities is currently utilized as an active parking lot for WPSC facilities which may require partial or total closure during removal action activities. North Jefferson Street, Utility Court, Elm Street, and North Madison Street are active roadways, which may require lane closure or traffic control during remedial activities. WPSC desires to minimize the magnitude of disturbance through use of administrative and construction scheduling methods. Accordingly, WPSC will meet with the City, City Engineering Department, public utilities, and AT&T (communication utility) to discuss the following considerations:

- Preferred traffic detour routes during upcoming right-of-way (ROW) work for the RA
- Requirements and accommodations for temporary shutdown, relocation, and/or bypass of utilities
- Information regarding utility dimensions, depths, and other details that may be required for shutdown, relocation, and/or bypass of utilities
- City standard or preferred offset distances for excavation adjacent to utilities and other infrastructure
- City standard or preferred specifications for replacing roadways, sidewalks, and other pavement improvements following the RA
- Other City standards or concerns associated with implementing the voluntary early action remedy

3.2 Utility Clearance and Topographic and Visual Surveys

This subsection summarizes information that is currently known about utilities at the Site and plans to obtain and update the information needed to support the PDI and voluntary early action activities.

3.2.1 Existing Utilities

Preliminary understanding of above ground and subsurface utilities was obtained during the 2003 removal actions. Existing underground utilities in the vicinity of the upland site, including storm water, sanitary, water, electric, communications, and gas, are depicted on Figure 2. The utilities in the vicinity of the north parking lot area include the following:

- **Sanitary and Storm:** The City of Green Bay and WPSC maintain public and private sanitary sewers and storm sewers within the site boundary. A storm sewer line runs north-south beneath the north parking lot sidewalk to an outfall at the shoreline. Storm sewer lines run beneath the north parking lot from the intersection of N Madison Street and Utility Court to intersect the sidewalk storm sewer near the WPSC Annex building. The surface water runoff in the area is collected in storm sewers located in the streets, sidewalks, and within the parking lots and is discharged via a storm sewer outfall into the East River.
- **Water and Electric:** The City of Green Bay and WPSC maintain the water and electric utilities in the vicinity of the Site. Underground electric lines run north-south beneath the north parking lot from Utility Court to the river walk easement with east-west intersecting lines and two lines located beneath the river walk. Overhead electric runs north-south from the intersection of Utility Court and N Madison Street to the shoreline. A water main runs east west beneath Utility Court.
- **Natural Gas** – WPSC maintains a natural gas line in the vicinity of the Site. A natural gas line run east-west beneath the Utility Court ROW, intersecting with the north-south line beneath the N Madison Street ROW. Additional natural gas lines run north to the Annex building and east to the shoreline.
- **Communications** – AT&T maintains a communication line located beneath Utility Court. Known communication lines are not identified within the north parking lot area of the Site.

3.2.2 Utility Clearance

Consideration was given to the known utilities when selecting the proposed investigation locations identified in Figure 8. Prior to initiation of any drilling or other intrusive work, underground and overhead utilities, including electric lines, gas lines, storm and sanitary sewers, and communication lines, will be identified. The process for conducting utility clearance is outlined below:

- Locate all investigation borings with flagging, survey stakes, and/or marking paint prior to the utility locate.
- Submit a request to Wisconsin's Diggers Hotline (Diggers), the utility one-call system, to initiate the utility-locating activities. Wisconsin state law requires that Diggers be notified at least three working days, and not more than 10 working days, before subsurface work is conducted.
- Subcontract a third-party utility location service to support identification of private subsurface utility infrastructure.
- Coordinate with participating utility-owning companies to locate and mark all respective subsurface utility lines within the Approximate Extent of Upland Site boundary presented on Figure 2.
- Precautions regarding safe distance from the overhead electrical lines will be reviewed and equipment offset distances flagged and marked, in accordance with the required clearances.
- Drilling and other intrusive activities will proceed with due caution for the top 10 feet of each investigation location.
- Proposed sampling locations identified on Figure 8 may be relocated to avoid subsurface and overhead utilities, as appropriate.

If offset borings are required beyond the boundary of the area on which utility clearance has been completed, a new request will be submitted to Diggers and work will not commence until the locates associated with the new request have been completed.

3.2.3 Survey

The following subsections describe the surveys to be conducted as part of the PDI.

3.2.3.1 Topographic, Boundary, and Utility Survey

To develop a suitable base map to support RI/FS and early action design, a Site survey will be completed by a licensed Wisconsin professional surveyor to update previously collected survey information. The surveyor will be responsible for providing an updated survey plat for the northern parking lot area of the Site including updates to the following as applicable:

- Property boundaries
- Surrounding streets/ROWs, structures, and driveway entrances
- Easements
- All above-ground and underground utilities, including utility poles and manholes, as identified during the Diggers and private utility locate process
- Existing Site features, including fences, fence gates, asphalt/concrete surfaces, monitoring wells, trees/brush, and grass areas
- The final location of all soil borings, wells, and other information necessary to document the location of PDI activities
- A Site topographic survey with 1-foot contours

All survey information will be completed in accordance with Multi-Site SOP SAS-02-02, using Wisconsin State Plane Central Zone as the horizontal datum and North American Vertical Datum of 1988 as the vertical datum. All survey information will be consistent with prior investigations and will be uploaded into Ramboll's database to produce accurate and updated figures for design and implementation of the RA.

3.3 WPSC Parking Lot Early Action

This subsection details the PDI activities that will be performed to support design for early action in the upland north parking lot area. Previous observations and plans to further define the extent of impacts are summarized below.

3.3.1 Locations, Visual Observations, and Field Delineation

Existing characterization of the source material areas is predominantly based on excavation samples from removal actions in 2003 and borings completed during the supplemental investigations which further delineated the extent of impacts within the upland. Previous removal areas and boring locations are shown on Figure 5.

Intermittent MGP residuals (classified in accordance with Multi-Site SOP SAS-05-02 Standard Descriptors – Visual Observations of NAPL) were observed in the northern portion of the site during investigation in 2015. Residuals were noted in SB-436 and SB-437 along the bank of the East River; SG-401, SB-418, SB-418A, and SB-418C through SB-418G between the Annex

building and the East River; and in historical boring SB-431-2002. Oil wetted/oil coated material was observed within the aforementioned locations above the native clay at various depths ranging from 1.7- to 12.8-ft bgs with the majority between 4- and 10-ft bgs. Staining, sheen, and/or oil-wetted NAPL was observed as fluid or viscous, malleable weathered material. Visual impacts were typically noted in conjunction with odors and elevated photoionization detector (PID) readings. Where NAPL residuals were highly weathered, olfactory or PID indications were at times absent. Trace amounts of NAPL were found within vertical clay fractures at SB-418E at a depth of 14.3- to 15.0-ft bgs.

To further refine extent of impact for early action, soil borings will be installed at locations where data gaps have been identified between a DNAPL-containing boring and a clean boring based on the previous investigation results. The vertical and horizontal extent evaluation will involve advancing soil borings for residual DNAPL visual and analytical observations. Soil borings will also be augmented with TarGOST® or equivalent technology such as Geoprobe Optical Image Profiler (OIP) that uses NAPL fluorescence to evaluate the extent of DNAPL. Proposed soil boring locations for early action refinement are shown on Figure 8. Proposed soil boring locations are shown on Figure 9 ~~in the context of~~along with 10^{-5} residential risk exceedances for context.

~~Soil borings are expected to be advanced using direct-push method. Unless otherwise noted, sampling will be continuous, to define the presence/absence and vertical extent of affected soil at each boring location and extend into confining clay layer (approximately 20 feet bgs). For the purpose of guiding PDI fieldwork, the vertical and horizontal extent of source material will be considered delineated if no oil-coated or oil-wetted observations are present for two consecutive sample intervals (e.g., 4 feet) of sample free from NAPL or into top of clay (whichever is deeper). For delineation of COPCs, the vertical and horizontal extent of non-source material we be considered delineated if analytical results for COPCs are below the industrial RGs.~~

Dakota Technologies or an equivalent NAPL fluorescence provider will be contracted by Ramboll to delineate the extent of DNAPL using NAPL fluorescence~~TarGOST®~~ technology. ~~The TarGOST® laser-induced fluorimeter response will be calibrated to the residual DNAPL prior to mobilization on site as recommended by Dakota Technologies to ensure TarGOST will detect DNAPL material. Though rare, s~~Some site-specific materials (e.g. wood content, mineralogical content, source material origin processing) can ~~negatively~~ impact emitter response accuracy; for this reason several visual observation borings (Figure 8) will be co-located to verify presence of source material and for collection of analytical samples. NAPL fluorescence borings will be advanced prior to the Geoprobe borings, with an initial co-located pair being collected to ground-truth emitter response. Intermittent ground-truthing may occur on an as needed basis to allow NAPL fluorescence observations to progress quickly and allow greater time for sample collection. Geoprobe ~~TarGOST®~~ borings will be located proximal to the NAPL fluorescence ~~Geoprobe~~ locations and depending on NAPL fluorescence~~TarGOST®~~ response, step out borings may be performed to delineate the extent of the DNAPL plume. The colocation of NAPL fluorescence~~TarGOST®~~ borings with Geoprobe borings will ground truth NAPL fluorescence~~TarGOST® fluorimeter r~~ response. Duplicate NAPL fluorescence~~TarGOST®~~ borings will provide an estimate of reproducibility of the response. The output from the NAPL fluorescence~~TarGOST®~~ investigation will include NAPL fluorescence~~TarGOST®~~ logs and an electronic file that can be input into environmental visualization software (EVS) for interpolation of the DNAPL plume extent. NAPL fluorescence~~TarGOST®~~ borings will be advanced a minimum of

Commented [A4]: or equivalent technology (select terminology and apply as appropriate, we may need to replace TarGOST with fluorimeter testing or something)

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Commented [A5]: This would require an earlier mobilization right? I assume this is off the table.

Commented [A6R5]: If we aren't doing this, why is it still in here. I am confused about the status of the Targost sequencing here and in the RTC

5 feet into the confining clay layer (or to a depth of approximately 20 feet bgs, whichever is achieved first) to fully define vertical and horizontal extent of source material.

Soil borings are expected to be advanced using direct-push method. Unless otherwise noted, sampling will be continuous, to define the presence/absence and vertical extent of affected soil at each boring location and extend a minimum of 5-ft into confining clay layer ~~(~~or to a depth of ~~approximately 20 feet bgs).~~ ft bgs, whichever is achieved first. ~~Direct-push soil borings, co-located with TarGOST® borings, may be terminated prior to clay if two conditions are met: ground truth TarGOST® and DPT borings confirm accuracy of TarGOST® to detect source material and no NAPL is observed in TarGOST® profile previously collected.~~

For the purpose of guiding PDI fieldwork, the vertical and horizontal extent of source material will be considered delineated if no oil-coated or oil-wetted observations are present for two consecutive sample intervals (e.g., 4-feet) of sample free from NAPL or into top of clay (whichever is deeper). For delineation of COPCs, the vertical and horizontal extent of non-source material will be considered delineated if analytical results for COPCs are below the industrial SLs.

If a field definition of the horizontal extents is not achieved after completing the initial borings, six contingent delineation step-out borings will be advanced to satisfy source material and/or non-source material delineation data gaps. Review of field visual observations ~~analytical results~~ will guide decisions about whether or not contingency borings be required. Contingency borings will generally be placed equidistant between PDI visual observation location and previously investigated sampling points.

All borings advanced as part of the PDI will be continuously logged, following Multi-Site SOP SAS-05-02, and will include a record of blow counts (as applicable), the presence of fill material, moisture content, photoionization detector readings, the nature of each geologic unit encountered, and visual and olfactory observations indicating the presence of NAPL (e.g., staining, oil-coated, or oil-wetted). Soil boring locations will be recorded in accordance with Multi-Site SOP SAS-03-03, and will be abandoned in accordance with the methods described in Multi-Site SOP SAS-05-05. Field equipment will be calibrated prior to use, as required by Multi-Site SOP SAS-02-01 from the Multi-Site FSP.

3.3.2 Soil Sampling~~, and A~~a~~nalytical and Geotechnical Parameters~~

Soil borings will be characterized for soil texture (grain size), visual indication of DNAPL, color, odor, bedding features, secondary porosity features (e.g. fractures), or notable inclusions (e.g. wood, peat). Figure 8 conveys the analysis scheme for each proposed boring while Figure 9 presents each proposed boring location in the context of residential risk threshold of 10^{-5}.
Subsurface soil samples will be collected from all delineation borings as follows:

- For borings that show no visual, olfactory, or PID indication of impacts, one sample within the 2-foot interval above the clay ~~defining layer~~confining layer will be collected.
- For borings that indicate the presence of contamination (through visual, olfactory, or PID indication), a sample of impacted material will be collected. A second sample will also be collected below the interval(s) of potential MGP residuals, to document vertical extent. A third sample will be collected from within the 2-foot interval above the clay ~~defining layer~~confining layer if not included in the other samples. Visual observations and fluorescence that both support the presence of NAPL will be used to inform sampling per the described protocol; fluorescence alone will not be used to select sample intervals.

Commented [A7]: Change wording to match RTC or does rTC need to match this? Wording was confusing

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Commented [A8]: confining

Commented [A9]: confining

Sampling criteria and estimated depths of sampling locations are detailed in Table 1 attached.

If no evidence of impacts is present in a boring, samples will be collected from selected intervals based on soil type and stratification to best represent soil in the boring. Where applicable, soil samples may also target intervals where impacts were observed in a neighboring soil boring(s). Logging guidance developed specifically for MGP investigations will be used to assist the field team in describing NAPL in borings is listed on below (Table B). If observations or field screening results suggest soil is impacted by a potentially unrelated source, it will be noted on the drilling logs.

Table B: Standard Descriptors for NAPL Observations

Descriptive Term	Standard Descriptors for Visual Observations of NAPL
No Visible Evidence	No visible evidence of oil on soil or sediment sample
Sheen	Any visible sheen in the water on soil or sediment particles or the core
Staining	Visible brown or black staining in soil or sediment; can be visible as mottling or in bands; typically associated with fine grained soil or sediment
Coating	Visible brown or black oil coating soil/sediment particles; typically associated with coarse grained soil or sediment (i.e. coarse sand, gravels, and cobbles).
Oil Wetted	Visible brown or black oil wetting the soil or sediment sample; oil appears as a liquid and is not held by soil or sediment grains

All soil samples collected for laboratory analysis will be analyzed for PAHs for in-filling of existing analytical data sets. Quality control (QC) samples will be collected as required by Multi-Site FSP SOP SAS-04-03. Samples will be labeled and packaged in accordance with Multi-Site FSP SOP SAS-03-01 and shipped using chain-of-custody procedures described in Multi-Site FSP SOP SAS-03-02. Equipment will be decontaminated after use in accordance with Multi-Site FSP SOP SAS-04-04.

Geotechnical laboratory analyses will be performed to inform the design for potential sheet pile wall or excavation shoring. Samples will be collected from locations shown on Figure 8. The analyses to be performed include: Particle-Size Distribution by ASTM D422-63, Moisture Content by ASTM D2216, Specific Gravity of Soils by ASTM D854, Bulk Density of Soils by ASTM D2937, and for cohesive soil (fine-grained soil only) - Atterberg Limits by ASTM D4318 and Unconfined Compressive Strength Test by ASTM D2166. An equivalent alternative analysis method may be considered.

Commented [A10]: Frank- After looking at the risk map and proximity to the river and building, we've added geotech

3.4 Natural Attenuation Evaluation

Positive indicators of the occurrence of natural attenuation have been presented in the SSWP. To further evaluate the potential for monitored natural attenuation within the groundwater, stable isotope probing (SIP) biotraps supplied by Microbial Insights, Inc. (Microbial Insights) will be deployed ~~to assess microbial communities. Biotraps will be deployed~~ in groundwater monitoring wells exhibiting groundwater standards exceedances for benzene, naphthalene, and benzo(a)pyrene according to the standards set by Microbial Insights Bio-Trap – Stable Isotope Probing Protocol. The biotrap analysis will be naphthalene and benzene specific. Biotraps will be deployed at four monitoring wells (MW-402R [or its replacement MW-402R2], MW-404, MW-403R, and MW-405A) in the vicinity of the former MGP structures. A replacement well will be installed for MW-402R and is further described in Appendix A.

Commented [A11]: update pending decision on benzene

Commented [A12R11]: I did not talk with MI, can someone confirm that there would be two separate deployments?

Commented [A13R11]: Yes, Sarah Jo did talk to MI and found this to be the case.

Sampling protocol as described by Microbial Insights involves purging of monitoring wells including removal of any LNAPL prior to installation of biotraps may be necessary (Appendix E). Naphthalene and benzene testing must be completed independently. Biotraps are to be suspended within the monitoring well at the depth where significant contaminant concentration exists or at the middle of the saturated screened interval. Estimated depths at which biotraps will be suspended is included in the attached Table 1. Naphthalene biotraps will be placed first, f~~F~~ollowing the typical 30-day incubation period, the biotrap samplers are removed from the wells ~~and~~ the wells will be purged and the benzene traps will be deployed.

3.5 Waste Characterization

A waste characterization soil sample will be collected for materials anticipated for excavation and off-site disposal, in order to document waste characteristics to amend waste profile HML15-159 for disposal to Advanced Disposal Hickory Meadows Landfill, which was recertified February 14, 2020. This profile will be utilized for anticipated removal actions within 2020. The analytes for the waste characterization sample will be determined through consultation with potential disposal facility based on their permit requirements.

Waste characterization groundwater samples will not be needed for profiling and disposal purposes. WPSC has a waste profile with SET Environmental, Inc. for disposing liquid waste generated during routine groundwater sampling. This profile will also be relied upon for disposal of any liquid waste generated during decontamination of equipment and purging of wells during installation and removal of biotraps.

3.6 Investigation Derived Waste Management

All investigation-derived waste (IDW) generated during the PDI will be collected in properly labeled, 55 gallon drums or bulk containers (e.g. roll-off container lined with polyethylene sheeting for solids, fractionation tanks for liquids). IDW includes soil cuttings, decontamination pad and plastic sheeting, personal protective equipment (PPE), decontamination water, and pumped groundwater.

Drums and containers of material will be labeled as "PENDING ANALYSIS – INVESTIGATION-DERIVED WASTE" with a description of the source (e.g., soil cuttings, decontamination water, pumping test water, etc.) and temporarily stored, pending characterization and proper disposal. The containerized soils will be disposed of off-site, at a facility permitted to accept such material.

Disposal facilities will meet the requirements of the "Off-Site Rule" (OSR) (USEPA, 1993) for the disposal of IDW. Prior to undertaking any disposal, Ramboll will contact the OSR Coordinator at the facility to confirm the facility is in compliance.

3.7 Reporting

In accordance with the AOC, the information collected from the PDI investigation will be presented to USEPA in the PDI Evaluation Report.

3.8 Schedule

The PDI field activities will be scheduled following USEPA approval of the PDI Work Plan, and will be dependent upon weather conditions, execution of access agreements, utility constraints, and contractor availability. WPSC ~~will~~ informed USEPA of the proposed schedule for PDI field activities ~~following USEPA's approval of the PDI Work Plan~~in email correspondence August 6, 2020. Field activities are targeted ~~to initiate within 30 days of USEPA's approval of the PDI Work Plan and are expected~~ to occur for approximately one week ~~in Q2~~ beginning August 24, 2020. A reference schedule is included below for duration of specific field activities. The Pre-Design Investigation Evaluation Report will be submitted to the USEPA 60 days following completion of field activities and receipt of all analytical results.

Table C: Estimated Field Analysis Schedule

Activity		Duration
Public Utility Locate		1 day
Private Utility Locate/Geophysical Investigation (GPRS Inc.)		1 day
~~TarGOST® DNAPL Fluorescence Delineation (Dakota Technologies)~~		3 days
Geoprobe: soil borings and monitoring well replacement ~~(On-Site Environmental)~~		1 ½ days
~~TarGOST® DNAPL Delineation (Dakota Technologies)~~		~~3 days~~
Natural Attenuation Evaluation (2 deployments)	Installation	1 day
	Incubation	30 days
	Retrieval	1 day

4. REFERENCES

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