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March 7, 2016

Mr. Ross del Rosario
USEPA Region 5 – SR6J
77 W. Jackson Boulevard
Chicago, Illinois 60604-3590

RE: Response to Comments
Crawford Station Former MGP Site – SSWP, Addendum 3, Revision 0, Group IV Parcels
The Peoples Gas Light and Coke Company
CERCLA Docket No. V-W-08-C-917
CERCLIS ID – ILN000510192

Dear Mr. del Rosario:

Enclosed are the following documents:

- Our response to your January 29, 2016 comments on our Crawford Site-Specific Work Plan (Group IV parcels), Addendum 3, Rev 0.
- Site-Specific Work Plan (Group IV parcels), Rev 1. which incorporates the aforementioned response to comments.

If you have any questions, please don't hesitate to contact me at (312) 240-4569 or nmprasad@integrysgroup.com.

Regards,

Naren M. Prasad, P.E., MPH
Senior Environmental Engineer

Enclosures as noted

cc: Tracy L. Hofmann – NRT
Paul Lake – IEPA

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Mr. Naren M. Prasad, P.E., MPH
Environmental Engineer – Environmental
WEC Business Services, LLC
200 East Randolph Drive – 24th Floor
Chicago, Illinois 60601

March 4, 2016
(2066)

RE: Response to USEPA Comments
Site-Specific Work Plan, Addendum 3, Revision 0, Group IV Parcels
Crawford Station Former MGP Site, Chicago, Illinois
The Peoples Gas Light and Coke Company

Dear Mr. Prasad:

Natural Resource Technology, Inc. (NRT) is providing this letter response to United States Environmental Protection Agency (USEPA) comments dated January 26, 2016 regarding the Site-Specific Work Plan, Addendum 3, Revision 0, Group IV Parcels (December 9, 2015) for the Peoples Gas Light and Coke Company (PGL) Crawford Station Former MGP Site, Chicago, Illinois. The subject document included a work plan for remedial investigation activities.

For ease of review, USEPA comments are presented below in italics, followed by responses.

General Comments

1. *The proposed investigation activities in the Group IV Parcel SSWP and specific sampling locations shown on Figures 20 through 22 appear reasonable and are generally adequate to supplement existing data for RI characterization purposes, with the caveats noted below. Some approaches and descriptions require additional clarification before final approval. Pursuant to a conference call with EPA and the PRP on January 25, 2016, the PRP provided an additional summary of recent site activities to explain the rationale behind the Group IV Parcel SSWP sampling approach, as well as the proposed Group II SSWP revisions requested in a January 8, 2016 modification letter that was received after the Group IV SSWP was submitted. In light of this discussion, the proposed Group II SSWP revisions included in the January 8, 2016 letter appear reasonable and acceptable. Please keep EPA informed of the proposed plans for addressing residuals along the former West Fork Channel and Parcel K so that the Remedial Investigation (RI) and time critical removal action (TCRA) activities continue to be coordinated among all involved parties.*

Response to General Comment (GC) 1: Comment noted. WBS will keep USEPA informed of any plans to address the MGP residuals on Parcel K during redevelopment and in the former West Fork Channel to continue to coordinate RI and TCRA activities between all involved parties.

2. *There are many references within Section 6.7 that refer the reader to sub-sections with Section 6.8 to obtain additional information (approximately 17). The first example appears on Page 74 at the end of Section 6.7.2.1. The text directs the reader to Section 6.8.5.1 for more information about the sampling intervals in each boring. However, Section 6.8 is a description of Investigation Derived Waste disposal, and there is no Section 6.8.5.1 in the report. It also does not appear that the reference mistake is simply a matter of changing 6.8.x.x.x references to 6.7.x.x.x, because using the example above, there is no Section 6.7.5.1 in the report either. Per request, we typically refrained from providing editorial comments, but in some cases like this one, it is difficult to identify information sources and further explanatory text. Please correct the text reference discrepancy issue.*

Response to GC 2: The section references have been revised accordingly in the text of Revision 1.

3. *Looking forward to later remedial investigation (RI) phases and the feasibility study (FS), it would be prudent to consider adding the following elements to the sampling approach in terms of documenting whether monitored natural attenuation (MNA) is occurring at the site. These elements may be added after the initial rounds of site-wide groundwater data are reviewed and evaluated. More than one line of evidence should be presented to demonstrate MNA. Examples would include:*
    - *Geochemical data showing plume size reduction over time*
    - *Hydrogeological or geochemical data showing rates of attenuation*
    - *Microcosm studies directly showing the presence certain microorganisms associated with a particular natural attenuation process*

Response to GC 3: At this time, none of the groundwater samples show elevated detections of organics (volatile or semi-volatile) above screening levels (SL) that would require evaluation of MNA. The current wells are mainly located along the outer parcels. As new wells are installed in the interior of the former MGP site, particularly in areas near known MGP residuals and organic concentrations above SLs, evaluation of MNA will be considered.

Specific Comments

1. ***Section 3.2, 3.2.1.1, Pages 21 to 30, Rail Spur Area, Figures 6A through 6D:***
   (Please note that the long USEPA comment has been divided into three comments by NRT to address more clearly.)
   1.a. *Section 3.2.1.1 is entitled Rail Spur Area, but this Rail Spur area is not shown/designated on any map. The inclusion of all of the Parcel S data in this Section is confusing because there does not appear to be a rail spur on Parcel S, and it is not obvious where a spur was located in the past. Please clarify the text and figures so it is clear what areas are described in the sections of 3.2.*
   1.b. *In addition, Section 3.2 only contains descriptions for two apparent former MGP areas (Rail Spur (presumably former), and Coal Storage Area (presumably former). However, Section 2.2.1 (bottom of page 7) lists 5 separate former MGP areas on the Group IV parcels, plus the former West Fork Channel that are not described in Section 3.2. Please explain why other former MGP areas like the machine shop and paint shop are not discussed separately in Section 3.2.*
   1.c. *It may be simpler to simply describe each parcel separately with a description of related former MGP operations on the parcel, and then observations of MGP residuals. This approach would also be more consistent with how the soil data is presented in Table 2A (i.e. by Parcel ID and not by MGP area).*

Response to Specific Comment (SC) 1a: Site investigation areas were originally outlined by major site features in the USEPA-approved Completion Report and all SSWP and SSWP Addenda produced since then have followed the same protocol. Section 3.2 of the Group IV SSWP, which describes the locations of observations of MGP residuals, is outlined in the same manner. The former Rail Spur Areas, as defined in the Completion Report, include Parcel A (which was historically full of rail tracks) and portions of Parcels B, O and S; and the former Coal Storage Area, as defined in the Completion Report, is a portion of Parcel B. This clarification has been added to the end of Section 3.2.1. This method of organization applies throughout the document.

It is noteworthy that Group IV Parcels are outside of the production areas where former gas holders and other former process structures once existed. Group IV Parcels (A, B, S and the western portion of O) consisted mainly of a series of former rail spurs for loading and unloading, presumably coal and MGP by-products.

The former rail spurs themselves were discussed in detail in the Completion Report. The former rail spurs, including those on Parcel S, are identified in the 1936 and 1953 Sanborn Maps, the 1938 and 1951 aerial

photographs and the 1938 and 1953 topographical maps provided in the SSWP Addendum 3, Rev 0 and Rev 1 (in Appendix A). An excerpt of the 1953 topographical map showing rail spurs (hatched lines) is included in Section 2.2.1. To see the locations of the rail spurs, Figure 3 has been changed to 3A and a figure 3B is now included which shows the historical site map without the aerial photo and showing key former features on Parcels A, B, O and S. Rail spur lines can also be seen on Figure 3, Historical MGP Site Features, simply as lines on the figure. These resources give the reviewer a general idea of where the rail spurs were located on the Parcels. The former rail spurs are also in the background of Figures 6A-6D, however because of the scale and number of features on the figures, the rail spur locations are not called out; to do so would clutter already complicated figures.

Response to SC 1b: Section 3.2.1 is organized into two sections (former Rail Spur Areas in Section 3.2.1.1 and former Coal Storage Area in Section 3.2.1.2) for reasons described above. For additional specificity, Section 3.2.1.1 is further divided into four areas where former MGP residuals have been observed. Those four areas are Parcel S and three major areas of Parcels A, B, O (the ABO RAA, the Former West Fork Channel Area, and the North Central Area). These four areas are shown on Figures 6A-6D.

A fifth area, the Former Machine, Carpenter, and Paint Shop Area has been added to figures 6A and 6B. These features, though previously discussed through the text of the other areas, are now combine as one area. As discussed in Section 3.2.1.1, MGP residuals have not been observed in the borings near these features. These features and boring observations around these features are presented on Figure 6B and text has been added to Section 3.2.1.1 to highlight the lack of observations of residuals at these features.

Response to SC 1c: To maintain consistency with the Completion Report, SSWPs for Groups I-III, and SSWP addenda, the organizational protocol for site investigation areas will not be modified other than the additions described above. Further modification of this protocol will be considered for RI reporting.

2. ***Section 3.2.3, Pages 26-28, Soil COPCs Screening:*** *As noted in the prior comment, the former MGP areas within Parcel Group IV are not clearly designated on the figures, and it is difficult to correlate results between the text descriptions and the data in Table 2A. Please clarify so the COPCs screening is clear for each area.*

Response to SC 2: As discussed in **Response to Item 1a,** Section 3.2.1 of the Group IV SSWP describes the locations of observations of MGP residuals in the same manner as originally described in the USEPA-approved Completion Report. In addition, the soil COPC screening discussion in Section 3.2.3 points out both the current parcels and former MGP structures, if previously present, in proximity of samples discussed. With the exception of the former West Fork Channel Area, potential MGP residuals, either identified through field observations or detected levels of COPCs above SLs, have not been found in Group IV areas specifically related to a former MGP structure. Instead, potential MGP residuals found in the subsurface are located near the former rail spurs or, as in the case of the ABO RAA, in areas not known to have had any process or operation for the former MGP facility.

Figures 6B-6D, which show both the sample identification tags and parcel identification letters, and data tables provide additional detail of where potential MGP residuals have been identified.

3. ***Section 3.2.4.4, 4.2.4, Page 28, 38:*** *Section 3.2.4.4 notes that groundwater results have been screened against the VISLs. However, site groundwater is very shallow, and if depth to groundwater is less than 5 feet, the flowchart and screening process for evaluating vapor intrusion in shallow groundwater conditions should apply in addition to the VISL comparison. Therefore, the SSWP should include a statement in appropriate sections to reference the process for these conditions. For example, Section 4.2.4 should include references to this process including a description of whether the building on Parcel B is expected to be in contact with the capillary fringe or groundwater. If so, the vapor intrusion*

evaluation approach for shallow groundwater, as documented in the recent technical memorandum and flowchart, should be used and included in the SSWP rather than the groundwater comparisons to VISLs.

Response to SC 3: The Vapor Intrusion (VI) Decision Matrix, which applies to **all sites** not just sites where groundwater is shallower than 5 feet below ground surface (bgs), was approved by the USEPA in February 2016. Give the approval date of the VI Decision Matrix, it was not incorporated into the SSWP Addendum 3, Revision 0 dated December 2015. The VI Decision Matrix has now been incorporated into Appendix F1 of the SSWP Addendum 3, Revision 1.

Regarding Parcel B, the depth to the water table surrounding Parcel B has historically been greater than 6 feet. At this time, no construction information for Building B-1 is known, however it is likely on a slab. If the building is on a slab, the slab of the building would not be in contact with the historical elevation of groundwater or capillary fringe. The groundwater depth will be evaluated at the time of Group IV RI groundwater and soil gas sampling to determine if VISLs can be used for comparisons to the groundwater and soil gas sampling results. The text of Section 3.2.4.4 and 4.2.4 of the SSWP has been modified for clarity.

4. ***Section 4.2.1, Page 37, Surface Soil:*** *EPA Region 5 has requested that future risk assessments use 0-6 inches for surface soil, with subsurface soil being below 6 inches. The approach to adding an additional category of near surface soil (6-24 inches) is acceptable, but those near surface soil result should not be used for surface soil risk assessment purposes. This should be changed/clarified in the SSWP.*

Response to SC 4: WBS requests a discussion with USEPA regarding this comment and the protocol for addressing surface soils going forward. To date in the WBS Multi-Site MGP Program, surface soil has been defined as 0-2 feet bgs and characterized and evaluated in multiple USEPA-approved SSWPs and Baseline Risk Assessments (BLRA) within the Superfund Alternative Sites (SAS) program. Previous SSWPs for other Groups on the Crawford Station former MGP Site, using this definition of surface soil, were already approved and executed. Section 4.2.1 of the original SSWP for the Crawford Station former MGP Site (SSWP, Rev 1 (Group I) dated August 3, 2012), approved by USEPA on December 5, 2012, states:

"Surface soil from 0-6 inches bgs is defined as true surface soils for purposes of the risk assessment because people would have the greatest potential to be exposed to these soils under current conditions. In addition, surface soil from 6-24 inches bgs is defined as near-surface soils, and people will have less potential to be exposed to these soils, but under certain conditions exposure to near surface soils may be possible (e.g. non-commercial activities like home gardening). The surface soil and near-surface soil samples will be used together to characterize potential exposure and risk to a range of human receptors in the BLRA."

This language has been carried throughout the SSWP addenda. Consistent with this approved protocol and PGL's SAS program approach, both surface and near surface soil samples are proposed for the Crawford Group IV parcels and both will be used to characterize potential surface soil exposure and risk in the BLRA.

5. ***Section 4.2.4, Page 39, Soil Vapor:*** *The text states "It should be noted that in areas of Group IV where VI COPCs are located in the soil on the remaining portion of Parcels A, B, O and S, but no buildings are currently in close proximity of the contamination, the potential for VI in these areas based on future building construction will be addressed in the FS considering appropriate risk management techniques (e.g., institutional controls to prevent the VI pathway from becoming complete)." However, the FS should also consider source removal as a potential remedial option.*

Response to SC 5: The FS will consider several options for risk management, including institutional controls and MPG residual removal.

6. ***Section 4.3.2, Page 42, Construction Worker:*** *The text states "Potential exposure of the construction worker will be qualitatively addressed in the risk assessment due to the short duration of exposure." However, EPA Region 5 has requested that future risk assessments address the construction worker exposure scenario semi-quantitatively by comparison to construction worker-based screening levels and qualitatively by addressing the potential for exposures to MGP residuals. Please revise the text and approach accordingly.*

Response to SC 6: Evaluation of the construction worker will be completed in the Baseline Risk Assessment to be included in the Remedial Investigation Report. The approach for evaluating the construction worker exposure pathway is currently under consideration by WBS.

7. *This entry was left blank in USEPA comments list.*

8. ***Section 4.4.2, Page 45: The text states:***

   "Benthic invertebrates are considered ecological receptors that may be exposed to COPCs in sediment and surface water. Based on the review of the MWRD report (MWRD 2008), the CSSC supports benthic invertebrates even though the habitat conditions are rated as poor. Similar to aquatic birds and fish, the risks to benthic invertebrates will be addressed qualitatively in the BLRA considering the locations of where MGP-affected sediments are found above ambient conditions."

   While it is understood that there are no plans for benthic invertebrate community analysis or whole-sediment toxicity testing at this time, a quantitative assessment of the potential risk to benthic invertebrates should be conducted by comparing the analytical results to sediment quality values such as the TECs and PECs.

   Propose changing the text to read:

   "Benthic invertebrates are considered ecological receptors that may be exposed to COPCs in sediment and surface water. Based on the review of the MWRD report (MWRD 2008), the CSSC supports benthic invertebrates even though the habitat conditions are rated as poor. At this time no direct quantitative measures of the benthic community are planned. Rather risk will be assessed by comparison of the analytical results to sediment quality values assumed to be predictive of benthic community risk.

Response to SC 8: While it is possible that the adjacent canal area (ACA) may provide habitat for benthic invertebrates, an effects-based evaluation of ecological risk to those organisms will not be used at this Site. Concentrations of COPCs in ambient sediment, sediment located outside the area of influence of the former MGPs, are orders of magnitude over sediment quality values such as the threshold effect concentrations (TEC) and probable effect concentrations (PEC) (MacDonald et al., 2000), and the ecological screening-level sediment benchmarks (EQP-SQG) (DiToro and McGrath, 2000) that are normally used to assess the risk associated with sediment to aquatic receptors. In addition, ambient sediments were tested for toxicity and found to be moderately toxic to sensitive ecological receptors (i.e., benthic invertebrates). Based on these conditions and the conditions observed throughout the Chicago River, sediments of the ACA are expected to be toxic to ecological receptors regardless of the presence of the former MGP site. For this reason, the ecological risk assessment for the ACA will focus on identifying whether exposure to MGP-related constituents in sediment and surface water depart from ambient conditions and not the comparison of the analytical results to sediment quality values as suggested.

For informational purposes, currently available sediment data from the ACA are compared to sediment quality values (TECs, PECs, and EQP-SQGs) in SSWP Table 5a.

9. ***Section 4.5, Pages 45-46:*** *Please describe what is known about the structural details of the sheet pile walls between the site and CSSC (Chicago River). The presence of sheet pile walls will affect the flow between groundwater at the site and the sediment/surface water, but without the structural details on the sheet piles (i.e. depth, materials, and specific locations), as well as the geology/hydrogeology on Parcel S and surface water data, an assessment of the potential for potential interconnection with the river cannot be fully evaluated. Please add this information, and/or attempt to obtain it.*

Response to SC 9: At this time, shoreline details are not known. ACA Investigation Step I – Site Reconnaissance (SSWP Section 6.7.4.3) will include a shoreline inspection and documentation of shoreline features such as sheetpile, if present, or other improvements, combined sewer outfalls (CSO), and utility crossings. If shoreline improvements are identified that may impact flow between groundwater and surface water/sediment, efforts will be made to describe the structures in detail through inspections and an information request will be made to MWRD or other property owners for additional details.

10. ***Section 6.5, Page 59, Groundwater Evaluation:*** *Pursuant to recent comments on the Pitney Court, and Throop Street Station RI reports, additional consideration of the groundwater to surface water interface (GSI) is warranted. Although there is not yet any groundwater data from Parcel S in the vicinity of the river to identify whether there are potential MGP impacts in groundwater, contingencies for evaluating GSI and potential connections with the river are warranted in the SSWP. If upland groundwater impacts are found in the future, contingencies for addressing this topic need to be integrated into the process now. To begin this process, it is recommended that groundwater results from monitoring wells on the upland OU be screened against potentially applicable surface water criteria (Chicago Area Waterway System (CAWS) Water Quality Standards [WQS]). If there are exceedances of these surface water criteria in upland groundwater monitoring wells, particularly on Parcel S near the river, it will be informative for the investigation of the South Branch River to focus on those areas where GSI may be a concern for the river, and may require additional actions on the upland OU. If there are no exceedances of the specified surface water criteria in upland groundwater monitoring wells, it should be noted in the future RI report. Please add this groundwater screening to the SSWP.*

Response to SC 10: Results from the RI groundwater investigation will be screened against the CAWS WQS for informational purposes. In addition, direct measurements of surface water and whole sediment COPC concentrations will be collected in areas adjacent to former MGPs where affected groundwater could potentially occur. Surface water measurements will then be screened against ecological SLs developed from a hierarchy of published values, per the USEPA-approved *Multi-Site Risk Assessment Framework Former Manufactured Gas Plant Sites* (2007), Section 7.2. Sediment data will be screened against site-specific SLs as described in the attached SSWP. Unlike comparing groundwater to surface water criteria such as the CAWS WQS, this approved method of collecting data in media that may be in direct contact with ecological receptors is a more direct approach for addressing potential ecological risks.

To further evaluate the potential effects of groundwater on surface water or sediment, aquifer characterization to evaluate hydraulic conductivity in soil units is proposed in Section 6.5.9. In addition, groundwater and surface water levels will be measured during sampling events as described in Sections 6.5.6 and 6.5.7. This data will be used to support information about the potential for groundwater flow into the ACA.

Please note that WBS has not received formal comments on the Pitney Court Station or Throop Street Station RI Reports to date.

11. ***Section 6.5.9, Page 65, Aquifer Characterization:*** *Please provide an estimate as to when the TCRA will be complete and dewatering efforts will cease.*

Response to SC 11: At the time of this letter, the RI has been completed on Group I parcels and is currently being conducted on Group II parcels. The SSWP for both Group III and Group IV parcels have been submitted to USEPA, but not approved or implemented. The RI on the remaining parcels should be completed prior to wrapping up the TCRA in order to determine if additional source areas exist. If source areas are found during future RI work, the TCRA may be considered as a method to address the source materials. Consequently, an estimate as to when the TCRA will be complete and dewatering efforts ceased cannot be reasonably provided at this time. We continue to keep USEPA updated on our TCRA activities.

12. ***Section 6.6, Page 67, Soil Vapor Evaluation (Parcel B), and Appendix F:*** *Please reference the latest proposed Vapor Intrusion Decision Flowchart (dated January 15, 2016) in this section and in Appendix F. Four "external" soil gas samples are proposed around the building on Parcel B, as described in the text. However, it is already known that the building is situated atop the Former West Fork, where MGP-related residuals are present. Therefore, pursuant to the agreed upon VI investigation approach, subslab sampling should be proposed rather than external soil gas sampling. Figure 20B currently shows one proposed soil vapor probe (BSV2) within the building footprint. At a minimum, this location should be proposed for subslab sampling.*

Response to SC 12: Soil vapor probe BSV2 will be a nested pair to include both a subslab probe and deeper soil vapor probe beneath the slab. The text has been modified where appropriate.

13. ***Section 6.7.2 – Page 73 of 99 - #2 in Second Paragraph*** *- RE: Submitting native clay sample for analysis – The text is confusing and it seems like none of the visually impacted clay material (if any) will be submitted for analysis. Please confirm. It is recommended that this investigation be modified to be consistent with the South Branch Sediment Sampling scheme of collecting 20% of the samples from the visually impacted clay intervals.*

Response to SC 13: The sampling scheme for clay intervals as described in SSWP Section 6.7.4.1.3 is the same as that used for the South Branch Site – River OU. Specifically, the Section 6.7.4.1.3 clay sampling scheme includes "If the clay shows evidence of potential MGP residuals, the first clay interval free of such indication will be submitted to the laboratory for COPC analysis. In addition to that sample condition, approximately 10% of all samples collected from the native clay will be submitted for laboratory analysis. Of these samples, approximately 20% will be submitted from a visually impacted interval, and the remainder will be equally split above and below intervals in which potential MGP residuals were identified." Clay sampling will be conducted according to this protocol, and the clay sampling description in Section 6.7.2 has been removed to avoid confusion.

14. ***Section 6.7.2.2, Page 74, Potential MGP Residual Sampling, 2nd Paragraph:*** *Biased sampling of materials – In addition to the 2007 data collected by BMCD, please include the visual observations and results from Step 1 Characterization in selecting the biased locations.*

Response to SC 14: Section 6.7.2.2 is referring only to the potential case where no MGP residuals are observed during Step II Characterization sampling. In that case, borings and samples may be collected from biased locations selected to target areas where MGP residuals were observed during historic sampling at the Site (February and March 2007). Section 6.7.2.2 has been modified for clarity and to indicate that potential locations of MGP residuals identified during Step I Site Reconnaissance may also be targeted for biased sampling.

15. ***Section 6.7.4.3.1 Page 83, Bathymetry Section:*** *Single beam or Multi beam survey results should be calibrated and verified against manual poling depths/elevations, especially near the shorelines. Also, the*

presence of any debris at the river bottom, bridges, abutments, and strong water currents will influence the survey and will require corrections to the single beam or multi beam survey results.

Response to SC 15: Comment noted.

16. ***Section 6.7.4.3.10 – Predictive Analytics:*** *If predictive analytics is to be used, a thorough technical memorandum, explaining the process, results and the data sets used should be submitted to USEPA well in advance (6-7 weeks) of its potential implementation period. Use of predictive analysis must be approved by USEPA prior to implementation.*

Response to SC 16: Comment noted.

17. ***Figure 15:*** *Please identify the circular structure with a corridor extending into the river (left side of figure). Is this a historic MGP feature that may be associated with a discharge to the river? Please also specify from the historical records whether the storm sewers shown on the figure near the circular structure were present during MGP operations. Lastly, please identify the structure extending into the river on the right side of the figure. Is this a historic MGP feature that may be associated with a discharge to the river?*

Response to SC 17: The circular structure on the left side of the figure is a deep tunnel (Tunnel and Reservoir Plan) vertical access shaft. The vertical shaft drops to a horizontal shaft that connects with the deep tunnel buried at approximately 290 feet bgs. The deep tunnel was not in existence when the MGP was in operation. The structure on the right side of the figure is a former water intake and pump house for the MGP. These details have been added to Figure 15. The large outfall at the left side of the figure, the Kostner Street Outfall, was installed between 1938 and 1940; the MGP operated until 1954. According to PGL documents, lateral drains from the MGP property were tied into the Kostner Street Outfall. Additional information regarding these features has been added to Section 4.5.

18. ***Figure 20B:*** *Please add a boring at the western border of the site within the area of the former West Fork Channel. There are orange and yellow designated borings (evidence of NAPL) that are not delineated to the west. However, this work plan includes a boring and monitoring well installation at location PA101S (shown on Figure 21) to address a prior EPA comment (Group I RI) that the current monitoring wells along the former West Fork Channel are not properly screened to monitor potentially migrating NAPL. Therefore, the PRP may consider moving boring PA101S (and the related well nest) to the western property boundary (but still within the former West Fork Channel) in order to both delineate soil impacts and provide proper groundwater monitoring locations along the western border within the former West Fork Channel.*

Response to SC 18: Well PA101S will be placed as far west as safely possible. Please note that a steeply sloped, uneven berm is present on the western edge of the property that prevents access to the property edge and fenceline. During the Group II RI, a GPS survey of the top and toe of the berm was completed and now is shown on Figure 20B. Installation of borings west or on top of the berm is not logistically possible.

19. ***Figure 20B:*** *There are also 4 contiguous boring symbols with yellow or orange coloring (evidence of NAPL) just to the south of the former West Fork Channel and to the north of proposed boring ASB102. These 4 locations do not have a boring to the west, at or near the property boundary, to delineate the apparent NAPL impacted borings. An additional boring appears necessary in this area.*

Response to SC 19: See response to comment 18.

NATURAL RESOURCE TECHNOLOGY

20. ***Appendix F:*** *Page 5 (Parcel B) – It states "To date, no soil, groundwater, or soil vapor samples have been collected on this parcel." This statement is untrue. Please revise.*

Response to SC 20: Appendix F has been revised accordingly.

21. ***Figure 18*** *– the inhalation pathway for visitor/trespasser/recreator should be shown as potentially complete.*

Response to SC 21: While the outdoor inhalation pathway for the visitor/trespasser/recreator is potentially complete, the effect of dilution by wind on airborne contaminants bound to particulates or chemical vapors released at the ground surface would render it an insignificant exposure pathway for this receptor. This has been clarified in the text of the SSWP, Addendum 3, Rev 1, Section 4 (Site-Specific Conceptual Site Model Summary). In addition, the definition of the open circle symbol for Figure 18, Site-Specific Conceptual Site Model, has been modified to read:

"Pathway not complete or *is potentially complete*, but considered insignificant; No further evaluation is recommended."

Please contact one of the undersigned if you should have any questions regarding the content of this document.

Sincerely,

NATURAL RESOURCE TECHNOLOGY, INC.

Tracy L. Hofmann, PE
Senior Engineer

Sarah L. Meyer
Senior Scientist

Enc: Site-Specific Work Plan, Addendum 3, Revision 1

For distribution to:
Mr. Ross del Rosario, USEPA (electronic copy and 1 hardcopy)
Mr. Paul Lake, IEPA (electronic copy and 2 hardcopies)
Mr. David Klatt. CH2M (electronic copy only)

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Site-Specific Work Plan, Addendum 3
Group IV Parcels

The Peoples Gas Light and Coke Company
Crawford Station Former MGP Site
Chicago, Illinois

Project No: 2066

Revision 1
March 4, 2016

NATURAL RESOURCE TECHNOLOGY

ENVIRONMENTAL CONSULTANTS

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SITE-SPECIFIC WORK PLAN, ADDENDUM 3
GROUP IV PARCELS

THE PEOPLES GAS LIGHT AND COKE COMPANY
CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

CERCLA Docket No. V-W-08-C-917
CERCLIS ID: ILN000510192

Project No. 2066

Prepared For:

WEC Energy Group
200 E. Randolph Street, 24th Floor
Chicago, Illinois 60601

Prepared By:

Natural Resource Technology, Inc.
300 S. Wacker Drive, Suite 1300
Chicago, Illinois 60606

Revision 1
March 4, 2016

Tracy L. Hofmann, PE
Senior Engineer

Joseph R. Ridgway, PE
Environmental Engineer

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES (on CD only)

ABBREVIATIONS / ACROYNMS

ACA	adjacent canal area
AOC	Administrative Order on Consent
API	American Petroleum Institute
ARA	adjacent river area
ArcGIS	Arc Geographic Information System
AST	aboveground storage tanks
ASTM	American Society for Testing and Materials
B&McD	Burns & McDonnell
BAP	benzo(a)pyrene
bgs	below ground surface
BLRA	Baseline Risk Assessment
BTEX	benzene, toluene, ethylbenzene and xylenes
CCD	Chicago City Datum
CERCLA ("Superfund")	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	CERCLA Information System
CESQG	Conditionally Exempt Small Quantity Generator
CFR	Code of Federal Regulations
COPC	constituents of potential concern
CORRACTS	Corrective Action Order
CR	Completion Report
CSM	Conceptual Site Model
CSO	Combined sewer outfall
CSSC	Chicago Sanitary & Ship Canal
CWG	carbureted water gas
DGPS	differential global positioning system
DNAPL	Dense Non-Aqueous Phase Liquid
DQO	data quality objectives
EDR	Environmental Data Resources, Inc.
ESA	Environmental Site Assessment
ESRI	Environmental Systems Research Institute
FINDS	Facility Index System
FOIA	Freedom of Information Act
FSP	Field Sampling Plan
FS	Feasibility Study
GC/MS/SIM	by gas chromatography/mass spectrometry/selected ion monitoring
GIS	geographical information system
GMP	Groundwater Monitoring Program
HASP	Health and Safety Plan

HSA	hollow-stem auger
HVAC	heating, ventilation, and air conditioning
IAC	Illinois Administrative Code
IBS	Integrys Business Support, LLC
IEPA	Illinois Environmental Protection Agency
LNAPL	Light Non-aqueous Phase Liquid
LQG	Large Quantity Generator
LUST	Leaky Underground Storage Tank
MDLs	method detection limits
META	META Environmental Laboratories
MGP	manufactured gas plant
MNA	Monitored natural attenuation
MOU	Memorandum of Understanding
MWRD	Metropolitan Sanitary District
NAPL	non-aqueous phase liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFR	No Further Remediation
NFRAP	No Further Remedial Action Planned
NPL	National Priority List
NRT	Natural Resource Technology, Inc.
OSFM	Office of the State Fire Marshal
OSR	Off-Site Rule
OSWER	Office of Solid Waste and Emergency Response
OU	Operable unit
OUC	Chicago Office of Underground Coordination
PADS	Polychlorinated Biphenyl Activity Database System
PAHs	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
PEC	Probable Effect Concentration
PGL or Peoples Gas	The Peoples Gas Light and Coke Company
PID	photoionization detector
PVC	polyvinyl chloride
PVOC	Petroleum volatile organic compounds
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
QC	quality control
RAA	Removal Action Area
RAF	Risk Assessment Framework
RAWP	removal action work plan
RCRA	Resource Conservation and Recovery Act
REC	recognized environmental condition
RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study

RO	remediation objectives
RSLs	regional screening levels
SL	Screening Level
SOP	Standard Operating Procedure
SOW	Statement of Work
SPLP	synthetic precipitation leaching procedure
SRP	Site Remediation Program
SSWP	Site-Specific Work Plan
SVOC	semi volatile organic compounds
TACO	Tiered Approach to Corrective Action Objectives
TarGOST®	Tar-Specific Green Optical Screening Tool
TARP	Tunnel and Reservoir Plan
TCL	target compound list
TCRA	Time Critical Removal Action
TEC	Threshold Effect Concentration
TOC	total organic carbon
USACE	United States Army Corps of Engineers
USCS	United Soil Classification System
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USTs	underground storage tanks
UTLs	upper tolerance limits
UTM	Universal Transverse Mercator
VI	vapor intrusion
VOC	volatile organic compounds
yd^3	Cubic Yards

1 INTRODUCTION

1.1 Overview

This Site-Specific Work Plan (SSWP), Addendum 3 describes procedures and tasks necessary to support completion of the Remedial Investigation and Feasibility Study (RI/FS) at the former Crawford Station manufactured gas plant (MGP) located in Chicago, Illinois (Figure 1). This SSWP was prepared in accordance with an Administrative Order on Consent (AOC) and Statement of Work (SOW) executed between the United States Environmental Protection Agency (USEPA) and The Peoples Gas Light and Coke Company (PGL) on October 31, 2008, Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Docket No. V-W-'08-C-917 (USEPA, October 2008). Under the AOC, a generic approach was developed to address these MGPs (multi-site approach), which has been, and will be, modified for site-specific differences.

Several investigations or remedial actions were previously completed under the Illinois Environmental Protection Agency (IEPA) Site Remediation Program (SRP) or for UST removal by others. This SSWP builds upon this previously collected data and was prepared in accordance with applicable federal statutes and regulations, including CERCLA, 42 United States Code (USC) 9601, et seq., and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), contained in Title 40 of the Code of Federal Regulations (CFR), Part 300.

The USEPA identification for the Crawford Station Site is ILN000510192. The primary project contacts include the following:

PGL Contact:	Mr. Naren M. Prasad, P.E. Senior Environmental Engineer 200 East Randolph Drive, 24th Floor Chicago, Illinois 60601 Telephone: 312.240.4569
USEPA Region V Contact:	Mr. Ross del Rosario / Pablo Valentin Remedial Project Manager 77 West Jackson Boulevard, Mail Code: SR-6J Chicago, Illinois 60604 Telephone: 312.886.6195

1.2 Objectives

MGP residuals were identified within, and in the vicinity of, former MGP structures, as well as within sediments in a portion of the adjacent Chicago Sanitary & Ship Canal (CSSC). Remediation is ongoing in selected areas through removal under a Time Critical Removal Action (TCRA) implemented under a separate USEPA-issued AOC (Docket No. V-W-11-C-981, dated October 12, 2011). However, soil, groundwater, and river sediment exhibiting MGP residuals have not been sufficiently delineated throughout the entirety of the Crawford Station Site. The overall objective of the RI is to fully delineate the MGP residuals at the Crawford Station Site.

Because of the size and complexity of property parcel ownership, the RI is being conducted in a phased approach, as detailed in Section 1.3 of this SSWP. The SSWPs for each phase of the investigation are being prepared separately, and specify the procedures for identifying and evaluating the nature and extent of affected soil, groundwater, and soil vapor in the upland portion of the Crawford Station Site as well as affected sediment and surface water in the CSSC. The data collected will be used to perform a Baseline Risk Assessment (BLRA) that will evaluate the Crawford Station Site's risks to human health and the environment. An FS will also be prepared, upon completion of the RI, to develop and evaluate remedial alternatives.

1.3 RI Approach

The Crawford Station Site is approximately 260 acres and has been subdivided into 22 parcels, designated as Parcels A through V[1]. PGL owns and operates Parcel O, A, B, K and L. The remaining parcels are owned by others. Since MGP operations ceased, various investigations and response actions were completed, by PGL and others. A Completion Report (Natural Resource Technology, Inc. [NRT], 2011] describes the investigations and response actions previously performed at the Crawford Station Site (prior to December 2011).

A meeting led by USEPA was conducted on January 24, 2012, whereby it was mutually agreed upon by all parties involved that a phased approach was appropriate for conducting the RI activities on the Crawford Station Site. This approach was selected due to the size and complexity of the Site as well as

[1] Parcel V was added to the list of Parcels during preparation of the Group II parcels. A portion of Parcel F has an NFR letter; therefore the portion of Parcel F not included in the NFR letter and will be referred to as Parcel V. Parcel F changes were discussed with USEPA prior to approval of SSWP, Addendum 1.

the number of different owners of the various parcels. Based on this phased approach, the Crawford Station Site was divided into four groups of parcels, as shown on the following table and on Figure 2:

Parcel Groupings

RI Group	Parcels/RI Work Elements
I	▪ Parcels K, P, Q, U, and portions of O (excludes portions of Parcel O that underwent a TCRA that was completed in the summer of 2013) ▪ Baseline well assessment of previously installed wells on PGL-owned parcels ▪ Initiate site-wide groundwater assessment
II	▪ Parcels C, D, E, F, G, H, L, R and V (excludes portions of Parcel L undergoing TCRA and Parcel F [see table note]) ▪ Portions of Parcels A and B within the former river channel (West Fork of the South Branch of the Chicago River) ▪ Continue site-wide groundwater assessment
III	▪ Parcels I, J, M, N, and T
IV	▪ Parcels A, B, and S ▪ Portions of Parcel O located within the TCRA that was completed in the summer of 2013 and 2015 (around the high-pressure gas lines) ▪ CSSC sediments

Table notes: Parcel F has a "No Further Remediation" letter from the IEPA and will be excluded from the Group II field work.

This phased approach was reflected in SSWP – Group I (NRT, October 2012), SSWP, Addendum 1 – Group II (NRT, January 2014), and SSWP, Rev 1 Modified (NRT, 2015) (Group III Parcels-pending approval) which addressed the first three RI Parcel Groups in the phased approach. This SSWP, Addendum 3 addresses the proposed RI activities on the Group IV parcels.

The Completion Report (NRT, December 2011) identifies available investigative or remediation reports within the Group IV parcel boundaries. Subsequent to the issuance date of the Completion Report, investigations were conducted at Parcel I, the results of the RI activities and sample analysis on Group I parcels, results of seven rounds of groundwater sampling and the removal action completed on Parcels A, B, and O were evaluated in combination with the previous historical data to develop this SSWP. The evaluation is provided in Section 2.4 of this SSWP.

In order to complete the RI activities described in this SSWP, access to areas of the Crawford Station Site not owned by PGL will be required. The proposed parcel groups are subject to change and will, in part, be dependent on gaining timely access to the parcels that are currently not owned by PGL. The RI activities will focus on supplementing any previously collected data to refine migration and exposure pathways identified within the Conceptual Site Model (CSM), as discussed in Section 4 of this SSWP. Property

reconnaissance and sampling activities will be completed to gather appropriate data that can be used to support human health risk assessments and FS evaluations.

A dynamic work plan approach has been developed to collect data necessary to satisfy the Data Quality Objectives (DQO) process recommended by USEPA, and address concerns regarding specific pathways in a timely manner. Representatives from USEPA, USEPA's technical support team, PGL, and consultants to PGL will participate in periodic technical meetings to review the progress of the RI activities and resolve issues that may arise.

2 SITE BACKGROUND AND SETTING

The Crawford Station Site is located at 3500 South Pulaski Road within Section 34, Township 39 North, Range 13 East in the City of Chicago, Cook County, Illinois (Figure 1). The Crawford Station former MGP Site is bounded on the south by the CSSC, on the north by the Chicago and Illinois Western Railroad, on the west by the Chicago and Western Indiana Belt Line Railroad, and to the east by South Pulaski Road (formerly Crawford Avenue). The former Crawford Station MGP Site does not include the far northeast corner of this area (approximately 30 acres on the southwest corner of the intersection of South Pulaski Road and the Chicago and Illinois Western Railroad).

2.1 Site Description and Current Conditions

RI Group IV parcels (Parcels A, B, S and the CSSC) are located in the west and south portion of the Crawford Station Site. The locations of these parcels are presented on Figure 2. The owner and occupant information is listed below for each parcel.

Parcel Summary (as of July 2014)

Parcel Name	Address*	PIN(s)*	Current Owner	Current Occupant(s)*
A	3600 S. Kostner Avenue	16-34-302-014 16-34-302-023	PGL	Schneider National Office / Truck Storage Yard
B	3600 S. Kostner Avenue	16-34-302-014 16-34-302-023	PGL	Schneider National Office / Truck Storage Yard
S	No street address(es) available	16-34-302-021 16-34-302-022 16-34-402-008 16-34-403-013	The Metropolitan Sanitary District of Greater Chicago (now known as MWRD)	MWRD Facilities
CSSC	Chicago Sanitary and Ship Canal	16-34-400-005-0000	MWRD	none

**Larger parcels may have multiple addresses, PINs, and occupants due to their acreage.*

2.2 History of Crawford Station MGP Site Use

This section describes the former MGP operations and the redevelopment and site use since MGP operations ceased.

2.2.1 MGP Operations

In 1921, the Koppers Company of Pittsburgh (Koppers) and PGL entered into an agreement whereby Koppers built, financed, and operated the Crawford Station Site. PGL bought gas and coke manufactured at the plant for distribution to consumers. PGL formally acquired the facility in 1928. By the end of the 1930s, the Crawford Station Site produced three types of gas: coke oven gas, carbureted water gas, and reformed natural gas. The Crawford Station Site was recognized by PGL as its largest production facility at the time.

By 1956, the Crawford Station Site was only used to supply gas and coke when the products were in high demand. Production was temporarily halted between 1958 and 1962 and operations ceased in 1963. The physical dismantling of the Crawford Station Site began in approximately 1956 starting with portions of the coke oven plant. The remainder of the Crawford Station Site was dismantled by 1965. PGL sold 146 of the original 260 acres to First Industrial Realty Company in 1966.

Coal gas production involved heating coal in an airtight chamber (i.e., retort) and driving off volatile aromatic hydrocarbons as a gas. This gas was then passed through purifiers to remove impurities such as sulfur, carbon dioxide, cyanide, and ammonia. The purifiers used trays and sieves containing lime or hydrated iron oxide mixed with wood chips. Production of manufactured gas created a number of different byproducts and wastes, such as various forms of tar, sludge, coke, ash, wood chips, and spent oxide/lime. The predominant byproduct at the Crawford Station Site was coal tar. Byproducts were often stored in tanks and were frequently sold to other companies for direct use or for conversion into other products. The finished gas product was then stored in large pressure relief holders prior to distribution for lighting and heating. The Crawford Station Site produced large amounts of coke and carbureted water gas (CWG), in addition to the finished gas product, for consumer use.

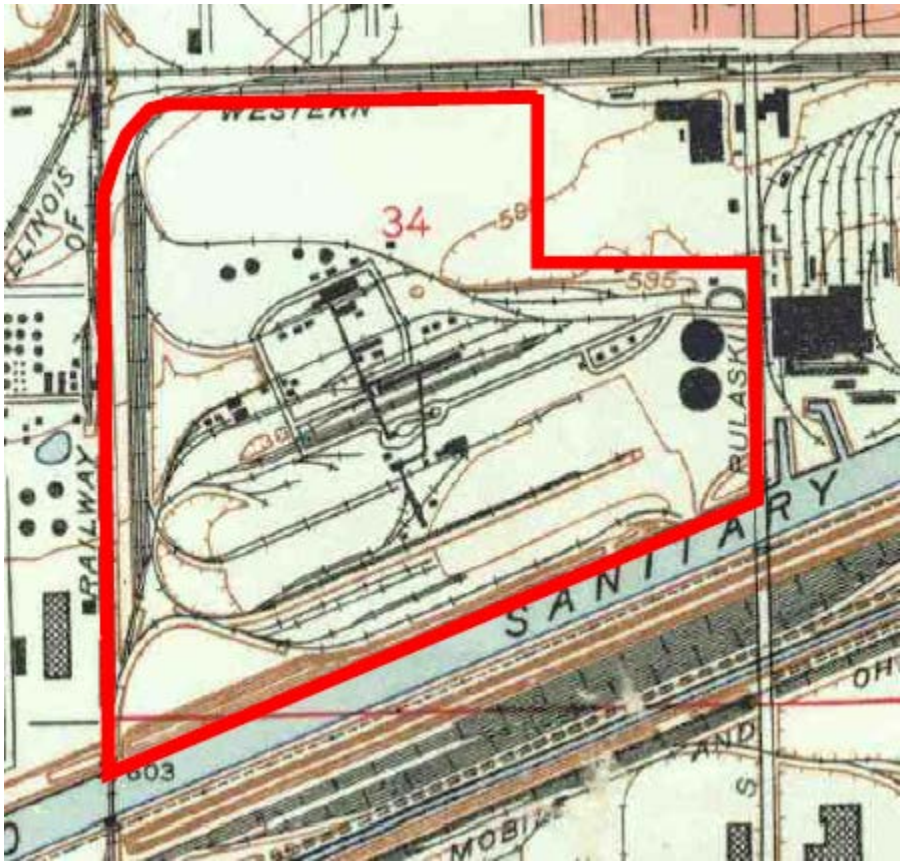
Former MGP-related structures and pertinent historic features on the Crawford Station Site are shown on Figure 3A with an outline of those within Group IV parcels. The primary MGP structures for the entire Crawford Station Site included the following:

- Main gas production and retort buildings
- Coke ovens
- Purifying houses
- Water gas sets

- Liquefied petroleum tanks, “oil” tanks, naphthalene tanks, odorant tanks, propane tanks, oxygen tanks, ammonia tanks, and acid storage tanks
- Two 10-million cubic foot water-sealed gas holders
- Tar settling wells, tar extractors, and tar tanks
- A coal and coke storage yard
- Rail yards
- A light oil refining plant
- Oil condensers
- Sumps, pits, and interceptors
- Air compressor buildings
- Pumps and scrubbers
- Ash and coke hoppers and conveyers
- Various equipment, storage, and office buildings

Specifically, with regards to Group IV parcels, the following former MGP facilities and site features were present (Figure 3B):

- Machine shop (northeast portion of Parcel B)
- Paint and Carpenter shops (northeast portion of Parcel B)
- Locomotive watering station (northeast portion of Parcel B)
- Coke and coal storage piles (southeastern corner of Parcel B)
- A series of liquefied petroleum tanks and propane tanks (east side of Parcel S)
- Railway and rail spur system (Parcels A mainly and spurs on Parcels B, O, and S) as seen on the 1936 and 1951 Sanborn Maps and seen in the following excerpt of the 1953 Topographical Map (Maps are provided in Appendix A1)



Historically, a former surface water body, the West Fork of the South Branch of the Chicago River (also known as West Fork Channel or Ogden Ditch), bisected the Crawford Station Site from the southwest to the northeast. This water body historically conveyed water from an area known as Mud Lake to the South Branch of the Chicago River, which in turn discharged to Lake Michigan. Following the construction of the CSSC in early 1900's, the flow direction of the Chicago River was reversed and water now flows from the South Branch to the CSSC and ultimately discharges to the Mississippi River (Solzman, 2006). Based on available historical aerial photographs and Sanborn Maps, the portion of the West Fork Channel bisecting the Crawford Station Site was filled in between 1938 and 1951. The reviewed historical aerial photographs and Sanborn Maps are provided in Appendix A1. The approximate location of the former West Fork Channel is also shown on Figures 3A and 3B transecting Parcels A and B.

Environmental Data Resources, Inc. (EDR) was retained to conduct a search of available environmental database records to identify listings associated with the former MGP operations (EDR, October 2011). A copy of the EDR report is provided in Appendix A2. According to the EDR report, the former MGP is listed in the following regulatory databases: Integrated Compliance Information System (ICIS) database, the Facility Index System (FINDS) database, the CERCLA Information System (CERCLIS) database, the

Resource Conservation and Recovery Act (RCRA)-Conditionally Exempt Small Quantity Generator (CESQG) database, the Polychlorinated Biphenyl (PCB) Activity Database System (PADS), the Manifest database, the Illinois Environmental Protection Agency (IEPA) Site Remediation Program (SRP) database, the Tier 2 database, and EDR's proprietary "Manufactured Gas Plant" database. In addition to the EDR, Brown's Directory Information was obtained and is provided in Appendix A3. Cultural and Natural Resource Data are provided in Appendix A4.

2.2.2 Commercial/Industrial Operations at the Crawford Station Site

Certain areas of the former Crawford Station Site began to be re-developed in approximately the late 1960s by distribution and commercial businesses, as well as electric utilities. Some of the parcels in RI Group IV are currently in use, as described in Section 2.1 of this SSWP. Parcels A and B are used for warehouse distributions and truck storage; Parcel O is used for utility activities by PGL and Parcel S is also used for utility activities by MWRD.

Review of available regulatory records was conducted to identify potential sources of environmental concern at the Crawford Station Site that are not related to the former MGP operations. Additionally, available historical Sanborn Maps and aerial photographs were reviewed. Historical and current land uses of potential concern not related to MGP operations are detailed in the following sections. The properties detailed are only those located within RI Group IV boundaries. At this time, both Parcels A and B are currently developed and being used for warehousing and trailer parking and Parcel S is the MWRD facility, but no current or regulatory information was available for these parcels. Please refer to Completion Report (NRT, December 2011) for a complete summary of identified parcels located at the Crawford Station Site that are of potential concern and historic operations not related to former MGP operations. Figure 4 depicts the on-site non-MGP concerns and also presents the surface conditions.

2.3 Adjacent Properties

The EDR search of available environmental records, historical Sanborn Maps, and historical aerial photographs was reviewed to identify potential sources of releases on properties adjacent to the Site. Properties greater than approximately 1,000 feet from the Crawford Station Site boundaries are not addressed in the discussion below. Many facilities adjacent to the Site operated petroleum underground storage tanks (USTs) or above ground bulk petroleum storage. Knowledge of the adjacent property uses provides insight as to the potential off-site impacts to Crawford. Many of the historical off-site facilities to the west were operating prior to the construction of the canal that reversed the flow of the river. The West Fork Channel bisects many of these facilities. For further information on most of the off-site facilities is provided in the Completion Report and the SSWP – Group I (NRT, 2012). Off-site facilities are shown on

Figure 5 in the Completion Report. Based on the above review, the following potential areas of concern nearest the Group IV parcels were identified:

3801 S. Cicero Avenue Property (Site 1 on Figure 5 of Completion Report [CR])

This facility is in the vicinity of the Crawford Station Site to the southwest (nearest Parcels A, B, O and S and along the canal). The property was formerly operated by Cities Service Oil and is currently operated as the Mobil Cicero Lube Plant. It is located cross-gradient of the Crawford Station Site. The Illinois Office of the State Fire Marshal UST (OSFM UST) database and the EDR report each identify 12 USTs associated with this facility. Additionally, a review of a recent aerial photograph (dated 2007) and observations during a reconnaissance indicated there were between 75-100 aboveground storage tanks (AST) of varying sizes at this facility. The State of Illinois does not require registration of ASTs; therefore, the exact number of ASTs at this facility is unknown. There are four IEPA Leaking UST (LUST) incidents currently open at this facility: Incident No. 902292 (registered August 11, 1990), Incident No. 911509 (registered June 4, 1991), Incident No. 903511 (registered November 27, 1990), and Incident No. 922121 (registered August 4, 1992). Closure has not been granted by the IEPA via NFR letters for these LUST incidents. This facility is also enrolled in the IEPA's voluntary SRP. The facility was enrolled on May 8, 1996 and the total acreage enrolled is 10.85 acres. Closure has not been granted by the IEPA for the SRP listing at this facility. This facility is listed in the USEPA's RCRA-Large Quantity Generator's (LQG) database, the USEPA RCRA "Corrective Action Order" (CORRACTS) database, and the USEPA CERCLIS/No Further Remedial Action Planned (NFRAP) database. This facility did not qualify for the USEPA's National Priority List (NPL). RCRA-Large Quantity Generator (LQG) facilities indicate quantities of hazardous waste greater than 1,000 kilograms (kg) are generated per month. Seven Violation Notices were recorded by the USEPA including two violations regarding being out of compliance during inspections.

This facility is also listed in EDR's proprietary "Manufactured Gas Plants" database. A review of historical Sanborn Maps (Appendix A) indicated that this facility was owned by Peoples Gas By-Products Corp., an affiliate of PGL, in 1938. The facility was noted as a "Refining Plant" and apparently was used as a byproduct storage and processing facility. This facility was not part of the Crawford Station MGP Site, rather, was a separate facility. Historical aerial photographs indicated that this facility was demolished at some point between 1962 and 1972 and replaced by buildings and newer ASTs.

3737 S. Cicero Avenue Property (Site 2 on Figure 5 of CR)

This facility is in the vicinity of the Crawford Station Site to the west (nearest Parcels A and B). It is currently operated by Citgo Petroleum Corporation. It is up-gradient to cross-gradient of the Crawford

Station Site. The Illinois OSFM UST database and the EDR report each identify 20 USTs (UST #7 is not registered and it is unknown whether it exists) associated with this facility.

Additionally, a review of a recent aerial photograph (dated 2007) and observations during a reconnaissance indicated there were between 25-50 ASTs of varying sizes at this facility as well. The State of Illinois does not require registration of ASTs; therefore, an exact quantity of ASTs is unknown at this facility. There are two LUST incidents associated with this facility. Incident No. 891714 enrolled September 7, 1989 has not been granted closure by the IEPA. Incident No. 901018 enrolled April 18, 1990 and was granted closure from the IEPA on November 25, 1997 without institutional or engineering controls.

3419 S. Cicero Avenue Property (Site 8 on Figure 5 of CR)

This facility is located west of the Site nearest Parcels A, R, C, E, and F. The property is currently operated by AruTrans, LLC, A&P Truck Service, and Nick's Transportation. It is down- to cross-gradient of the Crawford Station Site. According to the EDR report, this facility is a USEPA Brownfields facility. However, the only listed report completed for this facility was a Phase I Environmental Site Assessment (ESA). The total acreage for this facility is 3.35 acres. The previous tenants/owners of this facility are not known.

3417 S. Cicero Avenue Property (Site 9 on Figure 5 of CR)

This facility is in the vicinity of the Crawford Station Site to the west (nearest Parcels A, R, C, E, and F). This property operates as a Roadco Transportation facility. It is down- to cross-gradient of the Crawford Station Site. The Illinois OSFM UST database identified five USTs associated with this facility.

There are four LUST incidents associated with this facility: Incident No. 20101383 enrolled December 21; 2010; Incident No. 20101390 enrolled December 22, 2010; Incident No. 20110329 enrolled April 13, 2011; and Incident No. 20050820 enrolled June 14, 2005. Each LUST incident is listed as being open with the exception of LUST Incident No. 20050820, which was closed on August 4, 2006 via a NFR letter without institutional or engineering controls.

3475 S. Cicero Avenue Property (Site 12 on Figure 5 of CR)

This facility is in the vicinity of the Crawford Station Site to the west (nearest Parcels A, R, C, E, and F). This facility is currently occupied by Hoff Brothers Cartage, Inc. and Puerto Rico Diesel Power, Inc. It is down- to cross-gradient of the Crawford Station Site. The Illinois OSFM UST database identified four USTs associated with this facility: one 10,000-gallon diesel fuel UST, one 15,000-gallon gasoline UST,

and two 2,000-gallon used oil USTs. The two 2,000-gallon used oil USTs are listed as "Exempt from Registration" and the remaining two USTs are listed as having been removed. Additionally, this facility is associated with one IEPA LUST incident dated May 23, 1997 (Incident No. 970918). The release was reportedly gasoline and diesel fuel. A NFR letter was issued for this facility on April 20, 1998, closing the LUST incident. An Institutional Control in the form of a commercial/industrial land use restriction was established during the closure of this LUST incident.

Other properties that could also impact the canal are:

3501 S. Pulaski Road Property

This property is located east of the Crawford Station Site (nearest Parcels O, S, and Q). The property is owned by Midwest Generation and is currently operated as a coal-fired power plant. It is down to cross-gradient relative to the Crawford Station Site. Two USTs are associated with this facility, one 500-gallon gasoline UST (removed), and one 4,000-gallon diesel fuel UST (currently in use). The IEPA has no LUST incidents reported for this street address. EDR also listed this facility in their proprietary "Manufactured Gas Plant" database. However, this facility appears to have operated as a coal-fired power plant since at least 1938. Prior to 1938, this facility may have operated as an MGP; however, no evidence has been obtained confirming this fact as of the issuance of this report.

3741 S. Pulaski Road Property

This property is located southeast of the Crawford Station Site (nearest Parcels O, S and Q). The property was formerly operated by Triangle Refineries, Inc. It is down to cross-gradient of the Crawford Station Site. According to the EDR report and the Illinois OSFM database, there are three USTs associated with this facility: one 10,000-gallon gasoline UST, one 1,500-diesel fuel UST, and one 1,000-gallon heating oil UST. The 10,000-gallon and 1,500-gallon USTs are listed as having been removed from the facility and the 1,000-gallon UST is listed as being "Exempt from Registration". An IEPA LUST incident has been opened for this facility dated October 26, 1990 (Incident No. 903173). At the issuance of this report a NFR letter has not been issued by the IEPA for this LUST incident.

Intersection of Interstate 55 and S. Pulaski Road Property

This facility is in the vicinity of the Crawford Station Site to the southeast (nearest Parcels S, O, and Q). The property is operated by the City of Chicago. It is up-gradient of the Crawford Station Site. Two 10,000-gallon USTs are associated with this property, though the substance contained in the USTs is not listed by the Illinois OSFM. There are no reported LUST incidents associated with this facility.

3905 S. Pulaski Road Property

This facility is in the vicinity of the Crawford Station Site to the southeast (nearest Parcels S, O, and Q). The property is known as the Estate of Arthur E. Nelson and was formerly occupied by Itel, Inc. It is up-gradient of the Crawford Station Site. One 1,000-gallon gasoline UST was removed and an IEPA LUST incident was opened on April 17, 1997 (Incident No. 970656). Subsequently, this LUST incident was granted closure by the IEPA via a NFR letter without institutional or engineering controls.

3939 S. Karlov Avenue Property

This facility is in the vicinity of the Crawford Station Site to the southeast (nearest Parcels S, O, and Q). The property is operated by Cescoe-Englewood Electric. It is up-gradient of the Crawford Station Site. A LUST incident was registered to this facility on April 29, 1989 reporting release of unleaded gasoline and diesel fuel. The Illinois OSFM UST database indicated no registered USTs associated with this facility. The LUST incident was granted closure by the IEPA on January 15, 2008 via a NFR letter without institutional or engineering controls.

2.4 Dredging History

A Freedom of Information Act (FOIA) request was submitted to the Rock Island and Chicago Districts of the United States Army Corps of Engineers (USACE) to identify dredging activities that have taken place within or near the Adjacent Canal Area (ACA). A response from the Chicago District of the USACE indicated that two permits were approved to allow dredging activities near the ACA:

- On January 19, 2005, a tank barge exploded at mile marker 317.5 in the CSSC, just east of the Cicero Avenue Bridge, downstream of the ACA. An estimated 65 to 100 long tons of clarified slurry oil were released. The permit approved a plan to recover this product and the impacted sediment. No documents indicating the specific location or quantity of the product or sediment removed were obtained.

- A 10-year permit application was submitted to USACE in 2009 to allow maintenance dredging adjacent to a coal unloading dock at mile marker 318.6, just east of the Pulaski Street Bridge, upstream of the ACA. Initial dredging included removal of 2,802 cubic yards (yd^3) of sediment along the northern bank of the CSSC. This permit also allowed future dredging, as needed, to maintain barge access. No documents indicating the specific location or quantity of the sediment removed were obtained.

The Chicago District of the USACE indicated that two other documents related to dredging were identified in their database, listed as follows:

- LRC-2013-597 – Maintenance Dredge and Dock Repair

- 200600085 – Dredging

These documents were not included with the FOIA transmittal because the Chicago District of the USACE could not locate them. No other documents related to dredging at or near the ACA were obtained.

2.5 Previous Investigations

Previous site investigations on the Crawford Station Site and adjacent properties are discussed in the Completion Report (NRT, December 2011). A discussion of data quality with regards to these previous investigations is included in SSWP – Group I (NRT, October 2012), Section 2.4.2. Previous investigation information for Group IV parcels is provided in the following sections.

2.5.1 Investigation Summaries

2001 July, Burns & McDonnell, Site Investigation Report, The Former Crawford Station Manufactured Gas Plant, Properties A&B (Xtra Intermodal), Chicago, Illinois

Objective

Site investigations were conducted on behalf of PGL in anticipation of enrolling Parcels A/B into the IEPA SRP. The objectives were to characterize the magnitude and extent of MGP-related constituents beneath the Site and provide sufficient data to evaluate parameters exceeding residential, commercial, industrial, and construction worker scenario remediation objectives (RO).

Scope and Results

Ninety-four soil probes, three soil borings, and one hand auger were advanced at various locations across Parcels A/B. The probes and borings are identified as CEI-SP001 to CEI-SP098. Soil samples were collected from various depths within each soil probe and analyzed for target compound list (TCL) volatile organic compounds (VOC), TCL semivolatile organic compounds (SVOC), priority pollutant metals, and total cyanide. Nine soil probe and three soil boring locations were also converted to 2-inch diameter polyvinyl chloride (PVC) monitoring wells (CEI-MW001 through CEI-MW012). Groundwater samples were collected and also analyzed for the same parameters as the soil and amenable cyanide. During SI field activities, odors, staining, and small to large amounts of tars were observed in three separate areas at the site. The first area is in the southwest section of the site (ABO RAA). A hard layer of tar-like material saturated the soil surface to about 4 feet below ground surface (bgs), and tar-like substance appears within fractures in the brown/gray silty clay to a depth of 13 feet bgs. The second area is in the north central section of the site (south of the West Fork Channel on Parcel B), and impacts include odors, staining, and small amounts of Light Non-aqueous Phase Liquid (LNAPL). A tar-like substance was observed in the fractures of the silty clay from 15.5 feet to 16.5 feet bgs. Green staining

and wood fragments with a faint to strong odor were also noticed in this area. The green staining occurred from approximately 7 to 13 feet bgs. The third area is in the northwestern section of the site on Parcel A within the alignment of the West Fork Channel. Coal tar-like odors and tar-like substance were observed in the fractures of the brown/gray silty clay layer from 10.5 to 12 feet bgs. Migration of MGP-related constituents appears to be mainly through fractures in the brown/gray silty clay unit encountered at the site. Soil sample results non-naphthalene polycyclic aromatic hydrocarbons (PAHs), several SVOCs and several metals (mainly arsenic, beryllium and lead) the soil ingestions route (in the top 3 feet of soil), benzene exceeded the inhalation routes and benzene, toluene, ethylbenzene and xylenes (BTEX), naphthalene, non-naphthalene polycyclic aromatic hydrocarbons (PAHs), several SVOCs and several metals exceeded the soil component to the groundwater ingestion route of the industrial/commercial ROs. Groundwater results showed benzene, benzo(a)pyrene (BAP), naphthalene, selenium, and total cyanided exceeding Class II groundwater ROs.

2001 November, Burns & McDonnell, Propane Tank Removal, Former Crawford MGP Site – Property O/S, Chicago, Illinois

Objective

The letter report reviewed existing soil probe drilling logs and associated analytical results on Parcels O and S to determine whether the proposed propane tank excavation area would encounter MGP residuals.

Scope and Results

Soil and Groundwater sampling results from previously advanced soil probes and wells (SP047, SP049-SP056, SP059, SP060, MW004, and MW005) were screened against Tiered Approach to Corrective Action Objectives (TACO) ROs. No tar-like or other potential MGP residuals were observed in the borings. Several soil samples (SP051-SP055) exceeded the industrial/commercial ROs for beryllium. The remaining samples are below the soil ingestion and inhalation ROs. Several priority pollutant metals exceed the soil component to the groundwater ingestion RO; however, none of the metal exceeded the Class II groundwater ROs.

2002 June, Burns & McDonnell, Site Investigation Report, The Former Crawford Station Manufactured Gas Plant, Property O, Chicago, Illinois

Objective

Site investigations were conducted on behalf of PGL in anticipation of enrolling Parcel O into the IEPA SRP. The objectives were to characterize the magnitude and extent of MGP-related constituents beneath the Site and provide sufficient data to evaluate parameters exceeding residential, commercial, industrial, and construction worker scenario ROs.

Scope and Results

One hundred twenty-eight soil probes were advanced at various locations across Parcel O. Soil samples were collected from various depths within each soil probe and analyzed for TCL VOCs, TCL SVOCs, primary pollutant metals, and total cyanide. Twenty-two soil probe locations were also converted to 2-inch diameter PVC monitoring wells and groundwater samples were collected.

During field activities, odors, staining, and small to large amounts of tar-like substance was observed in proximity to the same materials observed on Parcels A and B as a continuation of the ABO RAA. Also area between 35th Place and 36th Street was identified as having a sheen in one of the borings. This location was addressed in the Group I RI Report.

Soil sample results show BTEX, naphthalene, non-naphthalene polycyclic aromatic hydrocarbons (PAHs), several SVOCs and several metals exceeding the industrial/commercial ROs. Groundwater results showed BAP, naphthalene, and lead exceeding Class II groundwater ROs.

2005 April, Burns & McDonnell, Crawford Delineation Results (Appendix) (Parcels A & B)

Objective

This document presents data from soil sampling events conducted on Parcels A and B of the Crawford Station Site. The work was performed on behalf of PGL to delineate MGP residuals on Parcels A and B identified during a previous investigation.

Scope and Results

Approximately 50 soil borings were advanced on Parcels A and B with samples taken at depths ranging from one-foot to 20-feet. Groundwater was also sampled during the course of this investigation. No report narrative was prepared. The document includes boring logs and analytical results in appendix format.

2007 April, Burns & McDonnell, Draft Canal Sediment Investigation Summary for the Former Crawford Station, Chicago, Illinois (no parcel)

Objective

Investigate potential subsurface and sediment effects associated with the Chicago Sanitary and Ship Canal located south of the Crawford Station Site and potentially delineate those effects.

Scope

The draft canal sediment investigation summary presents Tar-Specific Green Optical Screening Tool (TarGOST®) boring logs, a location map, photographs, and forensic analytical results collected in the

Chicago Sanitary and Ship Canal adjacent to the Crawford Station Site. The Canal sediment investigation activities were conducted in February and March 2007. No report narrative was provided. The TarGOST® screening showed that non-aqueous phase liquid (NAPL) may be present in the sediment of the Canal. See further discussion in Section 3.3 of this SSWP.

2007 June, Burns & McDonnell, Crawford Site Investigation Data, Parcel S, Chicago, Illinois

Objective

This report presents the sampling data in table format conducted on Parcel S as part of the comprehensive investigation performed.

Scope and Results

Twenty-three physical soil samples, 74 near surface soil samples, approximately 74 subsurface soil samples, and approximately 42 groundwater samples were taken on Parcel S. No report narratives were prepared or were the samples compared to a RO. The document includes Burns & McDonnell-generated tables and laboratory reports, including chain of custody forms. Further evaluation of this data is provided in the Completion Report (NRT, 2011).

2011 March, Burns & McDonnell, Site Investigation Activities at Crawford Parcel O Letter Report, Chicago, Illinois

Objective

This letter report combined data from the initial investigation conducted in 2001 and a subsequent investigation conducted in early 2011. The subsequent investigation covered distinct areas on the western, central, and eastern portions of Parcel O.

Scope and Results

Soil probes were advanced and observations were recorded on drilling logs in three areas where MGP residuals had been previously observed. In the western portion of Parcel O, 11 new soil probes were advance to depths ranging from 8 to 16 feet below ground surface (bgs). No soil samples were collected in this area and the conditions were characterized based on visual observations. In the central area of Parcel O, 12 soil probes were advanced. Soil samples were randomly collected between three and eight feet bgs. Soil samples were analyzed for BTEX, PAHs, RCRA total metals, and total cyanide. In the eastern area of Parcel O, three additional probes were advanced. Soil samples were collected from the probes, and analyzed for BTEX, PAHs and RCRA total metals. The 2001 and 2011 sample results were compared to industrial/commercial and construction worker ROs.

2011 September, NRT, Removal Action Work Plan, Revision 1.0, Crawford Station MGP Site, Chicago, Illinois (Parcels A, B, and O)

Objective

This removal action work plan (RAWP) was developed, on behalf of PGL, in response to a USEPA directive that a removal action be undertaken in areas of MGP source material identified on Parcels A, B, and O.

Scope and Results

Proposed activities include preparation, ambient air monitoring, fugitive emissions control, excavation of MGP source materials, a variety of confirmation and delineation sampling activities, stormwater management, and restoration activities. MGP source material was defined and a plan for removal was developed. Select samples were collected for analysis of petroleum volatile organic compounds (PVOCs), PAHs and total petroleum hydrocarbon (TPH). The samples will be evaluated under the RI.

2014 July, NRT, Former River Investigations Parcels A and B Data, Crawford Station Former MGP Site, Chicago, Illinois

Objective

This investigation was conducted in response to source materials identified on Parcel L during the TCRA. The former West Fork Channel historically bisected the Crawford Station MGP Site from southwest on Parcel A, through Parcels B, I, D, L, to the northeast of Parcel O prior to the period between 1938 and 1951 when it was filled in.

Scope and Results

Borings were placed to collect samples from the river material and the area outside the former river footprint. At each location, samples were collected at various depths to help characterize the MGP-related impact, or, in the case of borings showing no signs of source material, within native material. The samples were analyzed for a site-specific constituents of potential concern (COPC) developed during the ongoing RI and Removal Action work.

The results were evaluated against the removal action criteria. Source materials were identified within the former River area. (See Appendix B for the analytical results.)

2.5.2 Quality of Existing Data

Analytical reports from previous investigations were reviewed to generally assess data quality. This review is not intended to be a validation of analytical data. Rather, the review confirmed the availability of analytical laboratory reports citing the use of USEPA approved methods as well as supporting quality control data, including chain-of-custody records. The data packages reviewed are summarized below:

- Burns & McDonnell, 2002. *The Former Crawford Station MGP – Property O, Site Investigation Report Draft.* A data package was provided indicating that SW846 methods were used for sample analysis. Case narratives and quality control results are included. Soil and groundwater sample data evaluation memoranda were provided that validated analytical results performed by Test America, Inc. Overall quality of soil analytical results was acceptable; some SVOC values were flagged or qualified as estimated. Groundwater data was acceptable for use with qualification for minor analytical quality control issues on some resultant values.

- Geo Services, Inc. July, 2005. *Geotechnical Investigation (Parcels A, B, and O)*. A data package was provided indicating that American Society for Testing and Materials (ASTM) methods were used for geotechnical analysis of soil samples. No significant failures in test procedures were identified. Data quality is believed to be acceptable and the data is usable for the RI.

- Burns & McDonnell, 2005. *Crawford A&B Properties, Summary of Further Delineation Results Letter Report*. A data package was provided indicating that SW846 methods were used for sample analysis. Case narratives and quality control results are included. A soil sample data evaluation memorandum was provided that validated analytical results performed by STAT Analysis Corp. The overall quality of chemical analytical results was acceptable. No qualification was necessary.

- Burns & McDonnell, 2007. *Site Investigation Data, Parcel S*. A data package was provided in the report indicating that SW846 methods were used for sample analysis by Severn Trent Laboratories. Case narrative and quality control results are included. No significant failures in analytical procedures were identified. Data quality is believed to be acceptable and the data is usable for the RI.

- Burns & McDonnell, 2007. *Canal Sediment Investigation Summary*. A data package was provided in the report indicating that SW846 methods were used for sample analysis by META Environmental, Inc. Case narrative and quality control results are also included. No significant failures in analytical procedures were identified. Data quality is believed to be acceptable and the data is usable for the RI.

- Natural Resource Technology, Inc. September 2011. *Removal Action Work Plan, Rev. 1 – Properties A, B & O*. A data package was provided in the report indicating that SW846 methods were used for sample analysis by Pace Analytical. Quality control results are included. No significant failures in analytical procedures were identified. Data quality is believed to be acceptable and the data is usable for the RI.

- Natural Resource Technology, Inc. July 2014, Former River Investigation. A data package was provided in the report indicating that SW846 methods were used for sample analysis by Test America. Level 2 quality control results are included. No significant failures in analytical procedures were identified. Data quality is believed to be acceptable and the data is usable for the RI.

2.6 Previous Actions

No prior actions were performed within RI Group VI parcels at the Crawford Station Site including any activities under the IEPA LUST and SRP programs, not associated with the former MGP activities.

2.7 On-Going Actions

As previously mentioned, USEPA has issued a separate AOC (Docket No. V-W-11-C-981, dated October 12, 2011) allowing a TCRA to be implemented at the Crawford Station Site. To date, removal actions have been completed on portions of Parcels A, B, and O (Group IV, herein known as the ABO Removal Action Area [RAA]) and are ongoing at Parcel L (Group II) and Parcel I (Figure 5). During the removal action, open excavations are dewatered to lower the water table to access the MGP residuals. The dewatering activities affect the groundwater flow and elevations in the vicinity of the open excavations. Furthermore, the large excavations are also being backfilled with more pervious material which may have a longer range impact on GW flow on the site. Further discussion of the site activities on groundwater is provided in Section 3.2.4.

An area within Parcels D and M are proposed to be excavated. As of the issuance of this SSWP, work plans for removal actions have been submitted to the USEPA; however, these proposed removal actions have not commenced. Activities within Parcels D and M are being discussed between the involved parties, but access is pending.

3 CURRENT SITE CHARACTERISTICS

A complete discussion of current site characteristics was provided previously and therefore is not reiterated in this SSWP. See the Completion Report and SSWP – Group I (NRT, 2012) and associated Appendices for a discussion of the current site characteristics, including topography, drainage, geology, hydrogeology, meteorology, population, land use, cultural and natural resource features, previous investigation findings, current site status, areas of potential concern, and previous investigation results.

3.1 Upland Site Geology

The Site has been investigated in multiple phases, as previously noted. Soil boring locations are shown on Figure 6A and boring logs are provided in Appendix B of the Completion Report.

Based on characterization work previously performed, the unconsolidated stratigraphic units present on the Group IV parcels include the following:

- Fill Unit – 0-14 feet thickness with approximate average 6.5 feet thick
- Brown/Gray Silty Clay Unit – Approximate average 14 feet thick
- Gray Silty Clay Unit (Carmi Member of the Equality Formation) – Approximate average 40-50 feet thick

Geologic cross-section locations prepared from boring logs are shown on Figures 8 and 9 in the Completion Report. These units are described below.

3.1.1 Fill Unit

The surficial fill unit at the Site ranges from 0 to 14 feet in thickness and consists primarily of clay, gravel, and sand with smaller amounts of silt, bricks, cinders, glass, and wood. Asphalt, where present, was approximately 6 inches thick with up to 2 feet of gravel/sand base. Within the rail spur, cinders and crushed asphalt is observed at the surface. In numerous instances during probing activities on the Crawford Station Site, shallow refusal was encountered. As expected, the areas in or near the historical MGP structures (i.e. former gas holders) contain fill material to the total depth of the structure.

3.1.2 Brown/Gray Silty Clay Unit

Underlying the fill unit is a brown/gray silty clay unit. The unit is a medium to stiff silty clay with trace to some sand and gravel. The relative consistency of the unit appears to vary but generally becomes increasingly stiff with depth. Small fractures are noted within this unit. In addition, orange and brown mottling is also sporadically observed in the uppermost portions of the clay suggesting it is seasonally saturated.

3.1.3 Gray Silty Clay Unit

Underlying the brown/gray silty clay unit is a native gray silty clay unit presumably the Carmi Member of the Equality Formation. The top of the gray silty clay unit was encountered from 4 to 15 feet bgs. The silty clay unit is consistently made up of equal parts silt and clay with traces of sand and gravel. As with the overlying unit, the relative consistency of the unit appears to vary but generally becomes increasingly stiff and uniform with depth. In addition, orange and brown mottling is also sporadically observed in the uppermost portions of the clay suggesting it is seasonally saturated.

3.1.4 Bedrock

Regional information suggests the depth to bedrock is approximately 50 feet bgs. Bedrock underlying the Site is Silurian-age Niagaran dolomite formations. However, bedrock was not encountered during the Group I RI at a depth of 50 feet bgs.

3.2 Upland Evaluation

3.2.1 Observations of MGP Residuals

The discussion below provides an overview of site conditions and an identification of areas were potential MGP residuals exist, based on field observation that have been performed to date, mainly on Parcels A, B, O and S. Figures 6A through 6D present observations based solely on visual, olfactory and photoionization detector (PID) notations on available boring logs. Because of the removal action completed on the southwest corner of the site, this figure, which is similar to Figure 14 presented in the Completion Report, has been modified to reflect only the remaining affected soil. However, Figure 14 of the Completion Report was reviewed for purposes of planning this SSWP.

Borings are color-coded on the observation figures as follows:

- Green – No PID response or visual evidence of discolored/stained soils and odors
- Purple – PID response with a visual evidence of discolored/stained soils and odors

- Orange – Observation of oily sheens and/or LNAPL
- Yellow – Observation of soils saturated with coal tar-like substances and/or dense non-aqueous phase liquid (DNAPL)

Borings represented by circles had soil samples collected for laboratory analysis and borings represented by squares were not sampled, but the observations recorded. Numerous borings encountered shallow obstructions such that penetration was insufficient to yield useful subsurface information. These borings, and others that were blind drilled, are not shown on the soil observation figures.

Because Figures 6A through 6D are based solely on boring log notations, locations where no evidence of potential MGP residuals was observed does not also mean that corresponding soil analytical results were below residential screening values. Similarly, PID response or the observation of discolored/stained soil alone does not imply the presence of MGP-related residuals. Locations where sheens, LNAPL, and DNAPL were noted are intended to illustrate the distribution of more highly affected areas of the Crawford Station Site for RI planning purposes.

Parcels A, B, O and S at the Crawford Station Site have been extensively investigated through the performance of over 294 historical borings within the four parcels. The borings in the four parcel of Group IV are listed in the following table:

Parcels	Borings Performed within Parcel[1]
A/B	CEI-SP001 through CEI-SP147;
O	PCO-SP001 through PCO-SP034
S	CPS-SP12 through CPS-SP74

[1]The three letter prefix has been removed from the figures for ease of review.

Additional borings were completed for planning purposes for the TCRA (CSBSP-01 through CSBSP-07 for A&B and CSOSP-01 through CSOSP-07 for Parcel O) with the ABO RAA. As noted previously, PGL has implemented an interim remedy under the TCRA described in the RAWP (NRT, 2011) and subsequent addendums. The objectives of the TCRA include the following:

- Remove identified MGP source material to eliminate residual NAPL at the surface and associated direct contact concerns to the extent practicable.
- Remove other materials which may be affected by MGP residuals, but are not considered source material, on a selective basis within the removal action areas to support long term management within the multi-site framework for MGP facilities.

Because conditions within the ABO RAA have changed, due to the implementation of the TCRA remedy, the results of some of the borings performed and analysis of samples collected are not discussed in detail

in this SSWP, because portions or all of the borings and associated samples no longer represent conditions on the site. However, some of the borings performed previously within the ABO RAA still had portions of the borings remaining below the limits of the excavation. Therefore, the color code for these borings has changed as a result of the removal of the NAPL affected soil to reflect the conditions that exist following the completion of the removal action (Figures 6A through 6D).

Preliminary preparation activities for the ABO RAA were initiated in November 2011. Full-scale soil excavation operations commenced in January 2012. Post-excavation samples were collected from the removal areas to confirm the removal of source materials. These soil samples include sidewall and floor samples to document residual soil quality at the extent of the removal areas. These results are discussed further in Section 3.3.

The remainder of Section 3 discusses the results of the field observations and sample analyses of soil and groundwater at the Site in the two Group IV investigation areas as outlined in the Completion Report: Rail Spur Areas (Parcel A and portions of Parcels B, O and S) and the former Coal Storage Area (portion of Parcel B). The sediment evaluation completed to date is also discussed in Section 3.3.5.

3.2.1.1 Former Rail Spur Areas (Parcels A, B, O, S)

Parcels A, B, O: There were three major areas of MGP residuals within the former Rail Spur Area: the southwest corner of the site (ABO RAA), the area along the former West Fork Channel (Former West Fork Channel Area) alignment of Parcels A and B, and the area just south of the West Fork Channel (North Central Area). A fourth area is identified on Parcel B as the Former Machine, Carpenter and Paint Shop Area is discussed in this section for clarity, though MGP residuals have not been observed in this area. The areas are depicted on Figures 6A through 6D.

- **Former West Fork Channel Area:** The first location of potential MGP residuals is on Parcels A and B along the alignment of the former West Fork Channel (Former West Fork Channel Area). The former West Fork Channel historically traversed diagonally from the southwest to the northeast on Parcels L, A, B, I, D, P and north-south extension of Parcel O. The former location of the West Fork is shown on Figures 6A and 6B. Removal of MGP residuals on Parcel L has reach depths of 27 feet in this area. Additional characterization of the reach of the former channel on Parcels A and B was conducted in 2014 as part of the ongoing TCRA evaluation. Samples are identified on Figure 6B as SB01 through SB52. The results indicate possible source material within the former West Fork Channel Area (see Appendix B). This material represents a possible source of affected fill material and/or a preferential migration pathway and will be evaluated in conjunction with the site-wide groundwater assessment as part of the RI/FS process.

- A former locomotive water station was located south of the former West Fork, within the "Former West Fork Channel Area." The investigation in the area of the former locomotive station indicates possible source material is likely resulting from the presence of the former West Fork Channel.

- **North Central Area:** The second area of potential MGP residual is near the western edge of the former MGP production area and south of the former West Fork Channel (herein referred to as the "North Central Area") (Figure 6A and 6B). The affected soils are located within an approximate 10 acre area previously occupied by several rail spurs (Figure 3B) and may represent a railway distribution point for former MGP byproducts. Several borings exhibited signs of visible tar-like substance (such as borings CEI-SP110, CEI-SP058, CEI-SP112 and CEI-SP141) as shown on Figure 6B. The MGP residual were characterized as having tar-like substance in fractures of silty clay at depths ranging from 15.5 to 16.5 feet bgs, green staining at depths between 7 and 13 feet bgs, and suspect naphthalene odors within wood fill materials. Additional borings contained visible NAPL in fractures as well as elevated PID responses.

- **ABO-RAA:** The third area, ABO RAA, had no MGP structures (Figures 6A and 6C). However, previous investigation within the ABO RAA has shown approximately 40 soil borings that exhibited some degree of visible DNAPL tar-like product. The tar-like substance in fractures was noted predominantly at a depth of 8 to 13 feet bgs and averaging approximately 2 feet thick and widespread across the 13.7-acre area in the southwestern portion of the Site. Potential MGP residuals appeared to be concentrated along the westerly side of the 18 foot by 14.4 foot sewer that bisects the RAA in a north to south orientation. Furthermore, the presence of a tar-like substance was observed at the ground surface at multiple locations. Under the TCRA, this material was removed in 2012 around the sewer line and from around several of the high-pressure gas line and in 2015 around the remaining high-pressure gas lines, in accordance with the USEPA approved RAWP (NRT, 2011). Because the objective of the TCRA is to remove source materials, the remaining soil data from boring logs, soil boring samples, and excavation data was re-evaluated during the planning of this SSWP to determine if additional vertical delineation and data is required under the RI and for the BLRA.

- **Former Machine, Carpenter, and Paint Shop Area:** This area is discussed in this section for clarity as former MGP operational structures, though MGP residuals have not been observed in this area. This area is south of the former West Fork Channel Area and east of the North Central Area, where the former carpenter, machine, and paint shops were located. No staining with odors or elevated PID measurements were identified in the borings within the footprint or surrounding the shops. The boring observations are shown on Figure 6B.

The remainder of the borings advanced in the Rail Spur Areas (Parcels A, B, O) had no visible, olfactory, or PID responses that would suggest potential MGP effects.

Parcel S: Parcel S formerly contained several railspurs and former series of propane and liquefied petroleum tanks. In addition, the MWRD interceptor trench, which crosses the parcel from northeast to southwest, and the southern end and outfall of the north-south inceptor storm sewer, were present during the MGP operations. Minor staining and low-level PID responses (0.0 – 6.3 ppm) were detected sporadically throughout Parcel S (borings CPS-SP12, CPS-SP26, CPS-SP33, CPS-SP45, CPS-SP47,

and CPS-SP48) (Figures 6C and 6D); however, no LNAPL or tar-like saturation was detected in Parcel S. Several borings (CPS-SP29, CPS-SP31, and CPS-SP32), in a former vacant area, had elevated PID readings, as high as 120 ppm (Figure 6C). No staining was observed in the soils in the borings.

A small area located in the adjacent portions of Parcel O, south of the two 10,000,000 ft^3 gas relief holders, had elevated PID responses, but no staining or elevated PID reading were observed on the adjacent Parcel S to the south (CPS-SP73 and SP74).

No staining or PID was observed in the remainder of the borings.

3.2.1.2 Coal Storage Area (Parcel B)

The coal storage area is located on the southeastern corner of Parcel B but a majority of the storage area was located on Parcels J and N (not part of Group IV). Site investigation data is limited to borings within Parcel B. No soil borings have been advanced within adjacent Parcels J and N, but are planned under the SSWP, Addendum 2, Rev 1 Modified (NRT, 2015).

Several borings have been advanced on Parcel B within the Coal Storage Area boundaries. Most of these borings exhibited no visible, olfactory, or PID responses that would suggest potential MGP effects. However, three borings, located in the extreme southwestern corner of Parcel B, contained a tar-like substance (CEI-SP125, CEI-SP126, and CEI-SP127). The observed tar-like substance was identified in the first six feet of the boring and was described as “coated to saturated.”

3.2.2 Constituents of Potential Concern – Upland

The site-specific COPC are based on an evaluation of the COPCs found in the Multi-Site CSM (IBS, August 2007), Multi-Site Risk Assessment Framework (RAF) (Exponent, September 2007), and Multi-Site RAF Addendum, Revision 3 (Exponent, July 2014) as well as data collected on the Crawford Station Site and knowledge of historic land use. Over 800 soil samples and groundwater samples from permanent monitoring wells have been collected at the Crawford Station Site on Parcels A, B, D, F, I, K, L, O, P, Q, S, U and V. These parcels encompass most of the area where former MGP production facilities were located as well as broad representative areas of the Crawford Station Site where no MGP operations occurred. Soil and groundwater samples were analyzed for one or more of the following: volatile organic compounds (VOC) (also, standalone analyses for BTEX), SVOC (also, standalone analyses for PAHs), phenols, PCBs, herbicides/pesticides, metals, and cyanide. Constituents not detected in previous sample analyses were discussed in the SSWP – Group I (NRT, October 2012) in Section 3.9.1 (soil) and

Section 3.9.4 (groundwater). The analytes that were not detected during previous sampling events are not considered COPCs for the Crawford Station Site.

Site-specific selection of COPCs is partially based on current and former land use. As described in the Completion Report (NRT, 2011) and Section 2.2.1 of this SSWP, the MGP facility was constructed in 1921 and was closed in the early 1960s. PGL sold 146 of the original 260-acres to First Industrial Realty Company in 1966. The parcels were subsequently developed by a variety of commercial storage, distribution, and transportation businesses. Therefore, non-MGP residuals are also likely to be present.

Analyses of the historic site data and details regarding the selection of the site-specific COPCs are presented in Appendix C for soil and groundwater. Based on previous sampling events and the analysis documented in Appendices C and D of this SSWP and the previous SSWPs, soil samples collected for the RI will be analyzed for a modified Multi-Site RAF MGP COPC list. The modified list includes portions of the standard list from the 2007 RAF and a few additional Crawford specific COPCs. The list is provided on Table 1 and includes the following:

- Petroleum volatile organic compounds (PVOC): BTEX,1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene
- PAHs: acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene, and 2-methylnaphthalene
- SVOCs: 2,4-dimethylphenol, 2-methylphenol, 3&4-methylphenol, phenol, carbazole and dibenzofuran
- Inorganic compounds: Soil – antimony, arsenic, lead, thallium and mercury; and groundwater – total and dissolved – antimony, arsenic, cadmium, chromium, lead, mercury, nickel, selenium, and thallium.

The selection process for site-specific COPCs for soil also considered the property use history not related to the MGP. Based on current and/or historical land use on Group VI parcels to be evaluated during the RI, no modification to the soil or groundwater COPC list above is warranted. Appendix C re-iterates the initial site-specific soil and groundwater COPC evaluation for the Crawford Station Site. The COPC screening results are summarized in the next section.

The vapor intrusion COPC discussion is provided in Appendix F. Review of the available indicated that the appropriate COPCs are those related to MGP residual as listed in the RAF Addendum #3. No additional site specific COPCs are warranted.

3.2.3 Soil COPCs Screening

Approximately 253 samples remain of the soil investigation within the upland Group IV parcels as either historical samples or several Group I RI samples. The remaining soil samples from the historical soil boring was re-screened against the most current screening levels (SL) from Multi-Site RAF Addendum, Revision 3 (Exponent, July 2014) and the recent June 2105 published USEPA Regional Screening Levels (RSL) The evaluation was completed to determine if additional delineation is required for SSWP planning purposes.

3.2.3.1 Rail Spur Area (Parcels A, B, O, S)

Approximately 71 remaining surface soils (0-2 feet bgs) were collected for analysis within Parcels A, B, O and S and the remaining are from the subsurface (Tables 2a through 2d). The soil removal action in the ABO-RAA removed most of the source material found in the soil. Evaluation of confirmation samples from the excavation will be completed in the RI Report.

Parcels A/B

- **Former West Fork Channel Area: and North Central Area:** The vast majority of surface soil samples were below method detection limits (MDL) for VOCs and all were below the residential SLs. In the subsurface, BTEX were the primary VOCs detected in the railroad spur area. Several benzene and/or ethylbenzene and xylene residential SL exceedances coincide with a previously identified MGP residual source area in the central portion of Parcel B, as shown on Figure 7 and 8. Naphthalene also was detected near the MDL and below the residential SL in the surface samples (Figure 7 and 8). The non-naphthalene PAHs, when detected (Figure 9 and 10), consistently exceeded the residential SL for benzo(a)pyrene (15 µg/kg). When benzo(a)pyrene was detected, various other PAHs were typically detected and samples also often exceeded residential SLs for benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene. Occurrences were widely scattered across both Parcels A, B, S and O with no notable trends.

- **Former Machine, Carpenter, and Paint Shop Area:** This area includes the former carpenter, machine, and paint shops. Samples analyzed from the approximate area of these former facilities were either non-detect or below SLs with the exception of CEI-SP145 from 9-10 feet bgs. Naphthalene and several non-naphthalene PAHs were detected above the SLs, though there were no elevated PID readings or staining in the boring. No other VOCs were detected in these samples.

For both Parcels A and B, occasional isolated occurrences of chlorinated VOCs were detected at or near their MDL, including, 1,1,2,2-tetrachloroethane, cis-1,2-dichloroethene and trichloroethene and were below the SLs. Therefore chlorinated VOCs are not included in the COPC list.

Naphthalene, and in some cases, 2-methylnaphthalene and dibenzofuran, exceeded residential SLs primarily near the MGP residual source area on Parcel B. Lead was present above the residential SLs at the MGP source area on Parcel B (Figure 11 and 12). The large majority of samples analyzed for total cyanide were below MDLs and did not exceeded the residential SL. The few detections of total cyanide tended to occur in the central portions of Parcels A/B and on the west side of Parcel O, which have since been removed during the TCRA.

Parcel S

One isolated exceedances of the naphthalene residential SL also occurred in the eastern portion of Parcel S. The occurrence is adjacent to former “liquefied petroleum tanks”. No other SVOC (other than PAHs) were detected above the residential SLs in the soil samples in all areas within these parcels (Table 2a through 2d).

Samples collected on Parcel S along the canal were analyzed for herbicides, pesticides and PCBs. None of these compounds were detected above the MDLs or the residential SLs. These same samples were also analyzed for barium, cobalt, synthetic precipitation leaching procedure (SPLP) cobalt, vanadium, iron and manganese. SPLP cobalt was below MDLs. None of these metals exceeded residential SLs.

Thallium exceeded the residential SL but not the Industrial SL in some of these samples, mainly on Parcel S (Figures 11 and 12). No other metals exceeded their respective residential SLs with the exception of arsenic. Arsenic exceeded the residential SL (0.68 mg/kg) in most of the samples and the IEPA background of 13 mg/kg was exceeded in some of the samples analyzed within this investigation area (Figure 13). Total cyanide was not detected within Parcel S.

3.2.3.2 Coal Storage Area (Parcel B)

Surface soils were collected at seven locations within the coal storage area on Parcel B. No samples have been collected on the adjacent Parcels J and N, but are planned in the SSWP Add. 2, Rev 1, Modified.

BTEX and naphthalene were detected above the residential SLs in CEI-SP125, CEI-SP127 and CEI-SP033 in the subsurface soils, but only naphthalene concentrations and one benzene sample (CEI-SP127) exceeded the industrial SLs. No VOCs were detected in surface soils within this investigation area.

The same three locations exceeded the residential SL for non-naphthalene PAHs.

The residential SL and IEPA background for arsenic was exceeded in the three locations, but lead and antimony residential SL was exceeded in CEI-SP125, and lead exceeded the industrial SL in CEI-SP125.

Total cyanide was detected in all but one sample, none of which exceeded its residential SL.

3.2.4 Groundwater COPCs Screening

Groundwater has been collected for seven rounds (2014-2015) in newly installed and several existing wells. The groundwater COPC list for the RI was developed in the SSWP Revision 1 (NRT 2012c) based on results from prior soil sampling information (Appendix D of the SSWP Revision 1). The following COPCs were detected in groundwater samples during the sampling events: benzene, PAHs, carbazole, total antimony, total arsenic, total cadmium, total chromium, total lead, total nickel, total selenium, total thallium and available cyanide. Groundwater analytical results and statistics from January 2014 through January 2015 are summarized in Tables 3a through 3c. Laboratory reports of analytical results are provided in Appendix E of the RI Report (NRT, 2015). The following presents a summary of the laboratory results. See the RI report (NRT, 2015) for more details.

3.2.4.1 Benzene and Naphthalene

Analytical results indicate that benzene exceeded the groundwater SL in one well (MWO102) located in the approximate footprint of the former West Fork on Parcel O. The exceedance occurred in the January 2014 sampling event only. Benzene was detected at MWO102 below the groundwater SLs in April 2014 and has not been detected in the well again since that sampling event. Naphthalene was detected in nearly half of the groundwater samples collected over all sampling events. There were no exceedances of groundwater SLs other than the tapwater SL.

3.2.4.2 Non-Naphthalene PAHs

Several PAHs were detected in multiple groundwater samples, but none of the samples collected at the site to date have exceeded the groundwater SLs.

3.2.4.3 Inorganic Compound Concentrations

Arsenic exceeded the groundwater SL in MWA101, which is screened across the fill/silt interface, and MWB101, which is screened in the fill, exceed the groundwater SL for arsenic. The groundwater SL for arsenic was exceeded in only one sample from MWA102 (October 2014), and PA101 (January 2015) which are screened in native silt and stiff gray clay, respectively. Arsenic was detected above the groundwater SL in two groundwater samples from the piezometer at PB102 (July 2014 and January 2015) which is screened in stiff gray clay.

Total lead was detected above the groundwater SL for lead (MWA101, January 2015; MWO104, April 2014; PA101, October 2014), but were preceded by samples with lead concentrations two orders of magnitude lower. Lead had been previously detected (during investigation activities prior to the RI) in PCO-MW006 above groundwater SLs; but was not detected above the SLs in any of the five samples collected between February 2014 and January 2015. No groundwater samples exceeded SLs for antimony or thallium with the exception of four samples that exceeded the tapwater SL for thallium.

Available cyanide was not detected above its groundwater SL on any of the Group IV parcels, other than a few exceedances of tapwater SLs.

Groundwater detections are further evaluated in the BLRA of the RI report. .

3.2.4.4 Groundwater/Vapor Intrusion Screening

Groundwater sampling results for COPC have been compared to Multi-Site Program SLs for VI. Results indicate that the residential VI SL for groundwater (cancer risk 10^{-6}) was exceeded at well MWO102 for benzene in samples collected in February and April 2014, but not in subsequent events. The groundwater VI SL exceedances are shown on Figure 14. There were no exceedances of the industrial groundwater VI SLs in samples collected to date.

Applicability of the VI SLs on Group IV parcels will be evaluated after RI work has commenced and depth to water and building construction (Building B-1) are obtained. Observations and sampling results will be used in conjunction with the VI Decision Matrix (Appendix F1) to determine next steps.

The RI conducted on the Group IV parcels will include a site-wide assessment of groundwater quality. As was determined previously for the Crawford Station Site in the SSWP for Groups I-III, and based on available data for both soil and groundwater, the site-specific COPCs for groundwater will include the same COPCs selected for soil except that available cyanide will replace total cyanide as listed on Table 1. Additionally, dissolved metals will be analyzed for during sampling events to provide more data for the feasibility study and risk assessment. Sampling for dissolved constituents provides a more accurate representation of constituents in the groundwater media. These constituents are included on the Multi-Site RAF COPC list and they will be carried forward as site-specific COPCs until additional groundwater data is collected and future screening indicates that their removal from the COPC list is appropriate under approval by the USEPA.

3.2.5 Soil Vapor Screening

Based on the analysis documented in Appendix F3, soil vapor samples collected during implementation of this SSWP will be analyzed for the standard list of vapor intrusion (VI) COPCs for MGP sites as listed on Table 1.

3.3 Chicago Sanitary and Ship Canal Evaluation

3.3.1 Surface Water Evaluation

There is no historical surface water data to screen.

3.3.2 Sediment Evaluation

A sediment investigation was performed in the CSSC adjacent to the former Crawford Station Site during February and March 2007 by Burns & McDonnell (B&McD). The investigation consisted of 56 Tar-Specific Green Optical Screening Tool (TarGOST®) probes. TarGOST® is a laser-induced fluorescence screening tool that is designed to identify areas where potential NAPL may be present. The TarGOST® probe is a front-face fluorometer coupled via fiber optics to a sapphire-window that shines excitation light onto, and collects emission from, the same surface as the probe is pushed into the ground or sediment. If NAPL is present, the PAHs that exist in these NAPLs absorb some of the light and are driven into an electronically excited state. When the excited electrons in these PAHs return to their ground state (typically <10 nanoseconds), a portion of the PAHs emit red-shifted light (a longer wavelength light than the excitation laser). Some of this fluorescence, along with a small portion of the reflected excitation laser light, are collected by a mirror and focused into the second collection fiber optic for return to the TarGOST® instrument for detection.

The TarGOST® probes generally occurred along transects commencing approximately 30 feet from the shore and, in some instances, extending about 250 feet across the canal. Relating TarGOST probe responses to presence of NAPL is a complex procedure using a combination of %RE, shape of response log, and color of response log based on waveform. It is also important to compare field data to a TarGOST response collected from an ex-situ boring containing NAPL; the ex-situ data does not exist for the most of theTarGOST probes in the CSSC. Therefore, evaluation of TarGOST data was performed only using %RE and likely overstates the presence of NAPL because the TarGOST probe can respond to other organic material such as peat or animal residue and other sediment conditions. Figure 15 depicts the TarGOST® probe locations and Appendix A7 contains the associated logs.

The CSSC sediment and underlying native clay were further investigated in March 2007 by advancing seven borings from a barge with a track-mounted drill rig using an 8.25-inch outer diameter hollow-stem auger. The borings ranged in depth from 6 to 22 feet below the top of the sediment surface (below mudline) and typically terminated five feet below the sediment/native clay interface. The upper two to three sediment samples were typically collected with a 3-inch outer diameter, 2-ft long split spoon sampler. Deeper samples (including sediment and native clay) were collected with a 2-inch outer diameter, 2-ft long split spoon sampler.

The sediment borings were advanced adjacent to locations of previous TarGOST® probes to facilitate collection of samples for forensic evaluations and compare boring observations against TarGOST® probing results. Samples were screened for VOCs with a PID and visually inspected for tar-like substances, tar-like residue, odor, and sheen and/or staining. Boring logs are provided in Appendix E.

Boring logs indicated the presence of sediment thickness ranging from 1.2 feet to 17 feet in the CSSC. The sediment overlies medium stiff to hard clay with varying amounts of silt (i.e., trace silt to silty clay) and trace coarse to fine sand. The sediment borings exhibited various odors, including slight to strong petroleum-like odor and heavy to strong tar-like odor. PID responses ranged from 0 to 240 ppm. Tar-like material was observed in six of the seven sediment borings, as summarized in Table 4. Figure 16 presents these observations by depth.

3.3.3 COPCs – Canal

The site-specific COPCs for surface water and sediment are based on an evaluation of the COPCs found in the Multi-Site CSM (IBS, August 2007) and Multi-Site Risk Assessment Framework (RAF) (Exponent, September 2007), discussed in Appendix C, and summarized on Table 10.

3.3.3.1 Sediment COPCs screening

Based on the limited amount of analytical sediment data, samples will be analyzed for all constituents on the Multi-Site RAF MGP COPC list (including alkylated PAHs in certain instances).

3.3.3.2 Surface Water COPCs screening

Based on the absence of surface water quality data, surface water samples will be analyzed for all constituents on the Multi-Site RAF MGP COPC list.

3.3.4 Sediment COPC Screening

Twelve samples were collected from intervals that exhibited visual evidence of heavy impacts. The samples were sent to META Environmental Laboratories (META) for forensic evaluations. Additionally,

12 sediment samples were analyzed by gas chromatography/flame ionization detector (GC/FID) for fingerprinting and by gas chromatography/mass spectrometry/selected ion monitoring (GC/MS/SIM) for mono- and polycyclic aromatic hydrocarbons, alkylated PAH homologues and other selected compounds by META (March 2007). The Meta laboratory analytical reports are included in Appendix F.

The current sediment conditions of the CSSC portion of the Site are summarized as follows:

- Sediment sample results by META indicate total priority pollutant (PP) PAH concentrations ranging from 130 to 21,300 ppm. The sediments contained a mixed pattern of petrogenic/pyrogenic and pyrogenic material. The GC/FID fingerprints and GC/MS extracted ion current profiles indicated a number of potential PAH sources contributing to the samples, including CC tar, CW.

- Total PAHs were summed for each sample collected from the sediment borings. The total PAH sum was screened against the Threshold Effect Concentration (TEC) of 1.61 mg/kg and Probable Effect Concentration (PEC) of 22.8 mg/kg. (MacDonald et. al. 2000). TEC is a sediment concentration below which adverse biological effects are unlikely to occur. PEC is a widely-used sediment-quality guideline that is a concentration above which adverse biological effects are likely to occur (Multi-Site RAF [Exponent, 2007a]). All 12 samples exceeded both the TEC and PEC, as presented in Table 5a and shown on Figure 17.

- MacDonald et. al. 2000 does not include PEC and TEC for individual BTEX compounds. Therefore, sediment sample results were screened against Equilibrium Partitioning Sediment Quality Guidelines (EQP-SQG) (DiToro and McGrath 2000) (BTEX only). Also, as a point of reference, sample results were screened against the Residential Soil SLs. Each sample had concentrations of several PVOCs and PAHs that exceeded SLs, as presented in Table 5a.

- Table 5b compares the sample MDL to the sediment SLs and Table 5c presents the sample QC duplicate summary. None of the non-detects at the MDL exceeded the SLs and CRAW-CSB009-001 was the only duplicate sample. The duplicate results RPDs were below 30% in adherence with the QAPP, with the exception of heptadecane, in which the RPD was 39.3%.

- The summed total PAHs were also screened against the 95/95 upper tolerance limits (UTL) for surface and subsurface ambient sediment, as presented in Table 5d. The 95/95 UTLs were developed as part of the North Branch Chicago River ambient investigation (NRT 2013). Ten of the 12 samples exceeded the 95/95 UTL.

4 SITE-SPECIFIC CONCEPTUAL SITE MODEL SUMMARY

The CSM identifies the primary MGP-related components which includes the COPCs, potential transport mechanisms and relevant human and ecological receptors. A Site-Specific CSM was developed for Parcels A, B, O and S and the CSSC (Group IV parcels) (Figure 18), which is based on the Multi-Site CSM (IBS, August 2007a). The Site-Specific CSM provides the framework to identify data needs to characterize the Group IV parcels on the Crawford Station Site and evaluate potential human health and ecological risks. The Site-Specific CSM was refined to reflect conditions observed during the reconnaissance activities completed in July, 2011 and February, 2012 as well as information summarized in the Completion Report (NRT, December 2011) and Completion Report Addendum No. 1 (NRT, January 2012). In addition, a graphical Site-Specific CSM (Figure 19) was developed for the Group IV Parcels to provide a visual interpretation of the media involved as well as the current conditions of the site. The Site-Specific CSM and risk assessment approach will be routinely reviewed to refine the media of concern and individual pathways as more data are collected.

4.1 Site Reconnaissance

The primary purpose of a site reconnaissance is to evaluate whether exposure pathways are complete for human and ecological receptors. The reconnaissance also identifies existing land use and site conditions and completes ecological habitat assessments. If additional information is obtained during the RI that would suggest exposures to other receptors, further assessment of these exposure pathways will be addressed in the BLRA.

For the Crawford site, two areas are identified for human and ecological exposures: 1) upland, where the former MGP processes were located, and 2) the adjacent CSSC. Two site reconnaissances were completed mainly in the upland area. A site reconnaissance and ecological habitat assessment was conducted on the upland portion of the Crawford Station Site on July 19, 2011 by an Exponent environmental biologist and NRT engineer during a visit to the Crawford Station Site. On-site observations were made for PGL-owned Group I parcels (for which there was access on the day of the site visit) and from the PGL-owned parcels and public rights of way for remaining Groups II, III and Group IV parcels. The ecological checklist provided in the RAF was completed and photographs taken to document site conditions (refer to Appendix A6 of SSWP – Group I; NRT, October 2012). The ecological

habitat assessment is provided in Appendix A6 of this SSWP. These observations were supplemented with review of aerial coverage of the Crawford Station site conditions as present in Google Earth.

A second site reconnaissance visit was completed in February 2012 of the upland portion of the Crawford Station Site (i.e., excluding the CSSC). The purpose of this reconnaissance was to supplement the earlier visit on July 19, 2011. During the reconnaissance of the upland portion of the Site, observations were made of site conditions to understand human and ecological receptors having the potential to be exposed to MGP residuals which will require evaluation within the BLRA.

The overall site reconnaissance observations and site condition are reiterated for Group IV in the following paragraphs. Additional information regarding conditions (such as zoning information, post-MGP operation uses, and physical features) on the Crawford Station Site is contained in the Completion Report (NRT, December 2011) which was used, along with the observations made during the reconnaissance, to develop the Site-Specific CSM for Group IV.

The Crawford Station Site is considered industrial land use. The Site is zoned by the City of Chicago specifically for manufacturing land use. Refer to Figure 6 of the SSWP-Revision 1 (NRT, August 2012). Specific Group IV parcel land uses and physical features include the following:

- Parcel A is approximately10 acres, and is currently owned by PGL and is operated by Schneider and occupied by a truck staging area with no buildings. The surface of the parcel is covered with a pervious material in the form of crushed asphalt. The property is enclosed by a chain link fence with one main entrance along the eastern boundary.

- Parcel B is approximately 25 acres, and is currently owned by PGL and is operated by Schneider and occupied by a truck staging area with one building. The surface of the parcel is partially covered with an impervious material (asphalt parking lot and concrete) and pervious material in the form of crushed asphalt and gravel. The property is enclosed by a chain link fence with one main entrance along the eastern boundary and access through the west fence to Parcel A.

- Parcel O (that was part of the ABO RAA) is approximately 9.69 acres, and is currently owned by PGL and is occupied by a truck parking lot. The surface of the parcel is predominantly covered with a pervious material in the form of crushed asphalt and gravel. The property is enclosed by a chain link fence with one main entrance along the southern boundary.

- Parcel S is approximately 19.3 acres, and is currently owned and occupied by MWRD. No buildings exist on the parcel. The majority of the parcel is covered with a pervious material in the form of crushed asphalt, stone, topsoil with green space areas and other minor areas of solid surfaces. The parcel is enclosed by a chain link fence and other security fencing and its main entrance is controlled by security.

Group IV parcels are confined to the upland area being currently or previously developed with little to no observed ecological habitats, with the exception of Parcel S. The ground surface is primarily covered with

crushed asphalt and gravel, minor areas of concrete, and no surface water bodies observed. Parcel S does have areas of potential natural areas; however, site observations of Parcel S were made from the parcel boundaries, due to access issues. Once site access is granted and site observations can be made on-site, the need for additional ecological assessment will be determined, if site conditions are different than anticipated.

At present, the area immediately surrounding the Site includes manufacturing and industrial uses. However, a high school (Little Village Lawndale High School) and a public park (Piotrowski Park) are located just beyond the Crawford Station Site to the north along the north side of the railroad tracks on Parcel R. With this exception, the future land use of the Crawford Station Site and immediately surrounding area is expected to remain industrial in the future.

4.2 Media of Potential Concern

The Multi-Site CSM (IBS, August 2007a) considered the following as media of potential concern for the Crawford Station Site:

- Surface and subsurface soil
- Groundwater
- Soil vapor
- Surface water
- Sediment

The media of potential concern will be evaluated as part of the risk assessment to review if response actions, including risk management tools, are warranted to manage the potential risk to human health and the environment on the Crawford Station Site.

The risk assessment of the media of potential concern will be based on existing data and new data to be collected as described in Section 6 of this document and in the Site-Specific Quality Assurance Project Plan (QAPP) (Appendix D1). Previously collected data were assessed for data quality and discussed in Section 2.4.2 of this SSWP, and further assessment of the newly obtained data under the RI or for the TCRA will be performed prior to using data as part of the RI per the guidelines in the Site-Specific QAPP (Appendix D1). The data assessment considered (and will continue to consider in the case of newly obtained historical data and RI data) the age and quality control (QC) procedures of the data, detection limits, and the likelihood that the data are still representative of current conditions. Representative data to

be used for site evaluation for the RI and the BLRA are those that likely represent media still present on the Crawford Station Site at the time of the final FS. Therefore, any historic or more recent soil data that has been or is currently being removed from the Crawford Station Site will not be presented in figures and tables since these data are or will no longer be representative of current site conditions. However, these data have been and will continue to be used for RI planning and will not be eliminated during the evaluation. Review of the available data for the Group IV parcels indicated the subsurface materials that have recently been removed are those in the ABO RAA and those are currently anticipated to be removed or addressed with another type of remedy possibly under the TCRA are those within the alignment of the West Fork Channel

Similarly, historic groundwater data are not considered completely representative of current conditions because of the age of the data. Historical groundwater data will be used for planning purposes only.

As referenced, the COPCs for each media are discussed in Section 3. An analysis of the site historic data and details regarding the selection of the site-specific COPC lists are presented in Appendix C for each media of potential concern.

4.2.1 Surface Soil

Parcels A, B and O are covered by buildings, pavement, or crushed pavement, which may prevent or may not be suitable for collection of surface soil samples.

Surface soil will be evaluated, if possible, as a medium of potential concern because of the potential for current or future occupants to be exposed to COPCs, if present. Soils collected in the top 2 ft of soil are referred to as surface soils. Typically surface soil from 0-6 inches bgs is defined as surface soils for purposes of the risk assessment because people would have the greatest potential to be exposed to these soils if they are present. However, soil from 6-24 inches bgs (sometimes defined as near-surface soils) is also considered as people will have less potential to be exposed to these soils, but under certain conditions exposure to near surface soils may be possible (e.g. non-commercial activities like shallow soil excavation for utility work or landscaping). The surface soil and near-surface soil samples will be used together to characterize potential exposure and risk to a range of human receptors in the BLRA. Surface soil sampling is proposed at locations across the study area. The sampling strategy is presented in Section 6.4.2.

4.2.2 Subsurface Soil

Subsurface soil, defined here as being located either at or below 2 ft bgs will be evaluated as a medium of potential concern because past investigations have detected DNAPL/tar-like material and LNAPL/sheen in soil borings at the Crawford Station Site. Additionally, shallower (0–2 ft bgs) soil samples collected from beneath pavement, building slabs, or granular cover (such as stone or crushed asphalt) were also categorized as subsurface because of the barrier preventing human exposure under current conditions. Subsurface soil sampling is proposed on each of the RI Group IV parcels.

Humans are less likely to be exposed to subsurface soils because it is normally inaccessible. However, if redevelopment or underground utility work occurs, construction/utility workers could be exposed to subsurface soils. In addition, if subsurface soils are brought to the surface during excavation, the potential for exposure to these soils by other human receptors increases. For these reasons, subsurface soil data will be used to evaluate potential risks to a range of human receptors in the BLRA.

4.2.3 Groundwater

The public water supply for the City of Chicago is obtained from Lake Michigan; therefore, consumption of groundwater is not expected by residential or worker populations. The City of Chicago has a groundwater ordinance that prohibits the use of groundwater as a potable water source and restricts the installation of potable wells. The City of Chicago and the IEPA have a Memorandum of Understanding (MOU) that allows the groundwater ordinance to be used as an institutional control (See Appendix E for the City's Groundwater Ordinance [City of Chicago, 1997]). In contrast, the water table on the Crawford Station Site is perched creating the potential for VI from impacted groundwater, if present, and from dermal (i.e., skin contact) and inhalation exposure during construction activities if MGP residuals are present. Therefore, the potential for such exposure to groundwater will be further evaluated with the Group IV parcels.

Groundwater is being evaluated on a site-wide basis. Due to the presence of previously existing wells, a baseline well assessment (Section 6.5) was completed to determine the condition and utility of existing wells on site (NRT, SSWP, Rev. 1). Because of access issues at the time of the baseline assessment, existing wells on Parcel S need to be evaluated for usability. Existing wells meeting usability criteria will be used along with additional wells that will be installed throughout the Site (Section 6.6) over time to complete the site-wide evaluation. Overall groundwater quality and flow on Site will be assessed, along with the site hydrological conditions.

4.2.4 Soil Vapor

A preliminary soil vapor assessment was prepared for the Crawford Station Site and specifically evaluated the VI potential for the Group IV parcels. The assessment is presented in Appendix F1. The soil vapor assessment has determined that Group IV soil vapor has the potential to be impacted with MGP-related constituents because subsurface soil at the parcels (Parcel A, B, and O) and surrounding parcels (Parcels D, I, and L) is affected by volatile MGP-constituents (e.g., naphthalene and PVOCs). There is also potential for Group IV soil or groundwater to be affected and thereby, the soil gas could potentially be affected. Affected soil vapor near or beneath a Group IV parcel structure could potentially enter a building through cracks in the foundation floor and pose a risk to occupants and pose a potential risk to construction/utility site workers under redevelopment or subsurface utility work exposure scenarios.

To date, soil vapor samples have not been collected on the Crawford Station Site. Multiple lines of evidence are required to determine the need for a VI assessment, beginning with the presence of volatile MGP residual in the soil and groundwater. Detailed procedures for VI assessment can be found in Appendix F.

The first step of the VI assessment is to evaluate whether VI COPCs are present in close proximity or “inclusion zone” (approximately 30 ft for MGP residuals) of occupied buildings or preferential native or man-made migration pathways. The need for determining the extent of soil vapor characterization on or adjacent to the Crawford Station Site will be assessed based on evidence of an MGP residual source by the results of the proposed RI sampling, initially through soil and groundwater sampling (i.e., multiple lines of evidence). Additionally, based on previous discussions and meetings with the USEPA, any buildings located over a former MGP structure that could potentially contain MGP residual (e.g., gas holder) could pose a potential VI condition and will be considered a candidate for VI investigation (initial or contingency). One building (B-1) currently exists on Parcel B, located over the former West Fork Channel. Groundwater elevation collected quarterly in MW102 near Building B-1 (Table 3 of NRT, RI Report), shows the high level water table elevation was at 6.9 feet bgs, but is consistently below the well screen (at 12 bgs) such that the well is reported dry. Four exterior soil gas samples and one nest sub-slab sample within the building footprint are proposed in this SSWP for this building.

Furthermore, if known VI COPCs are not located within close proximity of a building structure or are not located below a building structure, then the VI exposure pathway will be considered incomplete for that building under current conditions. This approach is consistent with USEPA’s final Technical Guide (USEPA, 2015). It should be noted that in areas of Group IV where VI COPCs are located in the soil on the remaining portion of Parcels A, B, O and possibly S, but no buildings are currently in close proximity

of the contamination, the potential for VI in these areas based on future building construction will be addressed in the FS considering appropriate risk management techniques (e.g., institutional controls[2] to prevent the VI pathway from becoming complete) or remediation to remove the potential future risk.

Sumps can act as preferential pathways for contaminant migration and may require special consideration if VI COPCs are in close proximity to the buildings with sumps. Groundwater less than five feet below slab can also require special consideration. The USEPA VI SLs are valid only if there are no preferential pathways present that would allow contaminated groundwater or vapors to enter a building or shallow groundwater (or groundwater in contact with the slab), because these preferential pathways or shallow groundwater may lessen the attenuation of the chemical vapors compared to what was assumed in the development of the VI SLs.

If sampling results indicate the need for additional soil vapor assessment, additional probes may be installed near or in building foundations to assess the migration of soil vapor into indoor air. Soil vapor probes may also be installed in utility corridors to assess preferential migration of vapors or open areas to assess future use scenarios for the property. The decision to install additional soil vapor probes will be made based on the results of the subsurface characterization efforts and building characteristics, and if required, may result in the need for another RI field event.

Additional building information, such as building occupancy; the presence of heating, ventilation, and air conditioning (HVAC); and the presence of basements, sumps, cracks in floor slabs, etc., will be collected when access to the buildings is obtained.

4.2.5 Surface Water

Surface water samples have not been previously collected. Investigations are needed to assess surface water quality and to evaluate potential and incremental human health and ecological risks. Surface water will be evaluated as a medium of potential concern for the Group IV parcels, if access to the CSSC is granted.

[2] This is intended to indicate to future potential building developers that there may be a potential risk of VI to be considered during building construction, as discussed in the recent USEPA Technical Guide (USEPA, 2015).

4.2.6 Sediment

Previous investigations indicate the possible presence of NAPL in the CSSC sediments, as presented on Figure 16. Further investigations are needed to assess sediment quality and to evaluate potential and incremental risks to ecological receptors and will be evaluated as a medium of potential concern with the Group IV parcels, if access to the CSSC is granted.

4.3 Potential Exposure Pathways – Human Health

This section evaluates potential exposure pathways for human health receptors as presented in the Multi-Site CSM (IBS, August 2007a). An evaluation of the Multi-Site CSM exposure pathways has been considered to develop the CSM specific to Parcels A, B, O and S and the CSSC of the Crawford Station Site. This evaluation considers both current and potential future land use at the Crawford Station Site. The potential human receptors being evaluated under a range of land use scenarios include industrial/commercial workers, construction workers, recreational visitors/trespassers, and residents.

Exposure pathways will be evaluated as part of the risk assessment activities to assess if response actions, including risk management tools, are warranted to manage the potential risk to human health on the Group IV parcels of the Crawford Station Site. The methods that will be used to evaluate potentially complete exposure pathways are included in the Multi-Site RAF (Exponent, September 2007).

Exposure to soil, groundwater, and vapors will be evaluated for the upland portion of the site; this includes the Group IV parcels. Evaluation of potential exposure was previously discussed by media in Section 4.2 of this SSWP.

The CSSC represents the only water body in close proximity to the Crawford Station Site. The IEPA Secondary Contact and Indigenous Aquatic Life use designation advises limited direct contact with the surface water within the CSSC. IEPA recommends recreational or other water use where contact with the water is limited and the probability of ingesting appreciable quantities of water is minimal. Recommended uses are limited to fishing, commercial and small craft recreational boating (e.g., canoeing and kayaking), and any limited contact incident to shoreline activity such as wading (35 IAC [Illinois Administrative Code] 301.282). A detailed evaluation of the CSSC will be performed as part of the habitat assessment for the Group IV parcel area. Based on observations that will be made during a future habitat assessment of the CSSC, the human receptors to be evaluated further will be defined with the BLRA specific to the CSSC.

4.3.1 Industrial/Commercial Land Use Scenario – Worker

The Multi-Site CSM considered the exposure route to the industrial/commercial worker through incidental ingestion, dermal contact, and inhalation of Group IV soil due to either direct exposure to surface soil or subsurface soil due to soil disturbance as follows:

- Incidental ingestion, dermal contact with or inhalation of surface and subsurface soil on Parcels A, B, O and S.
- Inhalation of vapors through VI from soil and groundwater near or underneath selected building(s) (Appendix F). The need for any additional soil vapor sampling at current buildings or to consider future use will be evaluated based on soil and groundwater data to be collected during the RI.

In the risk assessment, existing data and data obtained from proposed sampling on all parcels will be used to evaluate exposures to surface soils by industrial/commercial workers by comparing soil concentrations to the most current regional screening levels (RSL) provided by the USEPA for the industrial worker soil exposure scenario.

In the future, if the subsurface soils were disturbed on the Crawford Station Site, exposure via inhalation, ingestion, and dermal contact may be possible, although industrial/commercial workers would not likely be the workers exposed during the disturbance; rather, construction worker exposure is more likely. Construction worker exposure is discussed in Section 4.3.2. However, in the absence of a soil barrier, paving and/or the building slab, exposure via inhalation, ingestion or dermal contact may exist to an industrial/commercial population; therefore, industrial/commercial worker exposure will be further evaluated in the RI/FS.

Exposure to groundwater by an industrial/commercial worker is not expected because the public water supply is obtained from Lake Michigan. However, the groundwater data will be compared to State and Federal drinking water standards and tap water SLs for informational purposes only.

Currently, the completeness of the exposure pathway for VI is unknown. Based on the current land use (industrial/commercial), the presence of buildings in the vicinity of former MGP structures, and known impacted media, potential inhalation of vapors from VI into buildings will be evaluated at the Parcel B building under this SSWP (Appendix F). In addition, once the extent of MGP residuals in soil and groundwater are established, the potential for VI due to the presence of impacted soil or groundwater will be evaluated on parcels where no current buildings are located to assess future use. Soil vapor and groundwater data, when obtained, will be compared to the most current VI SLs published by USEPA to evaluate if there is a potential risk associated with VI into current or future buildings in the study area.

4.3.2 Construction Worker

The Multi-Site CSM considered the potential exposure of the construction worker to impacted soil, groundwater and vapors. Potential exposure of construction workers to soil is through incidental ingestion, dermal contact, and inhalation of soil during soil disturbance. Consistent with the Multi-Site CSM, there is the potential that construction workers may be exposed to soil and soil vapor if portions of the Crawford Station Site are redeveloped or if subsurface utility work occurs. During this redevelopment or utility work, they may also be exposed to perched groundwater.

Potential exposure of the construction worker will be qualitatively addressed in the risk assessment due to the short duration of exposure. The construction worker scenario will be assessed using both previously collected data that meets the required DQOs (as discussed in Section 4.2) and new data to evaluate risks under the following exposures:

- Incidental ingestion, dermal contact or inhalation of soil (as well as chemical vapors) during soil disturbance on the Site parcels with un-remediated soil remaining at depths shallower than 10 ft bgs
- Inhalation of vapors derived from groundwater associated with excavation activities across the site
- Dermal contact with groundwater in excavations from across the site
- Direct contact with NAPL
- Incidental ingestion, dermal contact or inhalation of surface water or sediment from CSSC

4.3.3 Recreational Land Use Scenario – Visitor/Trespasser

The Multi-Site CSM considers that potential exposure to a recreational visitor/trespasser may occur through incidental ingestion and dermal contact of surface soils under future land use scenarios. Under current land use conditions, recreational users would not be exposed to surface or subsurface soils on most of the Crawford Station Site because the land surface is covered by buildings and pavement. In addition, access is restricted by fencing and gates. The potential risks to site visitors/trespassers with respect to upland areas will be addressed qualitatively considering the potential exposure to other receptors that would be expected to have the most exposure to the upland parcels (e.g., industrial/commercial workers or construction worker).

- Incidental ingestion or dermal contact of soil (as well as chemical vapors) during soil disturbance on the Site parcels with un-remediated soil remaining at depths shallower than 2 ft bgs.

- Incidental ingestion or dermal contact from subsurface soils (2 to 10 feet bgs), if exposed.
- Incidental ingestion or dermal contact of surface water from CSSC.

4.3.4 Residential Land Use Scenario

Soil and soil vapor data from all portions of the study area will be screened against the most recent residential soil SLs and VI SLs published by USEPA. This screening will include historic data and newly obtained RI data available for the Crawford Station Site. This screening will provide a perspective on any potential health risk associated with the potential for future residential development of each portion of the study area. However, within the BLRA, parcels will be evaluated for their current use as industrial property. The need to implement risk management tools on the parcels, which may include, but are not limited to, institutional and/or engineering controls, will be evaluated in the FS (see Section 8).

4.4 Potential Exposure Pathways – Ecological Receptors

This section evaluates the potential exposure pathways for ecological receptors as presented in the Multi-Site CSM (IBS, August 2007a). A site-specific evaluation of the Multi-Site CSM exposure pathways has been considered for the Crawford Station Site. The methods used to evaluate the potential exposures to ecological receptors are discussed in the Multi-Site RAF (Exponent, September 2007).

The results of the habitat assessment completed on July 19, 2011 by an Exponent environmental biologist was used throughout this subsection to evaluate which ecological receptors may be exposed to the contaminated media within the Crawford Station Site. Discussion of the habitat assessments is provided in the SSWP, 2011. As discussed previously in Section 4.1, there is no ecological habitat in the upland area, with the exception of Parcel S, because of the developed nature of the Crawford Station Site. This was documented as part of the habitat assessment (Appendix A6) and will also be documented in the ecological risk assessment performed for the Crawford Station Site.

The only potential ecological habitat is on Parcel S along the CSSC. As part of future RI activities once access is obtained, additional reconnaissance activities will be performed of the CSSC and the adjacent riparian area, and the Site-Specific CSM for these areas will be completed at that time. The additional observations that will be made of the CSSC and adjacent riparian area during future RI activities will include the general ecological habitat characteristics, which are more readily observed while performing the sediment investigation. These additional observations will be used to update the ecological habitat assessment performed in July 2011.

4.4.1 Mammals (Upland and Aquatic)

Carnivorous, piscivorous, insectivorous, omnivorous, and herbivorous mammals are ecological receptors considered in the Multi-Site CSM that may be exposed to COPCs through incidental ingestion of soil, sediment, or surface water and ingestion of plant and prey items. As noted during the site reconnaissance, there is no significant upland habitat that would support terrestrial mammals within the Group IV parcels of the Crawford Station Site. Other than isolated maintained grass areas on some of the Group IV parcels, the Group IV parcels are covered with gravel/crushed asphalt, asphalt pavement, or buildings. The maintained grass areas are not natural habitats for terrestrial mammals. Therefore, further ecological evaluation of terrestrial mammals may not be performed as part of the BERA for the area of the Group IV parcels.

4.4.2 Birds (Upland and Aquatic)

Carnivorous, piscivorous, insectivorous, omnivorous, and sediment probing birds are ecological receptors considered in the Multi-Site CSM that may be exposed to COPCs through either incidental ingestion or dermal exposure of soil, sediment, or surface water or ingestion of plant and prey items.

Terrestrial bird species were not observed on the Crawford Station Site on the day of the site reconnaissance. There is limited habitat for birds to nest or forage because the upland area is primarily covered with gravel, buildings, and crushed asphalt over the majority of the ground surface. None of the Group IV parcels are managed as natural area, and would only provide limited habitat for birds. Therefore, further ecological evaluation of terrestrial bird species will not be performed as part of the BERA for the Group IV parcel area of the Crawford Station Site.

4.4.3 Fish

Fish are considered an ecological receptor that may be exposed to COPCs in surface water and sediments. Based on the review of the MWRD report (MWRD 2008), the CSSC supports fish species even though the habitat conditions are rated as poor. Similar to aquatic birds, the risks to fish will be addressed qualitatively in the BLRA considering the locations where MGP-affected sediments are found above ambient conditions.

4.4.4 Benthic Invertebrates

Benthic invertebrates are considered ecological receptors that may be exposed to COPCs in sediment and surface water. Based on the review of the MWRD report (MWRD 2008), the CSSC supports benthic invertebrates even though the habitat conditions are rated as poor. Similar to aquatic birds and fish, the

risks to benthic invertebrates will be addressed qualitatively in the BLRA considering the locations of where MGP-affected sediments are found above ambient conditions.

4.5 Infrastructure and Preferential Migration Pathways

The main migration pathway to the subsurface is through the fill material, which typically lies from the surface to 9 feet bgs, but can be as deep as 14 feet. The highly permeable fill material consists of gravel and sand with smaller amounts of silt, clay, brick, cinders, glass and wood. Migration of DNAPL and affected groundwater also occurs through fractures in the upper portions of the clay unit.

Additionally, a surface water body, known as the West Fork of the South Branch of the Chicago River, formerly bisected the Site from northeast to southwest (see aerial photographs in Appendix A1 of the Completion Report, NRT 2011). This water body was filled in with fill material sometime in the 1940s. Borings have been advanced along this channel to assess fill type and channel depth and the presences of NAPL (Appendix B) The footprint of this former surface water body may also represent a preferential migration pathway.

Several subsurface utilities on and along the Site boundaries may create potential preferential pathways for migration where infrastructure is buried within the silty clay units. Of note is an 18 by 14.4 feet sewer located along the western boundary of the Site that leads to the Kostner Street Outfall along the CSSC, natural gas pipelines located parallel to the southern boundary of the Site, an 8 by 8 feet sewer located along the eastern boundary of the Site, and a 17.5-foot sewer interceptor running parallel along the southern boundary of Parcel O. These features are depicted on Figures 3A and 3B. Potential MGP residuals were removed from the top and sides of the sewer line where it transversed the affected soil in the ABO RAA. Portion of the sewer line also transects the former West Fork channel appears to transverse the potential MGP residual south of the Channel on Parcel B.

In addition, foundations of on-site structures can provide barriers to migration pathways. The Site contains several structures, each of which have the potential to block migration pathways in the upper few feet of the subsurface.

Potential conduits to the CSSC include the west-side Kostner Street Outfall and a former water intake and pump house for the MGP located near the eastern edge of the OU. The Kostner Street Outfall was constructed between 1938 and 1940 and, according to PGL documents, lateral drains from the MGP property were tied into it.

The circular structure near the west-side shoreline of the site (Figure 15) is a component of the Tunnel and Reservoir Plan (TARP); it is a vertical access shaft. The vertical shaft drops to a horizontal shaft that connects with the deep tunnel buried at approximately 290 feet bgs. The deep tunnel was not in existence when the MGP was functioning.

Further evaluation of the migration pathways will be completed during the RI.

4.6 RI Data Needs for Group IV Parcels

As described in the Completion Report (NRT, December 2011), and previous sections of this SSWP, the media that require further assessment with respect to public health, welfare, or the environment include the following:

- Surface or near surface soil on parcels A, B, O and S in areas not fully defined. Sampling is warranted to assess the direct contact exposure pathway.
- Subsurface soils potentially affected with MGP residuals on Parcels A, B, O and S in areas not fully delineated (horizontally and vertically). Sampling is warranted to evaluate potential exposure pathways.
- Soil vapor and the VI exposure pathway on Parcel B at building near MGP residuals of the former West Fork Channel and the North Central Area. The need for additional evaluation of the VI exposure pathway will be assessed.
- Groundwater potentially affected with MGP residuals on Group IV Parcels. Sampling is warranted evaluate potential exposure pathways.
- Sediment in the ACA. Sampling is warranted to evaluate potential exposure pathways.
- Surface water in the ACA has not been evaluated in the past. Sampling is warranted to evaluate potential exposure pathways.

5 PROJECT SCOPING AND PLANNING ACTIVITIES

As defined in the SOW, the scope of the Crawford Station Site work includes the following tasks:

Task 1: Project Scoping and RI/FS Planning Documents

Task 2: Community Involvement Support and Technical Assistance Plans

Task 3: Site Characterization

Task 4: Remedial Investigation Report (including human health and ecological risk assessments)

Task 5: Treatability Studies (if needed)

Task 6: Development and Screening of Alternatives (Technical Memoranda)

Task 7: Detailed Analysis of Alternatives (FS Report)

Task 8: Progress Reports

5.1 Project Scoping (Task 1)

5.1.1 Multi-Site Documents

The Project Scoping and RI/FS Planning Documents included the creation of multi-site documents that outlined general approaches and concepts with the intent of streamlining preparation of work plans and minimizing review times for future deliverables. In addition, the multi-site documents provide a consistent approach to investigating and assessing former MGP sites for PGL. The multi-site documents that have been prepared and approved by USEPA to achieve these objectives include the following:

- Multi-Site Health and Safety Plan, Rev 2, August 2007 (Multi-Site HASP) (IBS, August 2007b)
- Multi-Site QAPP, Rev 2, September 2007 (IBS, September 2007c)
- Multi-Site Conceptual Site Model, Rev 1, August 2007 (Multi-Site CSM) (IBS, August 2007a)
- Multi-Site Risk Assessment Framework, Rev 0, September 2007 (Multi-Site RAF) (Exponent, September 2007), Multi-Site RAF Addendum –Revision 3 (Exponent, July 2014)
- Multi-Site Field Sampling Plan, Rev 4, September 2008 (Multi-Site FSP) (IBS, September 2008)
- Multi-Site Feasibility Study Support Documents, Rev 1, March, 2010 (Multi-Site FS) (IBS, March 2010)

These multi-site documents are intended to set forth the general approaches and concepts for performing RI/FS activities. Site-specific revisions relevant to these multi-site documents are included in Appendix D.

5.1.2 Project Management Communications

The Site-Specific FSP included in Appendix D3 includes a flow chart of the lines of communication and contact information that will be used during field activities. Additional team members may be added throughout the project duration.

Meetings or teleconferences will be held at least once per week during field activities to provide schedule updates and to discuss problems that may have occurred and resolutions that have been implemented. The frequency of these meetings may be increased depending on the specific activity being performed.

These meetings will include the following personnel:

- USEPA Remedial Project Manager, Mr. Ross del Rosario and Mr. Pablo Valentin
- PGL Project Coordinator, Mr. Naren Prasad, P.E., MPH
- NRT Project Manager, Ms. Tracy L. Hofmann, PE

5.1.3 Purpose and Data Quality Objectives Review

DQOs for the Crawford Station Site are consistent with the DQOs presented in the Multi-Site QAPP. As discussed in Section 1 of this SSWP, data will be collected during the RI activities to satisfy the following site-specific objectives:

- Evaluate the nature and extent of MGP residuals in surface soil, subsurface soil, groundwater, sediment, surface water, and soil vapor at the Crawford Station Site and assess the characteristics of any residual material, if identified
- Support development and evaluation of potential remedial alternatives (FS), if response actions are necessary
- Collect data to support a BLRA for human health and evaluate the potential risk for human and ecological receptors

5.1.4 Preliminary Objectives for Remedial Action

The objectives for remedial action will be developed as part of the FS tasks described in Section 8.1 of this SSWP. In general, the remedial action objective is to protect public health, welfare, and the environment through risk reduction from MGP impacts.

5.1.5 Preliminary Remedial Action Alternatives

The remedial action alternatives will be developed as part of the FS tasks described in Section 8 of this SSWP and will include site-specific evaluation of Applicable or Relevant and Appropriate Requirements (ARAR) and To Be Considered requirements.

Remedial action alternatives were previously evaluated before selecting the response actions discussed in Section 2.6 of this SSWP. These response actions may again be reviewed and updated to reflect current conditions on the Crawford Station Site. In general, response actions including, but not limited to, one or more of the following may be appropriate to address MGP residuals:

Soil

- Removal and disposal (previous response action)
- In-situ treatment
- Capping and containment
- Institutional controls

Groundwater

- Containment
- Active remediation (in situ or ex situ)
- Monitored natural attenuation (MNA)
- Institutional controls

Surface Water and Sediment

- Dredge/excavate and disposal
- In-situ treatment
- Capping and containment
- MNA and recovery

Soil Vapor

- Engineering or institutional controls
- Soil removal and disposal
- Groundwater monitoring or treatment

5.2 Community Relations (Task 2)

PGL is prepared to provide community relations support if requested by the USEPA. In addition, PGL has and will continue communicating with local residents and authorities regarding the remediation efforts conducted in the specific Ward. All activities and communications will be coordinated with the USEPA.

6 SITE CHARACTERIZATION AND ASSESSMENT ACTIVITIES

The scope of RI characterization and assessment activities addressed by this SSWP includes:

- Mobilization planning
- Site surveying and reconnaissance
- Surface and subsurface soil sampling
- Groundwater monitoring well installation
- Groundwater sampling (a minimum of 4 quarters)
- Soil vapor sampling
- Sediment and surface water sampling

Sampling locations, frequencies, analytical parameters, and methods are presented below. Specific standard operating procedures (SOP) are referenced from the USEPA-approved Multi-Site FSP and are included in Appendix G. Work preparation, mobilization, site-specific dynamic sampling and analysis techniques, investigation-derived waste management, record keeping, sample analysis and validation, and data evaluation processes are also discussed. Project files will be managed as described in USEPA-approved SOP SAS-01-02 from the Multi-Site FSP.

Planned field activities will be completed in accordance with the methods and techniques described in the Multi-Site QAPP, Multi-Site RAF, and Multi-Site FSP; these general methods and techniques are not repeated herein. Site-specific information relevant to these multi-site documents are discussed below and details are included in Appendix D. The Site-Specific QAPP and HASP are presented in Appendix D1 and D2, respectively. The Site-Specific HASP is as stringent as or more stringent than the Multi-Site HASP and contains all components of the Multi-Site HASP. The Site-Specific HASP replaces the Multi-Site HASP in its entirety.

The Site-Specific FSP is presented in Appendix D3, and the Site-Specific CSM is included in Appendix D4. Copies of the SOPs referenced herein.

6.1 Mobilization Planning

Field mobilization activities will be completed in accordance with USEPA-approved SOP SAS-05-01 and Section 3 of the Multi-Site FSP. These activities include the following:

- Arranging access to all parcels (to be addressed by PGL).
- Notifying and locating utilities through DIGGER – Chicago Digger Hotline, the City of Chicago, and if necessary, a private utility locating contractor.
- Establishing clear communication from the field to office personnel, PGL, and the USEPA.
- Work near buried or overhead utilities will only proceed when utilities and reasonable setbacks can be field-verified and safety standards for operations can be maintained.

6.1.1 Daily Planning

Daily planning will occur as described in the Multi-Site FSP and the Site-Specific HASP including, but not limited to, the following:

- Tracking daily progress
- Identifying and resolving problems
- Communicating with office personnel, PGL, and the USEPA as appropriate, to ensure decision points and objectives for the work are fulfilled
- Holding safety meetings

A field log book will be maintained following the procedure outlined in USEPA-approved SOP SAS-01-01 from the Multi-Site FSP.

6.1.2 Demobilization

Generally, demobilization planning will occur during the pre-mobilization planning as staff and subcontractors plan for the field activities. Issues regarding final status of the property will be identified during the planning process (e.g., ensuring that landscaping issues are addressed).

6.1.3 Property Access and Safety

The RI for Parcel S and the CSSC is contingent on coordination with and approval by the respective owner, MWRD, to gain access to conduct the proposed activities. Work will proceed only if it can be performed safely and does not adversely impact ongoing operations on this property.

6.2 Site Surveying

Existing survey data will be reviewed to the extent it is available and applicable to establish existing conditions at the Crawford Station Site. Supplemental survey data will be completed as appropriate in accordance with USEPA-approved SOP SAS-02-02 and Section 7 of the Multi-Site FSP. Notable features will be accurately located and survey points will be converted to the USEPA-required Universal Transverse Mercator projection. Features from the individual parcels will be compiled into one comprehensive survey. Updated survey work and mapping will include the following:

- Establishing additional location survey information, as appropriate, so that drawings and maps reflect current features
- Establishing new survey control points so future activities and features can be accurately located and tied to a common datum
- Surveying the location and elevation of new borings and monitoring wells and surveying of existing wells on Parcel S that will remain
- Surveying subsurface utility infrastructure on the Crawford Station Site that have the potential to affect migration of MGP residuals

Recently, the Cook County Assessor has allowed geographical information system (GIS) access to parcel data information. As part of the survey and mapping task, current parcel data has been incorporated for the Group IV parcels and will be incorporated into the mapping of the RI Reports for the other parcels.

6.3 Supplemental Site Reconnaissance

Reconnaissance activities have occurred on portions of the Crawford Station Site over the past several years. In accordance with the Multi-Site RAF, additional reconnaissance will be conducted during Group IV, once site access is obtained. The site reconnaissance will be documented to support and refine the Site-Specific CSM developed in Section 4 of this SSWP. Reconnaissance will continue at the Crawford Station Site to evaluate pathway completeness for ecological receptors.

A FOIA was also submitted to the United States Geological Survey (USGS) for information pertaining to the CSSC, such as dredging. The results of these prior investigations will be reviewed as necessary to assist in the interpretation of RI findings as well as the development of future addenda to this SSWP, if appropriate. The FOIA will be evaluated for the RI once received.

6.4 Surface and Subsurface Soil Exploration and Sampling

6.4.1 Overview

Soil sampling strategy involves both overall site and focused areas of investigation. The former MGP structures and historical investigation data were reviewed to determine placement of soil borings. Additional soil exploration and sampling will evaluate the potential presence and extent, if any, of MGP residuals on Group IV Parcels A, B, O and S and the CSSC. Collected data will be used in a BLRA and FS. The BLRA will evaluate whether the Crawford Station Site presents a risk to human health and the environment.

The proposed soil sampling locations for the Group IV parcels are shown on Figures 20A through 20D The historical data is present based on field observations of potential residuals (staining, PID response and presence of NAPL). Table 6 presents a list of all proposed borings, probes, monitoring wells, and sampling locations for Group IV parcels sampling locations. All sampling locations are pending property access and the feasibility of the proposed locations relative to business operations on each property. If field conditions restrict placement of a proposed boring location, the boring will be executed as close to the proposed location as possible at the discretion of the property representative and field team. Special considerations for boring placement may be required on street right-of-ways where infrastructure may limit intrusive activity.

6.4.2 Soil Sampling Strategy

Soil borings will be advanced to depths of 20 to 25 ft bgs or until 4 ft of native clay is encountered which does not exhibit visual, PID or olfactory evidence of MGP residuals, whichever depth is greater. The sampling strategy are summarized on Table 6 and detailed below. Details of the sample frequency, number of samples (including QA/QC) and analytical are presented on Table 7. Soil samples will be collected from each soil boring and monitoring well location (prior to conversion to well) as outlined in the following sections, unless otherwise specified in the Sections 6.3 through 6.6.

6.4.2.1 Surface Soil Samples

One surface soil sample will be collected at each boring location from 0-6 inches bgs in areas where there is no ground cover (such as pavement or imported clean fill/gravel). In addition, a second sample will be collected from 6-24 inches bgs at 50% of these surface soil sampling locations.

6.4.2.2 Near-Surface Soil Samples

Where ground cover exists (such as pavement or imported clean fill/gravel) that prevents collection of a surface soil sample at 0-6 inches, a near-surface sample will be collected at 0-6 inches below the cover layer. A second sample from 6-24 inches bgs will NOT be collected at these boring locations.

6.4.2.3 Subsurface Soil Samples

Up to two subsurface soil samples will be collected at each soil boring location between 2 ft bgs and the boring termination depth. Sample selection will be based on the presence/absence of evidence of MGP residuals (e.g., visual or olfactory evidence and/or elevated PID readings) according to the following protocol:

- If no evidence of MGP residuals is present in a boring, one soil sample will be collected as follows:
    1) One sample from the 2-ft interval at the base of the fill unit where, historically, MGP residuals are commonly observed
    2) If MGP residuals are present in neighboring borings, one sample will be collected from the interval where the MGP residual are found and from a deeper interval if no vertical extent is noted in the neighboring borings
- If evidence of MGP residuals exists in a boring, two soil samples will be collected as follows:
    1) One sample from the 2-ft interval of most significant, non-NAPL evidence of MGP residuals, and
    2) One sample from the 2-ft interval below which evidence of MGP residuals is no longer observed (i.e., vertical extent)

Soil samples will be classified following USEPA-approved SOP SAS-05-02 from the Multi-Site FSP.

6.4.2.4 Contingency Borings

During RI operations, additional borings will be advanced at the discretion of the field team to further delineate the extent of MGP residuals on the Site. Particular attention will be paid to the presence of potential MGP residuals at the site boundaries. Installation of contingency borings (including those shown

on the figures) will be conducted in areas where prior property owner and utility clearance have been obtained, and safety protocols can be maintained.

6.4.3 Parcel Specific Sampling

6.4.3.1 Parcel A

Based on review of surrounding historical data and the location of former MGP structures, three areas of existing or removed MGP residual have been identified: the former West Fork Channel, the North Central Area of A and B and the ABO RAA. The locations of the borings and the depths of removal are presented on Figure 6A and 6B.

Under this SWPP, for the RI, two additional borings (ASB101 to ABS102) will be advanced on Parcel A to evaluate the potential presence of MGP residuals of samples along the AB boundary, north of the West Fork Channel were NAPL is present and vertically in the southern most portion of the parcel. Soil samples will be collected and analyzed in the laboratory in accordance with the SSWP.

In addition, a boring will be advanced to facilitate a well installed as part of the MWA101/PA101 nest. The well will be screened across the area of observed MGP residuals. The borings will be logged and sampled prior to installation of the wells. A soil sample with the MGP residual will be collected for laboratory analysis.

6.4.3.2 Parcel B

Parcel B affected areas are similar to Parcel A. Three areas of existing or removed MGP residual have been identified: the former West Fork Channel, the North Central Area of A and B and the ABO RAA. As part of the TCRA, soil borings have been advanced by NRT at Parcel B to investigate the potential for MGP residuals. MGP residuals were observed in soil within the former West Fork Channel as well as in the north central portion of Parcel B. Lateral delineation is fairly well defined with the exception along the A/B parcel boundary south of the North Central Area. Additional borings are needed to determine the depth at which both observed MGP residual and COPCs above SLs extend. Eighteen borings (BSB101 to BSB118) will be advanced on Parcel B as shown on Figure 20B and 20C. If necessary, contingency “step out” borings (field determined locations) will be completed around the planned borings to delineate potential MGP residuals.

In addition, borings will be advanced to facilitate the installation of five additional monitoring well nests on Parcel B. Two will be installed along the north border of Parcel B to evaluate potential migration of

observed MGP residuals in the former West Fork Channel (MWB103/PB103 and MWB104/PB104). A third well nest (MWB105/PB105) will be installed just south of the North Central Area to determine if groundwater in impacted and provide additional elevation data to determine groundwater flow direction once the dewatering activities stop. The fourth well nest (MWB106/P106) will be installed east of the ABO RAA on Parcel B to evaluated groundwater conditions in this area. The fifth well nest (MWB107/PB107) will be installed west of the sewer line. Soil samples will be collected from the intervals where potential MGP residual are noted in these borings or surrounded borings. These borings will be logged and sampled prior to the installation of the wells.

6.4.3.3 Parcel O

The extent of MGP residuals in the southwest portion of Parcel O has been defined vertically and laterally. MGP residual material in the ABO RAA has been laterally and vertically defined with the exception of south of the coal pile near the intersection of Parcels B and J. A soil boring (OSB101) will be advanced south the Parcel J to evaluation potential MGP residuals previously observed in PCO-SP130.

In addition, a soil boring will be advanced west of the excavation on Parcel O to facilitate the installation of a nested well (MWO108/PO108). The well will be used to evaluate groundwater conditions in this location.

6.4.3.4 Parcel S

Approximately nine borings (SSB101 to SSB109) are proposed throughout Parcel S to re-evaluate past samples. The samples will be used to further evaluate the surface soils were topsoil is exposed. Elevated metals and PAHs are likely the result of urban fill materials. Subsurface samples will be collected to confirm the condition of the clay beneath the fill materials.

As previously mentioned, any existing well found onsite will be evaluated for usability in the groundwater monitoring program. The procedure to evaluate the wells will follow the procedure described in the SSWP, Rev 1 (NRT, 2012) for Group I parcels. If existing wells are not usable, the well will be abandoned. An evaluation will be completed to determine if there is a need to replace the well. The same evaluation will be conducted if a well cannot be found, to determine if a well nest should be installed at the missing wells location. Any new wells installed, will be installed in accordance with the SSWP.

6.4.4 Sampling Methods and Abandonment

Drilling methods and procedures are described in the Multi-Site QAPP and Multi-Site FSP. Proposed subsurface soil samples will be collected via hollow-stem auger (HSA) borings or direct-push methods. Soil samples will also be collected as part of a groundwater monitoring well installation and soil vapor probe installation, if warranted by field conditions, as discussed in more detail in Sections 6.5 and 6.6. Sample depths within each boring will be identified and recorded in accordance with USEPA-approved SOP SAS-03-03 from the Multi-Site FSP.

Test pits may be excavated or exploratory borings installed to depths necessary to expose utility infrastructure backfill. Soil and/or groundwater grab samples will be collected if there is visual, PID, or olfactory evidence of affected conditions. The test pits or exploratory borings, if performed, will be in accordance with USEPA-approved SOPs SAS-05-06 and SAS-05-07 from the Multi-Site FSP.

Field equipment will be calibrated prior to use as required by USEPA-approved SOP SAS-02-01 from the Multi-Site FSP. During drilling, soil borings will be continuously field-screened to document subsurface conditions and identify samples for laboratory analysis according to USEPA-approved SOP SAS-06-01 from the Multi-Site FSP. Field screening will occur in accordance with the methods and screening techniques identified in the Multi-Site FSP. Borehole logging guidance developed specifically for MGP investigations will be used to assist the field team in describing tar in borings and is included in Appendix I. Observations or field-screening results suggesting that the soil is impacted by a potentially unrelated source will be noted on the drilling logs.

Grab samples will be collected for PVOC analysis using Terra-core samplers, or equivalent method, at the depth interval exhibiting the highest PID reading or as otherwise documented in the field. QC samples will be collected with the frequency described in Table 6 and required by USEPA-approved SOP SAS-04-03 from the Multi-Site FSP.

Samples will be labeled and packaged in accordance with USEPA-approved SOP SAS-03-01 from the Multi-Site FSP and shipped via overnight courier using chain-of-custody procedures described in USEPA-approved SOP SAS-03-02 from the Multi-Site FSP. Equipment will be decontaminated after use in accordance with USEPA-approved SOP SAS-04-04 from the Multi-Site FSP.

If soil borings are advanced to install a well and the borehole has to be offset due to refusal, or if for any reason the boring is not converted to a well, the original soil boring will be abandoned in accordance with the methods described in USEPA-approved SOP SAS-05-05 and Section 4 of the Multi-Site FSP.

6.4.5 Soil Sample Analysis

6.4.5.1 Chemical Samples

Soil samples will be collected and analyzed for the parameters listed on Table 6 following the corresponding analytical methods. This list will be carried through each Group IV sampling event until/unless the COPC list (Table 1 and Appendix C) is revised, based on continuing evaluation of previous sampling results.

6.4.5.2 Geotechnical Samples

One geotechnical sample per parcel will be collected on select samples. The sample will be collected above the water table and analyzed for the parameters listed on Table 6. One geotechnical sample of fill materials will be collected from a soil vapor probe location, as discussed in Section 6.6.1.

6.5 Groundwater Evaluation

A Site-Wide Groundwater Monitoring Program (GMP) will be completed throughout each phase of the RI. The GMP will consist of a baseline sampling event of existing wells (i.e. those wells meeting the well construction requirements per Section 6.5.1) and newly installed wells on Group I parcels. Figure 14 presents the current monitoring well network, used in the initial baseline sampling event, along with the approved Group II and proposed Group III well locations. As each phase of the RI proceeds (i.e., field activities on Group II, Group III and Group IV), the current monitoring well network will be enhanced by adding new wells to the monitoring network. At a minimum, groundwater samples will be collected quarterly for one year for each well following its installation. Upon completion of one year worth of data, the GMP will be evaluated to determine if modifications are necessary. This evaluation is discussed in Section 6.5.11.

6.5.1 Baseline Well Assessment

A baseline well assessment was completed in 2012 to identify previously existing wells suitable for long-term use at the site. See SSWP – Group I (NRT, October 2012), Section 6.5, for a summary of the baseline well assessment performed of previously installed monitoring wells on PGL-owned parcels in June 2012. The suitable wells are incorporated into the Site –Wide GMP and the unsuitable wells were or will be abandoned. Details of the any well abandonment to date will be presented in the RI Report for Group I Parcels.

Parcel S well have been previously assessed, but because several years have passed since the wells have been accessed, the condition of the well requires reassessment.

6.5.2 Well Locations

The site-wide groundwater monitoring network is presented on Figure 14. Group IV RI proposed well locations are presented on Figure 21 along with previously existing wells, recently installed Group I RI wells (early 2014), Group II RI proposed well locations (to be installed in late 2015 or early 2016) and Group III Parcels pending approval of the SSWP and site access. The proposed Group IV wells will supplement groundwater flow and quality within the fill and silty clay units and provide vertical elevation control points relative to other wells in the monitoring network. Table 7 lists the proposed Group IV well locations by parcel and the rationale for each well installation is provided.

6.5.3 Monitoring Well Installation

Proposed monitoring wells will consist of a nest of two wells; a water table well installed in the fill and a piezometer installed in the silty clay unit. The nested wells will enable definition of groundwater flow horizontally and vertically at the Crawford Station Site as well as establish the vertical extent of MGP residuals groundwater and provide information for VI assessment. The installation of the well nests will follow the Well Nest Installation Decision Tree described in Table 8. The exception is the installation of PA101S which will be installed within the layer of known MGP residuals regardless of the nested well requirements.

6.5.3.1 Water Table Wells

With sufficient fill thickness, water table wells will terminate within the fill to assess the presence of perched groundwater and flow direction. Because the presence of perched groundwater may be seasonal, water table wells will be installed regardless of whether groundwater is observed in the borehole at the time of well installation. No soil samples will be collected from water table borings where a nested piezometer is also proposed. If no nested piezometer is proposed at the location, soil samples will be collected from the water table well boring consistent with procedures described in Section 6.4.2.

Water table wells will be screened such that the well screen intersects the water table and does not penetrate the native clay unit. If the fill thickness is less than 13 ft, the well screen length will be decreased so at least 3 ft of casing will be below the ground surface to provide an effective surface seal. Well screen lengths of 3 ft (minimum), 5 ft or 10 ft (maximum) will be used and selected, based on the

depth to the silty clay unit and saturated thickness of the fill. If the fill is less than 6 ft thick, no water table well will be installed.

The water table wells will be installed in accordance with USEPA-approved SOP SAS-05-03 from the Multi-Site FSP and will be constructed of 2-inch diameter Schedule 40 PVC with flush mount covers.

6.5.3.2 Piezometers

6.5.3.2.1 Standard Installation

Piezometers will be installed to a target depth of approximately 17 ft below the top of the clay unit to enable a sealed interval of at least 5 ft between the base of the fill unit and the top of the piezometer screen filter pack. The piezometers will be installed in accordance with USEPA-approved SOP SAS-05-03 from the Multi-Site FSP and will be constructed of 2-inch diameter Schedule 40 PVC with a 10-ft screen length and flush mount covers. Due to the expected low permeability clay unit, the 10-ft screen length is specified for this work to facilitate the collection of groundwater samples. Soil samples will be collected from the piezometer borings consistent with procedures described in Section 6.4.2.

6.5.3.2.2 Installing Double-Cased Well

If MGP residuals are encountered in the fill or at the interface of the fill and silty clay units, drilling procedures will be implemented that will minimize the potential for cross-contamination of piezometer installations in the silty clay unit. Double-cased wells shall be constructed when there is reason to believe that cross-contamination may occur by dragging MGP residuals on drilling equipment downward into deeper strata.

A pilot borehole shall be bored through the contaminated fill zone into the silty clay unit. The borehole and outer casing shall extend beyond the zone where there is evidence of residuals into the silty clay by a minimum of five ft. An outer casing (sometimes called surface or pilot casing) shall then be placed into the borehole and sealed with grout. The borehole shall be of sufficient size to contain the outer casing and the 2-inch minimum outer annular space. The size of the outer casing shall also be of sufficient diameter to contain the inner casing and the 2-inch minimum annular space for installing the monitoring well.

The outer casing shall be pressure grouted by the tremie method or similar process to within 2 ft of the ground surface. The grout shall be pumped into the annular space between the outer casing and the borehole wall by placing the tremie tube in the annular space and pumping the grout from the bottom of the borehole to the surface, or placing a grout shoe or plug inside the casing at the bottom of the borehole

and pumping the grout through the bottom grout plug and up the annular space on the outside of the casing. If the outer casing is set into tight clay, both of the above methods may be used as the clay usually forms a tight seal in the bottom and around the outside of the casing preventing grout from flowing freely during injection.

The grout mixture used to seal the outer annular space can be neat cement, cement/bentonite, or cement/sand. However, the seal or plug at the bottom of the borehole and outer casing shall consist of a Type I Portland cement/bentonite or cement/sand mixture. A minimum of 24 hours shall be allowed for the grout plug to cure before attempting to drill through it.

When drilling through the seal to install the piezometer, care shall be taken to avoid cracking, shattering, and/or washing out the seal. Removal of outer casings following well construction is not acceptable. Trying to remove outer surface casings after the inner casings have been grouted may jeopardize the structural integrity of the well.

6.5.4 Groundwater Monitoring Well Development

The installed monitoring wells will be developed following installation in accordance with the bailing and pumping methods described in USEPA-approved SOP SAS-05-04 and Section 4 of the Multi-Site FSP. 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 from the Multi-Site FSP. If liquids are introduced into the borehole during drilling or well construction activities, an additional volume of water equal to three times the amount added will be removed from the well. Purge water from well development activities is anticipated to be sampled and disposed of at a permitted off-site treatment facility or treated through the current onsite groundwater treatment system. Approval will include any necessary compliance with the Off-Site Rule (OSR), 40 CFR 300.440 (USEPA, September 1993).

6.5.5 Groundwater Sampling

6.5.5.1 Standard Procedures

Low-flow groundwater sampling will be completed for all wells using a peristaltic pump as described in USEPA-approved SOP SAS-08-02 and Section 4 of the Multi Site FSP, provided the depth to water after sampling does not exceed 15 ft. If water depths exceed 15 ft after sampling, regardless of stability, subsequent low-flow sampling events will be conducted using a submersible pump.

Field parameters will also be recorded during well purging including pH, temperature, turbidity, dissolved oxygen, oxidation/reduction potential, and conductivity. Field parameters will be measured as described in USEPA-approved SOP SAS-08-02.

USEPA sample identification protocol and sampling forms will be used to ensure that samples are tracked accordingly and that the laboratory analytical data are provided in a manner consistent with the USEPA database requirements.

It is unknown if perched groundwater will be encountered in sufficient quantity within the fill to enable sampling at all proposed locations. Therefore, some events may have a reduced number of wells sampled.

Wells will be inspected for integrity at each sampling event according to USEPA-approved SOP SAS-08-05. In addition, the field measurements of total well depth will be compared to the monitoring well logs annually to detect potential issues with sediment accumulation in the well.

Groundwater sampling and analysis details are shown on Table 6.

6.5.5.2 Sampling Wells with Slow Recharge Rates

Following the criteria outlined in the Well Nest Installation Decision Tree (Table 8), piezometers will typically be installed into the native clay. Field observations recorded during previous well development and sampling activities at the Crawford MGP Site indicate that some of the existing piezometers exhibit slow recharge rates due to the low permeability of the native clay. In some cases during quarterly sampling events, piezometers have not produced a sufficient volume of water within 24 hours of purging to fill sample bottles required for analysis of all groundwater COPCs described in the SSWP. For wells that cannot be continuously purged and sampled within reasonable time constraints, alternate approaches appropriate to slow recharging conditions will be considered.

Well construction logs, field notes and purge logs generated during previous sampling or development of wells will be reviewed to assist in the selection of the most appropriate sampling method. Wells that produce sufficient water should be sampled as in Section 6.5.5.1, after continuous purging until field parameters stabilize, in a manner consistent with the SSWP and the Multi-Site SAS-08 Series SOPs: Groundwater Sampling and Measurement Procedures. If standard purging and sampling procedures would not yield adequate well volume and the well is determined to be a slow-recharging well, the procedures outlined in the August 2014 Technical Memorandum for Hough St. OU will be followed (NRT, August 2015).

Pace Analytical Services, Inc. (Pace), or Test America labs will be used for analysis of PAHs unless or until approval is obtained to use additional labs for this analysis. Both Pace and Test America labs are approved for use in the Multi-Site Program as documented in the Multi-Site QAPP, Revision 2 (NRT, 2008). Additional information for both labs regarding use of EPA Methods 3510/8270 SIM was submitted to USEPA in August 2014 (NRT, August 2014)

Standard procedures presented in Section 6.5.5.1 that apply to wells with slow recharge rates, despite longer recharge times and potentially lower sample volumes, will also be implemented.

6.5.6 Groundwater Level Measurements

Groundwater elevations will be documented to assess the direction of groundwater flow whenever the monitoring wells are sampled or as needed to assess flow conditions. Water level measurements will be collected from all monitoring wells regardless of whether the particular location is being sampled. Elevation measurements will be collected after wells are allowed to equilibrate after development and prior to purging before sampling. Thickness of NAPL, if present, will be measured concurrent to gauging of the monitoring wells. The measurements will be completed throughout the well network within the first 12 hours of a sampling event in accordance with the methods described in USEPA-approved SOP SAS-08-01, SAS-08-04 and Section 4 of the Multi-Site FSP. Observations regarding the presence of MGP residuals within a well will be recorded on the same forms as the water level measurements.

In the previous SSWP, a staff gauge or vertical benchmark on the CSSC was proposed to be installed during the Group I RI to correlate surface water elevation on the CSSC to the measured groundwater elevations within on-site monitoring wells. Optionally, if a staff gauge is not installed, the canal surface elevation and measurement of surface water levels would be conducted concurrently. Direct measurement of the surface water was completed during the first two groundwater sampling events. However, at present MWRD has declined further access to the CSSC from its property (Parcel S) and PGL does not have access to the canal to conduct further surface water gauging. Access discussions between PGL and MWRD will continue and USEPA will be notified when access is granted.

6.5.7 Surface Water Level Measurements

One benchmark will be installed on the CSSC to evaluate surface water/groundwater relationships. Measurement of surface water elevation will be conducted concurrent with all groundwater monitoring events. Actual location of the benchmark may be modified based on property access and permission. The location of the benchmark will be selected by the field team at a location accessible from shore and as

close as possible to the site shoreline. Steep channel bank slopes and heavy vegetation at the Site do not make access from the Site possible.

6.5.8 Sampling Schedule and Parameters

The baseline sampling event has been completed along with the first quarterly sampling event on the existing and Group I wells. The data was provided in the Group I RI Report submitted September 11, 2015.

Groundwater monitoring for wells installed during the RI on the Group IV parcels will be initiated on a quarterly basis for four sampling events following the well installation. The proposed sampling locations including existing wells and proposed new wells are presented on Figure 21. Groundwater samples will be collected and analyzed for the parameters listed on Table 2 following the corresponding analytical methods, until/unless the COPC list is revised, based on continuing evaluation of previous sampling results. The RI Report for the Group IV parcels will be prepared after four quarterly rounds of groundwater data are collected from the yielding wells with supplemental data added later.

Groundwater flow, quality and aquifer characteristics will be continually evaluated on a site-wide basis as each set of wells specific to a group of parcels are installed and evaluated. When a groundwater monitoring program has been developed (i.e., all wells installed), continued groundwater sampling will be completed for the following reasons:

- To detect changes in environmental conditions (e.g., hydrogeologic or chemical) that may result in a potential exposure risk
- To identify potentially toxic or mobile transformation products
- To assess the presence and stability of any plumes as well as groundwater concentration trends
- To assess the need to revise the COPC list
- To detect new releases of constituents to the environment that could affect potential remedial action alternatives (e.g., MNA or institutional controls)

The monitoring schedule will be continuously reviewed and updated, as appropriate. COPCs may be dropped from the list of analytical parameters for a well after they appear in concentrations less than drinking water SLs for two consecutive sampling events with specific agreement and approval from the USEPA. Samples will be analyzed in a fixed-base laboratory as described in the Multi-Site QAPP and the Multi-Site FSP.

6.5.9 Aquifer Characterization

Single well aquifer tests in the form of slug tests will be conducted to characterize hydraulic conductivity in accordance with the methods described in USEPA-approved SOP SAS-08-04 and Section 4 of the Multi-Site FSP. Aquifer tests will be performed in all piezometers installed within the clay unit. One-half of the water table wells within the surficial fill unit will be selected for slug testing. Testing will not occur until the TCRA is complete and dewatering is ceased.

6.5.10 Monitoring Well Abandonment

If any of the wells in the monitoring network require abandonment, these activities will be completed in accordance with the methods described in USEPA-approved SOP SAS-05-05 and Section 4 of the Multi-Site FSP.

6.5.11 On-Going Groundwater Monitoring

The GMP and the site-wide well network will be evaluated with the USEPA after completing at least one year of sampling. Concurrently, Group IV parcels will be evaluated upon completion of four quarters of groundwater sampling. The RI Report on the Group IV parcels will provide a plan for continued groundwater monitoring between the timeframe of the report issuance and implementation of remedial action. Post-RI report activities may include continued monitoring, reporting, and evaluating trends in groundwater quality.

In addition, the groundwater COPC list may be re-evaluated after the first and second rounds of sampling of the Site-Wide GMP. Modification of the COPC list may be warranted based on results of initial soil and groundwater sampling; COPCs may be dropped from the list of analytical parameters for a well after they appear in concentrations less than drinking water SLs for two consecutive sampling events with specific agreement and approval from USEPA. See further discussion concerning the groundwater COPC list in Appendix C.

6.6 Soil Vapor Evaluation

No soil vapor investigations have been conducted on the Crawford Station Site and historic MGP structures are known to have been located within and/or around current building footprints. Appendix F describes a multiple lines of evidence evaluation for the potential for VI on the Crawford Station Site, based on building placement, position of historic MGP structures, available soil and groundwater data,

USEPA's *Office of Waste Emergency Response (OSWER) Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), EPA530-D-02-004* (USEPA, November 2002), guidance provided by USEPA during a meeting on December 17, 2010, and subsequent discussion with USEPA and comments from USEPA regarding the Multi-Site approach to VI. Since the submittal of the SSWP Add #2, Rev0, the final USEPA VI guidance, *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathways from the Subsurface Vapor Sources to Indoor Air, June 2015,* OSWER Publication 9200.2-154 (herein referred to as the Final VI Technical Guide) has been released. Review of the final guidance, does not suggest a change in the planned VI evaluation, however, the planning VI assessment presented in Appendix F has been reviewed and revised to be consistent with the Final VI Technical Guide. The revised detailed assessment of VI at the Group III parcels is presented in Appendix F.

The northern portion of Parcels A and B are being leased to a transportation business. One building is located on Parcel B. Because a portion of the northern end of the building may lie over the former West Fork Channel and potential MGP residual, four exterior soil gas probes (BSV1, BSV3-5) and one nested pair of subslab probes (BSV2) within the building footprint are proposed in and around the building. The work is pending accessibility to the interior of the building. No other buildings are located on the Group IV Parcels.

VI evaluation for reasonable future land use scenarios, potentially impacted utility corridors, and any additional buildings of concern identified following analysis of the current RI sampling plan will be conducted after results of the proposed sampling are received. Both historical and RI data will be consideration of the need for additional VI evaluation.

6.6.1 Soil Sampling During Vapor Probe Installation

During soil vapor probe installation, up to two subsurface soil samples may be collected from proposed borings for chemical analysis. Subsurface soil samples for chemical analysis will be collected between 2 ft bgs and the termination depth (one ft above the water table). Selection of subsurface soil samples will be based on visual observations and/or elevated PID readings. If no evidence of impacts is present in a boring, a sample will be collected from the 2-4 ft bgs interval. Samples will be classified following USEPA-approved SOP SAS-05-02 from the Multi-Site FSP. If subslab and soil vapor probes are installed using a hammer drill and drive rods such that the soil cannot be logged or sampled during installation, then soil samples will not be collected at that location.

One geotechnical sample will be collected from one soil vapor probe boring location and tested for grain size distribution, moisture content, bulk density, and specific gravity in accordance with Table 6. Samples will be selected to represent the soil in the area of the probes; if more than one soil type is identified in the area of the vapor probes, additional geotechnical samples may be submitted. If soil vapor probes are installed using a hammer drill and drive rods because sampling locations are not accessible by a direct-push rig and such that the soil cannot be logged or sampled during installation, geotechnical samples will be collected from nearby locations that are likely to represent soil where the probes are installed.

6.6.2 Exterior Soil Vapor Probe Installation and Sampling

Exterior soil vapor probes will be installed and sampled per the procedures outlined in USEPA-approved SOP SAS-11-06 (Appendix G). At each proposed exterior soil vapor sampling location, one or more nested probes will be installed, based on the depth to the water table as follows:

- One probe will be installed in the soil column at a minimum of 5 ft bgs (the top of the screen will be set no shallower than 5 ft bgs). False negative results for soil gas samples collected from areas not underneath a building or other impermeable cover (e.g. parking lot concrete or asphalt) are possible in soils shallower than 5 feet bgs. If the depth to the water table is less than 9 ft bgs, only one probe will be installed.

- A second soil vapor probe will be installed such that the bottom of the screen is approximately 1 ft above the water table if the depth to groundwater is 9 ft bgs or greater.

- At the discretion of the field team, if the unsaturated zone is greater than 9 ft, a third probe may be installed midway between the shallow probe and the probe located above the water table. For adding a third probe, a minimum of three vertical ft between screens is suggested.

The USEPA-approved SOP for soil gas sampling for the Multi-Site Program (SOP SAS-11-06) states that probes will be installed no shallower than two ft bgs. Using a 2-ft minimum depth, an exception to the 5 ft minimum depth stated above, is possible if:

- An impermeable cover (e.g. parking lot concrete or asphalt) overlies the ground at soil gas sampling locations. At these locations, the risk of false negatives is less and shallower probes can be installed.

- Site-specific circumstances (e.g. a very shallow water table) compel the collection of soil gas samples at depths of less than 5 ft bgs. If this occurs, the reason why the shallow samples were collected will be explained and the data will be considered and evaluated separately in the risk assessment.

Installing nested probes at multiple depth intervals will allow evaluation of vertical attenuation over distance. For nested probes at varying depths, the probes will be installed in the same borehole and the

hole then packed with sand and bentonite per USEPA-approved SOP SAS-11-06. Probes driven into the ground using rods cannot be nested in this way and will instead be nested in separate holes in close proximity. Soil vapor probe nests will be identified as [*Parcel Letter*]SV#S (shallow), [*Parcel Letter*]SV#D (deep) or [*Parcel Letter*]SV#M (mid-depth).

Soil vapor samples will be collected in a 1- or 6-liter Summa^{TM} canister connected to a flow regulator, per USEPA-approved SOP SAS-11-06. The sample canister will be labeled with the sample name, date and time of collection. The canister label information plus the canister and flow controller serial numbers, and the final vacuum gauge reading will be recorded on the chain-of-custody. Samples will not be chilled or subjected to extreme temperature or pressure fluctuations. Samples will be shipped for analysis of soil vapor COPCs (Tables 2 and 6) by USEPA Method TO-15, and for O_2, CO_2, and methane by American Standard Test Method (ASTM) Method 1946 (ASTM International, 2010) or USEPA Method 3C.

6.6.3 Subslab Vapor Probe Installation and Sampling

Subslab vapor probes are not initially proposed for the RI on the Group IV parcels. Additional VI assessment will be performed when additional building information and soil vapor, groundwater and soil data are obtained to determine the whether subslab vapor probes are warranted. If warranted, subslab vapor probes will be installed and sampled per the procedures outlined in USEPA-approved SOP SAS-11-01 (Appendix G). At each proposed subslab vapor sampling location, at least two nested probes will be installed, unless the slab is estimated to be less than 2.5 ft above the water table. One probe will be installed in the soil column directly (approximately one ft) above the water table. This will provide an estimate of volatilization at the water table. The other probe will be installed just below the building slab to provide an estimate of soil vapor concentrations beneath the slab. If the unsaturated zone is sufficiently thick (i.e., greater than 8 ft), a third probe may be installed midway between the other two probes. Installing nested probes at multiple depth intervals will allow evaluation of vertical attenuation over distance. Soil vapor probes nests will be identified as [*Parcel Letter*]SV#SS (subslab shallow) and [*Parcel Letter*]SV#SD (subslab deep).

Subslab vapor sample collection, labeling, handling and shipping will proceed as described in Section 6.6.2 for exterior soil vapor sampling.

6.6.4 Sump Headspace Sampling

Sump headspace samples will be collected in buildings where sumps are present that provide a preferential pathway for affected groundwater or soil vapor to enter the building. At the selected sump,

one vapor grab sample will be collected. Prior to sample collection, the sump will be sealed off except for a sampling port that will allow the vapor sample to be withdrawn from the headspace after the sump is sealed off. Sump headspace samples will be identified as [*Parcel Letter*]SG#HS.

Prior to sample collection, an indoor air sampling survey will be conducted of the building interior to document the presence of any chemicals or materials that may contribute to background concentrations of COPCs in the sampling area.

Sampling can commence after the sump seal has cured for 24 hours. Sample location information, and meteorological conditions (e.g., temperature, barometric pressure, wind speed/direction, and relative humidity) will be recorded on a Field Data Air Sampling Form. Meteorological data will be obtained online from the nearest National Weather Service monitoring station. Sample collection, labeling, handling and shipping will proceed as described in Section 6.6.2 for exterior soil vapor sampling.

6.7 Sediment and Surface Water Evaluation

Investigation activities that will be completed within the CSSC are designed to supplement the sediment assessment performed by B&McD in 2007. The area of the CSSC immediately adjacent to Parcel S will be referred to as ACA. Portions of the investigated area will extend both upstream and downstream of the ACA. These areas, together with the ACA, will be referred to as the Investigation Area.

This sediment and surface water sampling and ambient sediment evaluation approaches detailed below are consistent with those currently being used at the South Branch Site River OU RI, another PGL site enrolled in the SAS program. Further discussion of the approach and decision strategy is provided in Appendix J.

6.7.1 Assessment Objectives

A phased approach to investigation activities will be implemented in order to characterize the CSSC in the Investigation Area. The phased approach to the investigation will differ from the phased approach implemented at the North Branch Site on the North Branch Chicago River. At the North Branch Site, an ambient investigation (Exponent 2009) was performed prior to the adjacent river area (ARA) sediment investigations at the three operable units (OU) of the North Branch Site. Multiple MGPs were operating along the North and South Branches of the Chicago River for decades prior to the construction of the CSSC, which was designed to act as a downstream channel to facilitate reversal of the Chicago River. Therefore, it is not practical to identify an ambient location prior to beginning the sediment investigation

adjacent to Parcel S. If necessary, a separate ambient investigation will be performed after evaluation of the initial data. Until and unless such a separate ambient investigation is deemed necessary, the ambient data collected as part of the North Branch ambient investigation (Exponent 2009) will be considered representative of background conditions.

CSSC investigation activities will be conducted in three steps with the following objectives:

1. **Step I – Site Reconnaissance**: Perform reconnaissance on the sampling area
2. **Step II – Site Characterization:** Characterize existing conditions in the Investigation Area
3. **Step III – Site Characterization Refinement:** If necessary, refine the areas of concern for use in the FS and evaluate background contaminant concentrations

Step I is designed to provide information that will be used in Step II. Step I tasks include the following:

- Determine sediment thickness
- Identify presence of debris
- Collect water velocity data
- Evaluate effectiveness of collecting sediment cores with vibrocore
- Collect limited sediment samples, if vibrocore techniques are deemed effective
- Collect samples of potential MGP-residual material for forensic chemistry analysis, if identified and vibrocore techniques are deemed effective
- Collect surface water samples
- Evaluate sediment coring equipment needs for Step II
- Evaluate shoreline structures
- Determine the river bathymetry

Step II will be implemented to characterize existing conditions in the Investigation Area. Step II tasks include:

- Collect the remaining proposed sediment samples to establish the upstream and downstream limits of potential MGP-derived effects in the CSSC
- Establish a statistically sound assessment of the overall area
- Characterize the presence of MGP residuals

- Investigate the potential for upland MGP residuals to migrate to the CSSC
- Preliminarily characterize the nature and extent of potential MGP-derived effects to surface water and sediment
- Use forensic chemistry methods on sediment samples to assess the potential source and origin of any PAHs present in the sediment profile
- Gather data to evaluate the relationship and interaction of surface water and groundwater

Because the nature of these efforts, some or all of Steps I and II may be completed in one mobilization. Step III will be implemented after the results of Step I and Step II have been evaluated. Step III will focus on defining the incremental PAH contributions from any potential MGP residuals identified in the Investigation Area as well as further delineation and data gathering needed to proceed with the FS. Step III may include an ambient sediment and surface water investigation, as discussed previously in this section.

The following sections refer to specific SOPs (Appendix G) as referenced from the USEPA-approved Multi-Site FSP Revision 4 (IBS 2008). Sampling locations, frequencies, analytical parameters, and methods as well as work preparation, mobilization, site-specific dynamic sampling and analysis techniques, investigation-derived waste management, record keeping, sample analysis and validation, and data evaluation processes are also discussed. Project files will be managed as described in USEPA-approved SOP SAS-01-02.

Planned field activities will be completed in accordance with the methods and techniques described in the Multi-Site QAPP (IBS 2007), Multi-Site RAF (Exponent 2014), and Multi-Site FSP (IBS 2008); these general methods and techniques are not repeated herein. Site-specific information relevant to these multi-site documents are discussed in following sections and details are included in Appendix D. The Site-Specific QAPP (NRT 2014) and HASP (NRT 2014) are presented in Appendices D1 and D2, respectively. The Site-Specific HASP contains all components of the Multi-Site HASP and adheres to the Multi-Site HASP criteria with the exception of areas where it is more stringent. The Site-Specific HASP replaces the Multi-Site HASP in its entirety.

The Site-Specific FSP is presented in Appendix D3, and the Site-Specific CSM is included in Appendix D4. Copies of the SOPs referenced herein and the Multi-Site FSP are provided in Appendices G and H, respectively.

6.7.2 Sediment Investigation Concept and Rationale

A three-step sediment sampling approach has been developed, as discussed in the previous section. Potential MGP residuals have been identified in the ACA (B&McD 2007). However, the previous investigation was only performed on select portions of the ACA, and was designed to identify potential MGP residual material. TarGOST® was used to identify potential MGP residuals and sediment borings were advanced in areas based on TarGOST® results. Based on a review of sediment boring logs (Appendix A7), sediment sample locations were generally biased towards areas with visual evidence of potential MGP residuals as described in SOP SAS-05-02 (Appendix G). Data from the prior sediment investigation was collected in a focused and biased manner and the dataset does not facilitate a statistically valid analysis of the ACA.

The sampling plan described in this SSWP has been developed to provide a random, stratified, statistically valid data set across the Investigation Area. A consistent sample interval program has been designed so that the entire data set can be evaluated as a whole. In addition, since PAHs are often ubiquitous in urban settings, the sampling plan has been developed to attempt to differentiate PAH combinations that can be attributed to historical MGP operations from general urban PAHs that could be attributed to other industrial activities or combined sewer outfalls (CSO). This sampling plan will evaluate the possibility for potential MGP residuals to have migrated to river sediment in areas that were not previously investigated.

Sediment sampling is broken down into three categories:

1. Characterization sampling (random locations)
2. Sampling of potential MGP residuals (biased locations), if needed
3. Background contaminant sampling

As described in Section 3.7.2, potential MGP residuals have been observed in the soft sediment, not in the underlying native clay layer. Therefore, the investigation has been designed to primarily evaluate the soft sediment and the majority of borings will terminate at the sediment/clay interface. However, at approximately 10% of boring locations the native clay layer also will be targeted for characterization sampling.

For characterization of the native clay, at 10% of boring locations, borings will be advanced a minimum of 4 feet into native material below sediment (generally hard, silty clay) for chemical and physical characterization. If potential MGP residuals are identified within the native, silty clay, the boring will

extend 4 feet below the deepest observation of potential MGP residuals, or at least 4 feet below the last sediment interval if MGP residuals are not observed. If refusal is encountered, the boring will be terminated.

Sediment sampling in the Investigation Area has the following objectives:

- Characterize the vertical and horizontal distribution of potential MGP residuals (based on visual and/or olfactory indicators) in sediments and surface water (just horizontal distribution)
- Provide data to support human and ecological risk evaluations for COPC concentrations in sediment and surface water

Sediment sampling is further described in subsequent sections.

6.7.2.1 Characterization Sampling

Characterization sediment sampling is based on a statistically generated random sampling pattern developed using Environmental Systems Research Institute (ESRI) Arc Geographic Information System (ArcGIS). The random sampling pattern provides for the collection of sediment samples from spatially unbiased sampling points. The ACA is being divided into 28 sampling areas, each being approximately 150-feet long (along the length of the CSSC) and extending across the entire width of the CSSC from bank to bank. The remaining portions of the Investigation Area (east of South Pulaski Road and west of the Chicago and Western Indiana Belt Line Railroad) are split into a total of four 200-foot long sampling areas of similar width.

In the ACA, each sampling area is divided into four approximately equal-sized rectangular segments (or lanes), such that the long side of each segment is parallel with the east and west banks of the CSSC. Sampling areas in the remainder of the Investigation Area are split into three such rectangular segments. A single boring will be advanced in each sampling area segment to visually inspect the sediment and evaluate COPC concentrations. The proposed sampling locations are presented on Figures 22A and 22B and Tables 9a and 9b. Analytical data will be used to evaluate the range of COPC concentrations in surface and subsurface sediments within and near the ACA. See Section 6.7.4.1 for additional information about the sampling intervals in each boring.

6.7.2.2 Potential MGP Residual Sampling

It is anticipated that potential MGP residuals will be encountered in borings advanced at the locations specified for characterization sampling described in Section 6.7.2.1. If no MGP residuals are observed during Step II characterization sampling, borings and samples may be collected from biased locations

where MGP residuals are suspected to be present. Biased boring and sampling locations will be selected based on observations made during historic site sampling and Step I site reconnaissance from the current investigation.

A previous sediment investigation was conducted in February and March 2007 (B&McD 2007). The investigation identified potential MGP residuals in the form of DNAPL in six out of seven sediment borings advanced in the ACA, and in intervals ranging from 0 to 13.7 feet below mudline. Potential MGP residuals in the form of odors, PID response greater than 2 ppm, and LNAPL or sheen were identified at depth intervals ranging between 0 and 16 feet below mudline, and across all seven sediment borings advanced. The distribution of observed potential residuals is presented on Figure 16. Visual observations and analytical data are available for depth intervals below the maximum extent of the potential MGP residuals.

Biased sampling of material expected to contain potential MGP residuals (DNAPL) may be conducted with the goal of developing a chemical fingerprint for the DNAPL. Samples will be analyzed for the expanded list of PAHs, which includes alkylated PAHs. If tar-like material of varying classification is encountered, samples will be collected to evaluate their differing characteristics. Tar-like material in historic borings was primarily observed in the overlying sediment (silt, organic silt, sand or fill) rather than in the stiff, underlying clay. Samples may be collected from either sediment or underlying native clay, depending on what is encountered.

6.7.2.3 Ambient Sediment Contaminant Concentrations

Due to the location of the former MGP within an urban setting and historic releases to the CSSC from a variety of industrial sources, PAHs are likely to be present in and near the Investigation Area. Ambient concentrations of PAHs and other MGP COPCs can be developed to compare COPC concentrations within the ACA to concentrations outside the ACA. However, due to the upstream orientation of several former MGPs currently enrolled in the USEPA SAS program, it is not practical to identify an ambient location prior to beginning this sediment investigation. Therefore, sediment sampling has been designed to gather information that could be used to develop ambient COPC concentrations and/or identify an area for a future ambient investigation.

The Investigation Area extends approximately 400 feet outside the ACA both upstream and downstream. Sediment samples collected from these areas will be used to define the extent of MGP influence on the CSSC using a weight-of-evidence approach, including:

- Visual observations of potential MGP-affected sediment (e.g., presence of DNAPL or tar-like material).

- An initial screen of the total PAH (13) and metals concentrations for sediment samples collected both inside and outside the ACA boundary against the upper tolerance limits (UTL) developed for these constituents through the North Branch Chicago River ambient investigation.

- Chemical data collected upstream of the ACA will be compared to chemical data collected inside the ACA to evaluate if an ambient zone can clearly be identified. This evaluation will include documentation of trends in the COPC concentrations inside and outside the ACA (e.g., total PAH concentrations reduce and stabilize outside the ACA) both comparisons of total PAH concentrations and forensic analyses (i.e., using an extended list of 34 PAHs [PAH-34]). Chemical fingerprinting of samples collected outside the ACA can be compared to MGP-residual samples.

The total PAH UTLs developed for the North Branch Chicago River (NRT 2013) will be used as a screening tool for data collected from the Investigation Area. Both settings are in the same river system, are located in heavily industrialized areas, and both settings have significant CSO contributions. The North Branch UTLs are:

- 342 mg/kg Total PAH-13 for surface sediment (0 to 18 inches below mudline)

- 410 mg/kg Total PAH-13 for subsurface sediment (greater than 18 inches below mudline)

Additional sampling areas may be established outside the Investigation Area if preliminary results indicate the extent of potential MGP residuals is not laterally characterized. The decision to collect additional samples downstream of the Investigation Area will be based on field observations, and, if available, laboratory analytical results from samples collected earlier in the sampling event. This dynamic approach to delineating sediment with residual concentrations above ambient concentrations or SLs is presented in Section 7 of the Multi-Site RAF Revision 3 (Exponent 2014).

The merit of performing a site-specific ambient investigation will be evaluated based on the results of the aforementioned sampling.

6.7.3 Surface Water Sampling Concept and Rationale

Surface water sampling will be conducted to characterize surface water quality in the Investigation Area. The previous investigation in the ACA (B&McD 2007) did not include surface water sampling and no surface water analytical data is known to be available from the Investigation Area. Fourteen randomly-generated surface water sampling locations were developed using ESRI ArcGIS (Figures 22A and 22B). The random sampling pattern provides for the collection of surface water samples from spatially unbiased sampling points. Twelve sampling locations are within the ACA and two are located elsewhere in the Investigation Area (evenly split between upstream and downstream of the ACA).

6.7.4 Investigation Methods and Sampling Summary

The following sections describe the specific data to be collected and methods of collection for the Step I and Step II investigations. Potential data to be collected as part of a Step III investigation is included in Section 6.7.4.5.

6.7.4.1 Sediment Sampling

Sediment samples will be collected from the proposed locations shown on Figures 22A and 22B.

6.7.4.1.1 Sediment Coring Equipment

The sediment cores will be collected using a barge-mounted drill rig or a vibrocore in accordance with USEPA-approved SOP SAS-07-03 and Section 4 of the Multi-Site FSP (IBS 2008). In general, the vibrocore will be used to collect cores in areas without debris and where sediment thickness is less than approximately 11 feet (the limit of the vibrocore unit). Based on experience at the nearby PGL South Branch Site River OU, the vibrocore will not allow any significant recovery of the underlying native silty clay. Therefore, a barge-mounted drill rig will be used in areas where the sediment thicknesses are expected to be greater than 11 feet and/or recovery of native silty clay is targeted.

Based on a limited set of previous sediment borings advanced in the ACA, the sediment thickness in the Investigation Area is expected to vary significantly based on proximity to the shoreline as well as other factors yet unknown. The boring logs from the March 2007 investigation indicate sediment thickness of less than 5 feet within 100 feet of the Parcel S shoreline on the east side of the ACA and increased sediment thickness (up to 17 feet) towards the center of the CSSC. Sediment thickness and presence of debris in the CSSC will be evaluated during Step I investigation activities.

At proposed vibrocore locations, if field observations (e.g., poling or visual identification of debris) indicate that sample recovery from a location may not be feasible, a different location within the same segment of that sampling area may be selected. If soft-sediment cores are attempted and fail to recover at least 75% of the depth penetrated in the first attempt, one more attempt will be made at that same general location within the same sampling area segment. If a sediment core with at least 75% recovery is still not obtained, at least one more location will be attempted at a different location within the same sampling area segment. The core with the greatest recovery after three attempts will be used for analysis, as the 75% recovery is not a minimum requirement. If no sediment is recovered (i.e. 0% recovery) after three attempts, a grab sampler (e.g., Ponar) or a 5-foot long, clear, Lexan™ sample tube attached to a push-core sampler with a check valve may be used to attempt to collect a surficial sediment sample at the

location. Boring locations will be recorded using a differential global positioning system (DGPS) with sub-meter accuracy in accordance with the methods described in USEPA-approved SOP SAS-03-03 and Section 7 of the Multi-Site FSP (IBS 2008).

At proposed HSA boring locations, if field observations (e.g., poling or visual identification of debris) or attempts to drill indicate that sample recovery from a location may not be feasible, a different location within the same segment of that sampling area may be selected. In addition, previous experience on the Chicago Rivers has shown that surficial sediments are unconsolidated and difficult to recover using HSA/split spoon sampling. Therefore, a grab sampler (e.g., Ponar) or a 5-foot long, clear, Lexan™ sample tube attached to a push-core sampler with a check valve may be used to attempt to collect a surficial sediment sample at HSA boring locations.

6.7.4.1.2 Sediment Coring Intervals

All proposed cores will be visually characterized, logged and subdivided into the following intervals for analysis:

- 0 to 0.5 feet below mudline
- 0.5 to 1.5 feet below mudline
- 1.5 to 2.5 feet below mudline
- 2.5 to 3.5 feet below mudline, etc.

Cores will be advanced to the sediment/clay interface at all boring locations. At approximately 10% of the characterization boring locations, cores will be advanced into the underlying native silty clay using a hollow-stem auger. Borings advanced to investigate or collect potential MGP residuals will be advanced to the depths required to evaluate the targeted potential MGP-residual material intervals (Table 4). As a part of the dynamic sampling plan, observations recorded at the sediment/clay interface of borings not advanced into native clay will be evaluated in the field to determine if the boring location should be re-occupied with a barge-mounted drill rig so that the boring can be advanced into native clay.

6.7.4.1.3 Sediment Samples Submitted for Laboratory Analysis

Material from each depth interval will be characterized, logged and bottled or bagged for laboratory analysis; however, not all samples will be analyzed. Intervals that appear clean or contaminated relative to the overall core appearance may be selected for analysis while the remaining core intervals will be archived for potential future laboratory analysis. By extending the sample hold times using the archiving

process, any number of un-analyzed samples can be archived and selected for analysis of (SVOCs and inorganics only) at a future date to supplement the initial sample set. Those decisions will be made following review and consideration of initial laboratory analytical results.

The archiving process is achieved by immediately freezing and storing samples at -20°C (USEPA 2005). Research suggests that archived samples can be stored for up to one year for SVOC analysis, and the sample extract can be stored an additional 40 days prior to analysis and still yield useful data (USEPA 1994). Samples for archive will be shipped to a storage facility where they will be archived at -20 degrees Celsius for up to one year.

Sediment samples will be labeled in accordance with USEPA-approved SOP SAS-03-01 from the Multi-Site FSP (IBS 2008). Sampling locations will be recorded using a DGPS unit with sub-meter accuracy in accordance with the methods described in USEPA-approved SOP SAS-03-03 and Section 7 of the Multi-Site FSP. Samples will be analyzed for the parameters listed on Table 10. Analytical methods, preservatives, required volumes and containers for these analyses are also presented on Table 11.

Table 10 provides a summary of anticipated samples and analyses. Due to the limited amount of sediment thickness data, the number of samples is based on the assumption that there is 5 feet of sediment in the outside lanes (i.e., the lanes along the shoreline) and 20 feet of sediment in the inner lanes. The actual number of samples will vary depending on sediment thickness encountered during field activities. Sample selection will be based on the presence or absence of potential MGP residuals. Samples located just above or below readily identifiable potential MGP residuals may be submitted for delineation purposes. Decisions regarding sample submission from each core will be determined in the field by the field team leader. The general sampling plan is described below and in Appendix H.

Sediment samples will be collected and analyzed to compare COPC concentrations to SLs and the ambient sediment UTLs. Samples of the upper six inches of sediment and the one foot of sediment immediately above the clay will be collected and analyzed for COPCs at every characterization boring location. One surface sediment sample from each sampling area (or transect) will also be analyzed for black carbon. Additionally, excluding the surface sediment and sediment/clay interface samples, one out of every three sediment intervals from each core will be submitted for laboratory analysis of COPCs. Of these samples, approximately 20% will be submitted from a visually impacted interval while the other 80% will be equally split above and below intervals in which potential MGP residuals were identified (based on visual or olfactory evidence or elevated PID readings).

Of the borings advanced into native clay (as stated in Section 6.7.4.1.2), the boring depth will extend a minimum of four feet beyond the last interval in which potential MGP residuals were observed (based on visual or olfactory evidence or elevated PID readings), or at least four feet below the last sediment interval if potential MGP residuals are not observed. The borings may terminate at a shallower depth if refusal is encountered. If the clay shows evidence of potential MGP residuals, the first clay interval free of such indication will be submitted to the laboratory for COPC analysis. In addition to that sample condition, approximately 10% of all samples collected from the native clay will be submitted for laboratory analysis. Of these samples, approximately 20% will be submitted from a visually impacted interval, and the remainder will be equally split above and below intervals in which potential MGP residuals were identified (based on visual or olfactory evidence or elevated PID readings).

Sediment samples will be identified as follows:

CSSC-SD-001 A or CSSC-SD-1000 A

CSSC – Chicago Sanitary and Shipping Canal
SD – sediment
001 – first boring from the characterization sampling (Section 6.7.2.1)
1000 – first boring from the potential MGP residual sampling (Section 6.7.2.2)
A – indicates sample interval (e.g., “A” for first sample interval [0 to 0.5 feet], “B” for second sample interval [1.5 to 2.5 feet], etc.)

As stated previously, all surface sediment samples collected from the characterization borings will be submitted for laboratory analysis of COPCs. At 75% of the surface sample locations and at sampling locations targeted for potential MGP residuals (Section 6.7.2.2 and Tables 9a and 9b), analysis for 34 alkylated PAHs (rather than the abbreviated list of PAHs) and total organic carbon (TOC) will be conducted. Analysis of the 34 alkylated PAHs and TOC will provide additional data regarding source and distribution of MGP residuals at depth in the sediment profile. As appropriate, surface and subsurface samples analyzed for the 34 alkylated PAHs may undergo further review and forensic analysis (i.e., hydrocarbon fingerprinting).

Of the subsurface samples (sediment and clay) collected from characterization borings and selected for laboratory analysis, 50% will be analyzed for 34 alkylated PAHs (rather than the abbreviated list of PAHs) and TOC (Table 11). The number of samples to be submitted from the potential MGP-residual borings will be evaluated based on visual observations.

According to toxicity testing performed on the North Branch Chicago River (NRT 2013), sediments in the ambient area are considered somewhat toxic to benthic invertebrates and total PAH concentrations in the CSSC, as obtained during the previous investigation (B&McD 2007), are similar to that observed in the

North Branch Chicago River. A preliminary screening of total PAH (13) concentrations in the sediment against ecological screening criteria (Probable Effect Concentration [PEC] and TEC, Table 5A) shows that PAHs are ubiquitous in urban sediment and a risk-based sediment SL is not appropriate in the ACA to characterize potential incremental effects from the MGP. For these reasons, toxicity testing will not be performed at this time. Since sediment toxicity testing is not going to be performed at this time, TOC analyses are not required in all samples.

Up to 10 sediment samples (depending on the variation in strata) will be submitted for analysis of geotechnical parameters for use in the FS. These parameters include the following:

- Atterberg limits
- Grain size distribution (sieve and hydrometer)
- Organic content (by loss on ignition)
- Moisture content

Field measurements to estimate shear strength will be collected using a pocket penetrometer. Geotechnical samples may be discrete intervals or composite samples, depending on observed conditions. Samples not immediately submitted for laboratory testing will be frozen and archived. These samples will be available for later laboratory or physical testing.

Geotechnical samples will be identified as follows:

CSSC-SD-001-GT Description

CSSC – Chicago Sanitary and Shipping Canal
SD – sediment
001 – boring number (only used for discrete samples; remove if composite)
GT – geotechnical
Description – describes the type of sediment or soil (e.g., hard clay, surface sediment, etc.)

A composite sample will also be prepared for waste characterization by collecting and combining sediments from the drum(s) of investigative-derived waste. The composite sample will be analyzed for waste characterization parameters as required by the landfill to identify disposal options for investigative waste and for FS purposes. Analytical requirements will be discussed with landfill representatives prior to sample collection to ensure the analysis is appropriate.

Waste characterization samples will be identified as follows:

CSSC-WC-001

CSSC – Chicago Sanitary and Shipping Canal
WC – waste characterization
001 – first sample submitted for analysis

6.7.4.2 Surface Water Sampling

Surface water samples will be collected from each location at 0.8 times the total water column depth at that location and will be submitted for laboratory analysis of COPCs (Tables 10 and 11). Surface water samples will be labeled in accordance with USEPA-approved SOP SAS-03-01 from the Multi-Site FSP (IBS 2008).

Surface water samples will be collected using a peristaltic pump with the tubing attached to a pole in accordance with USEPA-approved SOP SAS-09-01 and Section 4 of the Multi-site FSP. Field characteristics will be monitored during sampling using a flow-through cell to evaluate pH, temperature, dissolved oxygen, oxidation/reduction potential, conductivity and turbidity. Surface water samples will be analyzed for the COPCs listed on Table 10 in accordance with the Multi-Site QAPP (IBS 2008).

Surface water samples will be identified as follows:

CSSC-SW-001

CSSC – Chicago Sanitary and Shipping Canal
SW – surface water
001 – first surface water sample

6.7.4.3 Investigation Step I – Site Reconnaissance

Prior to implementation of the investigation, site reconnaissance will be performed to verify the investigation methodology and equipment described in this SSWP. Preliminary site reconnaissance will allow modifications to this SSWP prior to the start of field activities to ensure the objectives of this SSWP are achieved. Site reconnaissance will include a bathymetric survey, sediment poling, an evaluation of the applicability of vibrocore equipment, surface water sampling, water velocity measurements, water elevation data collection, and a shoreline inspection. Any elements of the reconnaissance not implemented during this phase can be completed during Step II or beyond, and will depend on schedule and availability of equipment and subcontractors.

During shoreline inspection, documentation of shoreline features such as sheetpile or other improvements, CSOs, and utility crossings. If shoreline improvements are identified that may impact flow between groundwater and surface water/sediment, efforts will be made to describe the structures in detail through inspections and an information request made to MWRD or other property owners.

6.7.4.3.1 Site Surveying

A survey will be completed in accordance with the survey methods detailed in Section 7 of the Multi-Site FSP (IBS 2008). This will ensure that site features are accurately located and that conversion of the survey data to the Universal Transverse Mercator (UTM) coordinate system is complete as is required by the USEPA.

Verification of local topography and an accurate bathymetric survey are required to develop a base map in support of final engineering design and to provide an accurate representation of project data. Collected survey coordinates may initially be in latitude/longitude (degrees, minutes, and seconds) and then converted to UTM on project drawings, as required. Vertical control will be referenced to the NAVD88. The base map will be used for the following:

- Verifying the topography and bathymetry of the Investigation Area
- Plotting sample locations on a uniform x-y-z coordinate system
- Establishing additional survey location information, as appropriate, so that drawings and maps reflect current Investigation Area features
- Establishing new survey control points, if needed, so future activities and features can be accurately located and tied to a common datum
- Locating the position and elevation of new borings and surface water sampling locations
- Identifying public and private shoreline features
- Providing a large-scale base map upon which utility data, derived from outside sources , can be accurately shown
- Establishing a construction grid system upon which engineering calculations will be based

Elevations in the City of Chicago are referenced in Chicago City Datum (CCD) (0.0 feet CCD = 579.19 feet NAVD88). The nearest City of Chicago-managed benchmarks to the Crawford Site are as follows:

- Benchmark 421: 9.3 feet east of the west line of Kenneth Avenue and 20.9 feet north of the north line of the first alley north of West 31st Street; the elevation is 16.262 feet CCD
- Benchmark 535: 20.0 feet south of the south line of West 43rd Street and 11.0 feet east of the west line of South Keeler Avenue; the elevation is 15.781 feet CCD
- Benchmark 577: 9.5 feet south of the south line of West 43rd Street and 11.0 feet west of the east line of South Keating Avenue; the elevation is 15.821 feet CCD

Site Morphology

The CSSC has a northeast-southwest orientation and water flows to the southwest. A USGS stream gauging station (#05536140) is located approximately 0.8 miles downstream from the western site boundary on the CSSC. The closest upstream USGS stream gauging station (#05536137) is located approximately 2.2 miles upstream at South Western Avenue. The water elevation in CSSC is controlled by MWRD using a series of locks and is generally maintained between -0.5 and -2.0 CCD.

A benchmark will be installed at the CSSC. Water level elevations will be measured daily during river sampling operations and concurrent with measurement of groundwater elevations during upland groundwater monitoring events.

Water level fluctuations in the CSSC will be monitored by deploying a pressure transducer and data logger affixed at a known elevation to a seawall, bollard, bridge abutment or similar fixed structure in the area. Water level elevations from the CSSC will be recorded every 15 minutes to assess daily variability and responses to precipitation events over approximately three months. Collected data, along with observations of bed and bank composition, sediment type, presence/absence of vegetation, and bathymetry will be used during the FS evaluations to assess flow in the CSSC.

Bathymetry

Bathymetry in the Investigation Area will be evaluated using single-beam or multi-beam sonar. The results from the sonar survey will provide a comprehensive assessment of the CSSC geometry and water depths which will be used to establish a baseline condition, measure water flow velocities and hydrologic characteristics, and provide data for use in the FS. The data collected will also be used with stream flow measurements to calculate flow velocities and discharge for this segment of the CSSC.

The bathymetric transects will be spaced appropriately to cover the CSSC from bank to bank and extend a distance of approximately 2,000 feet up/downstream of the ACA. Additional bathymetric transects may be added in the field.

Side Scan

Along with the bathymetric survey, a side-scan sonar survey will be performed. The results from the side-scan sonar will provide a three-dimensional picture of the bottom of the CSSC at a resolution fine enough to identify debris. Results will be used to determine areas where the sediment surface is irregular and to assist in identifying debris or other man-made materials present on the sediment surface in the CSSC which may be used to refine sediment boring locations. In addition, the side-scan sonar may provide information on the location of underwater utilities.

The side-scan sonar will cover the same area of the CSSC as the bathymetric survey. Additional side-scan sonar transects may be added in the field.

6.7.4.3.2 Sediment Poling

Sediment poling using an aluminum pole in accordance with USEPA-approved SOP SAS-07-01 as described in Section 4 of the Multi-Site FSP (IBS 2008) will be used to measure the water depth (i.e. depth to sediment) and thickness of soft sediment. The elevation of the water will be surveyed from a known benchmark, and this will serve as the reference for both the depth measurements for later conversion to elevations. These results will be correlated with the existing sediment thickness and results of the bathymetric survey and side-scan sonar survey. Sediment poling during the site reconnaissance phase will be conducted to measure sediment thickness and water depth and identify debris. This information will assist in determining the proper equipment to use during the field investigation.

Sediment poling reconnaissance will be conducted at every sediment and surface water sampling location identified on Figures 22A and 22B. It is anticipated that the entire sediment poling investigation will be performed as one event, such that all proposed boring locations will be evaluated via sediment poling prior to the start of any sediment coring activities. However, sediment poling can also be performed in conjunction with sediment coring, such that poling at each location will be performed while on location and immediately prior to sediment coring rather than as a single sediment poling event.

The thickness of soft sediment will be recorded on field forms as discussed in Section 4 of the Multi-Site FSP (IBS 2008). Polling will be conducted by pushing a rod into the sediment with both “soft” and “hard” push techniques, as described below:

- Soft Push Technique: push the pole into the sediment with arms extended using arm strength only
- Hard Push Technique: continue to push the pole into the sediment using body weight until refusal occurs

Both the soft and hard push technique sediment thicknesses will be recorded. If sediment or other material is observed on the tip of the poling rod, the observations (e.g., presence of clay, sand, evidence of tar-like material) will be recorded. If debris is encountered on the surface or within the sediment column, there is typically a distinguishable sound. If debris is suspected, additional poling may be performed in the immediate vicinity (5-foot radius or less) to evaluate the differences in the top of soft sediment. The presence of debris will also be noted on the field forms.

6.7.4.3.3 Sediment Vibrocoring for Characterization Sampling

Vibrocore equipment will be used to collect sediment cores where conditions are favorable for vibrocore use (i.e., areas where collection of native material is not required, sediment is less than 12 feet thick, and there is little or no debris in the sediment). Sediment thickness and presence of debris in the Investigation Area is unknown, except where the previous sediment borings were advanced. Sediment poling described in Section 6.7.4.3.2 will provide information about sediment thickness and presence of debris. This information will be supplemented by a field evaluation of vibrocore equipment to verify its suitability for this field investigation.

As shown on Table 9, vibrocoring technology is tentatively proposed for sediment coring locations in the outside lanes (i.e., the lanes near the bank, not the central lanes). During Step I, vibrocoring will be attempted at up to approximately 25% of the sediment characterization locations where poling indicates it may be feasible (i.e., sediment thickness less than 11 feet and no major obstructions from debris) to test the utility of the technology in the Investigation Area. Vibrocores will be advanced in accordance with SOP SAS-07-03 and Section 4.7.7.4 of the Multi-Site FSP. If coring is successful, sediment samples will also be collected from vibrocore test locations. Specific locations for Step I vibrocores are included in Table 9, but may be modified after the sediment poling investigation is complete. Additional detail about sampling methodology is included in Section 6.7.4.1.

6.7.4.3.4 Collection of Potential MGP Residuals

It is anticipated the potential MGP residuals will be encountered in borings advanced at the locations specified for the characterization sampling described in Section 6.7.2.1. If this is not the case, biased locations will be selected based on the observations from the February and March 2007 investigation so that potential MGP residuals can be sampled. If sampling at biased locations is required, sediment poling will be performed at each boring location to determine sediment surface elevation and sediment thickness. Sediment cores will be collected using a barge-mounted HSA, or vibrocore or push core in accordance with USEPA-approved SOP SAS-07-03 and Section 4 of the Multi-Site FSP (IBS 2008).

Sediment cores will be advanced to the sediment/clay interface or refusal using the methods described in Section 6.7.4.1.

The target interval for potential MGP-residual material analysis will be selected based on visual observations of tar-like material.

6.7.4.3.5 Surface Water Sampling

Surface water samples will be collected from all 14 surface water sampling locations, as described in Section 6.7.4.2, to characterize surface water quality in and near the Investigation Area. Surface water sampling locations are presented on Figures 22A and 22B and summarized on Tables 9a and 9b.

The location of the samples will be documented at the time of sample collection. Sample results for surface water will be compared to SLs identified in the most recent Multi-Site RAF Addendum (Exponent 2014). These data will be used to evaluate potential differences in water quality throughout the Investigation Area and determine if additional surface water sampling is warranted.

6.7.4.3.6 Water Velocity Measurements

At each surface water sampling location, the water velocity will be recorded for use in the FS to evaluate sediment stability. Water velocity will be measured in accordance with USEPA-approved SOP SAS-09-02 and Section 4 of the Multi-Site FSP (IBS 2008).

Actual sampling locations will be recorded using a handheld DGPS with sub-meter accuracy in accordance with the methods described in USEPA-approved SOP SAS-03-03 and Section 7 of the Multi-Site FSP (IBS 2008).

A velocity meter attached to a rigid steel rod will be used to record river velocity from the sampling boat. For water depths of 2.5 feet or less, a velocity measurement will be made at 0.6 times the total water column depth. The velocity measurements at locations where the water column is greater than 2.5 feet will be recorded at 0.2 and 0.8 times the total water column depth. At each depth, the velocity meter will be rotated until the maximum velocity is read on the display. The minimum and maximum velocity at each depth and each location will be recorded on field logs to evaluate the differences in water velocities with depth and for use in the FS.

6.7.4.3.7 Water Elevation Measurements

A single submersible pressure transducer and data logger will be installed during Step I to collect and record water elevation data, as described in Section 6.7.4.3.7. The exact location for deployment of the submersible pressure transducer will be evaluated for ease of installation and removal and protection from navigational traffic at the time of Step I field activities. The ultimate deployment location will be recorded using a handheld DGPS.

6.7.4.3.8 Shoreline Inspection

A shoreline inspection will be performed as a part of reconnaissance to document the following information:

- Ecological habitat details
- Location of outfalls
- Visual evidence of utilities
- Type and quality of shoreline improvement
- Upland activities that could impact in-water investigation

The shoreline inspection will be performed from the water and will include photo documentation and hand-written notes in accordance with SOP SAS-01-01. The location of observed features will be recorded using a handheld DGPS with sub-meter accuracy in accordance with the methods described in USEPA-approved SOP SAS-03-03 and Section 7 of the Multi-Site FSP (IBS 2008).

Ecological Habitat Assessment

The ecological habitat assessment will be included in the Baseline Ecological Risk Assessment. Information collected during site reconnaissance will include habitat for selected wildlife. Habitat includes banks, cobble, vegetation, land cover, etc.

Location of CSOs

As shown on Figures 22A and 22B, three CSOs discharge to the CSSC within the Investigation Area. The visual inspection will confirm the presence of those CSOs and record the location of any additional CSOs identified. CSOs discharging at the time of the visual inspection will be logged.

Visual Evidence of Utilities

Utility locations (overhead and underground) provided by the Chicago Office of Underground Coordination (OUC) (Figures 22A and 22B) and the side-scan sonar survey will be reviewed and identified in the field, if possible. Deviations from the OUC information that can be visually identified will be documented and updated on Figures 22A and 22B. Field personnel will also evaluate the Investigation Area for visual signs of unmarked utilities including, but not limited to: signage, flags, markings, manholes, meters, transformers, vaults, or trenches. Unmarked utility locations will be documented and added to Figures 22A and 22B.

Upland Activities

Upland activities that could impact the CSSC investigation will be documented. Examples of these types of activities include, but are not limited to the following: use of petroleum products, barge traffic on the CSSC, or active construction activities in or near the CSSC.

6.7.4.3.9 Step I Technical Memorandum

Following receipt of the Step I results, a brief technical memorandum will be prepared if any modifications to the Step II sampling plan are warranted.

6.7.4.3.10 Predictive Analytics

Due to the large number of proposed samples, use of predictive analytics is currently being evaluated. Predictive analytics encompasses a variety of statistical techniques from modeling, machine learning, and data mining that analyze current and historical facts to make predictions about future, or otherwise unknown events.

Specifically, predictive analytics for this case would use physical characteristics (rather than analytical data) of the sediment – United Soil Classification System (USCS) classification, PID readings, presence or absence of tar-like material, presence or absent of sheen, presence or absence of odor – to predict PAH concentrations above or below a selected concentration. If this method can be proven effective, the number of samples that would be required to be submitted the laboratory could be reduced. The number of boring locations would remain unchanged. Existing data and data collected during the Step I investigation will be modeled using predictive analytics to determine if the tool can be applied to the Step II investigation. If predictive analytics are to be used during the Step II investigation, a technical memorandum describing the analytics and sampling scheme will be submitted to USEPA for review and approval prior to beginning sampling activities.

6.7.4.4 Investigation Step II – Site Characterization

Step II sampling will include sediment sampling, surface water sampling, water velocity measurements, water elevation measurements and mobility testing.

6.7.4.4.1 Sediment Coring and Sampling

Sediment coring and sampling during Step II will be performed at all boring locations not included in Step I sampling using either a vibrocore or a barge-mounted drill rig. Of the borings proposed for Step I and Step II combined, 25% are included in Step I with the remainder to be completed during Step II. The Step II investigation will be performed using the methods described in Section 6.7.4.1. Sediment sampling locations are presented on Figures 25A and 25B and summarized on Tables 9a and 9b.

6.7.4.4.2 Surface Water Sampling

A second round of surface water sampling will be performed at the same locations identified in Section 6.7.4.2 to evaluate if fluctuations in water level or temperature affect surface water COPC concentrations. For example, more volatile and semi-volatile compounds would be expected in the water column in warmer months. Surface water sampling will be performed using the methods described in Section 6.7.3. The second round of surface water sampling will be targeted for a different season than the first round of surface water sampling. If the Step II investigation is performed during a similar season to the Step I investigation, the second round of surface water sampling may occur during a separate mobilization from the Step II investigation. Surface water sampling locations are presented on Figures 25A and 25B and summarized on Tables 9a and 9b.

6.7.4.4.3 Water Velocity Measurements

A second round of water velocity measurements will be collected during the second round of surface water sampling (Section 6.7.4.4.2). Water velocity measurements will be collected from the same locations and using the same methods described in Section 6.7.4.2 to evaluate seasonal fluctuations in water velocity.

6.7.4.4.4 Water Elevation Measurements

Pressure transducers and data loggers, as described in Section 6.7.4.3.7, may be installed during Step II to collect and record water elevation data during an alternate season (e.g., high spring flow). The exact locations for deployment of submersible pressure transducers will be evaluated for ease of installation

and removal and protection from navigational traffic at the time of Step I field activities. Deployment locations will be recorded using a handheld DGPS.

6.7.4.4.5 Mobility Testing

Up to 30 sediment samples from up to 15 locations where NAPL, DNAPL, oil-wetted, or oil-coated sediment is observed during Step I or Step II investigations will be revisited, sampled, and submitted to PTS Laboratories for free product mobility/residual saturation analysis (Modified ASTM D425 and American Petroleum Institute (API) Recommended Practice (RP40) [Dean-Stark Method]) or pore fluid saturation (API RP40 [Dean-Stark Method]), depending on strength of sediment. Visual observations recorded during coring activities will be evaluated to determine where the mobility samples can be collected. The location will be re-occupied by the barge-mounted rig and blind drilled to the targeted depth. An undisturbed core from each location will be frozen on dry ice and shipped to the laboratory.

6.7.4.4.6 Step II Data Summary

Following receipt of the Step I and Step II results, a brief technical memorandum will be prepared that summarizes data on maps and tables including the following:

- An assessment of current conditions and the distribution of COPCs (including data collected as a part of Step I and Step II activities as well as the previous investigation activity)
- Recommendations to submit archived samples for laboratory analysis to further evaluate areas of concern
- An evaluation of forensic results to further understand issues related to potential MGP residuals

The data will be reviewed to assess if conditions outside the Investigation Area are statistically different from conditions within the Investigation Area, if the North Branch UTLs (Exponent 2009) are appropriate for the Investigation Area, and if additional assessment of the potential risk to human or ecological receptors is required. The technical memorandum will include recommendations and an approach for Step III sediment sampling, if necessary.

6.7.4.5 Investigation Step III – Site Characterization Refinement

Additional investigation elements for the site may be necessary for further characterization or delineation of impacts. Specific elements of Step III sampling will be summarized in a technical memorandum that will be prepared prior to field mobilization. Potential elements include the following:

- COPC analysis in specific locations to further delineate distribution
- Ambient sediment investigation
- TarGOST®

6.7.4.5.1 COPC Analyses

If warranted, additional sediment cores will be collected to refine the COPC distribution in river sediment. This sampling would focus on delineating the extent of potential MGP residual material observed during Step I and II activities.

6.7.4.5.2 Ambient Investigation

After reviewing the Step I and Step II data, the applicability of the North Branch Chicago River UTLs will be evaluated. If it is believed that ambient conditions in the CSSC differ from those in the North Branch and it is determined that additional sampling on the CSSC will assist in identifying ambient conditions, an ambient investigation will be designed and performed in the CSSC. Sediment sampling data collected from outside the Investigation Area will be used to identify an appropriate ambient area.

The ambient investigation will be designed similarly to the North Branch ambient investigation (Exponent 2009). An ambient investigation plan will be submitted to USEPA prior to initiation of any field activities.

6.7.4.5.3 TarGOST®

As described in Section 3.7.2, TarGOST® is a laser-induced fluorescence screening tool that is designed to identify areas of potential NAPL. TarGOST® was used during February and March 2007 by B&McD within the ACA. Therefore, it has been used to the extent of its effectiveness at this time, and use of TarGOST® is not anticipated as a part of the Step I or Step II investigations. However, if areas of NAPL are identified during Step I or Step II investigation activities, TarGOST® may be used during the Step III investigation activities in accordance with Section 4.7.8 of the Multi-Site FSP to identify the lateral and vertical extent of NAPL. The use of TarGOST® in the CSSC may be limited by interference induced by naturally occurring organic matter, presence of gases, or other anthropogenic, tar-like material. If TarGOST® is used, sediment borings, as described in Section 3.7.2, would also be advanced to further investigate areas identified by TarGOST®.

6.8 Disposal of Investigation-Derived Waste

Investigative wastes will be placed in containers during field investigation activities in anticipation of off-site disposal. Confirmation that the disposal facilities meet the requirements of the OSR (USEPA, September 1993) for the disposal of investigation-derived waste will occur prior to undertaking any disposal activities.

Representative samples for disposal purposes will be obtained and provided as required by the disposal authority through which the wastes will be managed and disposed. A composite sample of soil will be prepared for waste characterization by collecting material from soil cuttings. Representative groundwater and decontamination water samples will also be prepared for waste characterization if off-site disposal is planned. The groundwater, decontamination water and composite soil samples will be sent to a fixed-based analytical laboratory for analysis of waste disposal parameters that will be specified by the landfill or in the case of the water, the treatment facility. All disposal activities will be completed in accordance with applicable state and federal regulations and the methods described in Section 9 of the Multi-Site FSP (Appendix H).

6.9 Record Keeping

Details of field and laboratory records and data management and storage are provided in the USEPA-approved Multi-Site QAPP, Multi-Site FSP, and SOP SAS-01-02.

6.10 Sample Analysis and Validation

Laboratories selected to perform analysis of chemical samples of soil, groundwater, soil vapor, surface water, and sediment will be fixed based facilities. Selected laboratories will be approved for the media of concern and COPCs in the Multi-Site QAPP. Reporting and detection limits for the labs will be verified prior to sample collection to ensure that the laboratory limits meet the current SLs for the Multi-Site MGP Program.

Tables 2, 7, 10 and 11 summarize the proposed sampling and analysis plan for the Crawford Station Site and includes samples to satisfy quality assurance/QC (QA/QC) requirements in accordance with Section 2 of the Multi-Site QAPP and USEPA-approved SOP SAS-04-03 from the Multi-Site FSP. As described in Section 6 of this SSWP, the dynamic work plan approach will be used and additional samples (including QA/QC samples) may be collected.

Laboratory procedures, field measurements, and sample results will be verified and/or validated as discussed in the Section 4 of the Multi-Site QAPP.

6.11 Data Evaluation and Tabulation for Risk Assessment

Verified and/or validated data will be entered into a database and tabulated for use as described in the Multi-Site QAPP. Procedures for assessing the precision, accuracy, representativeness, completeness, and comparability of field and analytical laboratory data are described in Section 4 of the Multi-Site QAPP and USEPA-approved SOPs SAS-04-01, SAS-04-02, and SAS-04-03 from the Multi-Site FSP. Data will be evaluated to assess if the DQOs identified in the Multi-Site QAPP have been met.

Analytical results will be organized in a logical manner such as by sample location number, sample type, or sample area. Analytical tables will indicate the unique sample identification number corresponding to the sample/location/well name, sampling date and time, sample depth, detection limits, analytical results (following the units of measurement presented in the Multi-Site QAPP Table 9), and validation qualifiers, if appropriate. Data may be presented in summary tables, graphs, or as plan or cross-sectional views with COPC concentrations, as determined necessary.

Data sets may be created for each medium and may include summary statistics such as detection frequency, arithmetic mean concentration, maximum detected concentration, standard deviation, and/or 95% upper confidence limit of the mean.

7 REMEDIAL INVESTIGATION REPORT

Data collected during the RI activities will be included in a RI Report in general accordance with the USEPA RI/FS guidance document (USEPA, October 1988). An RI Report will be prepared at the conclusion of the activities performed per the SSWP on each parcel group. The RI Report will include the following information and documentation, as appropriate, in accordance with Task 4 of the SOW attached to the AOC:

- A description of field procedures and methods used during the RI.
- A discussion of the nature and rationale for any significant variances from the scope of work described in this RI/FS SSWP.
- The data obtained during the RI and previously collected data of useable quality. This will include analytical data, field measurements, etc. To the extent practicable, RI and previously collected data will be presented in figures and tabular formats.
- The results of an assessment to evaluate if the RI acceptance/performance criteria were met as specified in the Site-Specific QAPP.
- The methods and rationales used in evaluating RI and previously collected data.
- Identification of potentially MGP-related residuals. Observation of discolored/stained soil alone does not imply the presence of MGP-related residuals. Similarly, sampling locations where no MGP-related residuals were visibly observed does not also mean that all soil analytical results were below the most recent SLs. Notations of sheens, LNAPL, and DNAPL are noted in the field to illustrate the distribution of more highly affected areas of the site and adjacent properties and inform the RI/FS process.
- Conclusions regarding extent and nature of MGP residuals in the media of concern.
- A revised Site-Specific CSM with a discussion of environmental fate and transport of COPCs.
- A BLRA Report as discussed in the Multi-Site RAF.
- A discussion of anticipated future land use and reuse assessment.
- Any supporting material for RI data, including boring logs, monitoring well construction diagrams, groundwater sampling logs, laboratory analytical reports, and similar information.

8 FEASIBILITY STUDY SCOPE OF WORK

The FS will be completed in accordance with the USEPA RI/FS guidance document (USEPA, 1988). Additional guidance is provided in the Multi-Site FS Support Document (IBS, 2009).

As described in Section 2.6, an extensive TCRA is ongoing at upland portions of the site, which will impact the conditions observed during the RI. Evaluation of the TCRA will be required to determine final conditions at the time of the FS. The FS scope and schedule will be decided upon by USEPA and PGL following completion of the RI activity and reporting.

A draft FS report will include a summary of the initial screening evaluation and will present the detailed analysis of media-specific remedial alternatives considered as a basis for developing a Record of Decision.

8.1 FS Report

A draft FS Report will be prepared to summarize the activities performed and to present the associated results and conclusions. The report will include a summary of the initial screening study and will present the detailed analysis of remedial alternatives considered as a basis for developing a Record of Decision.

The FS Report is anticipated to include the following sections:

- Introduction and Site Background
- Development of Remedial Action Objectives and General Response Actions
- Identification and Screening of Remedial Technologies
- Development and Initial Screening of Remedial Alternatives
- Detailed Analysis of Alternatives
- Comparative Analysis of Alternatives
- Summary and Conclusions

The feasible technology options for remediation, if warranted, will be identified for each general response action, and the results of the remedial technologies screening will be described. Remedial alternatives will be developed by combining technologies identified in the screening process. The results of the initial

screening of remedial alternatives will be described with respect to effectiveness, ability to implement, and cost. Final screening against the nine comparative criteria and the comparison of remedial alternatives will be presented with a final recommended remedial alternative. A description of the key requirements for implementation of the recommended alternative and an estimated construction will be presented in the summary and conclusions section of the report.

9 SCHEDULE

Figure 23 presents a preliminary project schedule for the major tasks to be performed in support of the former Crawford Station Site RI/FS for Parcels A, B, O and S and the CSSC (Group IV parcels). The overall schedule is dependent on USEPA approvals and weather conditions that may affect the timing of field sampling activities.

The preliminary schedule assumes the following:

- Approved subcontractors will be available during the time periods needed.
- Two rounds soil vapor sampling and analysis will be performed, approximately six months apart.
- Four rounds of quarterly groundwater monitoring from the proposed new wells will be collected.
- No major permit delays are experienced when planning to access the CSSC.
- Based on the sampling results, if additional investigation activities are needed to delineate areas of concern, the schedule will be modified as necessary to accommodate the additional work needed.
- Treatability testing is not included; however, if treatability studies are identified during the RI, the schedule will be modified when the scope of work is identified.

A revised schedule may be submitted to USEPA at least 15 days following approval of the SSWP with the first monthly progress report.

The schedule for the SSWP addendum to address the RI to be performed on the Group IV parcels and the Site-wide groundwater assessment will be determined with USEPA concurrence.

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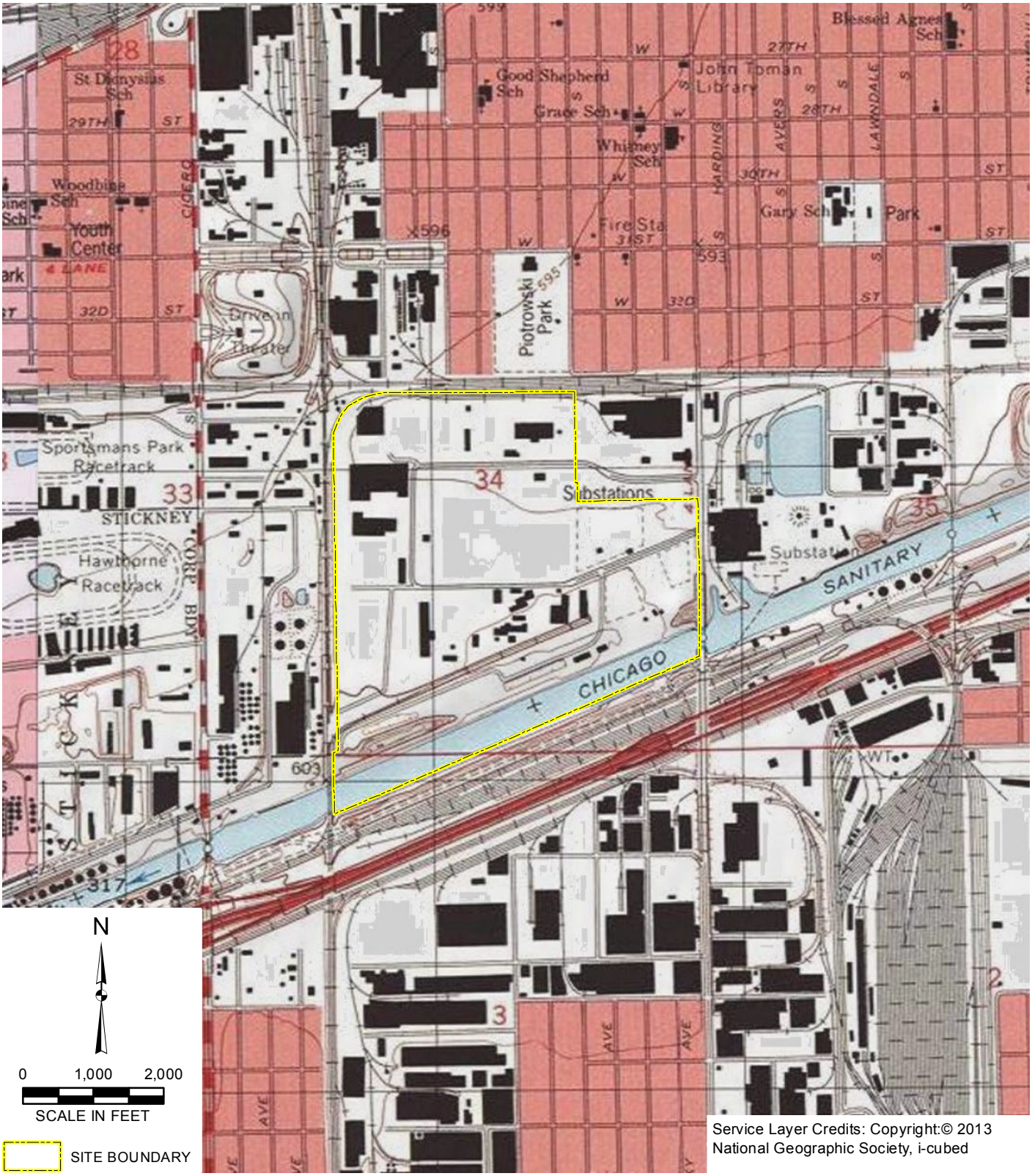
FIGURES



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TDC 9/21/15
REVIEWED BY/DATE:
CCD 9/22/15
APPROVED BY/DATE:
TLH 12/7/15

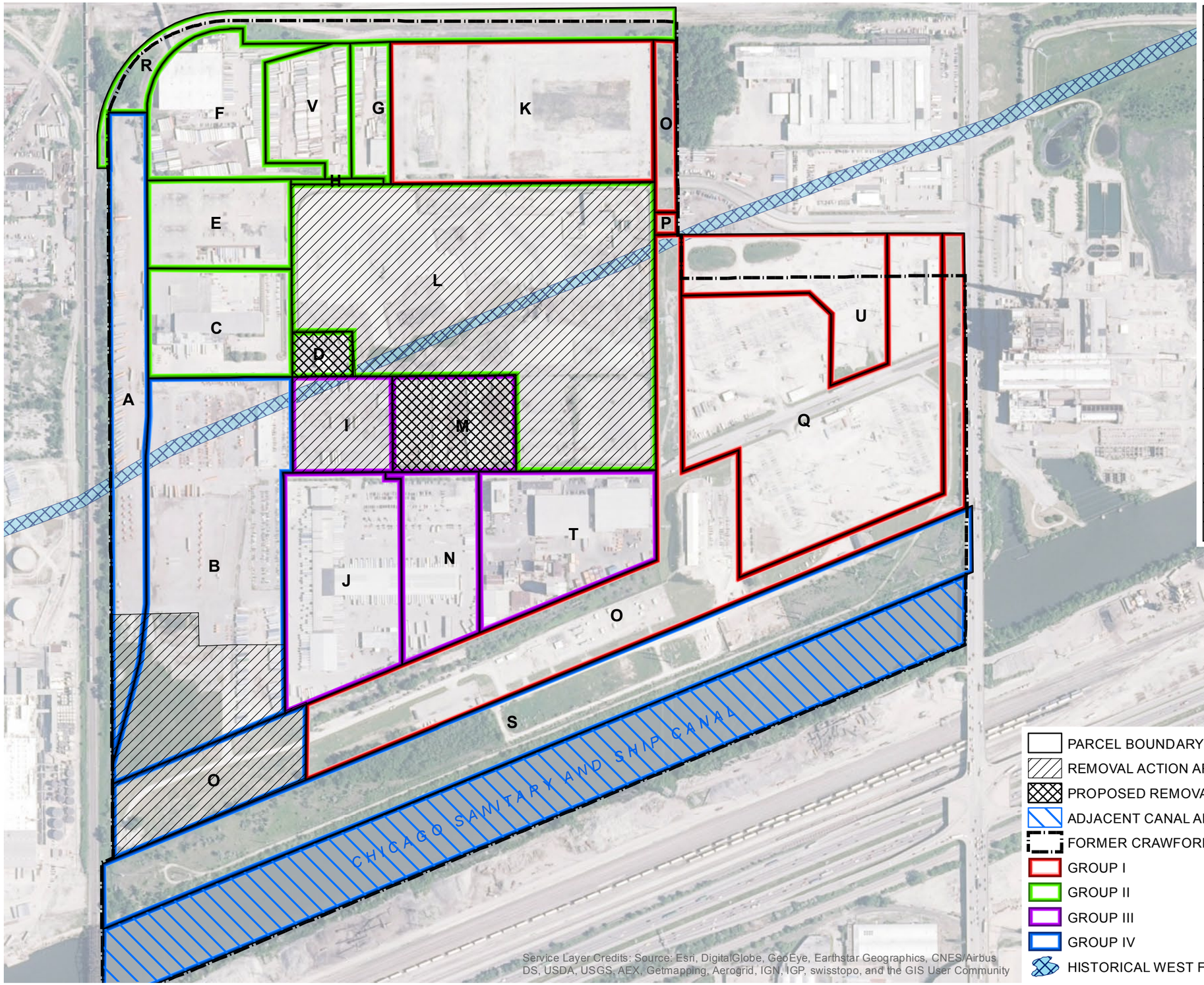
SITE LOCATION MAP

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO: 2066

FIGURE NO: 1

NATURAL RESOURCE TECHNOLOGY



PARCEL	OWNER
A	Peoples Gas Light and Coke Company (PGL)
B	PGL
C	Kostner/Chicago, LLC (LaGrou)
D	EJS Building Corporation
E	Kostner/Chicago, LLC (LaGrou)
F	Center Point Properties Trust & Central Can Co.
G	Marquette National Bank tr#11841
H	First American Realty
I	Kostner/Chicago, LLC (LaGrou)
J	R.L.R. Investments, LLC
K	PGL
L	PGL
M	UIR Campus & Tower, LLC
N	R.L.R. Investments, LLC
O	PGL
P	American National Bank & Trust Company tr#100785
Q	Commonwealth Edison (ComEd)
R	Chicago & Illinois Western Railroad The Belt Railway Company of Chicago
S	MWRDGC
T	UIR Campus & Tower, LLC
U	ComEd
V	Intermodal Maintenance Group, LLC

DRAWN BY/DATE: TDC 2/15/16
REVIEWED BY/DATE: TLH 2/15/16
APPROVED BY/DATE: TLH 2/15/16

RI GROUPING PLAN

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 2

NATURAL RESOURCE TECHNOLOGY

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HISTORICAL MGP SITE FEATURES WITH 1938 AERIAL IMAGERY

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

DRAWN BY/DATE:
TDC 2/15/16
REVIEWED BY/DATE:
TLH 2/15/16
APPROVED BY/DATE:
TLH 3/2/16

HISTORICAL MGP SITE FEATURES (APPROX. LOCATIONS)
HISTORICAL WEST FORK CHANNEL (FILLED 1940s)
GROUP IV PARCELS
PARCEL BOUNDARY

N

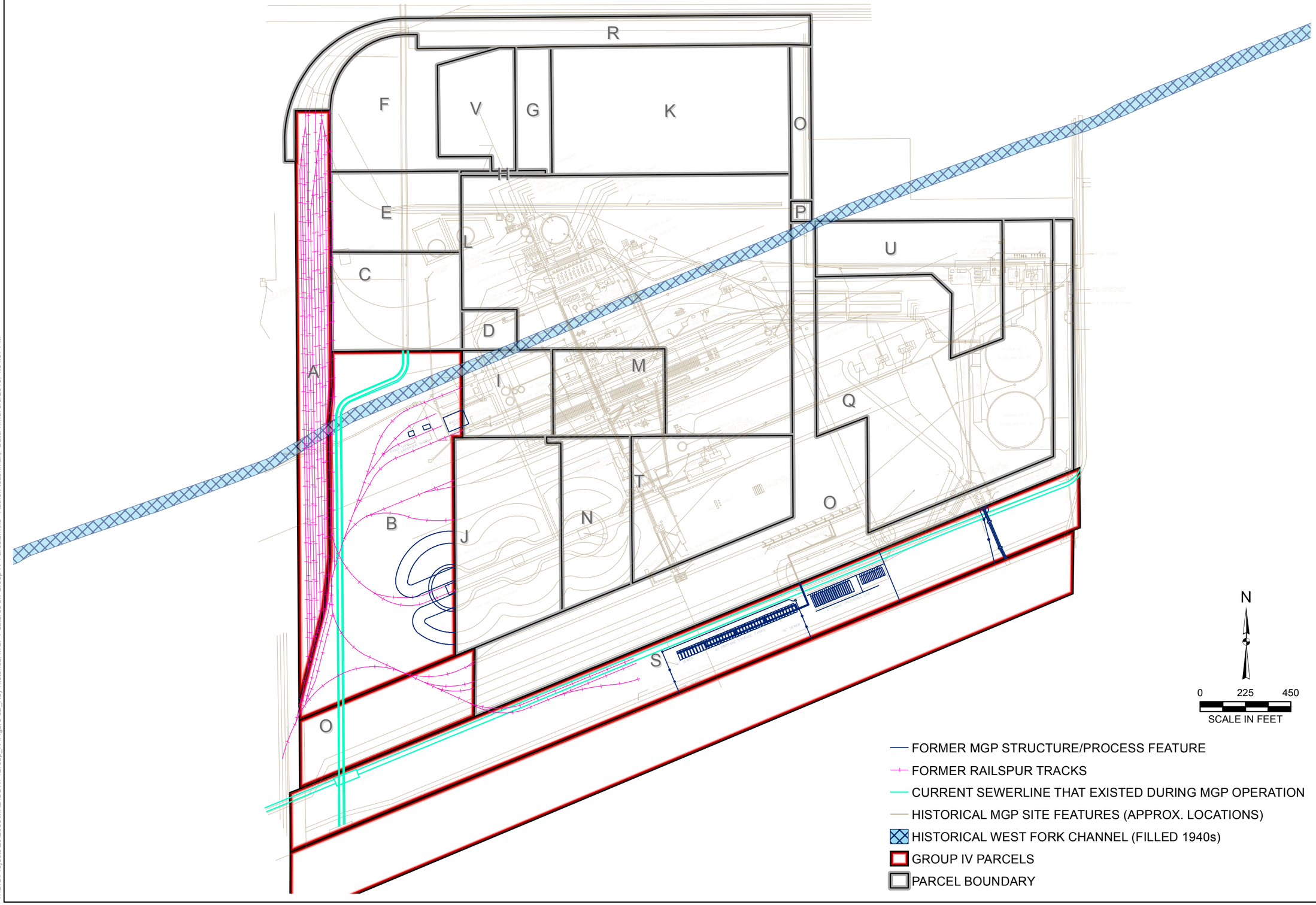
0 225 450
SCALE IN FEET

PROJECT NO. 2066

FIGURE NO. 3A

NATURAL RESOURCE TECHNOLOGY

Y:\GIS\Projects\2012066\MXD\SSWP\Group_IV\Figure 3A_Historical MGP Site Features.mxd Author: toushman; Date/Time: 3/2/2016, 10:11:13 AM



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REVIEWED BY/DATE: TLH 2/26/16
APPROVED BY/DATE: TLH 3/2/16

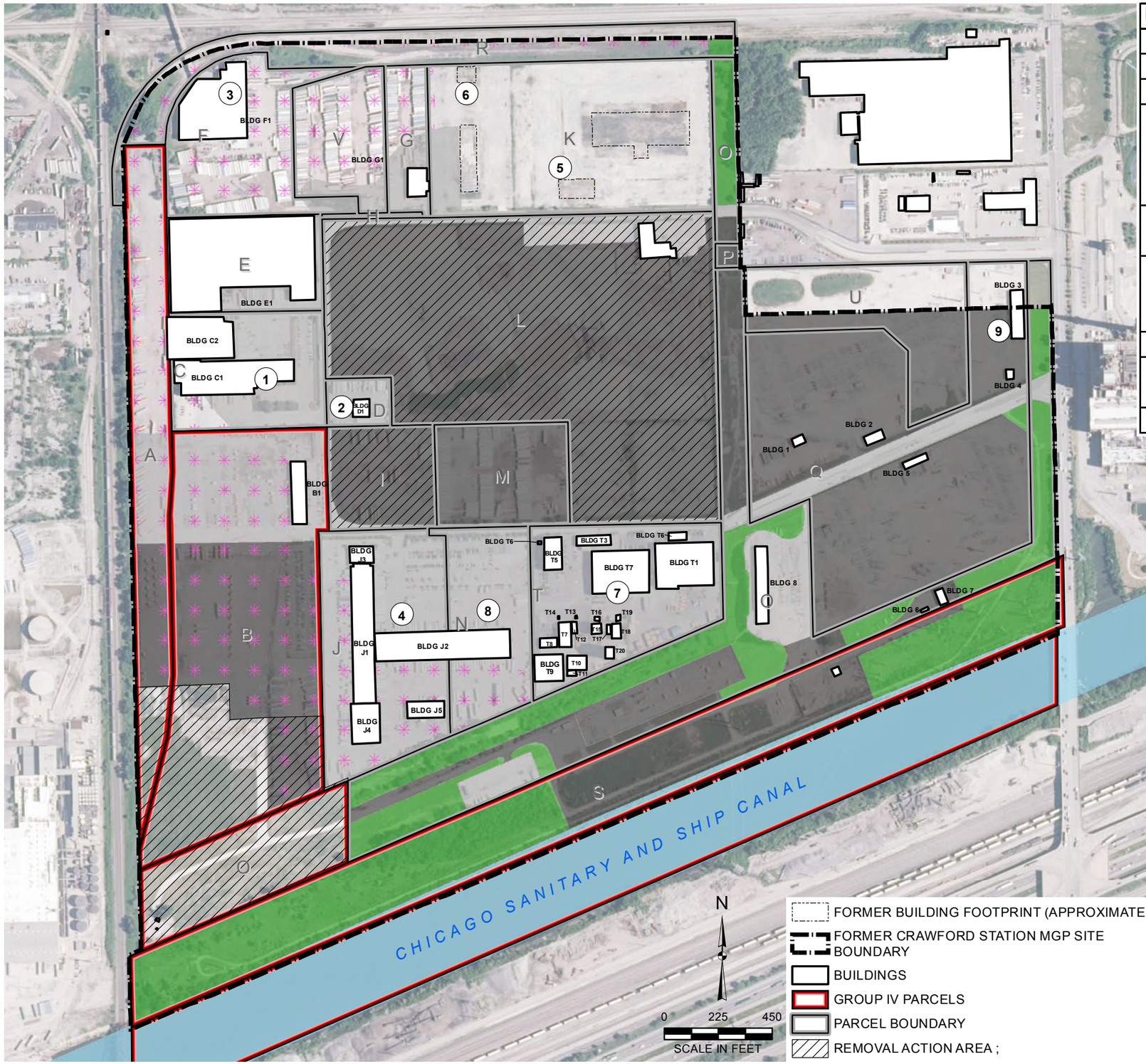
KEY HISTORICAL MGP FEATURES ON GROUP IV PARCELS

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 3B

NATURAL RESOURCE TECHNOLOGY



ID	ADDRESS	NON-MGP CONCERNS
1	3534 S. Kostner Ave.	Former USTs: 4
2	3535 S. Kostner Ave.	Closed LUST Incidents: 1
3	3600 S. Kostner Ave.	Existing USTs: 2
4	4359 W. 36th St.	Former USTs: 4 Existing USTs: 3 Closed LUST Incidents: 1 Active LUST Incidents: 1
5	4200 W. 35th St.	Former USTs: 7 Closed LUST Incidents: 1
6	4300 W. 35th St.	Former USTs: 6 Closed LUST Incidents: 1 Active LUST Incidents: 1
7	4201 W. 36th St.	Former USTs: 2
8	4301 W. 36th St.	Former USTs: 7 Closed IEPA SRP Facilities
9	3500 S. Pulaski Rd.	Closed LUST Incidents: 2

NOTES:
LUST: LEAKING UNDERGROUND STORAGE TANK
UST: UNDERGROUND STORAGE TANK
SOURCE: FIELD NOTES FROM FEBRUARY 2012 SITE RECONNAISSANCE PERFORMED BY NATURAL

- FORMER BUILDING FOOTPRINT (APPROXIMATE)
- FORMER CRAWFORD STATION MGP SITE BOUNDARY
- BUILDINGS
- GROUP IV PARCELS
- PARCEL BOUNDARY
- REMOVAL ACTION AREA ;
- VEGETATION
- ASPHALT/PAVEMENT
- GRAVEL/FILL MATERIAL
- CANAL
- AREA NOT VISIBLE DURING SITE RECONNAISSANCE IN FEB 2012

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APPROVED BY/DATE: TLH 12/7/15

SITE SURFACE CONDITIONS AND ON-SITE NON-MGP CONCERNS

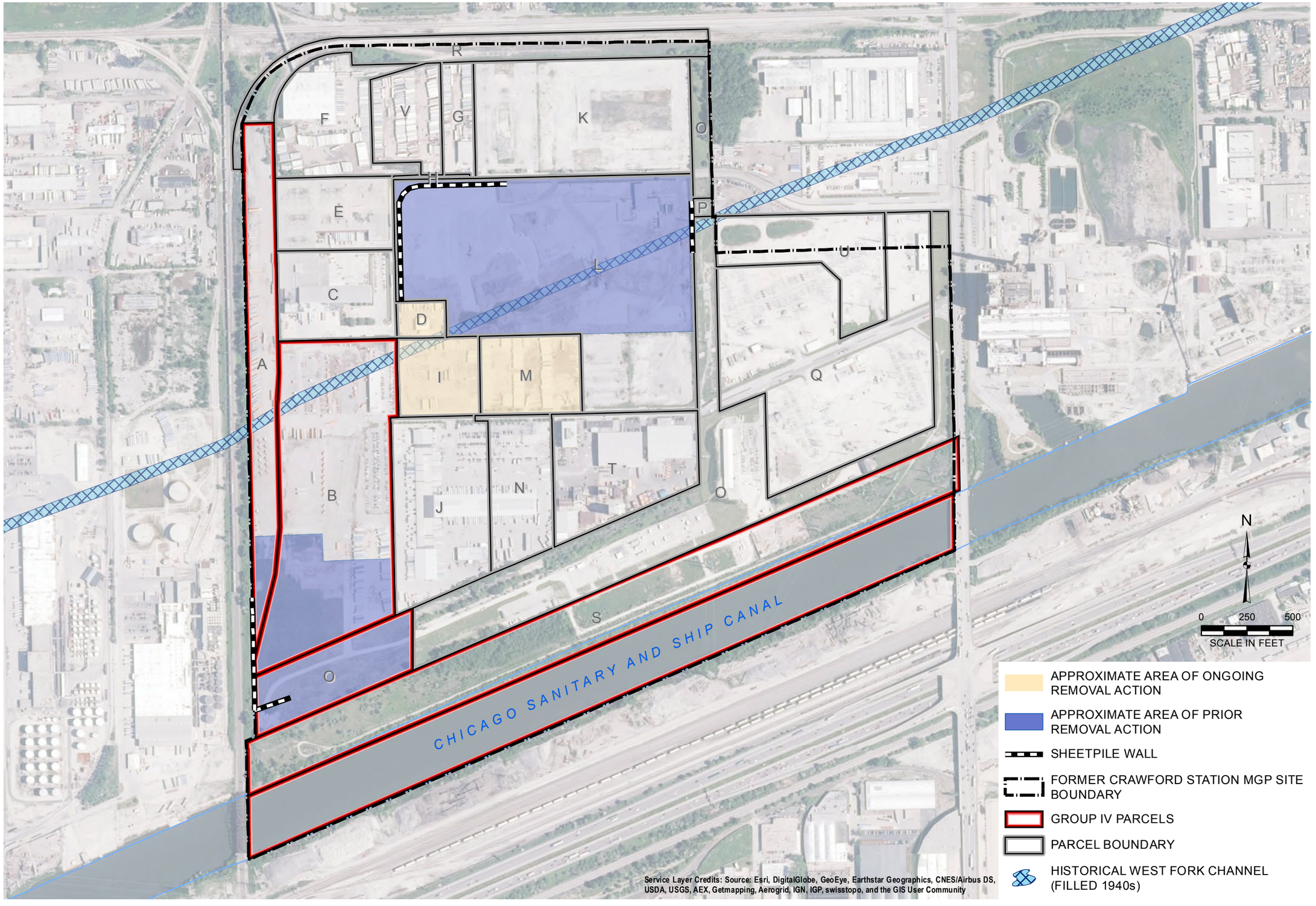
SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 4

NATURAL RESOURCE TECHNOLOGY

Y:\GIS\Projects\20\2066\MXD\SSWP\Group_IV\Figure 4_Site Surface Conditions and On-Site Non-MGP Concerns.mxd Author: tcushman; Date/Time: 2/15/2016, 12:38:59 PM



PREVIOUS AND ONGOING REMOVAL ACTION

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

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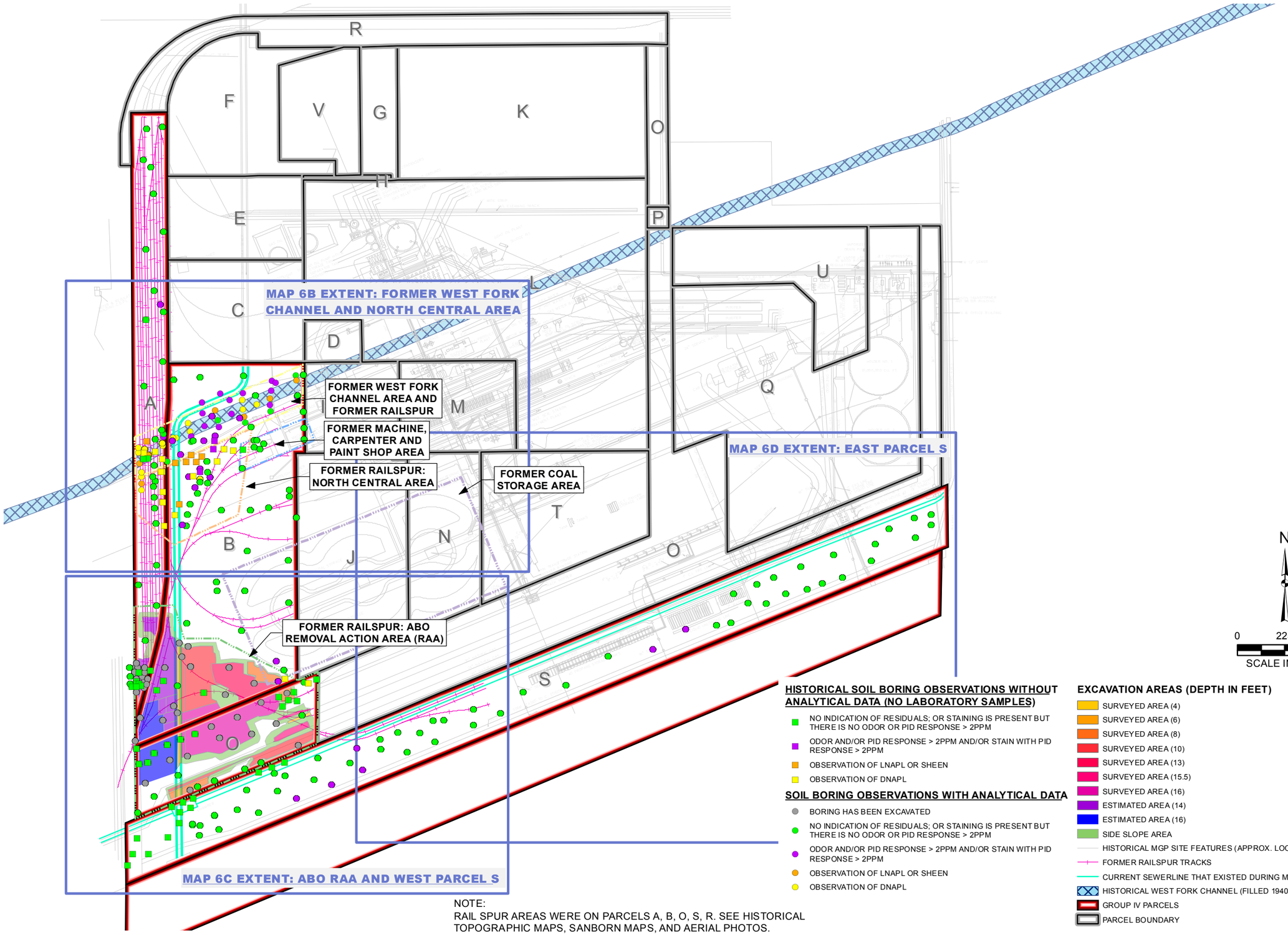
APPROVED BY/DATE: TLH 12/7/15

PROJECT NO. 2066

FIGURE NO. 5

NATURAL RESOURCE TECHNOLOGY

Y:\GIS\Projects\20\2066\MXD\SSW\Group_IV\Figure 5_Previous and Ongoing Removal Action.mxd Author: tcushman; Date/Time: 2/22/2016, 11:19:40 AM



N

0 225 450

SCALE IN FEET

HISTORICAL SOIL BORING OBSERVATIONS WITHOUT ANALYTICAL DATA (NO LABORATORY SAMPLES)

- NO INDICATION OF RESIDUALS; OR STAINING IS PRESENT BUT THERE IS NO ODOR OR PID RESPONSE > 2PPM
- ODOR AND/OR PID RESPONSE > 2PPM AND/OR STAIN WITH PID RESPONSE > 2PPM
- OBSERVATION OF LNAPL OR SHEEN
- OBSERVATION OF DNAPL

SOIL BORING OBSERVATIONS WITH ANALYTICAL DATA

- BORING HAS BEEN EXCAVATED
- NO INDICATION OF RESIDUALS; OR STAINING IS PRESENT BUT THERE IS NO ODOR OR PID RESPONSE > 2PPM
- ODOR AND/OR PID RESPONSE > 2PPM AND/OR STAIN WITH PID RESPONSE > 2PPM
- OBSERVATION OF LNAPL OR SHEEN
- OBSERVATION OF DNAPL

EXCAVATION AREAS (DEPTH IN FEET)

- SURVEYED AREA (4)
- SURVEYED AREA (6)
- SURVEYED AREA (8)
- SURVEYED AREA (10)
- SURVEYED AREA (13)
- SURVEYED AREA (15.5)
- SURVEYED AREA (16)
- ESTIMATED AREA (14)
- ESTIMATED AREA (16)
- SIDE SLOPE AREA
- HISTORICAL MGP SITE FEATURES (APPROX. LOCATIONS)
- FORMER RAILSPUR TRACKS
- CURRENT SEWERLINE THAT EXISTED DURING MGP OPERATION
- HISTORICAL WEST FORK CHANNEL (FILLED 1940s)
- GROUP IV PARCELS
- PARCEL BOUNDARY

NOTE:
RAIL SPUR AREAS WERE ON PARCELS A, B, O, S, R. SEE HISTORICAL TOPOGRAPHIC MAPS, SANBORN MAPS, AND AERIAL PHOTOS.

DRAWN BY/DATE: TDC 2/26/16
REVIEWED BY/DATE: TLH 2/26/16
APPROVED BY/DATE: TLH 3/2/16

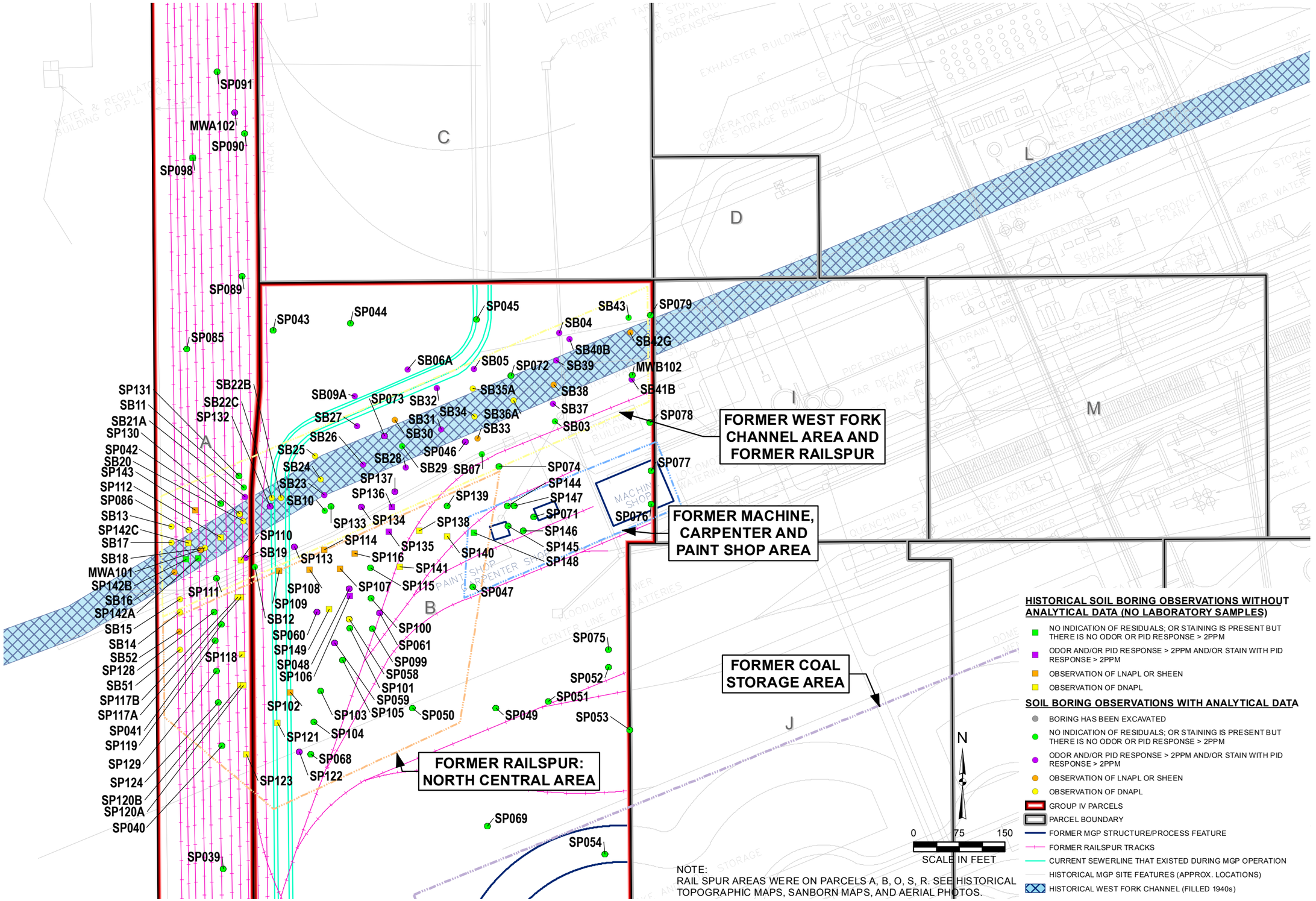
SOIL BORING LOCATIONS AND OBSERVATIONS OVERVIEW MAP

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 6A

NATURAL RESOURCE TECHNOLOGY



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REVIEWED BY/DATE: TLH 2/26/16
APPROVED BY/DATE: TLH 3/2/16

SOIL BORING LOCATIONS AND OBSERVATIONS

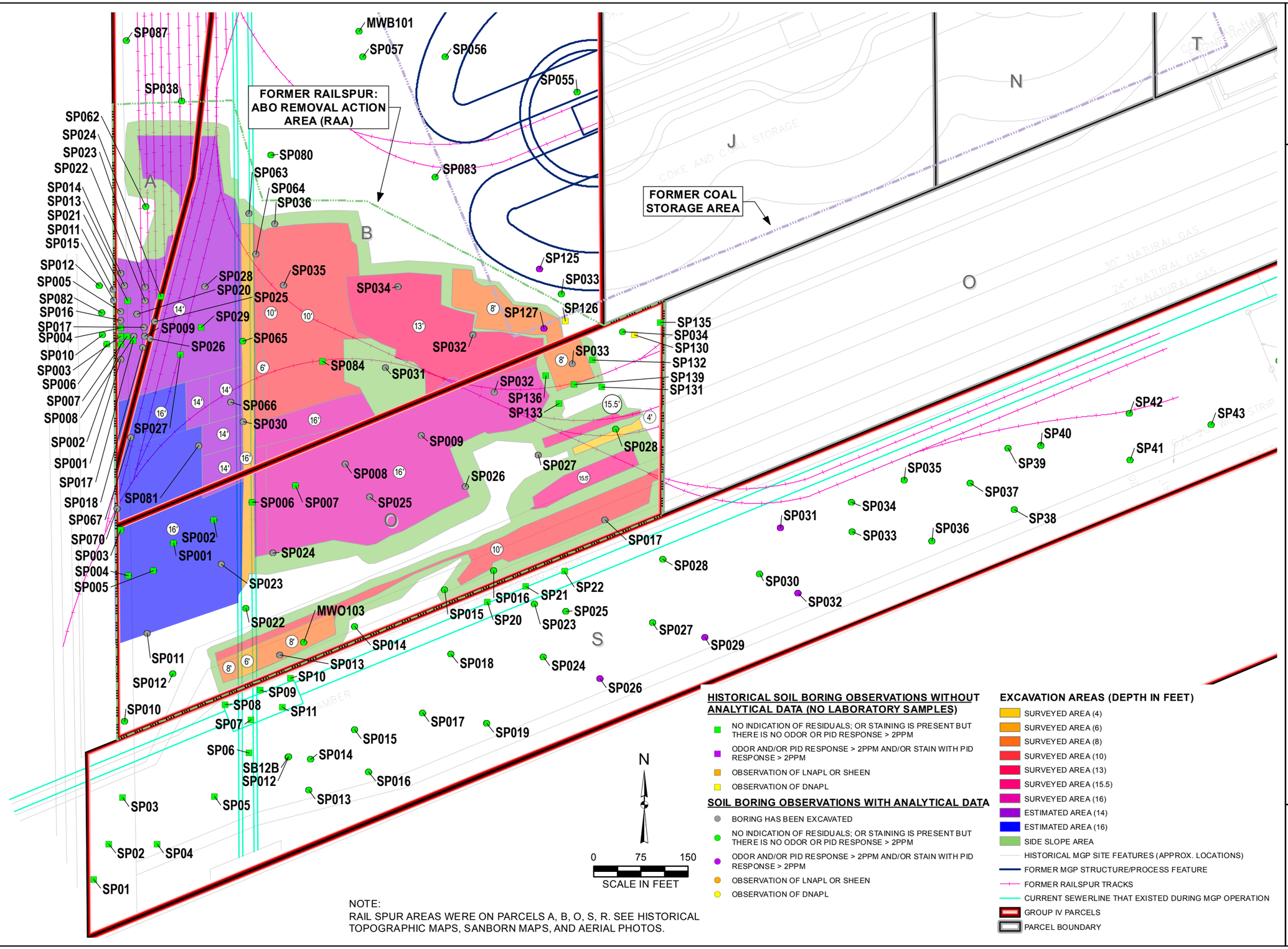
SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 6B

NATURAL RESOURCE TECHNOLOGY

Y:\GIS\Projects\2\2066\MXD\SSWP\Group_IV\Figure 6B_SB_Locs_and_Observations.mxd Author: tcushman; Date/Time: 3/2/2016, 10:43:10 AM



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SOIL BORING LOCATIONS AND OBSERVATIONS

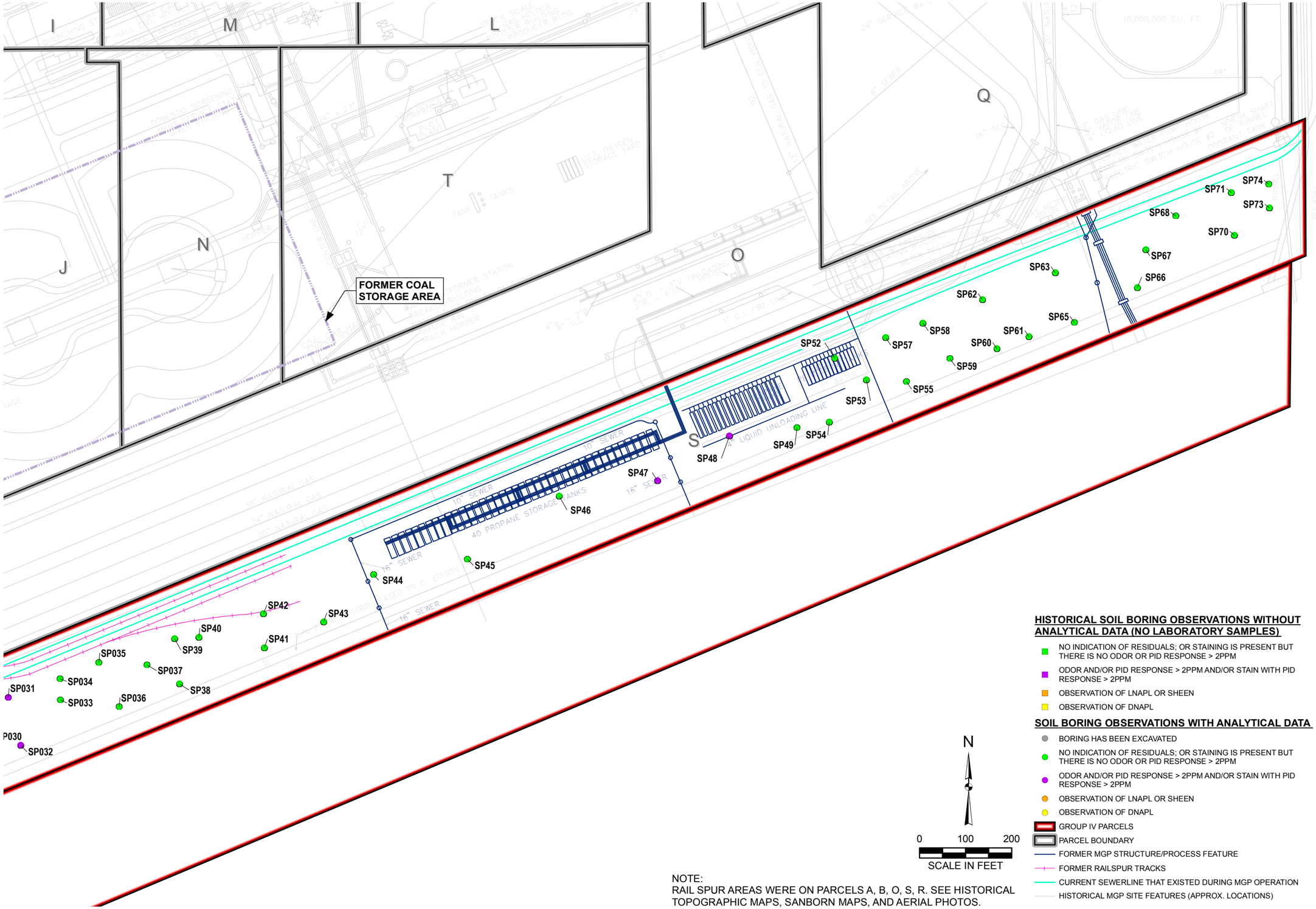
SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 6C

NATURAL RESOURCE TECHNOLOGY

Y:\GIS\Projects\20\2066\MXD\SSWP\Group_IV\Figure 6C_SB_Locs_and_Observations.mxd Author: tcushman; Date/Time: 3/2/2016, 12:20:53 PM



HISTORICAL SOIL BORING OBSERVATIONS WITHOUT ANALYTICAL DATA (NO LABORATORY SAMPLES)

- NO INDICATION OF RESIDUALS; OR STAINING IS PRESENT BUT THERE IS NO ODOR OR PID RESPONSE > 2PPM
- ODOR AND/OR PID RESPONSE > 2PPM AND/OR STAIN WITH PID RESPONSE > 2PPM
- OBSERVATION OF LNAPL OR SHEEN
- OBSERVATION OF DNAPL

SOIL BORING OBSERVATIONS WITH ANALYTICAL DATA

- BORING HAS BEEN EXCAVATED
- NO INDICATION OF RESIDUALS; OR STAINING IS PRESENT BUT THERE IS NO ODOR OR PID RESPONSE > 2PPM
- ODOR AND/OR PID RESPONSE > 2PPM AND/OR STAIN WITH PID RESPONSE > 2PPM
- OBSERVATION OF LNAPL OR SHEEN
- OBSERVATION OF DNAPL
- GROUP IV PARCELS
- PARCEL BOUNDARY
- FORMER MGP STRUCTURE/PROCESS FEATURE
- FORMER RAILSPUR TRACKS
- CURRENT SEWERLINE THAT EXISTED DURING MGP OPERATION
- HISTORICAL MGP SITE FEATURES (APPROX. LOCATIONS)

NOTE:
RAIL SPUR AREAS WERE ON PARCELS A, B, O, S, R. SEE HISTORICAL TOPOGRAPHIC MAPS, SANBORN MAPS, AND AERIAL PHOTOS.

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REVIEWED BY/DATE: TLH 2/26/16
APPROVED BY/DATE: TLH 3/2/16

SOIL BORING LOCATIONS AND OBSERVATIONS

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 6D

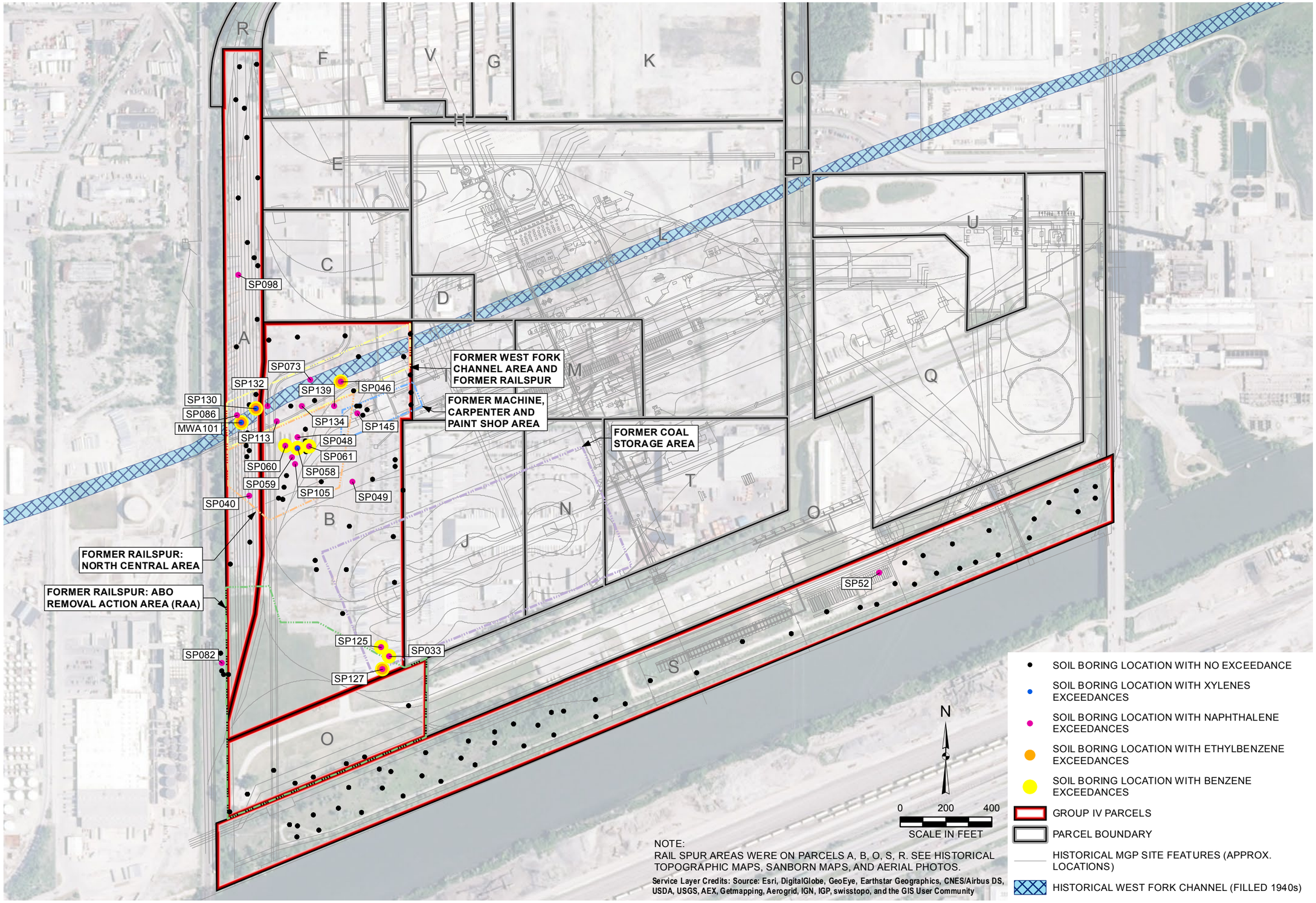
NATURAL RESOURCE TECHNOLOGY

Y:\GIS\Projects\20\2066\MXD\SSWP\Group_IV\Figure 6D_SB_Locs_and_Observations.mxd Author: tcushman; Date/Time: 3/3/2016, 2:09:27 PM

PVOCS AND NAPHTHALENE EXCEEDING RESIDENTIAL SCREENING LEVELS IN SOIL

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

DRAWN BY/DATE: TDC 2/22/16
REVIEWED BY/DATE: TLH 2/22/16
APPROVED BY/DATE: TLH 3/2/16



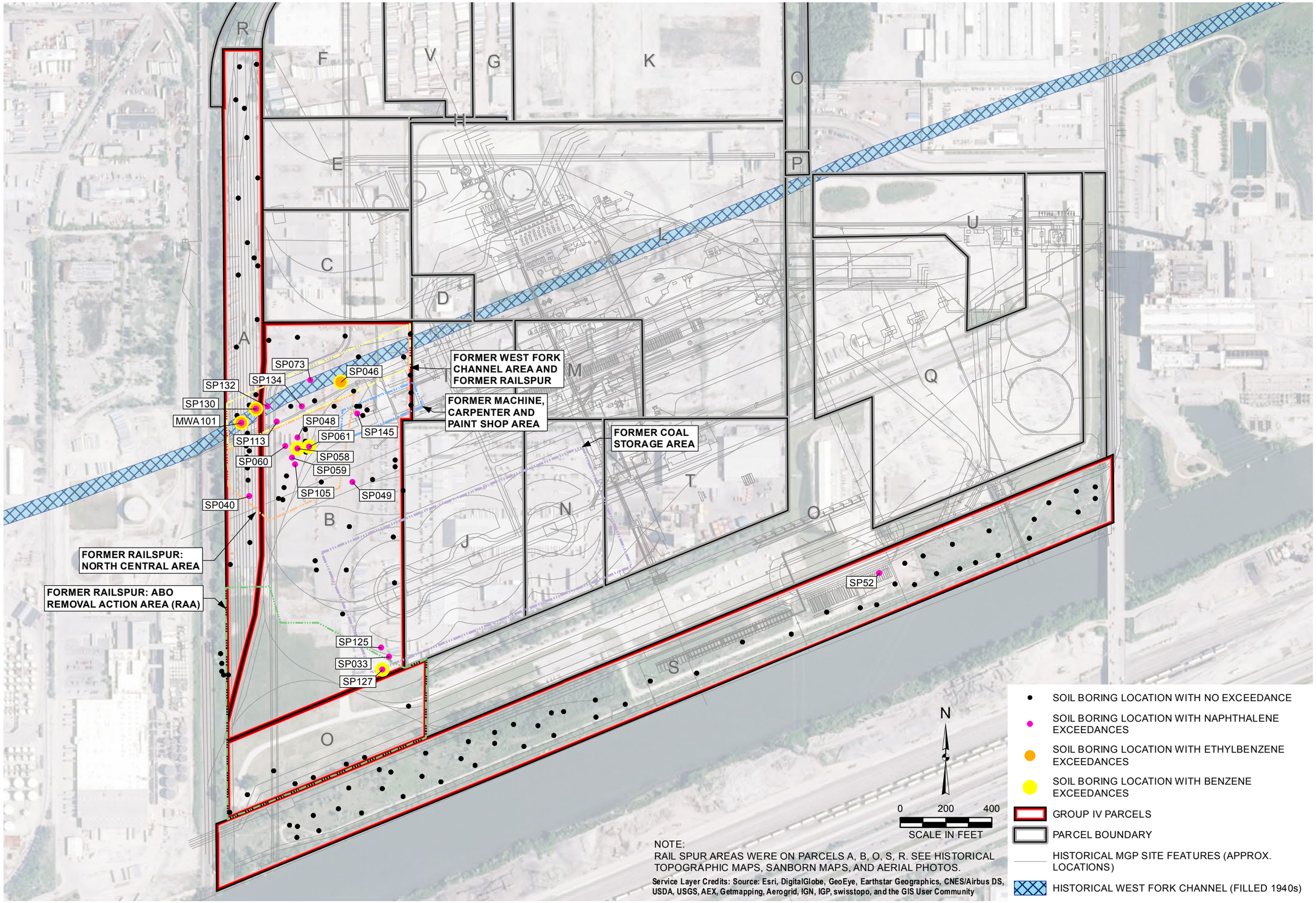
NOTE:
RAIL SPUR AREAS WERE ON PARCELS A, B, O, S, R. SEE HISTORICAL TOPOGRAPHIC MAPS, SANBORN MAPS, AND AERIAL PHOTOS.

- SOIL BORING LOCATION WITH NO EXCEEDANCE
- SOIL BORING LOCATION WITH XYLENES EXCEEDANCES
- SOIL BORING LOCATION WITH NAPHTHALENE EXCEEDANCES
- SOIL BORING LOCATION WITH ETHYLBENZENE EXCEEDANCES
- SOIL BORING LOCATION WITH BENZENE EXCEEDANCES
- GROUP IV PARCELS
- PARCEL BOUNDARY
- HISTORICAL MGP SITE FEATURES (APPROX. LOCATIONS)
- HISTORICAL WEST FORK CHANNEL (FILLED 1940s)

PROJECT NO. 2066

FIGURE NO. 7

NATURAL RESOURCE TECHNOLOGY



NOTE:
RAIL SPUR AREAS WERE ON PARCELS A, B, O, S, R. SEE HISTORICAL TOPOGRAPHIC MAPS, SANBORN MAPS, AND AERIAL PHOTOS.

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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TLH 3/2/16

PVOCS AND NAPHTHALENE EXCEEDING INDUSTRIAL SCREENING LEVELS IN SOIL

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 8

NATURAL RESOURCE TECHNOLOGY

NON-NAPHTHALENE PAHS EXCEEDING RESIDENTIAL SCREENING LEVELS IN SOIL

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

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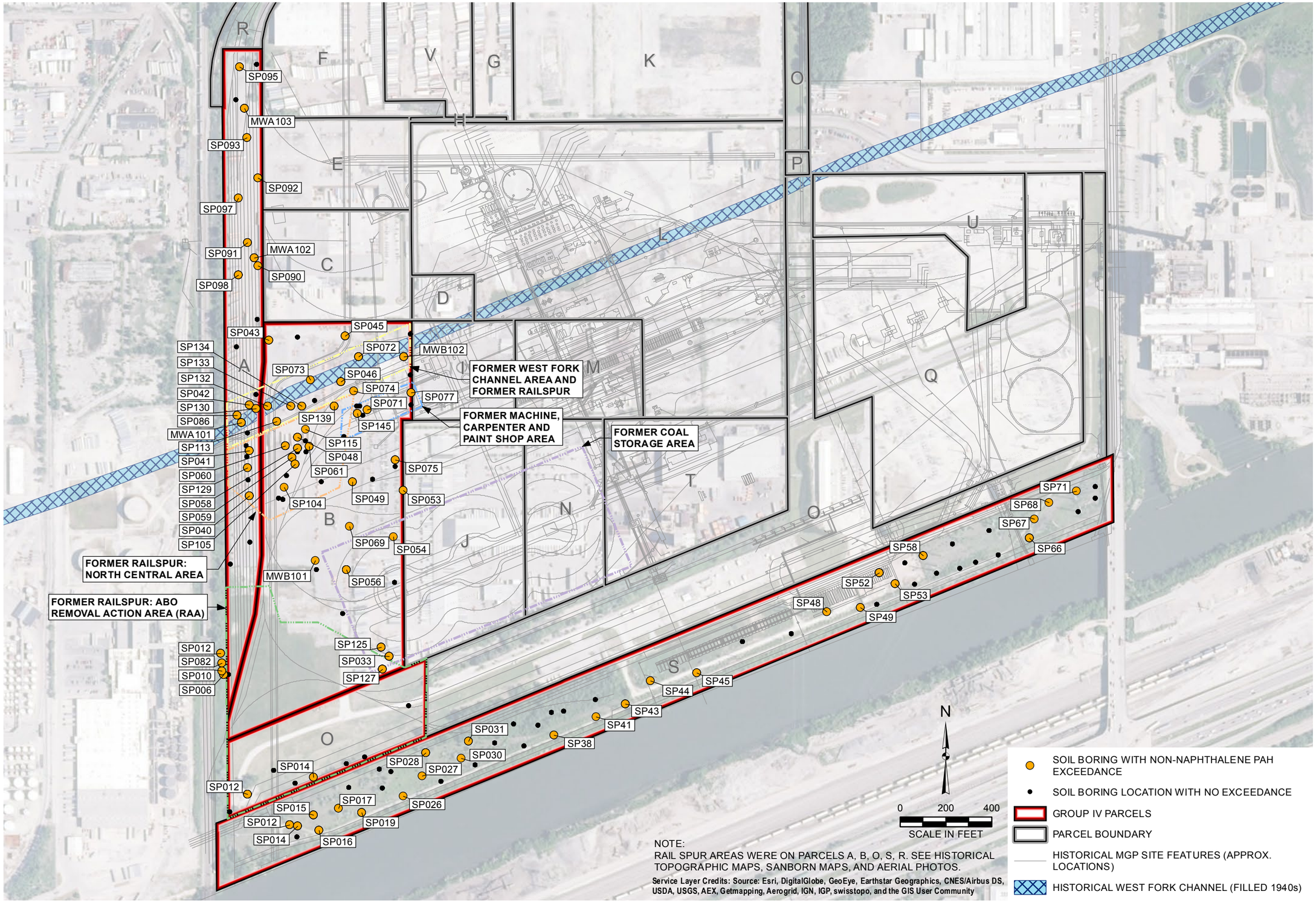
REVIEWED BY/DATE: TLH 2/22/16
APPROVED BY/DATE: TLH 3/2/16

PROJECT NO. 2066

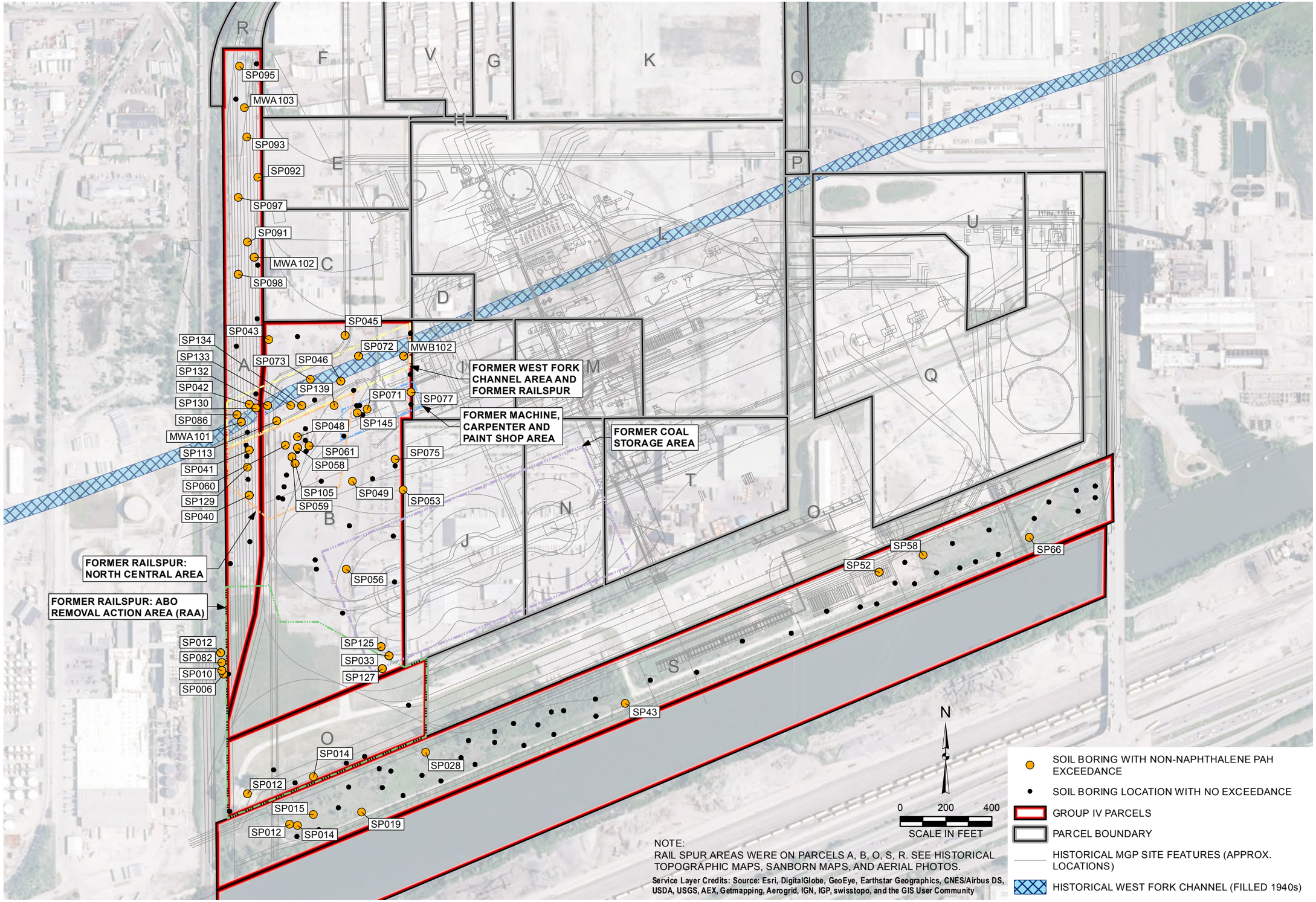
FIGURE NO. 9

NATURAL RESOURCE TECHNOLOGY



NOTE:
RAIL SPUR AREAS WERE ON PARCELS A, B, O, S, R. SEE HISTORICAL TOPOGRAPHIC MAPS, SANBORN MAPS, AND AERIAL PHOTOS.

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



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TLH 2/22/16
APPROVED BY/DATE:
TLH 3/2/16

NON-NAPHTHALENE PAHS EXCEEDING INDUSTRIAL SCREENING LEVELS IN SOIL

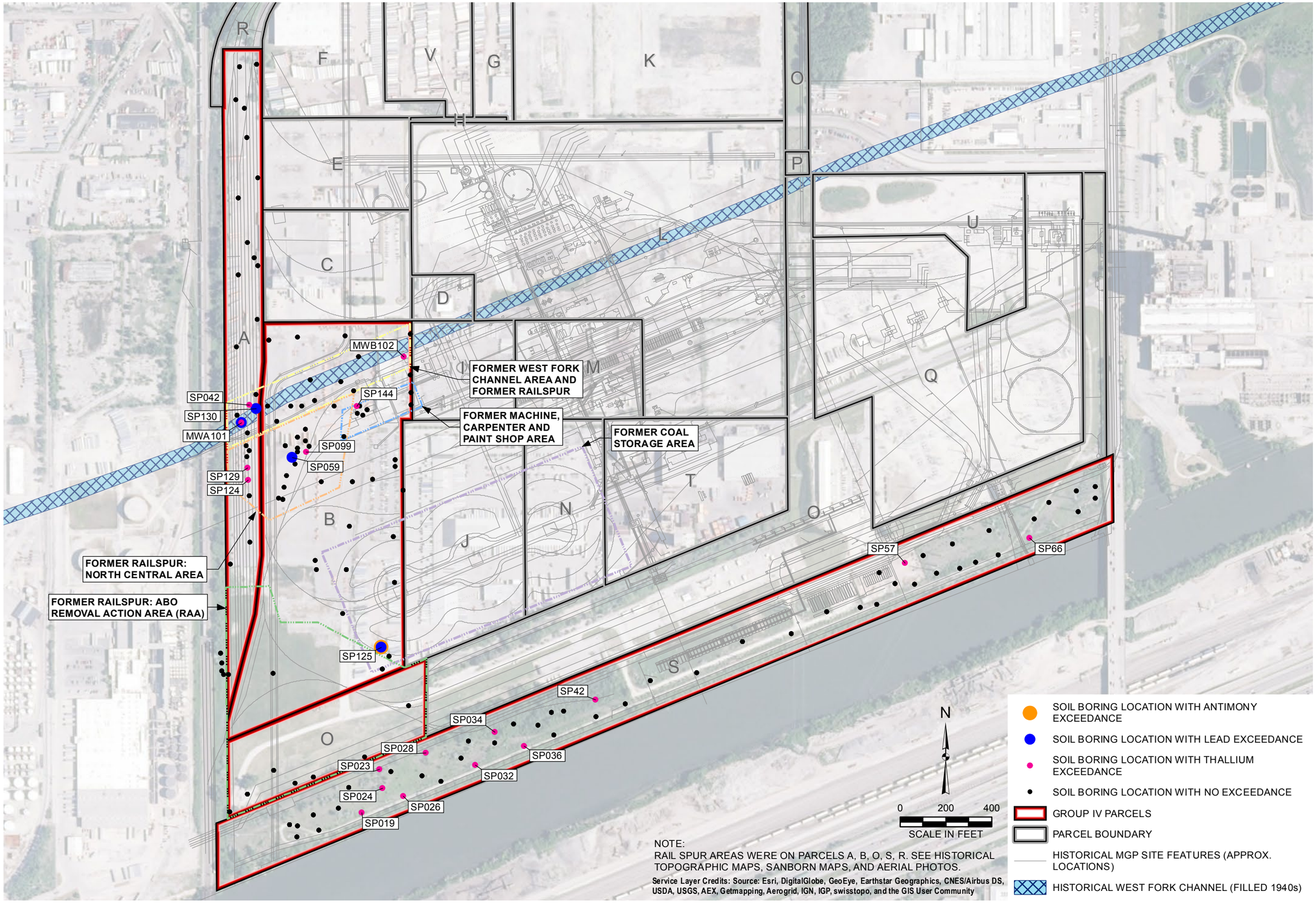
SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 10

NATURAL RESOURCE TECHNOLOGY

Y:\GIS\Projects\2066\MXD\SSWP\Group_IV\Figure 10_Non-Naphthalene PAHs Exceeding Industrial SLs in Soil.mxd Author: tcushman; Date/Time: 3/2/2016, 10:57:36 AM



NOTE:
RAIL SPUR AREAS WERE ON PARCELS A, B, O, S, R. SEE HISTORICAL TOPOGRAPHIC MAPS, SANBORN MAPS, AND AERIAL PHOTOS.

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TLH 2/22/16
APPROVED BY/DATE:
TLH 3/2/16

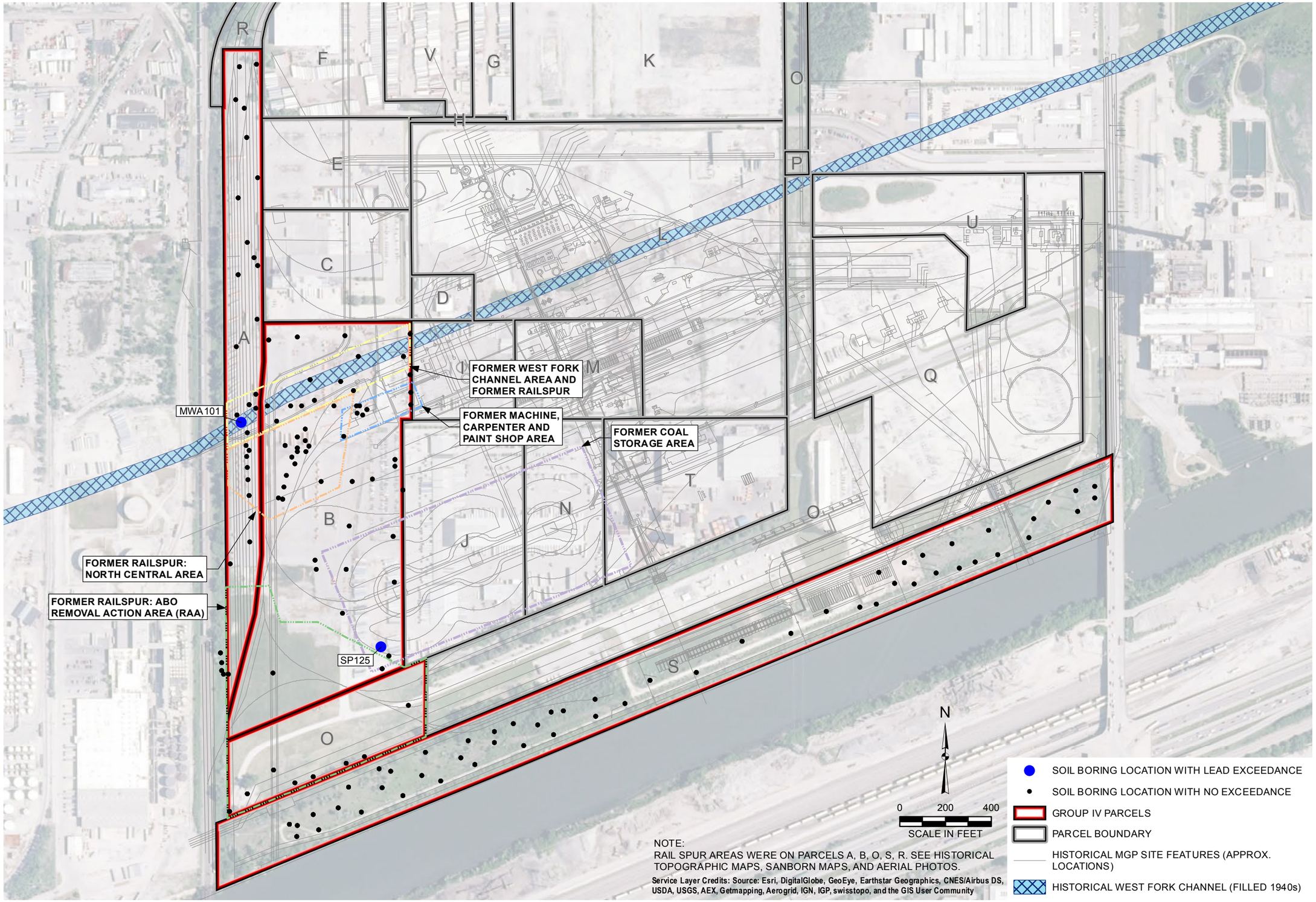
INORGANIC EXCEEDANCES OF RESIDENTIAL SCREENING LEVELS IN SOIL

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 11

NATURAL RESOURCE TECHNOLOGY



NOTE:
RAIL SPUR AREAS WERE ON PARCELS A, B, O, S, R. SEE HISTORICAL TOPOGRAPHIC MAPS, SANBORN MAPS, AND AERIAL PHOTOS.

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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TDC 2/22/16
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TLH 2/22/16
APPROVED BY/DATE:
TLH 3/2/16

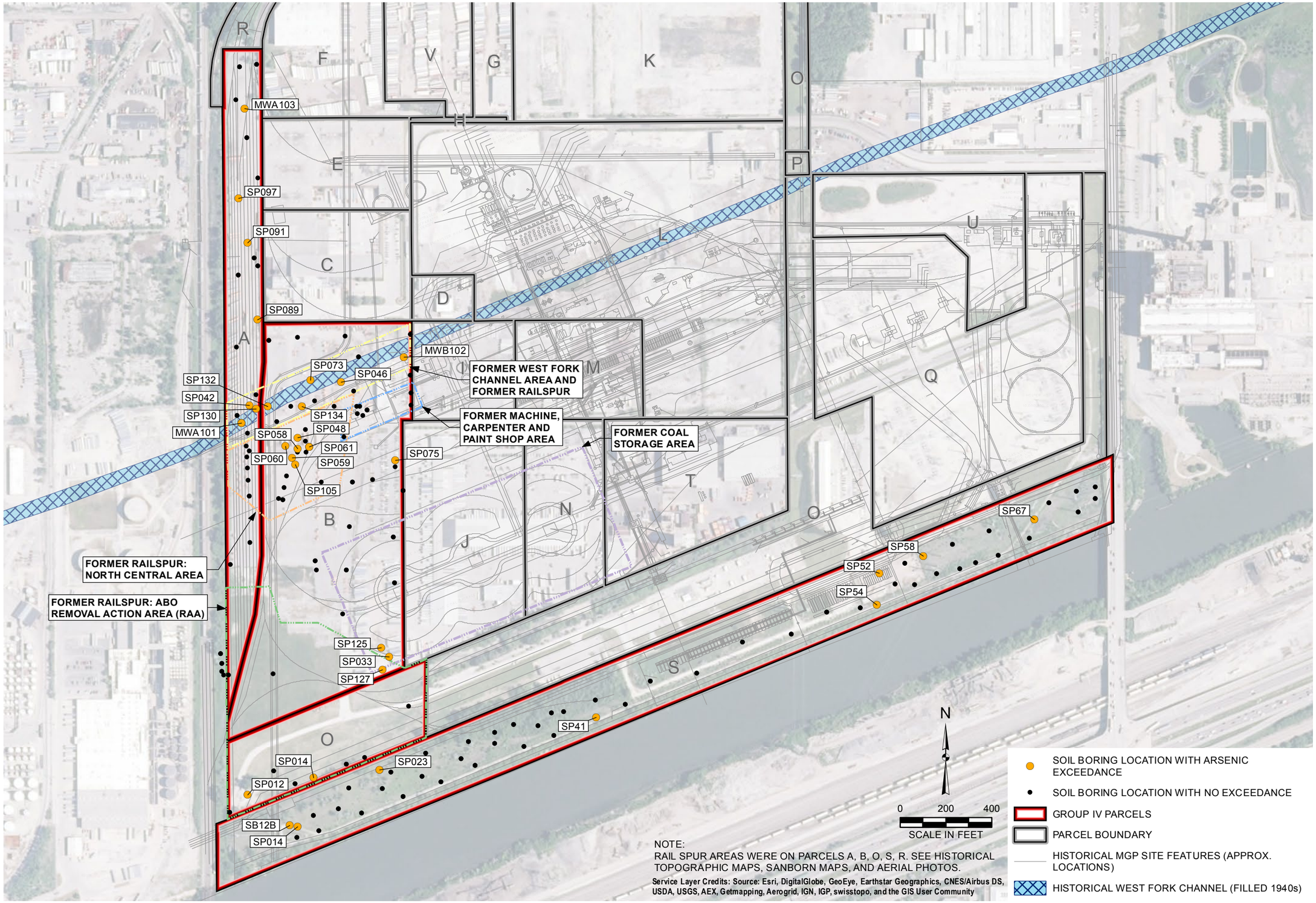
INORGANIC EXCEEDANCES OF INDUSTRIAL SCREENING LEVELS IN SOIL

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 12

NATURAL RESOURCE TECHNOLOGY



NOTE:
RAIL SPUR AREAS WERE ON PARCELS A, B, O, S, R. SEE HISTORICAL TOPOGRAPHIC MAPS, SANBORN MAPS, AND AERIAL PHOTOS.

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TDC 2/22/16
REVIEWED BY/DATE:
TLH 2/22/16
APPROVED BY/DATE:
TLH 3/2/16

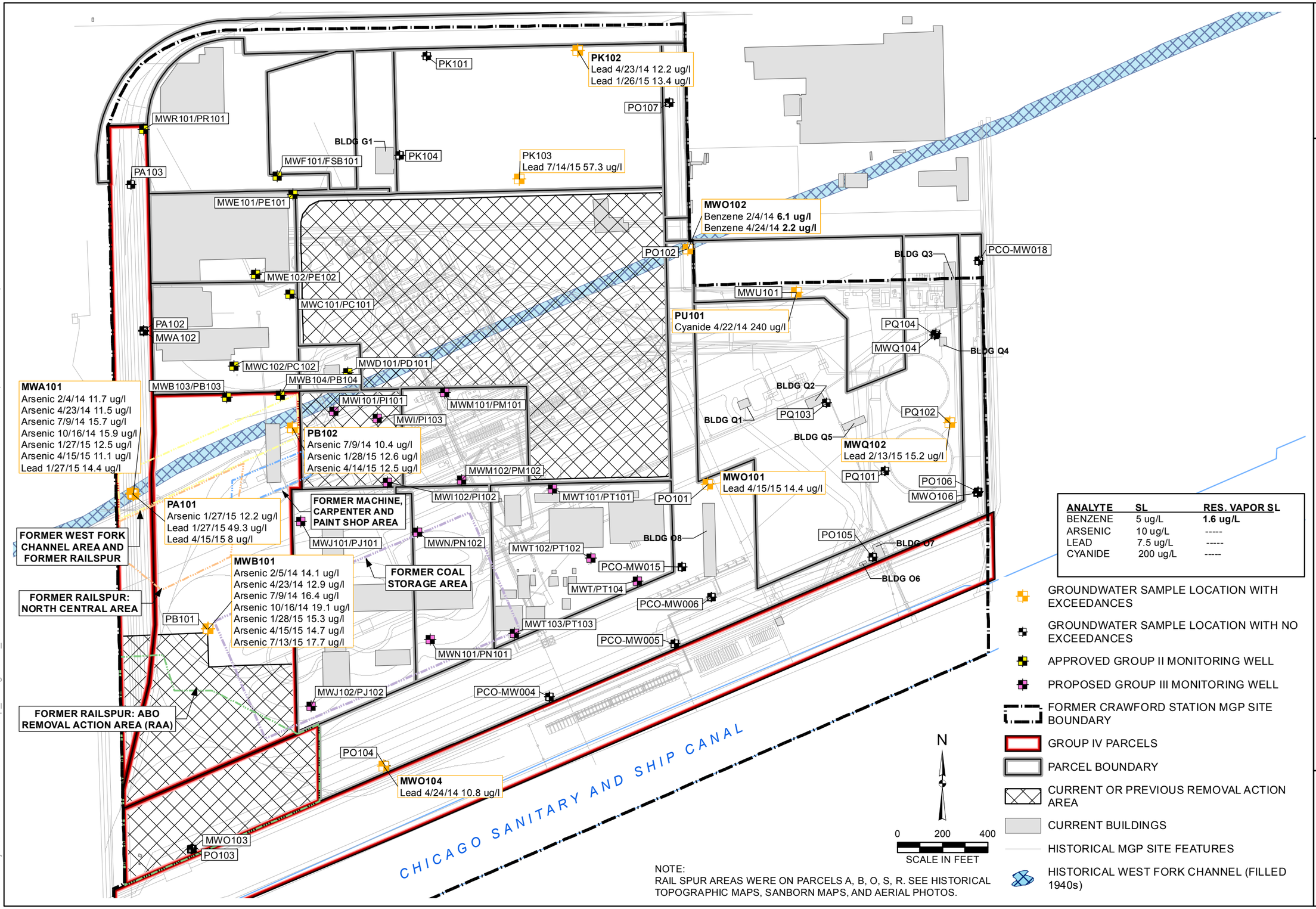
BACKGROUND SCREENING LEVEL EXCEEDANCES OF ARSENIC IN SOIL

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 13

NATURAL RESOURCE TECHNOLOGY



ANALYTE	SL	RES. VAPOR SL
BENZENE	5 ug/L	**1.6 ug/L**
ARSENIC	10 ug/L	-----
LEAD	7.5 ug/L	-----
CYANIDE	200 ug/L	-----

- GROUNDWATER SAMPLE LOCATION WITH EXCEEDANCES
- GROUNDWATER SAMPLE LOCATION WITH NO EXCEEDANCES
- APPROVED GROUP II MONITORING WELL
- PROPOSED GROUP III MONITORING WELL
- FORMER CRAWFORD STATION MGP SITE BOUNDARY
- GROUP IV PARCELS
- PARCEL BOUNDARY
- CURRENT OR PREVIOUS REMOVAL ACTION AREA
- CURRENT BUILDINGS
- HISTORICAL MGP SITE FEATURES
- HISTORICAL WEST FORK CHANNEL (FILLED 1940s)

NOTE:
RAIL SPUR AREAS WERE ON PARCELS A, B, O, S, R. SEE HISTORICAL TOPOGRAPHIC MAPS, SANBORN MAPS, AND AERIAL PHOTOS.

DRAWN BY/DATE: TDC 2/22/16
REVIEWED BY/DATE: TLH 2/22/16
APPROVED BY/DATE: TLH 3/2/16

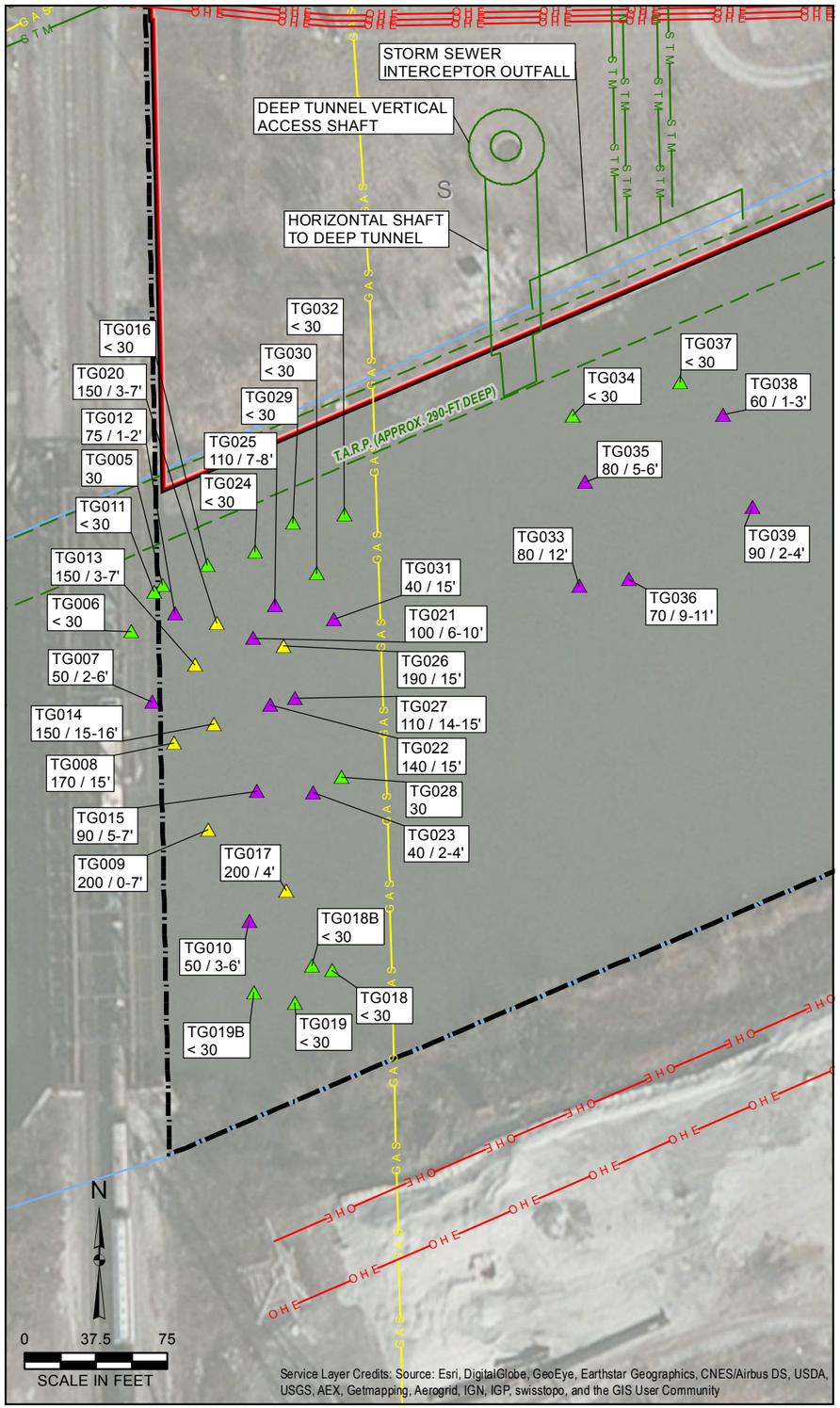
SL EXCEEDANCES FOR GROUNDWATER AND VAPOR INTRUSION JANUARY 2014 - JULY 2015

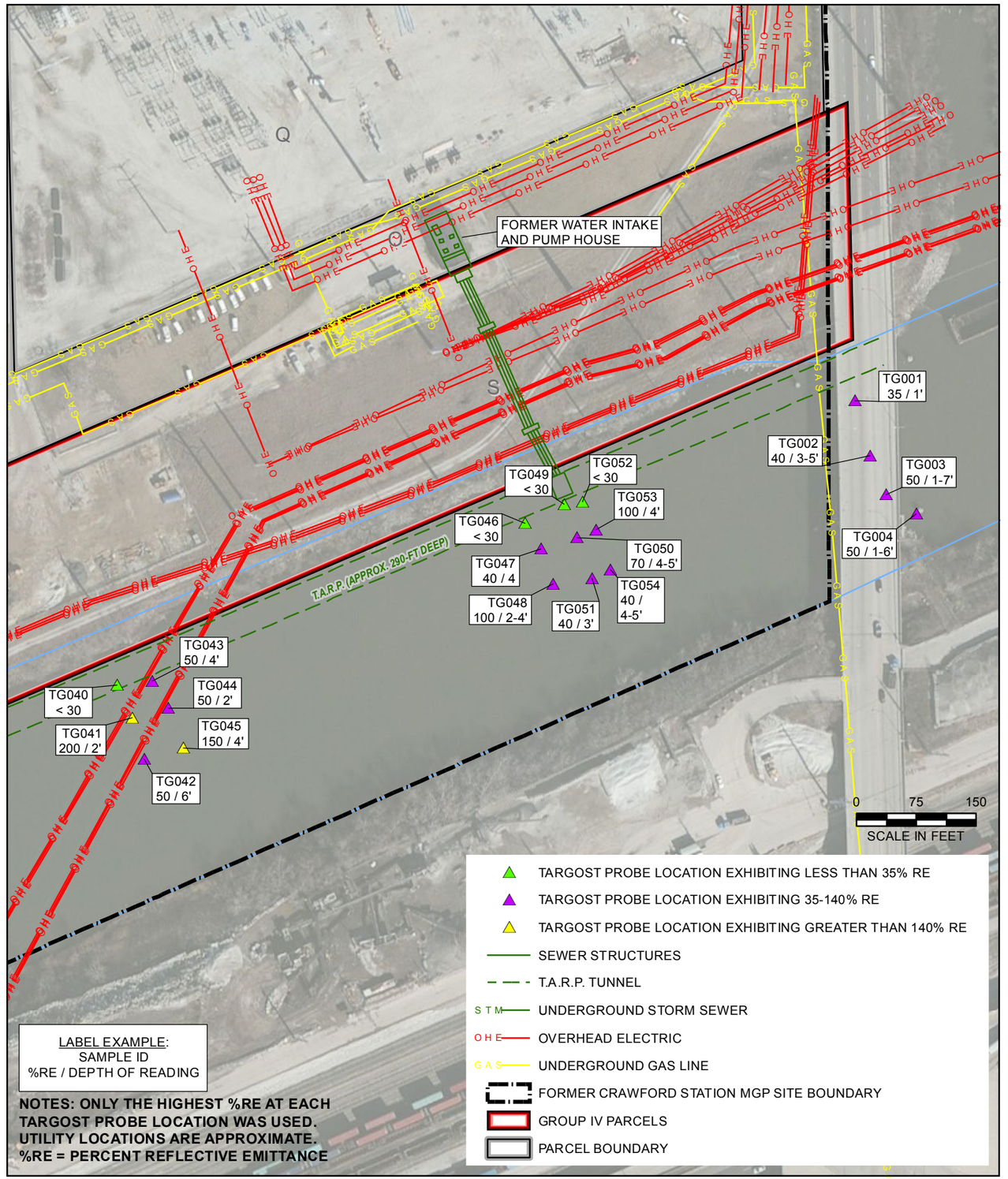
SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 14

NATURAL RESOURCE TECHNOLOGY





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TDC 2/22/16
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SLM 2/22/16
APPROVED BY/DATE:
TLH 3/2/16

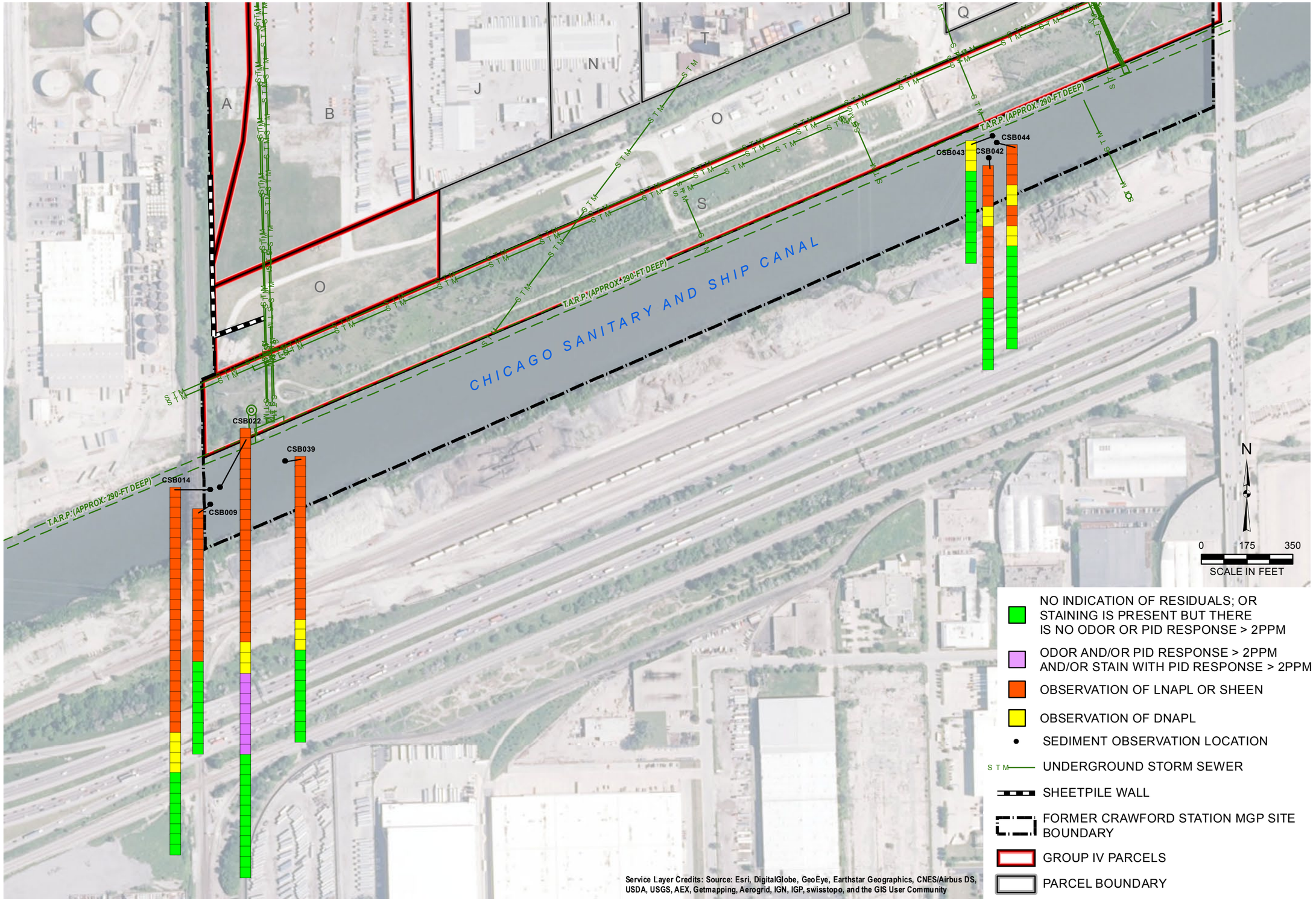
TARGOST PROBE LOCATIONS AND OBSERVATIONS

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 15

NATURAL RESOURCE TECHNOLOGY



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TDC 2/26/16
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TLH 2/26/16
APPROVED BY/DATE:
TLH 3/2/16

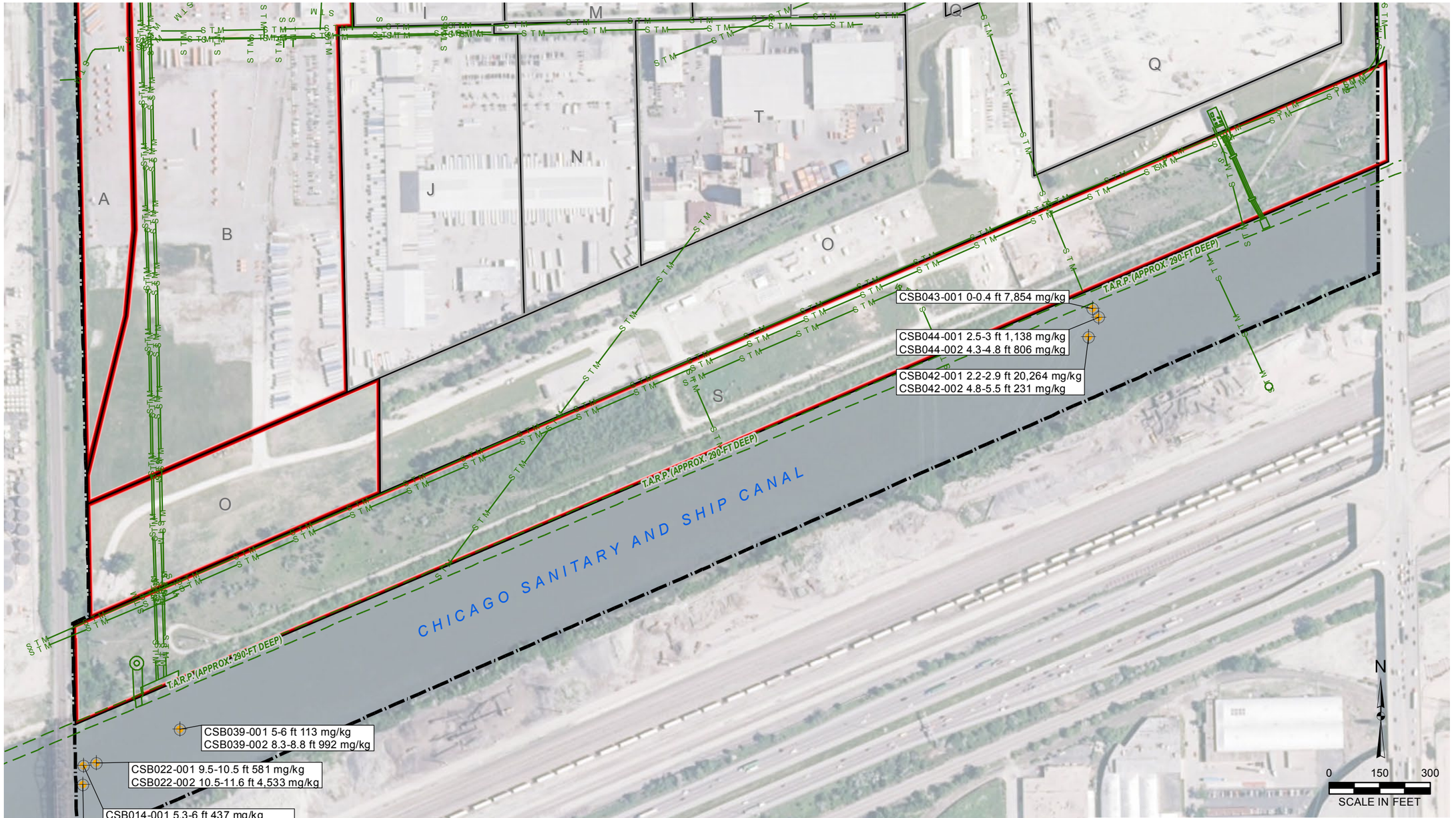
SEDIMENT BORING STICKLOGS

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 16

NATURAL RESOURCE TECHNOLOGY



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

NOTES:
SAMPLE LABELS IDENTIFY SAMPLE ID; SAMPLE DEPTH IN FEET BELOW MUDLINE; AND TOTAL PAH CONCENTRATION IN MG/KG

TOTAL PAH RESULTS CALCULATED BY SUMMING THE AVAILABLE RESULTS FOR THE FOLLOWING 13 PAHS: ACENAPHTHENE, ACENAPHTHYLENE, ANTHRACENE, BENZO(A)ANTHRACENE, BENZO(A)PYRENE, BENZO(B)FLUORANTHENE, BENZO(K)FLUORANTHENE, CHRYSENE, FLUORANTHENE, FLUORENE, NAPHTHALENE, PHENANTHRENE AND PYRENE.

BENZO(K)FLUORANTHENE CONCENTRATION NOT REPORTED BY META LABORATORIES.

TEC: THRESHOLD EFFECT CONCENTRATION, PEC: PROBABLE EFFECT CONCENTRATION
FT: FEET; MG: MILLIGRAM; KG: KILOGRAM

- SEDIMENT BORING LOCATION EXCEEDS TEC (1.61 mg/kg) AND PEC (22.8 mg/kg)
- STM — UNDERGROUND STORM SEWER
- FORMER CRAWFORD STATION MGP SITE BOUNDARY
- GROUP IV PARCELS
- PARCEL BOUNDARY

DRAWN BY/DATE: TDC 2/26/16
REVIEWED BY/DATE: TLH 2/26/16
APPROVED BY/DATE: TLH 3/2/16

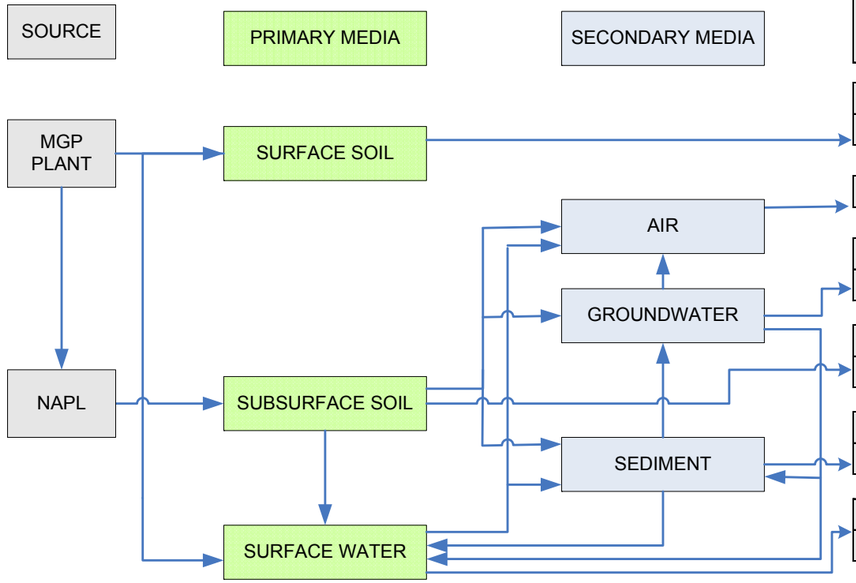
SEDIMENT BORING LOCATIONS AND SAMPLING RESULTS

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 17

NATURAL RESOURCE TECHNOLOGY



EXPOSURE ROUTE	HUMAN RECEPTORS				ECOLOGICAL RECEPTORS			
	INDUSTRIAL/ COMMERCIAL WORKER	CONSTRUCTION WORKER	VISITOR/ TRESPASSER/ RECREATOR	RESIDENTIAL	BIRDS	MAMMALS	FISH	BENTHIC INVERTEBRATES
INGESTION	●	●	●	●	○	○	NA	NA
DERMAL	●	●	●	●	○	○	NA	NA
INHALATION	●[a]	●[b]	○	●[a]	○	○	NA	NA
INGESTION	○[c]	○	○	○[c]	○	○	NA	NA
DERMAL	○[c]	●	○	○[c]	○	○	NA	NA
INGESTION	◒	◒	◒	◒	○	○	NA	NA
DERMAL	◒	◒	◒	◒	○	○	NA	NA
INGESTION	○	●	○	○	○	○	●	●
DERMAL	○	●	○	○	○	○	●	●
INGESTION	○	●	●	○	○	○	●	●
DERMAL	○	●	●	○	○	○	●	●

LEGEND:

● Pathway potentially complete and warrants further evaluation within the Baseline Risk Assessment.

◒ Pathway incomplete or considered insignificant under current land use condition, but potentially complete under hypothetical future land use scenario.

○ Pathway not complete or is potentially complete, but considered insignificant; No further evaluation is recommended.

[a] This pathway includes vapor intrusion into indoor air from subsurface sources.

[b] This pathway includes the potential migration of soil vapors into excavations created as part of construction activities.

[c] This pathway is incomplete, but was evaluated for informational purposes.

NA: Not Applicable

NAPL: nonaqueous-phase liquid

DRAWN BY/DATE: JLP 3/2/16
REVIEWED BY/DATE: TLH 3/2/16
APPROVED BY/DATE: TLH 3/2/16

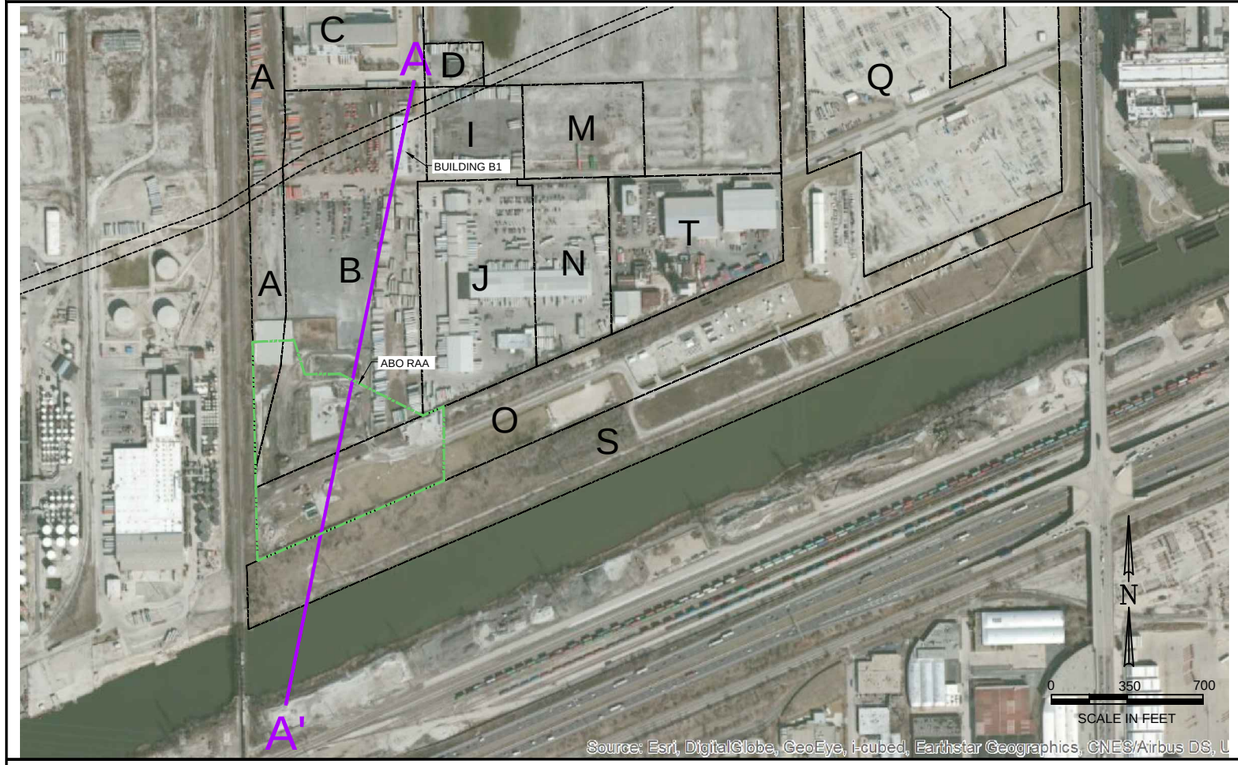
SITE-SPECIFIC CONCEPTUAL SITE MODEL

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 18

Natural Resource Technology

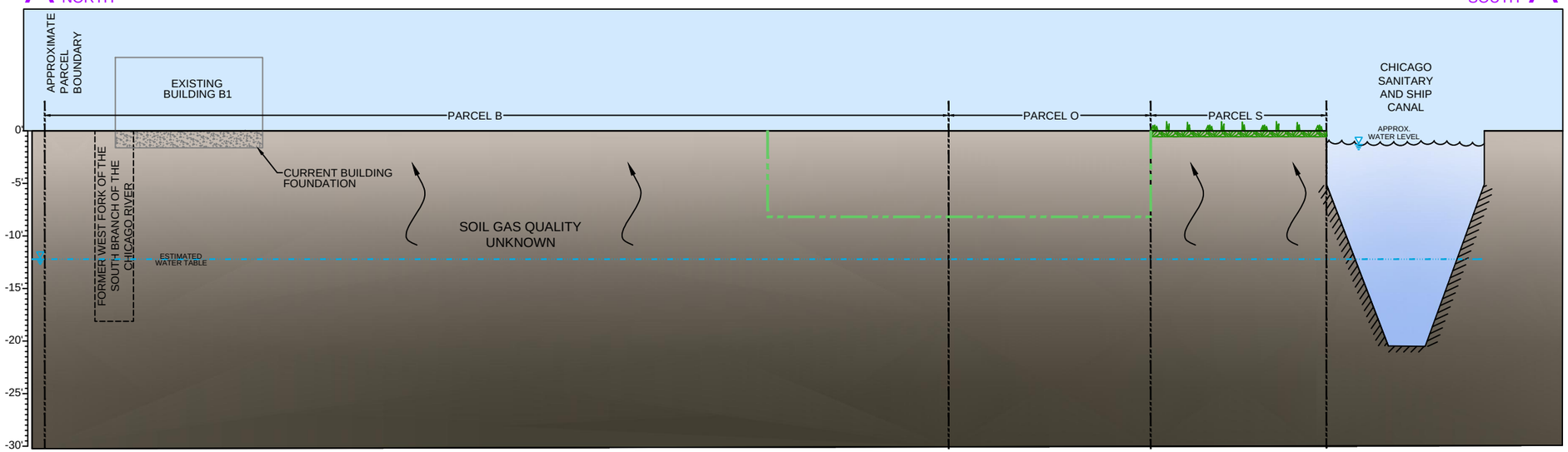


- APPROXIMATE AREA OF PRIOR EXCAVATION
- APPROXIMATE PARCEL BOUNDARY
- A — A' CROSS SECTION LINE
- ESTIMATED WATER TABLE
- HISTORICAL WEST FORK CHANNEL (FILLED 1940s)
- POTENTIAL MGP STRUCTURES
- CURRENT BUILDING FOUNDATION
- UNDERGROUND UTILITIES
- ASPHALT
- CRUSHED ASPHALT
- LANDSCAPED WITH GRASS
- CRUSHED CONCRETE WALL

NOTES:
1. DETAILS OF THE PRIOR EXCAVATION AREA CAN BE FOUND ON FIGURE 5, "PREVIOUS AND ONGOING REMOVAL ACTION"

SOURCE NOTES:
1. AERIAL PHOTO SOURCE: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEX, GETMAPPING AEROGRID, IGN, IGP, SWESSTOPO, AND THE GIS USER COMMUNITY.
2. DRAWING COODINATES ARE REFERENCED TO ILLINOIS STATE PLANE, NAD 83, EAST ZONE, US FOOT.

GENERALIZED LAND USE SCENARIO



VERTICAL SCALE IN FEET: 15
HORIZONTAL SCALE IN FEET: 240
VERTICAL EXAGGERATION = 16

DRAWN BY:	DMD	DATE: 10/22/15
CHECKED BY:	CCD	DATE: 02/25/16
APPROVED BY:	TLH	DATE: 03/02/16
DRAWING NO:	Figure 19_Graph Conc Site Model	
REFERENCE:		

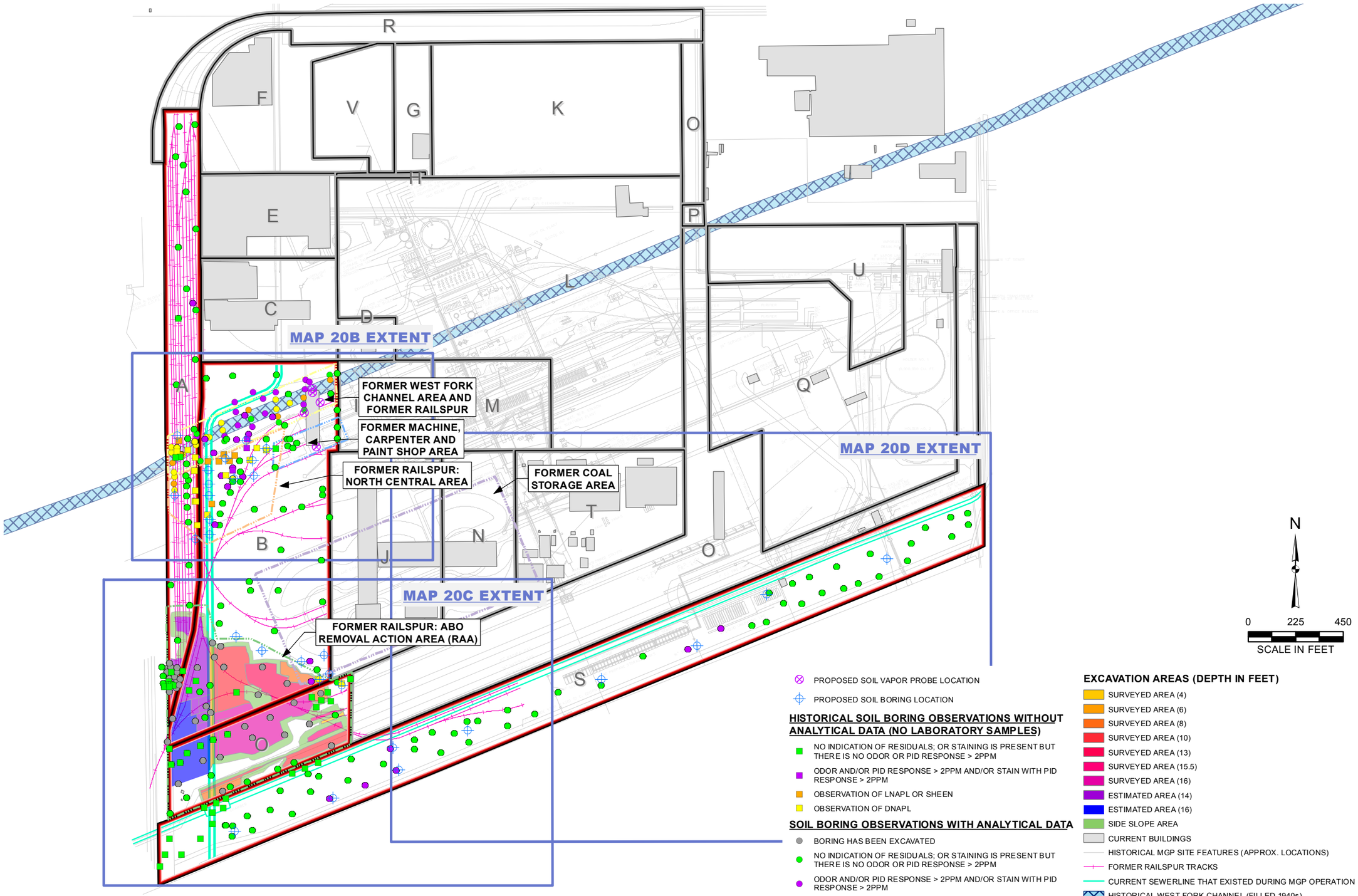
GRAPHICAL CONCEPTUAL SITE MODEL (GROUP IV PARCELS) (A-A')

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

NATURAL RESOURCE TECHNOLOGY

PROJECT NO.
2066/17.0

FIGURE NO.
19



N

0 225 450

SCALE IN FEET

NOTE:
RAIL SPUR AREAS WERE ON PARCELS A, B, O, S, R. SEE HISTORICAL TOPOGRAPHIC MAPS, SANBORN MAPS, AND AERIAL PHOTOS.

PROPOSED SOIL VAPOR PROBE LOCATION

PROPOSED SOIL BORING LOCATION

HISTORICAL SOIL BORING OBSERVATIONS WITHOUT ANALYTICAL DATA (NO LABORATORY SAMPLES)

- NO INDICATION OF RESIDUALS; OR STAINING IS PRESENT BUT THERE IS NO ODOR OR PID RESPONSE > 2PPM
- ODOR AND/OR PID RESPONSE > 2PPM AND/OR STAIN WITH PID RESPONSE > 2PPM
- OBSERVATION OF LNAPL OR SHEEN
- OBSERVATION OF DNAPL

SOIL BORING OBSERVATIONS WITH ANALYTICAL DATA

- BORING HAS BEEN EXCAVATED
- NO INDICATION OF RESIDUALS; OR STAINING IS PRESENT BUT THERE IS NO ODOR OR PID RESPONSE > 2PPM
- ODOR AND/OR PID RESPONSE > 2PPM AND/OR STAIN WITH PID RESPONSE > 2PPM
- OBSERVATION OF LNAPL OR SHEEN
- OBSERVATION OF DNAPL

EXCAVATION AREAS (DEPTH IN FEET)

- SURVEYED AREA (4)
- SURVEYED AREA (6)
- SURVEYED AREA (8)
- SURVEYED AREA (10)
- SURVEYED AREA (13)
- SURVEYED AREA (15.5)
- SURVEYED AREA (16)
- ESTIMATED AREA (14)
- ESTIMATED AREA (16)
- SIDE SLOPE AREA
- CURRENT BUILDINGS
- HISTORICAL MGP SITE FEATURES (APPROX. LOCATIONS)
- FORMER RAILSPUR TRACKS
- CURRENT SEWERLINE THAT EXISTED DURING MGP OPERATION
- HISTORICAL WEST FORK CHANNEL (FILLED 1940s)
- GROUP IV PARCELS
- PARCEL BOUNDARY

DRAWN BY/DATE: TDC 2/22/16
REVIEWED BY/DATE: TLH 2/22/16
APPROVED BY/DATE: TLH 3/2/16

PROPOSED UPLAND SAMPLING LOCATIONS

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 20A

NATURAL RESOURCE TECHNOLOGY

PROPOSED UPLAND SOIL AND SAMPLING LOCATIONS PARCELS A AND B NORTH

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

DRAWN BY/DATE: TDC 2/26/16
REVIEWED BY/DATE: TLH 2/26/16
APPROVED BY/DATE: TLH 3/2/16

PROJECT NO. 2066

FIGURE NO. 20B

NATURAL RESOURCE TECHNOLOGY

FORMER WEST FORK CHANNEL AREA AND FORMER RAILSPUR

FORMER MACHINE, CARPENTER AND PAINT SHOP AREA

FORMER RAILSPUR: NORTH CENTRAL AREA

FORMER COAL STORAGE AREA

BSV1 BSV2 BSV3 BSV4 BSV5

ASB101 ASB102 ASB103

MWA101

BSB101 BSB102 BSB103 BSB104 BSB105 BSB106 BSB107 BSB108 BSB109 BSB110 BSB111

NOTE:
RAIL SPUR AREAS WERE ON PARCELS A, B, O, S, R.
SEE HISTORICAL AERIAL PHOTOS.

N

0 50 100
SCALE IN FEET

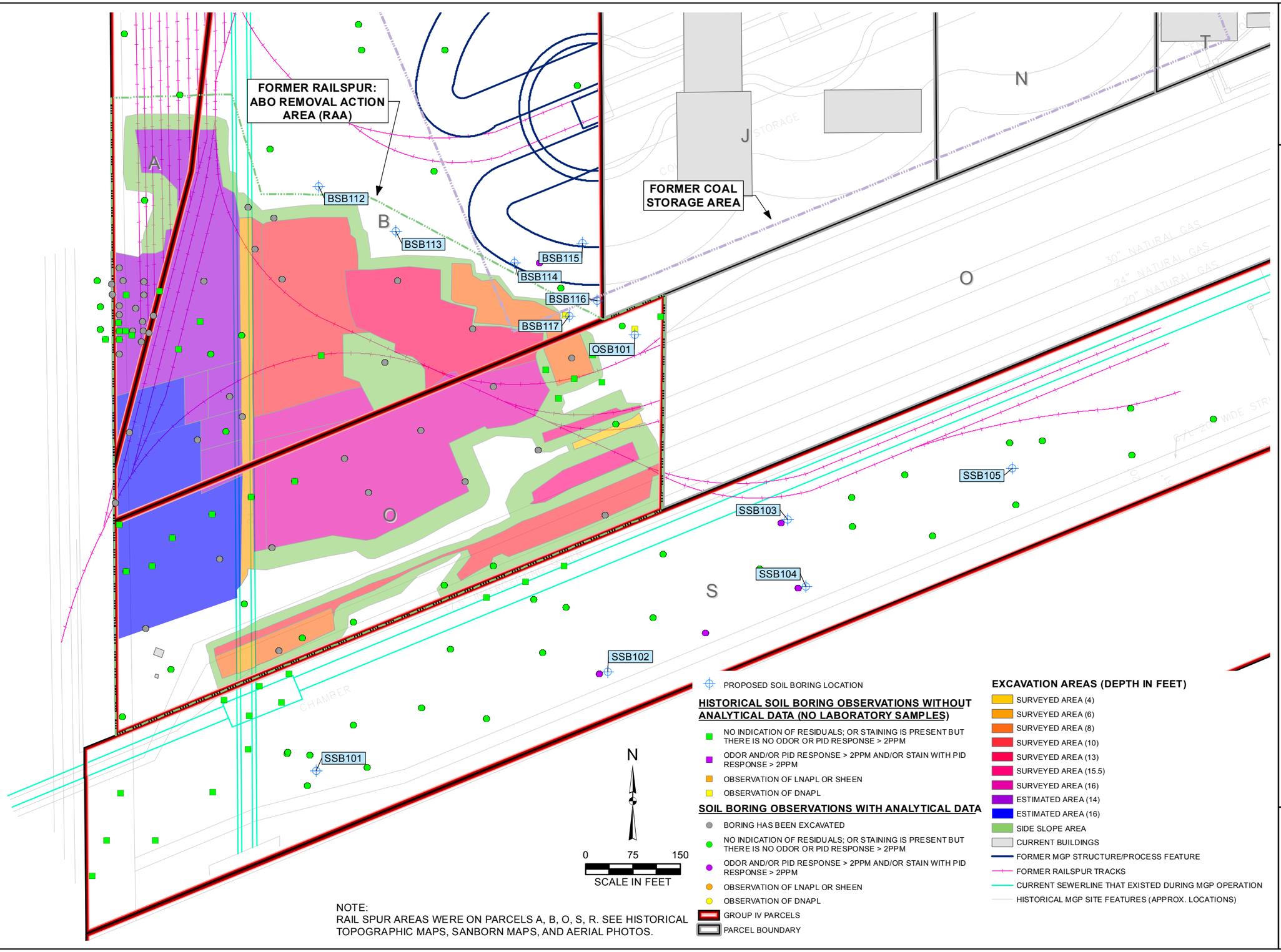
- MONITORING WELL LOCATION
- SOIL BERM FEATURE
- PROPOSED SOIL VAPOR PROBE LOCATION
- PROPOSED SOIL BORING LOCATION

HISTORICAL SOIL BORING OBSERVATIONS WITHOUT ANALYTICAL DATA (NO LABORATORY SAMPLES)

- NO INDICATION OF RESIDUALS; OR STAINING IS PRESENT BUT THERE IS NO ODOR OR PID RESPONSE > 2PPM
- ODOR AND/OR PID RESPONSE > 2PPM AND/OR STAIN WITH PID RESPONSE > 2PPM
- OBSERVATION OF LNAPL OR SHEEN
- OBSERVATION OF DNAPL

SOIL BORING OBSERVATIONS WITH ANALYTICAL DATA

- BORING HAS BEEN EXCAVATED
- EXCAVATION CONFIRMATION SAMPLE - NO OBSERVATION MADE
- NO INDICATION OF RESIDUALS; OR STAINING IS PRESENT BUT THERE IS NO ODOR OR PID RESPONSE > 2PPM
- ODOR AND/OR PID RESPONSE > 2PPM AND/OR STAIN WITH PID RESPONSE > 2PPM
- OBSERVATION OF LNAPL OR SHEEN
- OBSERVATION OF DNAPL
- GROUP IV PARCELS
- PARCEL BOUNDARY
- CURRENT BUILDINGS
- FORMER MGP STRUCTURE/PROCESS FEATURE
- FORMER RAILSPUR TRACKS
- CURRENT SEWERLINE THAT EXISTED DURING MGP OPERATION
- HISTORICAL MGP SITE FEATURES (APPROX. LOCATIONS)
- HISTORICAL WEST FORK CHANNEL (FILLED 1940s)



NOTE:
RAIL SPUR AREAS WERE ON PARCELS A, B, O, S, R. SEE HISTORICAL TOPOGRAPHIC MAPS, SANBORN MAPS, AND AERIAL PHOTOS.

PROPOSED SOIL BORING LOCATION

HISTORICAL SOIL BORING OBSERVATIONS WITHOUT ANALYTICAL DATA (NO LABORATORY SAMPLES)

- NO INDICATION OF RESIDUALS; OR STAINING IS PRESENT BUT THERE IS NO ODOR OR PID RESPONSE > 2PPM
- ODOR AND/OR PID RESPONSE > 2PPM AND/OR STAIN WITH PID RESPONSE > 2PPM
- OBSERVATION OF LNAPL OR SHEEN
- OBSERVATION OF DNAPL

SOIL BORING OBSERVATIONS WITH ANALYTICAL DATA

- BORING HAS BEEN EXCAVATED
- NO INDICATION OF RESIDUALS; OR STAINING IS PRESENT BUT THERE IS NO ODOR OR PID RESPONSE > 2PPM
- ODOR AND/OR PID RESPONSE > 2PPM AND/OR STAIN WITH PID RESPONSE > 2PPM
- OBSERVATION OF LNAPL OR SHEEN
- OBSERVATION OF DNAPL
- GROUP IV PARCELS
- PARCEL BOUNDARY

EXCAVATION AREAS (DEPTH IN FEET)

- SURVEYED AREA (4)
- SURVEYED AREA (6)
- SURVEYED AREA (8)
- SURVEYED AREA (10)
- SURVEYED AREA (13)
- SURVEYED AREA (15.5)
- SURVEYED AREA (16)
- ESTIMATED AREA (14)
- ESTIMATED AREA (16)
- SIDE SLOPE AREA
- CURRENT BUILDINGS
- FORMER MGP STRUCTURE/PROCESS FEATURE
- FORMER RAILSPUR TRACKS
- CURRENT SEWERLINE THAT EXISTED DURING MGP OPERATION
- HISTORICAL MGP SITE FEATURES (APPROX. LOCATIONS)

DRAWN BY/DATE: TDC 2/26/16
REVIEWED BY/DATE: TLH 2/26/16
APPROVED BY/DATE: TLH 3/2/16

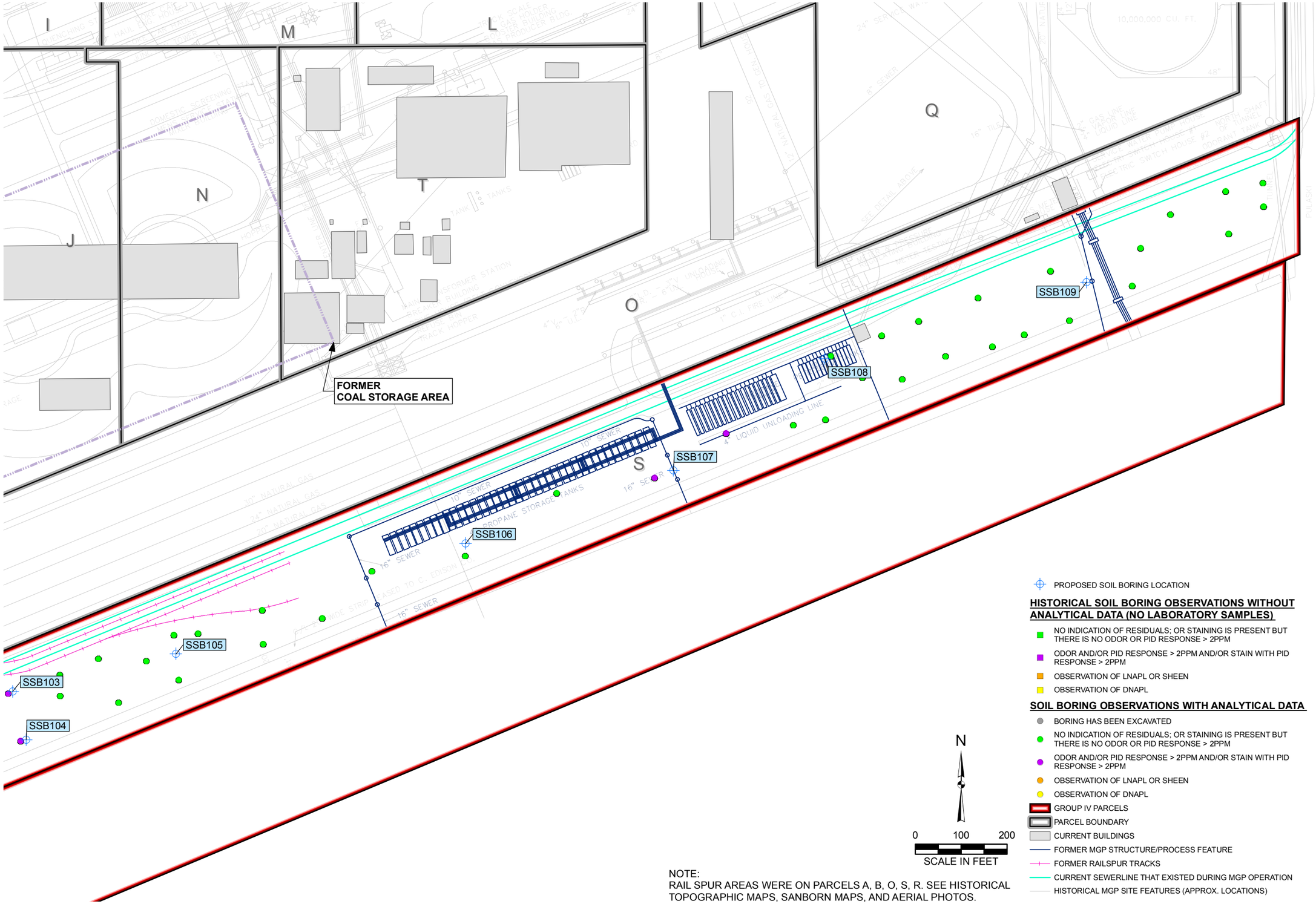
PROPOSED UPLAND SAMPLING LOCATIONS PARCELS A, B, O AND S SOUTH

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 20C

NATURAL RESOURCE TECHNOLOGY



NOTE:
RAIL SPUR AREAS WERE ON PARCELS A, B, O, S, R. SEE HISTORICAL TOPOGRAPHIC MAPS, SANBORN MAPS, AND AERIAL PHOTOS.

DRAWN BY/DATE:
TDC 2/22/16
REVIEWED BY/DATE:
TLH 2/22/16
APPROVED BY/DATE:
TLH 3/2/16

PROPOSED UPLAND SAMPLING LOCATIONS PARCEL S EAST

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

PROJECT NO. 2066

FIGURE NO. 20D

NATURAL RESOURCE TECHNOLOGY

Y:\GIS\Projects\20\2066\MXD\SSWP\Group_IV\Figure 20D_Proposed Sampling Locations_Parcel S East.mxd Author: tcushman; Date/Time: 3/3/2016, 2:13:16 PM

PROPOSED GROUP IV MONITORING WELL AND PIEZOMETER LOCATIONS

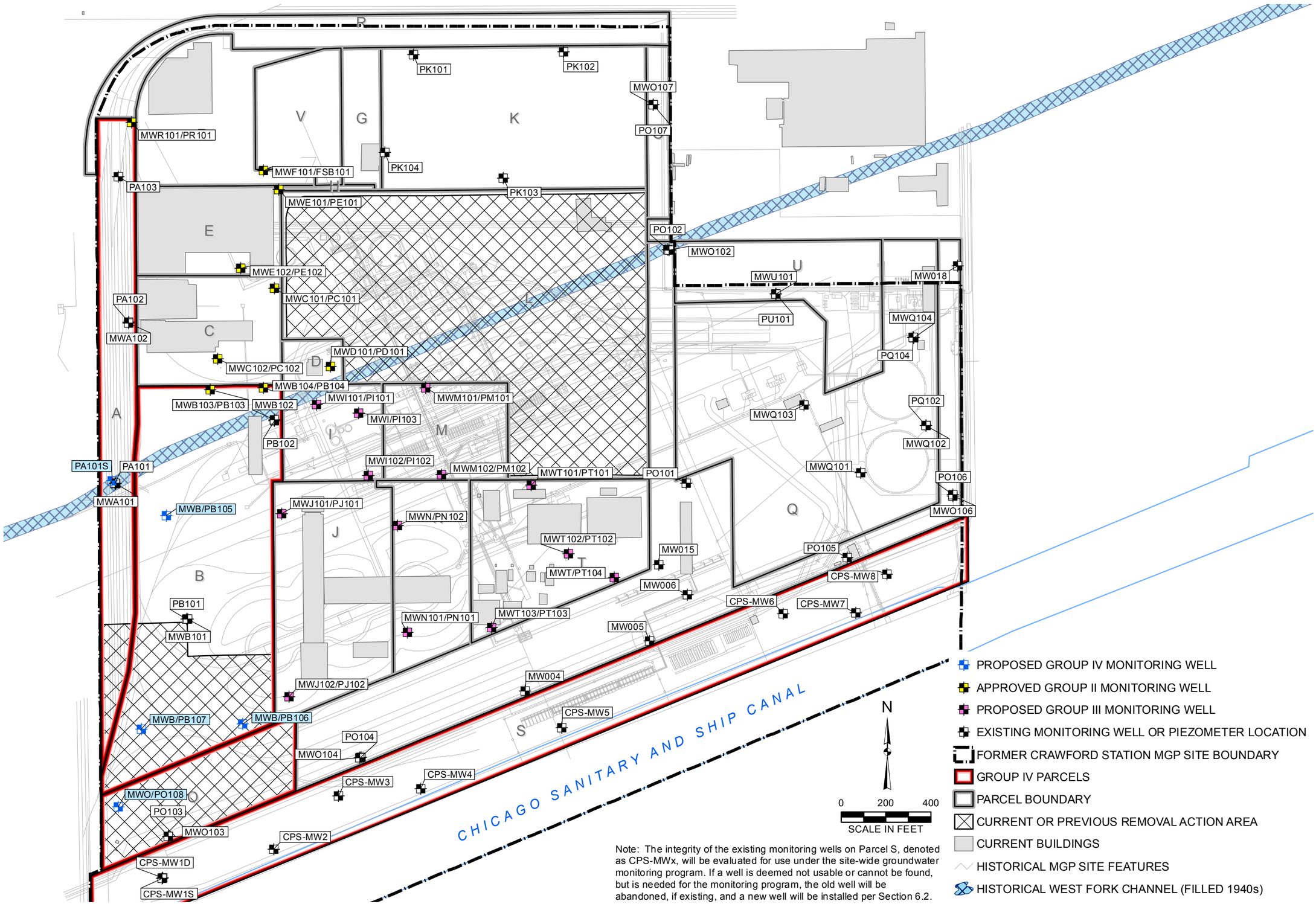
SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

DRAWN BY/DATE: TDC 11/23/15
REVIEWED BY/DATE: TLH 11/23/15
APPROVED BY/DATE: TLH 12/7/15

PROJECT NO. 2066

FIGURE NO. 21

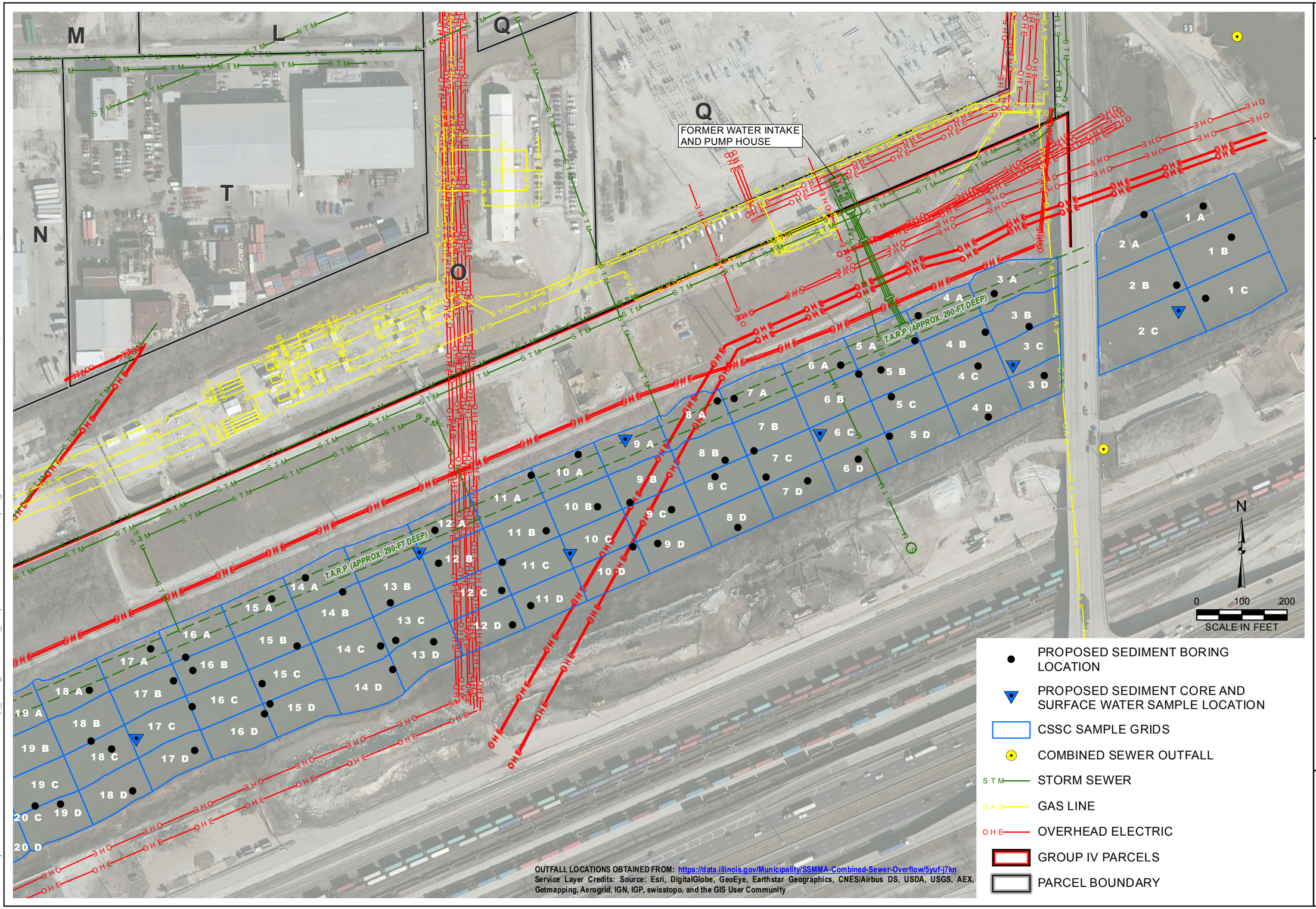
NATURAL RESOURCE TECHNOLOGY



Note: The integrity of the existing monitoring wells on Parcel S, denoted as CPS-MWx, will be evaluated for use under the site-wide groundwater monitoring program. If a well is deemed not usable or cannot be found, but is needed for the monitoring program, the old well will be abandoned, if existing, and a new well will be installed per Section 6.2.

- PROPOSED GROUP IV MONITORING WELL
- APPROVED GROUP II MONITORING WELL
- PROPOSED GROUP III MONITORING WELL
- EXISTING MONITORING WELL OR PIEZOMETER LOCATION
- FORMER CRAWFORD STATION MGP SITE BOUNDARY
- GROUP IV PARCELS
- PARCEL BOUNDARY
- CURRENT OR PREVIOUS REMOVAL ACTION AREA
- CURRENT BUILDINGS
- HISTORICAL MGP SITE FEATURES
- HISTORICAL WEST FORK CHANNEL (FILLED 1940s)

Y:\GIS\Projects\2012066\MXD\SSWP\Group_IV\Figure 21_Proposed Group IV Monitoring Well and Piezometer Locations.mxd Author: tcushman Date/Time: 2/15/2016, 12:40:50 PM



OUTFALL LOCATIONS OBTAINED FROM: https://data.illinois.gov/Municipality/SSMMA-Combined-Sewer-Overflow/5yuf-j7kn
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

PROPOSED SEDIMENT BORING AND SURFACE WATER SAMPLING LOCATIONS

SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

DRAWN BY/DATE:
TDC 2/15/16
REVIEWED BY/DATE:
SLM 2/15/16
APPROVED BY/DATE:
TLH 3/2/16

PROJECT NO. 2066

FIGURE NO. 22A

NATURAL RESOURCE TECHNOLOGY

Y:\GIS\Projects\20\2066MXD\SSWP\Group_IV\Figure 22A-B_Proposed Sediment Sampling Locations.mxd Author: tcushman; Date/Time: 3/2/2016, 11:50:47 AM

PROPOSED SEDIMENT BORING AND SURFACE WATER SAMPLING LOCATIONS

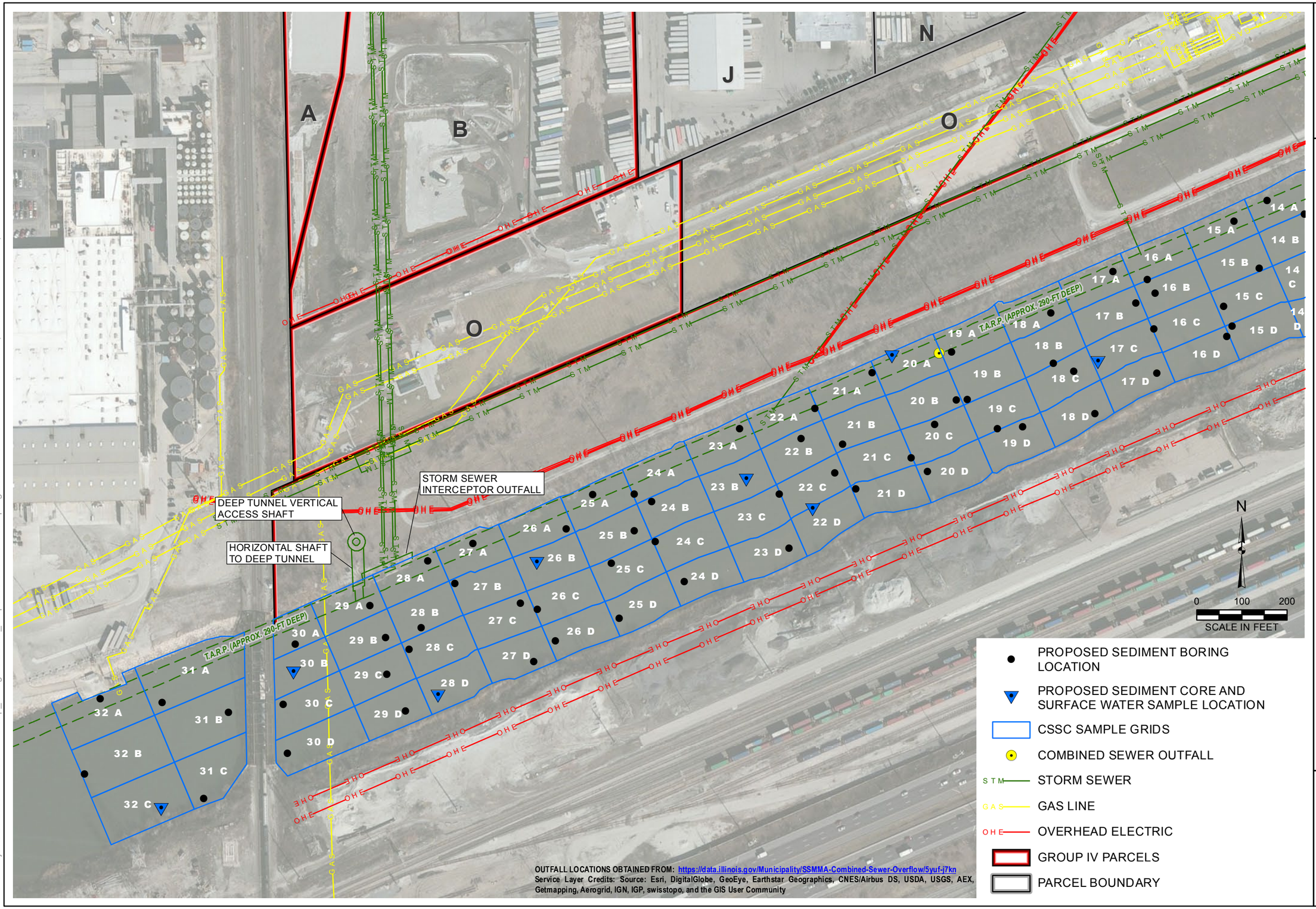
SITE-SPECIFIC WORK PLAN, REVISION 1
GROUP IV PARCELS, CRAWFORD STATION FORMER MGP SITE
CHICAGO, ILLINOIS

DRAWN BY/DATE: TDC 2/15/16
REVIEWED BY/DATE: SLM 2/15/16
APPROVED BY/DATE: TLH 3/2/16

PROJECT NO. 2066

FIGURE NO. 22B

NATURAL RESOURCE TECHNOLOGY



OUTFALL LOCATIONS OBTAINED FROM: https://data.illinois.gov/Municipality/SSMMA-Combined-Sewer-Overflow/5yuf-j7kn
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

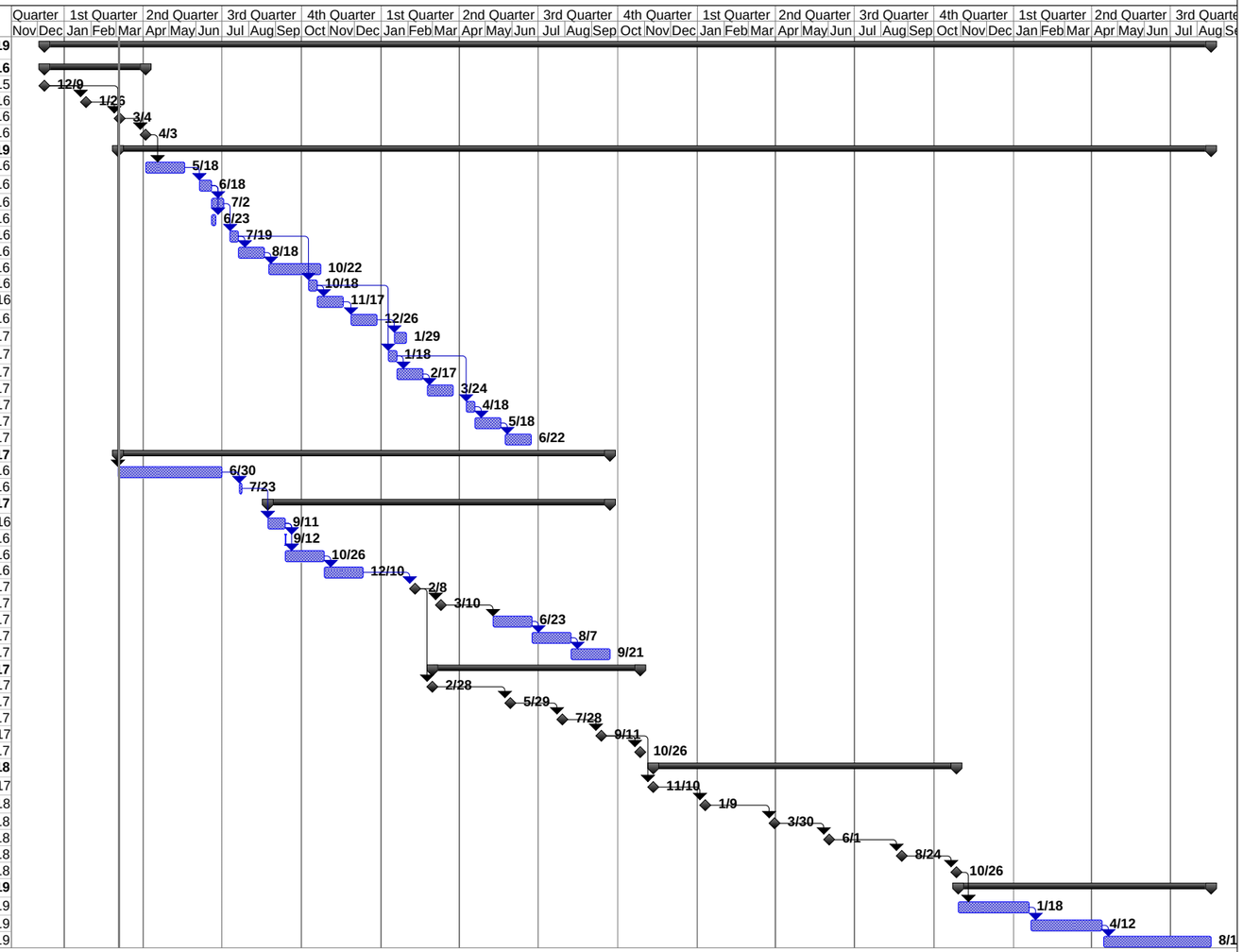
Y:\GIS\Projects\20\2066\MXD\SSWP\Group_IV\Figure 22A-B_Proposed Sediment Sampling Locations.mxd Author: tcushman; Date/Time: 3/2/2016, 11:49:44 AM

FIGURE 23
Proposed Schedule

Date:March 4, 2016

Crawford Station Group IV Peoples Gas Light and Coke Company Former Manufactured Gas Plant
CERCLA Docket No. V-W-08-C-917

ID	Task Name	Duration	Start	Finish
1	**Crawford Station Site ID: SSID B5HK**	**1193 days**	**Wed 12/9/15**	**Fri 8/16/19**
2	**Project Planning - Parcel Group 4**	**117 days**	**Wed 12/9/15**	**Sun 4/3/16**
3	Submit Site Specific Work Plan - Revision 0 to USEPA	0 days	Wed 12/9/15	Wed 12/9/15
4	Received USEPA Comments on Draft SSWP Revision 0	0 days	Tue 1/26/16	Tue 1/26/16
5	Submit Site Specific Work Plan Revision 1 to USEPA	0 days	Fri 3/4/16	Fri 3/4/16
6	USEPA Approves SSWP Revision 1	0 days	Sun 4/3/16	Sun 4/3/16
7	**Initiate RI Field Work - Parcel Group 4**	**1108 days**	**Thu 3/3/16**	**Fri 8/16/19**
8	Contractor Procurement and Permitting	45 days	Mon 4/4/16	Wed 5/18/16
9	Soil Boring Installation/Sampling	14 days	Sun 6/5/16	Sat 6/18/16
10	Groundwater Monitoring Well Installation/Development	14 days	Sun 6/19/16	Sat 7/2/16
11	Soil Gas Probe Installation	5 days	Sun 6/19/16	Thu 6/23/16
12	First Quarter RI GW and Soil Gas Sampling	10 days	Sun 7/10/16	Tue 7/19/16
13	Laboratory Analysis (first Quarter gw, soil gas, and soil)	30 days	Wed 7/20/16	Thu 8/18/16
14	Data Validation (first Quarter gw, soil gas, and soil)	60 days	Wed 8/24/16	Sat 10/22/16
15	Second Quarter RI GW and Soil Gas Sampling	10 days	Sun 10/9/16	Tue 10/18/16
16	Laboratory Analysis (second Quarter gw and soil gas)	30 days	Wed 10/19/16	Thu 11/17/16
17	Data Validation (second Quarter gw and soil gas)	30 days	Sun 11/27/16	Mon 12/26/16
18	Data Gap Analysis	14 days	Mon 1/16/17	Sun 1/29/17
19	Third Quarter RI GW Sampling	10 days	Mon 1/9/17	Wed 1/18/17
20	Laboratory Analysis (third Quarter gw)	30 days	Thu 1/19/17	Fri 2/17/17
21	Data Validation (third Quarter gw)	30 days	Thu 2/23/17	Fri 3/24/17
22	Fourth Quarter RI GW Sampling	10 days	Sun 4/9/17	Tue 4/18/17
23	Laboratory Analysis (fourth Quarter gw)	30 days	Wed 4/19/17	Thu 5/18/17
24	Data Validation (fourth Quarter gw)	30 days	Wed 5/24/17	Thu 6/22/17
25	**River Investigation**	**568 days**	**Thu 3/3/16**	**Thu 9/21/17**
26	Contractor Procurement and Permitting	120 days	Thu 3/3/16	Thu 6/30/16
27	Bathymetric, Side-Scan, Sub-Bottom Sonar Surveys	3 days	Thu 7/21/16	Sat 7/23/16
28	**Sediment/Surface Water Sampling**	**395 days**	**Tue 8/23/16**	**Thu 9/21/17**
29	Sediment Delineation	20 days	Tue 8/23/16	Sun 9/11/16
30	Surface Water Sampling	1 day	Mon 9/12/16	Mon 9/12/16
31	Laboratory Analysis	45 days	Mon 9/12/16	Wed 10/26/16
32	Sediment Sample Validation	45 days	Thu 10/27/16	Sat 12/10/16
33	Submit Sediment Sampling Tech Memo to USEPA	0 days	Wed 2/8/17	Wed 2/8/17
34	Receive USEPA Comments on Sediment Sampling Tech Memo	0 days	Fri 3/10/17	Fri 3/10/17
35	Data Gap Sediment Sampling, if necessary	45 days	Wed 5/10/17	Fri 6/23/17
36	Data Gap Laboratory Analysis, if necessary	45 days	Sat 6/24/17	Mon 8/7/17
37	Data Gap Data Validation, if necessary	45 days	Tue 8/8/17	Thu 9/21/17
38	**Prepare RI Report - Parcel Group 4**	**240 days**	**Tue 2/28/17**	**Thu 10/26/17**
39	Review Preliminary RI Data with USEPA	0 days	Tue 2/28/17	Tue 2/28/17
40	Submit RI Rpt - Rev 0 to USEPA	0 days	Mon 5/29/17	Mon 5/29/17
41	Receive USEPA Comments on RI Rpt - Rev 0	0 days	Fri 7/28/17	Fri 7/28/17
42	Submit RI Rpt - Rev 1 to USEPA	0 days	Mon 9/11/17	Mon 9/11/17
43	USEPA Approves RI Rpt - Rev 1	0 days	Thu 10/26/17	Thu 10/26/17
44	**Prepare FS Report - Parcel Group 4**	**280 days**	**Fri 11/10/17**	**Fri 10/26/18**
45	Submit Alternatives Array Tech Memo to USEPA	0 days	Fri 11/10/17	Fri 11/10/17
46	Receive USEPA Comments on Alternatives Array Tech Memo	0 days	Tue 1/9/18	Tue 1/9/18
47	Submit FS Rpt - Rev 0 to USEPA	0 days	Fri 3/30/18	Fri 3/30/18
48	Receive USEPA Comments on FS Rpt - Rev 0	0 days	Fri 6/1/18	Fri 6/1/18
49	Submit FS Rpt - Rev 1 to USEPA	0 days	Fri 8/24/18	Fri 8/24/18
50	USEPA approves FS Rpt - Rev 1	0 days	Fri 10/26/18	Fri 10/26/18
51	**Record of Decision**	**210 days**	**Mon 10/29/18**	**Fri 8/16/19**
52	USEPA prepares Prelminary Remedial Action Plan	60 days	Mon 10/29/18	Fri 1/18/19
53	Preliminary Remedial Action Plan Public Review	60 days	Mon 1/21/19	Fri 4/12/19
54	USEPA issues Record of Decision	90 days	Mon 4/15/19	Fri 8/16/19



Project: \\pewfle\projects\1500\1515\Status Meeting Agend
Date: 03/04/16

Task	Rolled Up Milestone	Project Summary	Inactive Summary	Manual Summary			
Milestone	Rolled Up Progress	Group By Summary	Manual Task	Start-only			
Summary	Split	Inactive Task	Duration-only	Finish-only			
Rolled Up Task	External Tasks	Inactive Milestone	Manual Summary Rollup	Progress			

1. This preliminary schedule is dependent on USEPA-approval and weather conditions to completed field investigations.

TABLES 1, 4, 6, 7, 8, 10, 11

(TABLES 2, 3, 5, 9 INCLUDED ON CD)

Table 1: Site-Specific COPCs for Soil, Groundwater, and Soil Gas
Site-Specific Work Plan, Addendum 3 (Group IV)
Crawford Station Former MGP Site - Chicago, IL
EPA ID# ILN000510192

COPCs	Parcels Upland (Parcels A, B, S and Part of O)
Soil	
PVOCs[1]	X
SVOCs[2]	X
PAHs[3]	X
Metals[4]	
Total Antimony	X
Total Arsenic	X
Total Lead	X
Total Thallium	X
Total Mercury	X
Total Cyanide	X
Groundwater	
PVOCs[1]	X
SVOCs[2]	X
PAHs[3]	X
Metals[4]	
Total/Dissolved Antimony	X
Total/Dissolved Arsenic	X
Total/Dissolved Cadmium	X
Total/Dissolved Chromium	X
Total/Dissolved Lead	X
Total/Dissolved Mercury	X
Total/Dissolved Nickel	X
Total/Dissolved Selenium	X
Total/Dissolved Thallium	X
Available Cyanide	X
Soil Gas [5]	
Multi-Site RAF PVOCs	X
Naphthalene	X

NOTES:

1. PVOC list of COPCs - benzene, ethylbenzene, toluene, m&p-xylenes, o-xylene, total xylenes, 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene.

2. SVOC list of COPCs - 2,4-dimethylphenol, 2-methylphenol, 3&4-methylphenol, phenol, carbazole and dibenzofuran.

3. PAH list of COPCs - acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)flouranthene, benzo(ghi)perylene, benzo(k)flouranthene, chrysene, dibenz(a,h)anthracene, flouranthene, flourene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene and 2-methylnaphthalene.

4. Metal list of COPCs - antimony, arsenic, cadmium, chromium, lead, mercury, nickel, selenium, and thallium. These were detected at least once in the media and above the MDLs at a frequency greater than 5%.

5. On Parcel B, soil vapor samples will be completed as part of initial field work.

X - Parameter selected as COPC

COPC - Constituents of potential concern

PAH - Polycyclic aromatic hydrocarbon

PVOC - Petroleum VOC

Table 4: Observed Tar-Like Material in Sediment Borings Summary
Site-Specific Work Plan, Addendum 3 (Group IV)
Crawford Station Former MGP Site
Chicago, IL
EPA ID# ILN000510192

Probe Number	Observation Depth (feet below mudline) of Tar-Like Material	Depth of native Material (feet below mudline)[1]	Matrix from Boring Logs	Notes	Summary
Chicago Sanitary and Shipping Canal-Adjacent to Parcel S					
CSB009	--	7.4	--	--	--
CSB014	12 - 13.7	13.7	Coarse to fine sand	Tar saturated straw-like material, little animal hair, strong tar-like odor	Above native material
CSB022	10.5 - 11.6	17	Coarse to fine sand with gravel, medium dense	Tar saturated, little cinders, trace coal fragments, strong tar-like odor	Above native material
CSB039	8.3 - 9.2	9.2	Coarse to fine sand, trace silt, loose	Tar coated, heavy sheen, heavy tar-like odors	Above native material
CSB042	2.2 - 2.9	6.4	Coarse to fine Sand, some coarse to fine gravel, loose	Tar saturated, strong tar-like odor	Above native material
CSB043	0 - 1.2	1.2	Coarse to fine sand with coarse to fine gravel, loose	Tar coated, heavy sheen, heavy tar-like odors	Above native material
CSB044	2 - 3 and 4 - 4.8	4.8	Coarse to fine sand, some silt, trace fine gravel, very loose	Trace coal fragments, sheen to tar coated, strong tar odor	Above native material

Notes: [1] Native material defined as continuous layer of medium stiff to hard clay

Table 6: Upland Sampling and Analysis Plan Summary
Site-Specific Work Plan, Addendum 3 (Group IV)
Crawford Station Former MGP Site
Chicago, IL
EPA ID# ILN000510192

Sample Type	Sample Frequency	Estimated Number of Samples[1]	Parameter	Method	Field Duplicates[2] (1 extra volume)	MS/MSD[3] (2 extra volumes)	Equipment Blanks	Trip Blanks	TOTAL[4] (excludes Equipment Blanks and Trip Blanks)	Estimated No. of Containers	Container Type	Minimum Volume	Preservation (Cool All Samples to 4° ± 2°C Unless 'None' Indicated)	Holding Time from Sample Date
Soil														
Soil Parcels S (HHRA and Feasibility Study)	9 borings 9 surface (0-6") samples or near surface (6"-24") sample[9] (1 per boring) 18 subsurface (>24") samples[10] (Up to 2 per boring, 1 as an effected sample and 1 as a clean sample in clay)	27	PVOCs[7]	5035/8260B	Number of field duplicates is calculated based on the total number of soil samples collected as shown in the "Soil QA/QC Summary" Row	Number of MS/MSD samples is calculated based on the total number of soil samples collected as shown in the "Soil QA/QC Summary" Row	Equipment blanks will be collected at a frequency of 1 per soil or sediment sampling day with non-dedicated sampling equipment.	PVOC trip blank will accompany each cooler containing PVOC samples.	27	27 sets	5 g Encores (3/sample)	15 g	--	14 days
			PAHs[6]	8270 SIM					27	27	Amber Glass	8 oz	--	14/40 days
			Carbazole, Dibenzofuran	8270C					27	27	Amber Glass	8 oz	--	14/40 days
			Total Arsenic, Total Lead, Total Thallium	6020A					27	27	Plastic	8 oz	--	6 months
			Total Cyanide	9012A					27	27	Plastic	8 oz	--	14 days
Soil Parcel O (HHRA and Feasibility Study)	1 borings and 1 well nest boring 2 surface (0-6") samples or near surface (6"-24") sample[9] (1 per boring) 4 subsurface (>24") samples[10] (Up to 2 per boring, 1 as an effected sample and 1 as a clean sample in clay)	6	PVOCs[7]	5035/8260B					6	6 sets	5 g Encores (3/sample)	15 g	--	14 days
			PAHs[6]	8270 SIM					6	6	Amber Glass	8 oz	--	14/40 days
			Carbazole, Dibenzofuran	8270C					6	6	Amber Glass	8 oz	--	14/40 days
			Total Arsenic, Total Lead, Total Thallium	6020A					6	6	Plastic	8 oz	--	6 months
			Total Cyanide	9012A					6	6	Plastic	8 oz	--	14 days
Soil Parcel A (HHRA and Feasibility Study)	2 borings and 2 well nest borings (1 boring in excavated area[13]) 3 surface (0-6") samples or near surface (6"-24") sample[9] (1 per boring) 10 subsurface (>24") samples[10] (Up to 2 per boring, 1 as an effected sample and 1 as a clean sample in clay)	13	PVOCs[7]	5035/8260B					13	13 sets	5 g Terra-core or similar (3/sample)	15 g	--	14 days
			PAHs[6]	8270 SIM					13	13	Amber Glass	8 oz	--	14/40 days
			2,4-dimethylphenol, 2-methylphenol, 3&4-methylphenol, phenol, carbazole and dibenzofuran	8270C					13	13	Amber Glass	8 oz	--	14/40 days
			Total Antimony, Total Arsenic, Total Lead, Total Thallium	6020A					13	13	Plastic	8 oz	--	6 months
			Total Cyanide	9012A					13	13	Plastic	8 oz	--	14 days
Soil Parcels B (HHRA and Feasibility Study)	18 borings and 4 well nest borings 22 surface (0-6") samples or near surface (6"-24") sample[9] 52 subsurface (>24") samples[10] (Up to 2 per boring, 1 as an effected sample and 1 as a clean sample in clay)	74	PVOCs[7]	5035/8260B					74	74 sets	5 g Terra-core or similar (3/sample)	15 g	--	14 days
			PAHs[6]	8270 SIM					74	74	Amber Glass	8 oz	--	14/40 days
			2,4-dimethylphenol, 2-methylphenol, 3&4-methylphenol, phenol, carbazole and dibenzofuran	8270C					74	74	Amber Glass	8 oz	--	14/40 days
			Total Antimony, Total Arsenic, Total Lead, Total Thallium	6020A					74	74	Plastic	8 oz	--	6 months
			Total Cyanide	9012A					74	74	Plastic	8 oz		14 days
Soil (Soil Vapor Assessment) Chemical Parameters	5 borings Up to 2 subsurface (>24") samples per boring	10	PVOCs[7]	5030B/8260B					10	10 sets	5 g Terra-core or similar (3/sample)	15 g	--	14 days
			PAHs[6]	8270 SIM					10	10	Amber Glass	8 oz	--	14/40 days
			2,4-dimethylphenol, 2-methylphenol, 3&4-methylphenol, phenol, carbazole and dibenzofuran	8270C					10	10	Amber Glass	8 oz	--	14/40 days
			Total Antimony, Total Arsenic, Total Lead, Total Thallium	6020A					10	10	Plastic	8 oz	--	6 months
			Total Cyanide	9012A					10	10	Plastic	8 oz	--	14 days
Soil (Soil Vapor Assessment) Geotechnical Parameters	1 sample of clay per parcel 1 Sample of fill from 1 soil vapor probe	1	Grain Size Distribution	ASTM D421/D422	--	--	--	--	1	1	16 oz glass	16 oz	None	--
			Moisture Content	ASTM D2216	--	--	--	--	1	1	16 oz glass	16 oz	keep in dark	28 days
			Bulk Density	ASTM D2937	--	--	--	--	1	1	Undisturbed Sample from Shelby Tube	Shelby Tube	None	--
			Specific Gravity of Soil Solids	ASTM D854	--	--	--	--	1	1			None	--
Soil QA/QC Sample Summary														
Soil QA/QC Sample Summary Chemical Parameters	As Indicated Above for Each Parcel	130 (Total Soil Samples)	PVOCs[7]	5035/8260B	7	7	--	--	14	14 sets	5 g Encores (3/sample)	15 g	--	14 days
			PAHs[6]	8270 SIM	7	7	--	--	14	14	Amber Glass	8 oz	--	14/40 days
			Carbazole, Dibenzofuran	8270C	7	7	--	--	14	14	Amber Glass	8 oz	--	14/40 days
			Total Arsenic, Total Lead, Total Thallium	6020A	7	7	--	--	14	14	Plastic	8 oz	--	6 months
			Total Cyanide	9012A	7	7	--	--	14	14	Plastic	8 oz	--	14 days
Soil Waste Characterization														
Soil Waste Characterization	Composite	1	Protocol B (Verify with receiving facility)	Various	--	--	--	--	1	1	Glass Jars	32 oz	--	varies
Groundwater														
Crawford Station Site Groundwater - Wells (Risk Assessment, Feasiblity)	Groundwater will be sampled quarterly for 4 quarters following well installation. Parameters may change after 12 months depending on initial results and Group II RI Site-wide groundwater assessment.	Group IV 15 wells[12]	PVOCs[7]	8021B or 8260B	2	1	--	'PVOC trip blanks will accompany each cooler containing PVOC samples.	18	18 sets	Glass Vial	Three 40 mL	HCl to pH<2, Zero Headspace	14 days
			PAHs[6]	8270 SIM	2	1	--		18	18	Amber Glass	1 L	--	7/40 days
			2,4-dimethylphenol, 2-methylphenol, 3&4-methylphenol, phenol, carbazole and dibenzofuran	8270C	2	1	--		18	18	Amber Glass	1 L	--	7/40 days
			Total and Dissolved Metals[11]	6020	2	1	--		18	18	Plastic	500 ml	HNO3 to pH <2	6 mo.
			Available Cyanide	OIA-1677	2	1	--		18	18	Amber Plastic	500 ml	PbCO3; NaOH to pH>12	14 days
			GW Field Parameters[5]	Field	--	--	--	--	18	--	Field Measured	--	--	--

Table 6: Upland Sampling and Analysis Plan Summary
Site-Specific Work Plan, Addendum 3 (Group IV)
Crawford Station Former MGP Site
Chicago, IL
EPA ID# ILN000510192

Sample Type	Sample Frequency	Estimated Number of Samples[1]	Parameter	Method	Field Duplicates[2] (1 extra volume)	MS/MSD[3] (2 extra volumes)	Equipment Blanks	Trip Blanks	TOTAL[4] (excludes Equipment Blanks and Trip Blanks)	Estimated No. of Containers	Container Type	Minimum Volume	Preservation (Cool All Samples to 4° ± 2°C Unless 'None' Indicated)	Holding Time from Sample Date
Water Waste Characterization														
Water Waste Characterization	Composite	1	Code B - CID Bio (or site specific for onsite treatment)	Various	--	--	--	1	1	1	Glass Jar	32 oz	--	varies
Soil Vapor														
Soil Vapor (HHRA Indoor air pathway)	5 locations		PVOCs[7]		1	--	--	--	11	11	Summa Canisters[8]	**1 L or 6 L**	none	
			Naphthalene		1	--	--	--	11					
	2 probes per location; 1 sample per probe		Oxygen, Carbon Dioxide, and Methane	ASTM D1946 or USEPA Method 3C	1	--	--	--	11					

Notes:

1. Proposed number of samples does not include contingency investigation locations.
2. Field duplicates will be collected at a frequency of 1 per 10 or fewer investigative water and soil vapor samples, and 1 per 20 or fewer investigative soil/sediment samples.
3. Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples will be collected at a frequency of 1 per group of 20 or fewer investigative water samples or soil samples. Additional volume will be determined by laboratory requirements.
4. Number of equip,ent and trip blanks is dependent on field conditions, equipment used, number of field days and number of coolers.
5. Field parameters for groundwater include temperature, pH, specific conductivity, oxidation-reduction potential, dissolved oxygen and turbidity.
6. PAHs include these 17: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, benzo(g,h,i)perylene, and 2-methylnaphthalene.
7. PVOCs include benzene, ethylbenzene, toluene, xylenes (total), 1,3,5-trimehtylbenzene, and 1,2,4-trimethylbenzene.
8. Six liter summa canister will be used unless otherwise specified by laboratory to meet detection limit requirements or reduced volume of soil gas in the field necessitates the use of one liter summa canisters.
9. Near surface soil samples from 6-24" bgs will be collected only at locations where true surface soil samples are collected (i.e. no surface cover is present).
10. Subsurface soil samples will be collected from intervals where impacts are observed (visible impact, odor, PID response). Where tar-like material is observed, soil samples may not be analyzed because these observations may be presumed to be MGP source material. If no impacts are observed, the sample will be collected a the base of the fill layer.
11. Total and Dissolved Metals in groundwater includes total antimony, total arsenic, total cadmium, total chromium, total lead, total nickel, total selenium and total thallium
12. The number of monitoring wells account for the proposed 6 nested wells (the piezometer not included) and the current 9 wells in Parcel S, if existing and accessible.

COPC - Compound of Potential Concern
FS - Feasibility study
HHRA - Human health risk assessment
PAH - Polycyclic aromatic hydrocarbon
PID - Photoionization detector
PVOC - Petroleum VOC
VOC - Volatile organic compound

Table 7: Upland Boring, Probe and Monitoring Well Location Strategy
Site-Specific Work Plan, Addendum 3 (Group IV)
Crawford Station Former MGP Site - Chicago, IL
USEPA ILN000510192

Location		Rationale
Monitoring Well Nests[1]		
Parcel O	MWO/PO108	Evaluate groundwater quality and parameters in the southern corner of Parcel O west of the removal action.
Parcel A	PA101S	Evaluate groundwater quality and parameters at the interval were NAPL is located.
Parcel B	MWB/PB103	Evaluate groundwater quality north of the West Fork Channel (UNDER PARCEL II)
	MWB/PB104	Evaluate groundwater quality and parameters at the northeastern corner of Parcel B adjacent to the historical west fork channel. (UNDER PARCEL II)
	MWB/PB105	Evaluate groundwater quality and parameters at the central portion of Parcel B
	MWB/PB106	Evaluate groundwater quality and parameters at the southeastern corner of Parcel B adjacent to Parcel O and Parcel J.
	MWB/PB107	Evaluate groundwater quality and parameters beneath the area of the removal action.
Soil Borings[2]		
Parcel S	SSB101	Determine the vertical extent of non-naphthalene PAH exceedances in the southwestern corner of Parcel S.
	SSB102	Evaluate extent of DNAPL impact observed in adjacent boring SP026.
	SSB103	Evaluate extent of DNAPL impact observed in adjacent boring SP031
	SSB104	Evaluate extent of DNAPL impact observed in adjacent boring SP032.
	SSB105	Determine the vertical extent of non-naphthalene PAH exceedances in the south-central area of Parcel S.
	SSB106	Determine the vertical extent of non-naphthalene PAH exceedances in the north-central area of Parcel S.
	SSB107	Evaluate extent of DNAPL impact observed in adjacent boring SP047.
	SSB108	Evaluate extent of DNAPL impact observed in adjacent boring SP048.
	SSB109	Determine the vertical extent of non-naphthalene PAH exceedances in the northeastern corner of Parcel S.
Parcel O	OSB101	Evaluate extent of DNAPL impact observed in adjacent boring PCO-SP130.
	MWO/PO108 (soil boring)	Evaluate soil quality in the southern corner of Parcel O.

Soil Borings (cont.)		
Parcel A	ASB101	Evaluate south boundary extent of DNAPL impact observed in adjacent soil boring CEI-SP143.
	ASB102	Evaluate south boundary extent of DNAPL impact observed in adjacent boring CEI-SP123.
	MWA/PA104 (Soil Boring)	Evaluate soil quality in the south portion of Parcel A west of the ABO-RAA.
	PA101S (Soil Boring)	Evaluate soil quality in a further vertical extent at the location of MWA101/PA101.
Parcel B	BSB101	Evaluate extent of DNAPL impact observed in adjacent borings CEI-SP138 and CEI-SP140.
	BSB102	Delineate vertical extent of DNAPL impact detected in adjacent boring CEI-SP134.
	BSB103	Evaluate extent of DNAPL impact observed in adjacent boring CEI-SP141.
	BSB104	Delineate east and vertical extent of DNAPL impact detected in adjacent boring CEI-SP061.
	BSB105	Evaluate extent of DNAPL impact observed in adjacent boring CEI-SP058.
	BSB106	Evaluate extent of DNAPL impact observed in adjacent borings CEI-SP107 and CEI-SP108.
	BSB107	Evaluate extent of DNAPL impact observed along the nearby boring CEI-SP117.
	BSB108	Evaluate extent of DNAPL impact observed along the nearby boring CEI-SP118.
	BSB109	Evaluate extent of DNAPL impact observed along the nearby boring CEI-SP120.
	BSB110	Evaluate extent of DNAPL impact observed in adjacent borings CEI-SP121 and CEI-SP123.
	BSB111	Evaluate south boundary of DNAPL impact observed in adjacent boring CEI-SP121 in Parcel M.
	BSB112	Evaluate west extent of DNAPL impact observed at the nearby boring CEI-SP127.
	BSB113	Evaluate soil quality at the north boundary of excavated area in Parcel B.
	BSB114	Evaluate soil quality at the north boundary of excavated area in Parcel B.
	BSB115	Evaluate soil quality at the north boundary of excavated area in Parcel B.
	BSB116	Evaluate north extent of DNAPL impact observed at the nearby boring CEI-SP125.
	BSB117	Evaluate soil quality in the southeastern corner of Parcel M.
	BSB118	Evaluate south boundary of DNAPL impact observed in adjacent boring CEI-SP126.

Soil Borings (cont.)		
	MWB/P103 (Soil Boring)	Evaluate soil quality at the north boundary of Parcel B.(COVERED UNDER PARCEL II)
	MWB/P104 (Soil Boring)	Evaluate soil quality at the northeastern corner of Parcel B adjacent to the historical west fork channel. (COVERED UNDER PARCEL II)
	MWB/P105 (Soil Boring)	Evaluate soil quality at the central portion of Parcel B.
	MWB/P106 (Soil Boring)	Evaluate soil quality at the southeastern corner of Parcel B adjacent to Parcel O and Parcel J.
Soil Gas Probes[3]		
Parcel B	SSV101	Determine the potential vapor intrusion risks surrounding the building located on the northeast corner of Parcel B.
	SSV102	
	SSV103	
	SSV104	
	SSV105	

Notes:

[1] Monitoring well locations will consist of a well nest: one water table well intersecting the water table in fill and one piezometer screened and sealed at least 5 feet into the silty clay. Piezometer will be installed to a target depth of approximately 15 feet below the top of the clay unit to enable a sealed interval of at least 5 feet between the base of the fill unit and the top of the piezometer screen. Soil borings for monitoring wells will be advanced to depths of 25 feet below ground surface or greater.

[2] Unless otherwise noted, soil borings will be advanced to a minimum depth of 20 feet below ground surface or until 4 feet of native clay is encountered which does not exhibit visual, PID or olfactory evidence of impacted conditions, whichever depth is greater. Minimum depth variances are noted in table above. Samples will be collected as follows:

1) One sample at the surface (or 0-6" below surficial gravel/asphalt)
2) At locations where there is no ground cover, an additional sample will be collected from 6-24 inches bgs.
3) One subsurface soil samples will be collected at each soil boring location between 2 feet bgs and the boring termination depth. Two samples may be collected per the SSWP if evidence of MGP residuals is observed.

[3] Soil vapor probes will be advanced to depths of 6 feet below ground surface or greater. The depth is the one without taking the overlying cover such as asphalt or concrete into account. If no evidence of impacts is present in a boring, a sample will be collected from the 2-4 feet below ground surface interval.

Table 8: Well Nest Installation Decision Tree
Site-Specific Work Plan Addendum 3
Crawford Station MGP Site
USEPA ILN000510192

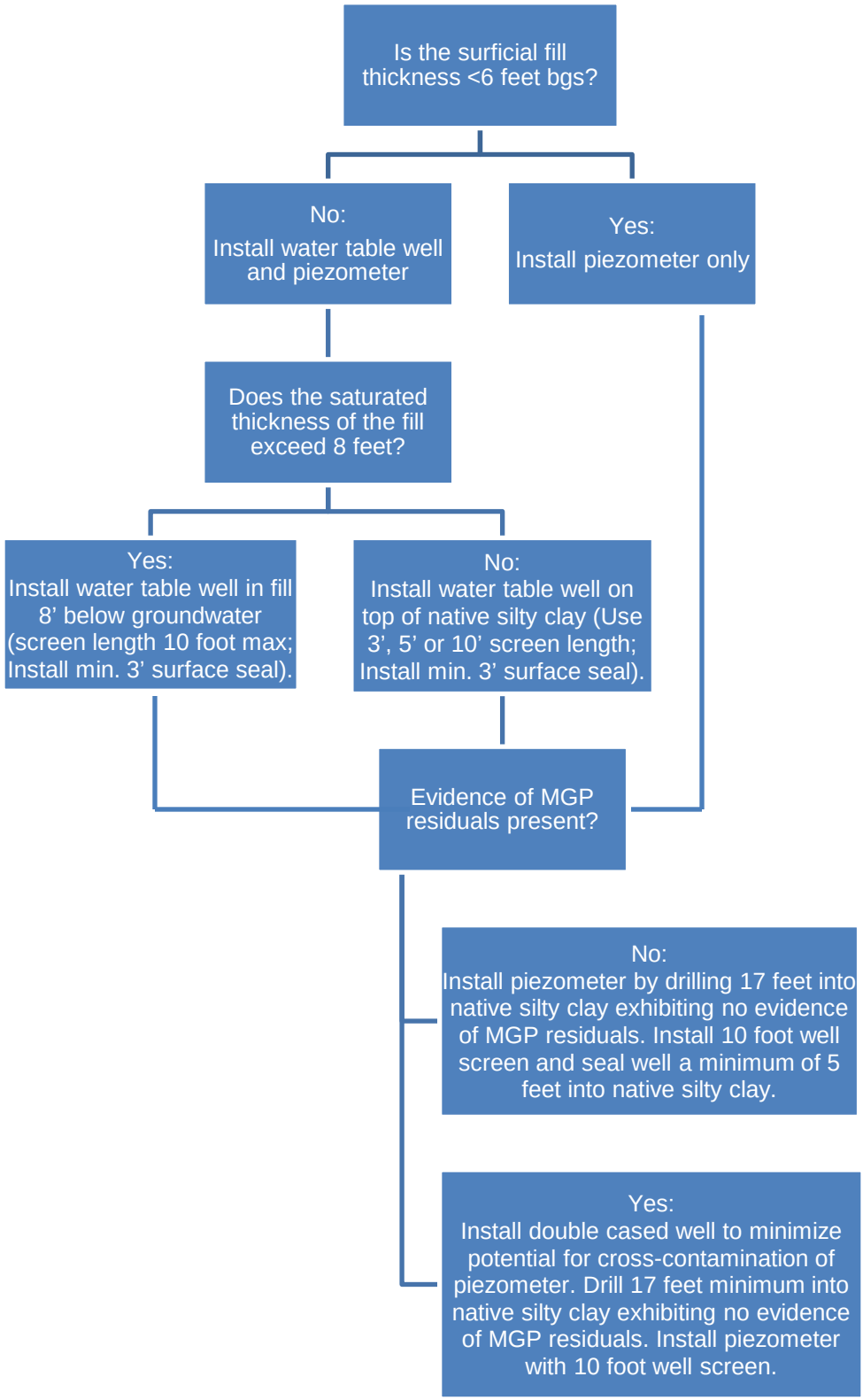


Table 10: Sediment and Surface Water COPCs
Site-Specific Work Plan, Addendum 3 (Group IV)
Crawford Station Former MGP Site - Chicago, IL
EPA ID# ILN000510192

COPCs	Sediment	Surface Water
PVOCs		
Benzene	X	X
Ethylbenzene	X	X
Toluene	X	X
Xylenes (total)	X	X
1,2,4-Trimethylbenzene	X	X
1,3,5-Trimethylbenzene	X	X
PAHs		
Acenaphthene	X	X
Acenaphthylene	X	X
Anthracene	X	X
Benzo(a)anthracene	X	X
Benzo(a)pyrene	X	X
Benzo(b)fluoranthene	X	X
Benzo(g,h,i)perylene	X	X
Benzo(k)fluoranthene	X	X
Chrysene	X	X
Dibenzo(a,h)anthracene	X	X
Fluoranthene	X	X
Fluorene	X	X
Indeno(1,2,3-cd)pyrene	X	X
Naphthalene	X	X
2-Methylnaphthalene	X	X
Phenanthrene	X	X
Pyrene	X	X
Acid Extractables		
2,4-Dimethylphenol	X	X
2-Methylphenol	X	X
4-Methylphenol	X	X
Phenol	X	X
Metals and Inorganics		
Aluminum	X	X
Antimony	X	X
Arsenic	X	X
Barium	X	X
Cadmium	X	X
Chromium	X	X
Copper	X	X
Cyanide	X	X
Iron	X	X
Lead	X	X
Manganese	X	X
Mercury	X	X
Nickel	X	X
Selenium	X	X
Silver	X	X
Vanadium	X	X
Zinc	X	X

Notes:
X - Parameter selected as COPC
COPC - Constituents of potential concern
PAH - polycyclic aromatic hydrocarbon
PVOC - petroleum volatile organic compound
RAF - Risk Assessment Framework

Table 11: Sampling and Analysis Plan Summary
Site-Specific Work Plan, Addendum 3 (Group IV)
Crawford Station Former MGP Site - Chicago, IL
EPA ID# ILN000510192

Sample Type	Sample Frequency	Estimated Number of Samples per Event[1]	Parameter	Method	Field Duplicates[2] (1 extra volume)	MS/MSD[3] (2 extra volumes)	Equipment Blanks	Trip Blanks	TOTAL[4]	Estimated No. of Containers	Container Type	Minimum Volume	Preservation (Cool All Samples to 4° ± 2°C Unless 'None' Indicated)	Holding Time from Sample Date
Surface Water														
Surface Water	Surface water will be sampled at least once per every ten sediment sample locations	13	PVOCs[5]	8021B or 8260B	2	1	--	VOC trip blanks will accompany each cooler containing VOC samples.	16	48	Glass Vial	Three 40 mL	HCl to pH<2, Zero Headspace	14 days
		13	PAHs[6]/Phenols[7]	8270C or 8270 SIM	2	1	--		16	16	Amber Glass	1 L	--	7/40 days
		13	Dissolved Metals[8]	6020 or 7470A	2	1	--		16	16	Plastic	500 mL	HNO3 to pH <2	6 mo./ 28 days for Hg
		13	Available Cyanide	OIA-1677	2	1	--		16	16	Amber Plastic	500 mL	PbCO3; NaOH to pH>12	14 days
		13	Hardness	6020	2	1	--		16	16	Plastic	500 mL	HNO3 to pH <2	28 days
		13	Field Parameters[9]	Field	--	--	--		--	--	field measured	--	--	--
Sediment Samples														
Sediment (Surface 0-6 inches)	Chemical Analysis 1 surface (0-6") sample per characterization boring	124	PVOCs[5]	8260B	7	7	Equipment blanks will be collected at a frequency of 1 per soil or sediment sampling day with non-dedicated sampling equipment.	VOC trip blanks will accompany each cooler containing VOC samples, including equipment blanks.	138	138	Glass	4 oz	MeOH	14 days
		31	PAHs[6]/Phenols[7]	8270C	2	2			35	35	Amber Glass	8 oz	--	14/40 days
		93	34 PAHs[10]	8270C or 8270 SIM	5	5			103	103	Amber Glass	8 oz	--	14/40 days
		124	Metals[8]	6020A or 7471A	7	7			138	138	Plastic	125 ml	--	6 mo./ 28 days for Hg
		124	Percent Solids	Various	7	7			138	138	Glass	4 oz	keep in dark	28 days
		124	Cyanide	9012A	7	7			138	138	Plastic	125 ml	--	14 days
		93	Total Organic Carbon	Lloyd Kahn Method	5	5			103	103	Plastic	100 g	keep in dark	28 days
		32	Black Carbon[11]		2	2			36	36	Plastic	500 g	keep in dark	28 days
Sediment (Subsurface)	1 subsurface sediment spl at sediment/clay interface per core 1 subsurface bottom of clay sample per core 33% of all other intervals in sediment 10% of all other intervals in clay	562	PVOCs[5]	8260B	29	29	Equipment blanks will be collected at a frequency of 1 per soil or sediment sampling day with non-dedicated sampling equipment.	VOC trip blanks will accompany each cooler containing VOC samples, including equipment blanks.	620	620	Glass	4 oz	methanol	14 days
		281	PAHs[6]/Phenols[7]	8270C	15	15			311	311	Amber Glass	8 oz	--	14/40 days
		281	34 PAHs[10]	8270C or 8270 SIM	15	15			311	311	Amber Glass	8 oz	--	6 mo./ 28 days for Hg
		562	Metals[8]	6020A or 7471A	29	29			620	620	Plastic	125 ml	--	--
		562	Percent Solids	Various	29	29			620	620	Glass	4 oz	--	14/40 days
		562	Cyanide	9012A	29	29			620	620	Plastic	125 ml	keep in dark	28 days
		281	Total Organic Carbon	Lloyd Kahn Method	15	15			311	311	Plastic	100 g	--	14 days
Sediment (FS Parameters)	Up to 10 samples	10	Grain Size Distribution (sieve and hydrometer)	ASTM D421, D422	--	--	--	--	10	10	5 Gallon Bucket	5 gal	None	--
		10	Atterberg Limits	ASTM D4318	--	--	--	--	10	10	Glass or Plastic	8 oz	None	--
		10	Organic Content by LOI	ASTM D2974	--	--	--	--	10	10	Plastic	100 g	keep in dark	28 days
		10	Moisture Content	ASTM D2216	--	--	--	--	10	10	Glass or Plastic	8 oz	None	--
Sediment Waste Characterization														
Sediment Waste Characterization	Composite	1	Verify with receiving facility	Various	--	--	--	--	1	1	Glass Jar	32 oz	--	varies

Notes:
1. Proposed number of samples does not include contingency locations. Assumes 124 characterization boring locations.
2 Field duplicates will be collected at a frequency of 1 per 10 or fewer investigative water samples, and 1 per 20 or fewer investigative sediment samples.
3 Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples will be collected at a frequency of 1 per group of 20 or fewer investigative water samples or sediment samples. Additional volume will be determined by laboratory requirements.
4. Includes estimated number of trip blanks and equipment blanks, based on number of days sampling and estimated number of coolers.
5. PVOCs include benzene, ethylbenzene, toluene, xylenes (total), 1,3,5-trimehtylbenzene, and 1,2,4-trimethylbenzene.
6. PAHs include these 17: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, benzo(g,h,i)perylene, and 2-methylnaphthalene.
7. Phenols include 2, 4-dimethylphenol, 2-methylphenol, 4-methylphenol, and phenol (acid-extractable organic compounds).
8. Metals in surface water and sediment: aluminum, antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, vanadium and zinc.
9. Surface water field parameters include temperature, pH, specific conductivity, oxidation-reduction potential, dissolved oxygen, and turbidity.
10. PAH analysis for these sediments include a list of 34 PAHs, including chain parameters as provided in USEPA Guidance Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures, 2002 by SW-846 Method 8270C with gas chromatograph/mass spectrometry in selected ion mode of operation.
11. Black Carbon ("Soot" Carbon) is the remaining carbon after muffle furnace drying and acid treatment of sediments to remove other forms of carbon.

FS - Feasibility Study
LOI - loss on ignition
PAH - polycyclic aromatic hydrocarbon
PVOC - petroleum Volatile Organic Compound
VOC - Volatile Organic Compound

NATURAL RESOURCE TECHNOLOGY

APPENDICES

(INCLUDED ON CD)