3 SITE CHARACTERIZATION ACTIVITIES

Data needs to characterize the site and evaluate potential human health and ecological risks were identified through a site-specific conceptual site model (CSM). The pre-RI CSM is provided in Appendix H. The pre-RI CSM was developed to reflect conditions observed in the November 1, 2006 site reconnaissance (Section 4.1 of the SSWP, NRT, April 2007) and information from the Completion Report (NRT, June 2006).

The COPCs for each media evaluated in the RI (Section 3.7 of the SSWP, NRT, April 2007) were based on previous analytical results and the previously performed remedial actions. The COPCs analyzed for each media are summarized below.

Media	**COPCs**
Soil	Adjacent to excavation areas: petroleum volatile organic compounds (PVOCs) and polynuclear aromatic hydrocarbons (PAHs) Potential Source Areas: PVOCs, PAHs, phenols, inorganics (aluminum, antimony, arsenic, barium, cadmium, chromium, copper, cyanide, iron, lead, manganese, mercury, nickel, selenium, silver, vanadium, and zinc)
Groundwater	Benzene and PAHs
Sediment	PVOCs, PAHs (including alkylated PAHs), phenols, inorganics (aluminum, antimony, arsenic, barium, cadmium, chromium, copper, cyanide, iron, lead, manganese, mercury, nickel, selenium, silver, vanadium, and zinc)
Surface Water	PVOCs, PAHs, inorganics (aluminum, antimony, arsenic, barium, cadmium, chromium, copper, cyanide, iron, lead, manganese, mercury, nickel, selenium, silver, vanadium, and zinc)
Storm Sewer Water	PVOCs and PAHs

RI activities were performed in accordance with the Multi-Site Field Sampling Plan (FSP) – Revision 1 (NRT, April 2007) the Multi-Site Quality Assurance Project Plan (QAPP) – Revision 1 (NRT, December 2006), and the Multi-Site Health and Safety Plan (HASP) – Revision 1 (NRT, December 2006). Modifications to the Multi-Site documents were discussed in the SSWP included in Appendix D of the SSWP (NRT, April 2007).

RI activities are summarized in the following sections with the methodologies, sampling locations and analytical parameters.

3.1 Site Surveying and Base Map Development

WPSC personnel surveyed site features in June and August 2007. The June survey included existing site features and the August survey included soil and groundwater sampling locations in 2007. Survey data was completed to update drawings and base maps to reflect current conditions, particularly in areas not owned by WPSC.

The survey ensured the site features were referenced to the same horizontal and vertical datum and that conversion of these survey points to the USEPA required Universal Transverse Mercator (UTM) projection was consistent. In the field, the Wisconsin County Coordinate System datum for Portage County (WCCS-PC) was used for horizontal control and the 1929 National Geodetic Vertical Datum (NGVD) was used for the vertical datum. The location of all site features in both the UTM and WCCS-PC coordinate systems are included in Appendix I.

3.2 Soil and Groundwater Vapor Assessment

A preliminary screening level assessment to evaluate potential for vapor intrusion was performed and is discussed in Section 4.4. Both on-property and off-property areas are addressed; however, the preliminary screening assessment focuses on areas of the site where buildings are present within the vicinity of the groundwater plume.

3.3 Soil Sampling

Twenty-five soil borings were completed between July 16 and 23, 2007 (Figure 5). Soil samples for laboratory analysis were collected from 20 of these borings. The boring locations were selected based on 1) previous analytical results, 2) the soil remediation activities, and 3) USEPA's conditional approval of the SSWP (NRT, April 2007), dated July 11, 2007. Borings performed for soil sampling purposes include the following:

- SB-301 and SB-302 – surface soil borings located near the northern most property boundary between the WPSC property and the adjacent residential properties;
- SB-303 through SB-308 – surface soil borings located in Pfiffner Pioneer Park for use in risk assessment;

- SB-309 through SB-321 – soil borings located within and adjacent to the former slough to delineate the slough and assess whether source material is located adjacent to the pond that may affect the river and pond sediment quality;

- Piezometer PZ-16 and well OW-17 – borings for monitoring wells were sampled to assess whether a significant source may be located in the vicinity of the former slough outlet; and

- Borings SB-313a and SB-315a were also installed and abandoned due to refusal before reaching the target depth.

Visual and olfactory observations were used to assess the presence/absence of MGP residuals in the subsurface. Samples for laboratory analysis were collected as described in Section 4 of the Multi Site FSP. To satisfy QA/QC requirements, a blind duplicate and a matrix spike/matrix spike duplicate (MS/MSD) sample set was collected for every 20 environmental samples. Equipment blanks were not required because disposable and dedicated sampling equipment was used to collect the samples.

Soil borings were not advanced to the former slough elevation in the pond because there were safety concerns with staging the drill rig along the sheet pile wall. These concerns were raised during the June 13, 2007 meeting with the USEPA and WDNR, and it was agreed to forgo these borings at this time.

Soil boring logs and abandonment forms are included in Appendix B. Selected borings and wells are included on the geologic cross-sections (Sheet 1).

3.3.1 Property Boundary and Pfiffner Pioneer Park Surface Soil Sampling

Surface soil samples were collected using a hand auger as described in Section 4 of the Multi-Site FSP. Sample locations were recorded using a differential GPS (DGPS) unit. Sample locations are shown on Figure 5 and soil boring logs are provided in Appendix B.

Surface soil samples SB-301 and SB-302 were collected near the northern most WPSC property boundary and the adjacent residential properties. Samples from SB-301 and SB-302 were representative of the soils from zero to one foot bgs and were submitted to Pace Analytical Services (Pace) for PVOCs, PAHs, phenols, aluminum, antimony, arsenic, barium, cadmium, chromium, copper, cyanide, iron, lead, manganese, mercury, nickel, selenium, silver, vanadium, and zinc analysis.

Surface soil samples SB-303 through SB-308 were collected from west of the WPSC property boundary in Pfiffner Pioneer Park for use in the human health risk assessment. Samples from SB-303 through SB-308 were representative of the soils from zero to two feet bgs, which were submitted to Pace for PVOC and PAH analysis.

Surface soil borings were abandoned in accordance with the methods described in Section 4 of the Multi-Site FSP following completion of soil sampling. Abandonment forms are also included in Appendix B.

3.3.2 Former Slough Sampling

Soil borings were advanced to assess soil quality within, beneath and along the side slopes of the former slough and to evaluate whether a source was present for elevated PAH concentrations previously observed in the river and pond sediments. Soil samples from borings SB-309 through SB-321 (Figure 5) were collected using hydraulic push sampling techniques as described in Section 4 of the Multi-Site FSP. Boart Longyear advanced soil borings and the sample locations were surveyed by a WPSC crew. Sample locations are shown on Figure 5 and soil boring logs are provided in Appendix B.

Soil borings SB-309 through SB-318 were advanced on the upland side of the pond, in the vicinity of the retaining wall and up to approximately 100 feet east of the retaining wall. An underground gas line is located between the curb and retaining wall, so only boring SB-318 could be performed in the immediate vicinity of the wall. In general, the borings were advanced to the underlying native sand, with the exception of borings SB-313a, SB-315, and SB-315a which were terminated due to refusal at 5, 13, and 10 feet bgs, respectively. It is assumed SB-313a was advanced outside of the former slough. SB-315 and SB-315a may have encountered fill material or a structure associated with the former pump house.

Borings SB-319, SB-320, and SB-321 were advanced further east in the vicinity of the former slough to assess the presence of MGP residuals in areas where the WPSC property abutted the slough.

Visual and olfactory observations were used to assess the presence/absence of MGP residuals in the subsurface and identify samples for laboratory analysis. Borings with observed impacts were sampled within the impacted interval and below the impacted interval or beneath the base of the former slough to evaluate potential vertical migration. Borings without observable impacts were sampled to confirm that impacts were not present beneath the lowest portion of the former slough along that transect of borings.

Samples were submitted to Pace for analysis of potential source area COPC. Samples were not submitted from SB-309, SB-310, and SB-313 because samples were collected and analyzed from adjacent borings SB-311, SB-312, SB-317, and SB-318. Samples were also not collected for laboratory analysis from SB-313a and SB-315a.

The soil borings were abandoned in accordance with the methods described in Section 4 of the Multi-Site FSP following completion of the soil sampling activities. Abandonment forms are also included in Appendix B.

3.3.3 Monitoring Well Soil Sampling

Soil samples from piezometer PZ-16 and OW-17 were collected to document subsurface conditions. Visual and olfactory observations were used to assess the presence/absence of MGP-residuals in the subsurface adjacent to the pond. MGP residuals were not observed in these borings.

Soil samples from the screened intervals of OW-16 and OW-17 were submitted to Pace for laboratory analysis of COPCs to confirm impacts were not present and to characterize the quality of the soil within the screened interval.

The drilling techniques for piezometer PZ-16 and OW-17 are discussed in the following sections.

3.4 Groundwater Evaluation

3.4.1 Monitoring Well/Piezometer Installation

3.4.1.1 July 2007 Well Installation

Four groundwater monitoring wells (OW-14, OW-15, OW-16, and OW-17) and three piezometers (PZ-14B, PZ-15B, and PZ-16B) were installed in July 2007 (Figure 5). The wells were installed to address the following:

- OW-14/PZ-14B and OW-15/PZ-15B – expand the existing monitoring network and establish the extent of MGP-residuals in groundwater east and south of well nests (downgradient) of the former facility and downgradient of OW-12/PZ-12B where benzene concentrations have frequently exceeded the maximum contaminant levels (MCL); and
- OW-16/PZ-16B and OW-17 – evaluate potential source areas in the vicinity of the pond and assess groundwater gradients along the river bank.

Drilling and well construction were performed in accordance with the methods described in Section 4 of the Multi-Site FSP. Table 1 summarizes the well construction details regarding screen placement, length, and well elevations. The boring logs, construction and development forms, and abandonment forms for the new wells and piezometers are included in Appendix C. Selected wells are also included on the geologic cross-sections (Sheet 1).

Boart Longyear installed the wells and piezometers using roto-sonic drilling methods with the exception of PZ-14, which was installed using hollow stem auger and air rotary methods. Shallow bedrock (approximately 20 feet bgs) was encountered at wells OW-14 and OW-17. The bedrock was extremely hard, preventing the sonic rotary equipment from penetrating the rock. The soil boring for PZ-14B was attempted at three different locations within a 40-foot radius of OW-14 using rotary sonic methods without success. The boring was later completed using air-hammer drilling methods to set the well within the bedrock. Proposed piezometer PZ-17B was also attempted at three different locations without success because of the shallow bedrock (Section 2.1.2). This well was not completed because there was not adequate space available for drilling the well using air-hammer techniques.

The new monitoring wells and piezometers terminated at approximate elevations between 1,070 feet and 1,040 feet, respectively, which is similar to the completion elevations for existing site wells/piezometers.

3.4.1.2 October 2008 Well Installation

Monitoring wells TW-1 and TW-2 were installed in October 2008 to further delineate the groundwater plume following conversations with USEPA (Figure 5). Drilling and well construction were performed in accordance with the methods described in Section 4 of the Multi-Site FSP. Well construction information is on Table 1 and the boring logs, construction, and development forms are provided in Appendix C.

On-Site Environmental Services, Inc. (On-Site) installed the wells using hollow-stem auger drilling methods. Originally intended to be temporary wells to evaluate the groundwater plume, they were converted to permanent, NR141 compliant monitoring wells. The wells terminated at approximate elevations between 1,071.5 and 1,072.2 feet, respectively (Table 1).

3.4.1.3 January 2011 Groundwater Grab Sampling and Monitoring Well Installation

Following installation of wells TW-1 and TW-2, USEPA requested additional monitoring wells to further define the plume, based on the distance between these wells and other site monitoring wells.

To assist in locating the additional monitoring wells appropriately, groundwater grab samples were collected to assess benzene and naphthalene concentrations between OW-14 and TW-1. Twenty-one grab samples were collected on January 10 and 11, 2011 in the immediate vicinity of Center Point shopping mall and then moving southeast towards TW-1. The first points were located approximately 200 to 300 feet down gradient of OW-14 at the anticipated edge of the groundwater plume (Figure 5). Groundwater grab samples were collected using a GeoProbe SP16 and peristaltic pump as described in the July 2, 2010 response to USEPA and in accordance with the USEPA-approved Standard Operating

Procedure (SOP) SAS-05-03. The SP16 has a permanent 3.3 foot (40 inch) screen that was driven to a depth of 17 or 19 feet bgs which, based on groundwater measurements, was screened across the water table when samples were collected.

Samples were to be analyzed in an iterative approach (i.e., samples nearest OW-14 were analyzed first and all other samples were placed on hold at the laboratory). Nine samples and one duplicate were submitted for rapid turn-around time analysis of benzene and naphthalene using Method 8260 and method detection limits (MDL) of 1 µg/L and 5 µg/L, respectively, for screening purposes. Groundwater grab samples were submitted to Pace Analytical Services (a September 4, 2007 USEPA approved Multi Site Quality Assurance Project Plan – Revision 2 (QAPP) laboratory) under chain of custody procedures described in Section 5, SAS-03-01 and SAS-03-02 of the Multi Site FSP.

Benzene exceeded the MDL in only one of the nine initial samples; naphthalene was below the MDL in all the samples (listed below). The results negated analysis of any additional samples and the locations for four additional monitoring wells (OW--18 through OW-21) were selected based on these results.

Grab Sample Location	Sample Date	Sample Interval	Benzene (µg/L)	Naphthalene (µg/L)
GG001	01/10/11	13 to 17	<0.41	<0.89
GG002	01/10/11	15 to 19	<0.41	<0.89
GG003	01/10/11	15 to 19	0.54	<0.89
GG004	01/10/11	13 to 17	<0.41	<0.89
GG005	01/10/11	13 to 17	<0.41	<0.89
QC01 (GG005)	01/10/11	13 to 17	<0.41	<0.89
GG006	01/10/11	13 to 17	<0.41	<0.89
GG009	01/10/11	13 to 17	<0.41	<0.89
GG010	01/10/11	13 to 17	<0.41	<0.89
GG012	01/11/11	13 to 17	<0.41	<0.89

Monitoring wells OW-18 through OW-21 were installed January 13 and 14, 2011 (Figure 5) by On-Site using hollow-stem auger drilling methods and in accordance with NR141. The wells terminated at elevations between approximately 1,071.3 and 1,071.9. Well construction information is on Table 1 and the boring logs, construction, and development forms are provided in Appendix C.

3.4.2 Well Development

Following installation of the groundwater monitoring wells and piezometers, each well was fully developed to remove sediment that may have accumulated during drilling.

Well development was performed at all wells except PZ-14B using a submersible pump as described in Section 4 of the Multi-Site FSP. Piezometer PZ-14B was developed slowly with a peristaltic pump because it could be pumped dry. Purge water was containerized on-site and disposed through the Plover POTW as described in Section 3.8. Well development forms are included in Appendix C.

3.4.3 Groundwater Elevation Measurements

Groundwater levels (Table 1) were measured to assess the elevation and direction of groundwater flow on a quarterly basis, concurrent with quarterly groundwater monitoring events. Water levels were collected from all wells and piezometers through march 2011. If applicable, observations regarding the presence of MGP-residuals within a well were recorded on the field sampling forms. Groundwater elevation measurements were collected using a water level tape and recorded on field forms in accordance with the methods described in Section 4 of the Multi-Site FSP.

3.4.4 Sampling Schedule and Parameters

Groundwater monitoring continued during the RI to achieve the following objectives:

- To detect changes in environmental conditions (e.g., hydrogeologic, geochemical, or other changes) that may result in an increased risk or exposure potential;
- To identify potentially toxic and/or mobile transformation products;
- To assess plume stability and groundwater concentration trends;
- To ensure downgradient receptors are not detrimentally impacted; and
- To detect new releases of contaminants to the environment that could impact potential remedial action alternatives.

Groundwater sampling has continued using low-flow sampling techniques and has occurred on a quarterly and then semi-annual basis since 2007; two events were completed in 2011 based on submittal of a Feasibility Study (FS) along with this RI Report. The sampling schedule since April 2007 is below.

2007	2008	2009	2010	2011
April July October	January April August October	April October	April October	January March

Wells present prior to July 2007 have continued to be sampled during most events, with the exception of OW-8, which has not been sampled since January 2008 due to its long history of no-detections. Well nest OW-14/PZ-14B was not sampled in January 2008 because snow from the parking lot had been piled over the well nest. In April and July 2008, only wells on the east side of the former MGP site or with COPCs exceeding the groundwater screening levels were sampled; wells and piezometers not sampled during these events included OW-2, OW-4, OW-8, OW-11, PZ-3B, and PZ-11B. These wells have continued to be sampled since October 2008, and all site wells and piezometers, with the exception of OW-8, were sampled in January and March 2011. Wells TW-1, TW-2, and OW-18 through OW-21 have been sampled during all events since they were installed.

Prior to purging the wells, the depth to water was recorded on field forms. A peristaltic pump and tubing with a flow through cell were used to collect groundwater samples. A groundwater quality meter was used to monitor indicator parameters (pH, temperature, conductivity, oxidation-reduction potential (ORP), and dissolved oxygen (DO) and establish stability in accordance with Section 4 of the Multi-Site FSP.

Observations regarding the presence of MGP residuals observed during sampling were also recorded. MGP residuals were observed in well OW-5 in July and October 2007 and January 2008, but it had not been observed at this location prior to or since these sampling events. The MGP residuals were observed as small sticky globules within the water and/or smeared on the bottom inch or two of the rigid tubing after sampling was complete.

Samples were submitted to Pace for analysis of benzene and PAHs in each event. Samples were also submitted to evaluate monitored natural attenuation (MNA) parameters in April and October 2007. The Monitored Natural Attenuation (MNA) parameters included the following:

- Laboratory parameters - alkalinity, dissolved iron, nitrate+nitrite, and sulfate; and
- Field parameters - pH, temperature, DO, ORP, and conductivity.

To satisfy QA/QC requirements, a trip blank was submitted with each cooler containing the aqueous benzene samples. One blind duplicate sample was collected for every 10 environmental samples and a MS/MSD sample set was collected for every 20 environmental samples. Equipment blanks were not required because dedicated and disposable sampling equipment was used at each location.

Groundwater sampling logs are included in Appendix J.

3.4.5 Aquifer Characterization

Drilling observations indicated that subsurface materials encountered in the new wells were primarily fine to medium grained sand, similar to the existing wells. Therefore, additional single well aquifer testing was not warranted.

3.5 Storm Sewer Sampling and Groundwater Interaction

Three rounds of storm sewer water samples were collected at manholes MH-1, MH-3, MH-4, and MH-5 (Figure 4) concurrent with the July and October 2007 and January 2008 groundwater sampling event. Manhole MH-3 was not sampled in January 2008 because snow had been piled over the manhole.

Manhole MH-1 served as the background location while the other three manhole locations were used to assess concentrations in water that flows through and from the Site. The storm sewer assessment also evaluated the frequency and duration of groundwater discharge to the storm sewers through the perforations. Water level fluctuations were monitored with a pressure transducer and data logger in well OW-6 from July 2007 through January 2008. The groundwater elevation data from the well was compared to the elevation of the perforated sewer sections to assess the frequency of groundwater flow into the pipe.

The depth of water in the sewer was measured with a water level meter prior to collecting water samples. Storm sewer water samples were collected using a peristaltic pump with tubing as described in Section 4 of the Multi-Site FSP. The open end of the tubing was lowered beneath the water surface, just above the base of the sewer. The tubing was purged a minimum of two “tubing volumes” of water prior to sample collection. Samples were submitted to Pace for analysis of PVOCs and PAHs.

3.6 Wisconsin River Assessment

3.6.1 Site Morphology

River discharge and surface water elevation data were obtained from the CWPC to assist in evaluating the flow characteristics and velocities in this segment of the river, as discussed in Section 2.4.

Surface water elevation data was used to assess the surface water-groundwater interaction. Surface water elevations were obtained from the hourly readings collected at the dam. The river discharge information was used to support the Feasibility Study.

3.6.2 Surface Water Sampling

Surface water sampling in the Wisconsin River was completed on three transects (SWT-1 through SWT-3) across the river on July 13, 2007 (Figure 6) to characterize surface water quality for use in the risk assessments. Field crews remobilized on July 20, 2007 and collected additional water because the laboratory was unable to analyze phenol from the original samples.

Surface water transect locations included:

- SWT-1 – represents background water quality, located south of the island, in the vicinity of previously established sediment transect T201;
- SWT-2 – established in the vicinity of previously identified affected sediment, just downstream of the former slough outfall; and
- SWT-3 – represents downstream water quality.

Discrete sub-samples were collected using a peristaltic pump with rigid tubing from three locations along each transect at one-quarter, at one-half, and at three-quarters of the distance across the river. The discrete sub-samples were collected from each transect location at 0.8 times the total water column depth and combined to form the single composite water sample. A flow through cell and water quality probe was used to measure field parameters including pH, temperature, DO, ORP, and conductivity.

Each transect sub-sample location was identified by the “A”, “B”, or “C” suffixes, depending on whether it was located closest to or furthest from the east shore of the river (Figure 6). The surface water sampling locations were recorded using a DGPS as described in Section 7 of the Multi-Site FSP.

Surface water samples were submitted to Pace for analysis of PVOCs, PAHs, phenols, aluminum, antimony, arsenic, barium, cadmium, chromium, copper, cyanide, iron, lead, manganese, mercury, nickel, selenium, silver, vanadium, and zinc. For QA/QC purposes, one blind duplicate and one trip blank were submitted with the surface water samples.

Surface water sampling logs are provided in Appendix J.

3.6.3 Bathymetric and Side Scan Surveys

Veolia ES Special Services, Inc. (Veolia) performed a river bathymetric survey and side scan sonar survey on June 5-6, 2007 (Appendix K). The surveys were completed over the entire width of the river

and extended from the Hwy 10 bridge to a point approximately 1,000 feet upstream thereof on each side of the river. A total of approximately 23 acres were surveyed.

The bathymetric survey was performed using a multi-beam sonar system. The system was real-time corrected for heave, pitch, roll, and heading fluctuations. The side scan survey was performed using a 600kHz sonar set to a 50 meter range. Both systems used DGPS to record locations.

The multi-beam sonar survey provided information necessary to evaluate the river flow velocities and hydrologic characteristics. The side scan survey was completed to provide information pertaining to substrate conditions and the presence of obstacles. The side scan survey did locate "pole-like" obstacles within the river. Both surveys were completed in accordance with SSWP.

Veolia's report and the Figures of the bathymetric and side scan sonar results are provided in Appendix K.

3.6.4 Sediment and Substrate Poling

Sediment poling was completed on June 13, 2007 and July 9 through 13, 2007 (Figure 8). Sediment poling was used to verify the multi-beam and side scan sonar and assist with identifying sample locations.

Sediment poling locations were established along an initial transect in the same area of coverage by the multi-beam and side scan sonar. A 2-inch diameter aluminum pole was used to probe the river bottom. In addition to soft sediment thickness, sediment observations on the tip of the pole (e.g., presence of clay, sand, etc.) were recorded on the field form.

Initial poling locations were approximately 100-feet apart starting at the shoreline and terminated at either the center of the river or until no soft sediment was observed. If suspected debris was encountered, additional poling was performed in the immediate vicinity (5-foot radius or less) to evaluate the differences. Intermediate sediment poling was performed to refine potential soft sediment volumes if the difference between sediment thicknesses at given locations was significant.

Soft sediment thickness was generally less than 3 inches and often not observed. As summarized on Table 2, the river bottom is generally sandy and gravelly to rocky. The thickest sediment deposits were observed at the mouth of the former slough (5 inches in sediment boring T3-A3).

The poling was completed as described in Section 4 of the Multi-Site FSP and Section 6.7.5 of the SSWP.

3.6.5 River Sediment and Bottom Sampling

River sediment and bottom samples were collected from July 9 through 12, 2007 (Figure 6). River sediment and bottom samples were collected to evaluate the following:

- The vertical and horizontal contaminant distribution within the river sediments and bottom materials through chemical analysis;
- Potential risk to human health and ecological receptors; and,
- Appropriate remedial action option/alternatives to support an FS.

3.6.5.1 Boring Locations

Background transect T1 and four on-site transects, T2 through T5, were initially established to advance borings and collect sediment and river bottom samples (Figure 6). Each transect initially included four boring locations ("A" through "D") to focus sampling locations based on previously observed affected sediments. Boring locations with "A" designations were collected adjacent to the eastern shore (within approximately 10 to 20 feet) of the Wisconsin River. The subsequent boring locations ("B" through "D") were located approximately 100 feet out, along transects, towards the center of the river.

Additional borings were added in an iterative approach to delineate samples with concentrations above the screening levels, based on total PAH concentrations, or where MGP-residuals are visually observed (i.e., sheen, coal tar, etc.). The sediment logs are included in Appendix E.

New Age/Landmark operated an on-site mobile laboratory operated to provide near real-time analytical results. For purposes of field making decisions, the threshold effect level (TEC, MacDonald et al, 2000) was used to compare total PAH concentrations.

Only one boring was completed on transect T2 because it was determined that the location was further upstream than intended in the SSWP. Transect T6 was added in the approximate location of where T2 was intended. Transect T7 was also added downstream of transect T3 based on visual and olfactory observations of MGP residuals. Additional borings were also added along transects T3 and T4 based on field observations, and a single point (T6T3-A1) was added upstream of transect T3 to provide data regarding the extent of impacts observed in T3-A1 (Figure 6). These data are discussed in Section 4.3.

3.6.5.2 Sediment Sampling Methods

Boart-Longyear performed drilling services from a McMullen-Pitz barge using roto-sonic methods, as described in Section 4 of the Multi-Site FSP. Roto-sonic drilling was selected based on known conditions and because the method returns a largely intact core for the depth of the run, which was generally 10 feet or to refusal, based on the conditions encountered. Sampling locations were recorded using a DGPS unit.

Prior to boring, the water depth and presence of soft sediment was measured using the poling techniques described above. The physical characteristics of the river bottom materials (i.e. rock, sand, wood, etc.) were recorded for each location. The borings were advanced to either refusal or through the surface layer and up to 10 feet into the underlying native soils below. The sediment logs are included in Appendix E.

Samples were visually characterized, logged and sub-sampled in accordance with Section 4 of the Multi-Site FSP. The sediment core was subdivided into the following intervals:

- 0 to 6 inches below mudline
- 6 to 18 inches below mudline
- 18 to 30 inches below mudline
- 30 to 42 inches below mudline
- 42 to 54 inches below mudline, etc.

The 0 to 6 inch interval was collected to assess concentrations to which the benthic community is exposed. The core continued to be subdivided in one-foot intervals thereafter to the bottom. Samples for analysis of PVOCs were collected immediately, while all other COPCs were collected following sample homogenization in dedicated and disposable sample trays, as described in the SSWP.

3.6.5.3 Sediment Sample Analysis

Samples were submitted to the on-site mobile analytical laboratory for PVOCs, parent and alkylated PAHs (total of 34), and phenols. All the samples collected from transect T1, and select samples from transects T3, T4, and T7 were analyzed for inorganic compounds (aluminum, antimony, arsenic, barium, chromium, iron, manganese, nickel, selenium, silver, and vanadium) in the mobile laboratory (New Age/Landmark). Cyanide was submitted to Pace for analysis in a fixed-based laboratory. Analysis of the

inorganic parameters was completed in select samples to assess near-shore concentrations with upstream results from transect T1.

Seven samples from transects T1 and T3 (background and at the mouth of the former slough transects, respectively) were collected for laboratory analysis of total organic carbon (TOC) for potential use in the equilibrium sediment partitioning benchmark (ESB) approach, if necessary. Samples were collected at or near the surface and included T1-A (0-6"), T1-B1 (0-6"), T1-C1a (6-18"), T1-D1 (0-6"), T3-B1 (0-6"), T3-C1 (0-6"), and T3-D1a (0-6"). A portion of the all samples submitted to the mobile laboratory were retained for potential analysis of TOC or soot carbon in a fixed based laboratory in the event the ESB approach would be necessary.

Five composite samples were also collected for geotechnical testing to support the feasibility study from river locations T1-B1 (0-90"), T3-A1 (0-66"), T3-A3 (0-66"), T3-B1 (0-102"), and T4-A1 (0-72"). The geotechnical parameters were tested by CGC, Inc. and included:

- Atterberg limits;
- Grain-size (sieve and hydrometer);
- Specific gravity;
- Organic content by loss-on-ignition; and
- Moisture content.

A composite sample was also prepared for waste characterization by collecting and combining the entire core from 3 different locations in the project area. Pace analyzed the composite sample using Protocol B to identify potential disposal options.

3.6.6 Additional Step One Elements for River Sampling

The SSWP included additional work activities that were to be completed to evaluate potential ecological risks if specific conditions existed at the site. These additional elements included:

- Bioavailability analysis;
- Toxicity testing; and
- Benthic community structure evaluation.

These additional step-one elements were not performed because the extent of MGP-residuals observed in the river, based on visual and/or analytical results, indicated the affected sediment was relatively localized and consistent with previous RI sediment borings.

3.7 Pond Assessment

3.7.1 Surface Water Sampling

One composite water sample, consisting of three grab samples, was collected from the pond on July 20, 2007. The sub-samples were collected at the midpoint of the water column at the same locations where sediments were sampled (Psed-201, Psed-202, and Psed-203, Figure 6).

Surface water samples were collected using the peristaltic pump and flow through cell to monitor water quality parameters (pH, temperature, DO, ORP, and conductivity). The pond water sample was submitted to Pace to be analyzed for PVOCs, PAHs, phenols, aluminum, antimony, arsenic, barium, cadmium, chromium, copper, cyanide, iron, lead, manganese, mercury, nickel, selenium, silver, vanadium, and zinc.

3.7.2 Pond Sediment Poling/Sampling

Pond sediment samples were collected by NRT personnel on July 11, 2007 by wading into the pond and using a clear PVC tube to collect the sample. The tube was driven into the sediment to refusal, which occurred between 25 and 30 inches at all three locations (Figure 6). The core tube was filled with water, sealed to create a vacuum, and retrieved. Careful observance of the water within the core tube assured that the sediment material was not compacted or compressed during retrieval.

Sediment was extruded from the core, visually characterized, logged (Appendix E), and sub-sampled into the intervals consistent with the river borings. After collecting the PVOC sample, each interval was homogenized in a stainless steel bowl using a stainless steel spoon. A post was driven into the sediment to mark the location for surface water sampling (discussed above), and the locations were recorded using a DGPS unit. New Age/Landmark analyzed the sediment samples in the on-site mobile laboratory for PVOCs, PAHs, phenols, aluminum, antimony, arsenic, barium, cadmium, chromium, copper, cyanide, iron, lead, manganese, mercury, nickel, selenium, silver, vanadium, and zinc,.

One composite sediment sample, collected from sampling locations Psed-201 through Psed-203, was analyzed for the geotechnical parameters listed above for use in the FS, because the sediment characteristics were significantly different from those observed in the river.

3.8 Vapor Intrusion (VI) Sampling

A Supplemental RI Field Work Technical Memorandum (Appendix O) to address potential vapor intrusion was submitted to USEPA on March 5, 2010 and approved on November 12, 2010. The Technical Memorandum included the rational for selecting vapor sample locations and constituents to be analyzed.

Pairs of soil vapor probes were installed at 13 locations (SV1 through SV13) between January 10 and 14, 2011. Shallow vapor probes were installed approximately 3 feet bgs and deep probes were installed approximately one to two (1 to 2) feet above the water table. The vapor probes were installed at multiple depths at each location to estimate attenuation effects of the soil column. Probe locations were selected to evaluate potential vapor intrusion where the highest benzene and naphthalene concentrations have been detected in groundwater in the vicinity of nearby buildings (Figure 5):

- SV1 through SV4 – One probe on each side of this commercial building (Figure 5).
- SV5 through SV11 - Seven probes around the former Center Point mall and other nearby buildings to the south (Figure 5).
- SV12 and SV13 – Two probes in the area of highest groundwater concentrations or downgradient thereof. Probe SV12 was installed to assess lateral attenuation in the mall parking lot and is approximately half way between well OW-9 and the mall building (Figure 5). SV13 is within a right-of-way downgradient of well OW-09, the well which typically exhibits the highest benzene and naphthalene concentrations in groundwater (Figure 5).

Soil vapor probes were installed with flush mount covers and sampled in January and March 2011 to assess data consistency and temporal effects. Vapor sampling was conducted during cool months, which are the most conservative conditions when ambient temperatures are generally lowest and contaminant volatilization is likely to be lower in shallow soils compared to warmer months. Soil vapor sampling was performed concurrent with January 2011 and March 2011 groundwater sampling events.

Probes SV2, SV4, and SV13 were installed in grass; all other soil vapor probes were installed beneath pavement in parking areas to simulate sub-slab conditions. The probes were installed by On-Site in accordance with the Multi-Site FSP SOP No. SAS-11-03 using direct-push techniques. The probes consisted of ¼-inch outer diameter Teflon tubing connected to a ¼-inch diameter, 0.5-foot long stainless steel screen with a filter pack and bentonite grout seal. Two probes were nested within the same borehole and separated with bentonite placed between the screens/filter packs to collect two samples at different depths from each location, The tubing remained closed to the atmosphere via a four-way micro-valve and was only opened during soil vapor sampling events.

Soil samples were collected and logged at each vapor probe location during installation (Appendix D). Four samples were collected for grain size analysis, bulk density, specific gravity, and moisture content. These samples were collected from SV4 (3.0-3.5 ft. and 6.5-8.0 ft. bgs), SV7 (11-12 ft. bgs), and SV13 (10-12 ft bgs).

Soil vapor samples were collected in one-liter Summa canisters supplied and certified by the laboratory. Samples were collected in accordance with the procedures and methods described in the Multi-Site FSP SOP Nos. SAS-11-04 (probe sampling) and SAS-11-01 (sub-slab sampling) including proper purge volume, sample collection, flow rate, and vacuum requirements. Mechanical and chemical leak detection testing was conducted using the direct method as described in the above SOPs, including the use of a helium tracer gas, shroud, and field screening to detect the presence of helium in the soil vapor samples. Probe SV5S could not be sampled in March 2011 due to a blocked air line.

Samples were analyzed for benzene and naphthalene. Samples were also analyzed for carbon dioxide, oxygen, and methane for vertical profiling to assess bioattenuation and quality control purposes. Vapor samples were submitted under chain-of-custody procedures to STAT Analysis Corporation (STAT), a Multi-Site QAPP and USEPA approved laboratory.

3.9 Disposal of Investigation-Derived Waste

Investigative wastes were containerized during site investigation activities prior to off-site disposal. Solid wastes, which included all soil and sediment wastes generated during the investigation activities, were disposed at the Veolia Cranberry Creek landfill in Wisconsin Rapids following receipt of the Protocol B analytical results. Previous site solid wastes have also been disposed at Cranberry Creek.

Purge water from well development and well sampling activities, as well as the waste water from drilling activities, was disposed through the Plover POTW. Representative samples continue to be obtained and provided as required by the disposal authority.