NATURAL RESOURCE TECHNOLOGY

WISCONSIN DEPT. OF NATURAL RESOURCES

Remedial Investigation/ Feasibility Study

Lincoln Park /Blatz Pavilion Site

March 29, 2007

Project 1845

NATURAL RESOURCE TECHNOLOGY

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

LINCOLN PARK/BLATZ PAVILION SITE
MILWAUKEE, WISCONSIN

Project No: 1845

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EXECUTIVE SUMMARY

Presented herein, on behalf of the Wisconsin Department of Natural Resources (WDNR), is a Remedial Investigation/Feasibility Study (RI/FS) of sediments located in the Milwaukee River at the Lincoln Park/Blatz Pavilion site (Figure 1). The RI/FS activities are limited to sediments within the small embayment adjacent to the Blatz Pavilion, and not the larger area of the Estabrook Impoundment/Milwaukee River and Lincoln Creek sediments that contain polychlorinated biphenyls (PCBs) resulting from unidentified historic releases. The Blatz Pavilion represents a historic Milwaukee structure located within Lincoln Park and directly upstream of Estabrook Park. Both parks and the Estabrook Impoundment represent important community assets for continued upland and water resource recreation. Remedial options were evaluated to meet applicable regulatory requirements and risk based remedial action goals protective of human health and the environment. Remedial technologies were considered with proven effectiveness as well as more innovative applications.

In total, the Milwaukee River drains approximately 850 square miles (mi^2) in southeastern Wisconsin (Steuer et al, 1999). PCB contamination in the river was initially identified through fish tissue sampling, and fish advisories were issued in 1981. The Estabrook Impoundment contributes the greatest mass loading of PCBs in the Milwaukee River Basin, which is estimated to contain 64,000 cubic yards (cy) of contaminated sediment with slightly more than 5,380 pounds of PCBs (WDNR, 2005). A portion of this impoundment is the small embayment immediately adjacent to the Blatz Pavilion, which is estimated to contain approximately 3,900 cy of contaminated sediment and approximately 300 pounds of PCBs.

The Estabrook Impoundment is formed by the downstream dam, and is a 103-acre pool with a maximum storage of 700 acre-feet. The impoundment extends approximately 2.5 miles upstream, which is just upstream of Silver Spring Road. The dam and resulting impoundment also influences flow within Lincoln Creek to a point approximately 0.5 miles upstream of the confluence with the Milwaukee River. The dam is typically opened (allowing unrestricted water flow) around October 1 and closes around May 1. The dam is closed in summer to fill the impoundment to a target elevation of 616 feet above mean sea level (msl). The Estabrook Impoundment has also been lowered in anticipation of high flow events.

Sediments observed at the site are generally comprised of silt and clay with organic material, ranging in color from dark gray and dark brown to black. The average sediment thickness is slightly more than three feet and the maximum and minimum thickness observed at the site was 4.8 feet and 1.5 feet, respectively. The sediment overlies native gray clay till.

A Conceptual Site Model (CSM) was developed for the embayment to graphically illustrate possible exposure pathways by which human or ecological receptors could become exposed to the PCBs within the river sediments at the Blatz Pavilion. Exposure pathways for human receptors were identified on the basis of fish ingestion and for dermal and inhalation exposure during periods when the embayment is dewatered. Ecological receptors were identified for benthic invertebrate dermal and ingestion exposure to impacted sediment. Based on further evaluation of ecological risk using consensus based sediment quality guidelines (CBSQGs), a remedial action goal of 1 mg/kg was established for assessment of remedial options that would be protective of human health and the environment.

A variety of remedial options were identified and screened on the basis of effectiveness, implementability, restoration time frame and economic feasibility. Technologies initially screened included in-situ and ex-situ treatment technologies (e.g., stabilization/solidification, soil washing and vitrification), capping, excavation and removal and "no action". Based on the initial screening, two remedial options were selected for detailed analysis consisting of Option 1 (Removal and Landfilling) and Option 2 (Capping).

Based on the results of the detailed analysis, Option 2 (Capping) was eliminated based on concerns with limited long-term effectiveness as annual monitoring and maintenance would be required to ensure its effectiveness. Also, capping was considered undesirable for future recreational use of the embayment. The already shallow water depth would be severely reduced by the cap installation, which would then require institutional controls to prevent disturbance. The recommended remedial option is Option 1 (Removal and Landfilling) based on long-term effectiveness and implementability, limited or negligible requirements for institutional controls, and relatively lower cost when compared to in-situ or ex-situ treatment technologies.

Concept design plans are included in this document outlining a phased excavation approach and segregation strategies for removal of the PCB impacted sediment for off-site disposal. Key remedial objectives include maintaining access to the Blatz Pavilion, minimizing disruption to the community during remediation, and restoring the embayment for future recreational use. Following removal of the PCB impacted sediment, the embayment would be restored with materials such as clean well graded sand to enhance future recreational access, provide structural stability for the existing embayment stone retaining wall and improve fish habitat.

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CBSQG	Consensus Based Sediment Quality Guidelines
Cfs	Cubic feet per second
CSM	Conceptual Site Model
Cy	Cubic yards
ES	NR 140 Enforcement Standard
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FS	Feasibility Study
GLNPO	Great Lakes National Program Office
GPS	Global Positioning System
HARP	Hayton Area Remediation Project
MCPD	Milwaukee County Parks Department
MEC	Midpoint Effect Concentration
MMSD	Milwaukee Metropolitan Sewerage District
MNR	Monitored Natural Recovery
Msl	Mean sea level
NHPA	National Historic Preservation Action
NOI	Notice of Intent
PAL	NR 140 Preventive Action Limit
PCBs	Polychlorinated Biphenyls
PRV	Post-Remedial Verification
RI	Remedial Investigation
SEWRPC	Southeastern Wisconsin Regional Planning Commission
TOC	Total Organic Carbon
TSCA	Toxic Substance Control Act
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WDNR	Wisconsin Department of Natural Resources
WPDES	Wisconsin Pollutant Discharge Elimination System

1 INTRODUCTION

1.1 Overview

Natural Resource Technology, Inc. (NRT) was retained by the Wisconsin Department of Natural Resources (WDNR) to conduct a Remedial Investigation/Feasibility Study (RI/FS) of sediments located in the Milwaukee River at the Lincoln Park/Blatz Pavilion site (Figure 1). The RI/FS activities are limited to sediments within the small embayment adjacent to the Blatz Pavilion, and not the larger area of the Estabrook Impoundment/Milwaukee River and Lincoln Creek sediments that contain polychlorinated biphenyls (PCBs) resulting from unidentified historic releases. The WDNR will use the RI/FS for the Blatz Pavilion embayment to select and design a remedial alternative, and it is a goal to implement the selected remedy by the end of 2007. A site plan of the embayment area is provided on Figure 2. Representative site photographs are provided in Appendix A.

The Blatz Pavilion represents a historic Milwaukee structure located within Lincoln Park and directly upstream of Estabrook Park. Both parks and the Estabrook Impoundment represent important community assets for continued upland and water resource recreation. Assessment of remedial alternatives to address PCBs in sediment within the Blatz Pavilion embayment required careful consideration of potential short and long-term impacts to park users and neighbors, as well as long-term environmental restoration of the Estabrook Impoundment. The future value of the parks and impoundment is an important criterion for selecting a proposed remedy.

1.2 Project Background

In total, the Milwaukee River drains approximately 850 square miles (mi^2) in southeastern Wisconsin (Steuer et al, 1999). PCB contamination in the river was initially identified through fish tissue sampling, and fish advisories were issued in 1981. Based on the fish sampling results, numerous studies have been completed focusing on the river or specific reaches thereof (pertinent studies will be discussed further in Section 2), and these studies indicated that there were a number of locations where PCBs accumulated in river sediments. One of these areas was the Estabrook Impoundment, which is located immediately upstream of the Estabrook Dam.

The Estabrook Impoundment contributes the greatest mass loading of PCBs in the Milwaukee River Basin, which is estimated to contain 64,000 cubic yards (cy) of contaminated sediment with slightly more than 5,380 pounds of PCBs (WDNR, 2005). A portion of this impoundment is the small embayment immediately adjacent to the Blatz Pavilion, which was originally estimated to contain approximately 3,600 cy of contaminated sediment and 286 pounds of PCBs. The Blatz Pavilion embayment is isolated from the other contaminated areas in the impoundment and has easy public access. Despite signs indicating the presence of PCBs, the public continues to risk potential exposures through swimming, wading, and fishing activities. Thus, the embayment was selected by the WDNR to be the first area to be remediated in the impoundment.

1.3 Site History

Prior to the 1930s, a need to control the flow and flooding of the Milwaukee River was identified by civic and state leaders. A flood control project was undertaken between 1934 and 1938 with the goal of reducing uncontrolled flooding within the Milwaukee River basin, especially within the City of Milwaukee and surrounding urban areas.

The Estabrook Dam was built in 1936 for flood control purposes and to provide additional surface water for recreation purposes. The dam has a hydraulic height of eight feet, and a spillway elevation of 616 feet above mean sea level (msl) (Milwaukee Quadrangle, United States Geological Survey [USGS], 1971). The dam was built on a limestone outcrop in the river channel, and it has been reported that about 1,500 feet of rock ledge was removed from the Milwaukee River bed in this area as part of this project (WDNR, 2006).

The Estabrook Impoundment is formed by the dam, and it is a 103-acre pool with a maximum storage of 700 acre-feet. The impoundment extends approximately 2.5 miles upstream, which is just upstream of Silver Spring Road. The dam and resulting impoundment also influences flow within Lincoln Creek to a point approximately 0.5 miles upstream of the confluence with the Milwaukee River.

The Milwaukee County Park System was created on January 1, 1937 through consolidation of the Milwaukee County Park Commission and the City of Milwaukee Park Board[1], and both Estabrook and Lincoln Parks were incorporated into the park system at that time. In addition to the park system, the

[1] January 12, 2007. History of the Parks, Milwaukee County Website, URL is http://www.co.milwaukee.wi.us/HistoryoftheParks16572.htm.

Milwaukee County Parks Department (MCPD) controls operation of the Estabrook Dam, which includes opening and closing the dam in the fall and spring of each year, respectively, or whenever necessary given expected flow/precipitation conditions.

1.4 Current Property Use

Lincoln and Estabrook Parks are an integral part of the park system, and continue to serve as recreational points for local residents. Aquatic activities are an important aspect of the parks, as well as the open green space they provide. The MCPD allows residents to portage non-motorized watercraft across park land and to launch into the rivers controlled by the Department, including the Milwaukee River and the Estabrook Impoundment. There are three designated access sites for canoeing and kayaking in Estabrook Park and one near the Lincoln Park fishing pier, which is located on the east bank of the river, north of Hampton Avenue.

Within Lincoln Park, in the vicinity of the Blatz Pavilion, there are picnic areas as well as baseball and softball diamonds, football/soccer fields, a playground, a swimming pool, and walking trails. The relative location of these areas to the Blatz Pavilion affords easy access to the river, which increases the possibility of exposure by the public to PCBs in the river sediments. This is especially true in summer, when outdoor temperatures are elevated and the river provides opportunities for wading and/or (possibly) swimming as a means for cooling off at this time of year.

2 SUMMARY OF SITE CONDITIONS

2.1 Previous Investigations

A number of investigations have been completed on the Milwaukee River since the fish advisories were issued in 1981. The investigations have generally included long reaches of the river; however, only the sampling completed by WDNR between September 2002 and August 2003 contributed data regarding sediment PCB concentrations or thickness data for the Blatz embayment (WDNR, 2005). The sampling points, collection date, and sample collection method for these points are listed below, and the locations are shown on Figure 2.

Sample Location	Sample Date	Sample Collection Method
EST 2-1	9/25/2002	Eckman Dredge
EST 2-2	10/10/2002	Push Corer
EST 2-3		
EST 2-4		
EST 2-5		
EST 2-6		
EST 2-7		
EST 2-8		
EST 2-9		
4X8	8/6/2003	Piston Corer
4X9		
4X10		

The PCB results from these points, along with data collected by NRT in December 2006, comprise the data set used for this study and evaluation of remedial alternatives.

2.2 Site Investigation Activities

In December 2006, the WDNR requested that NRT complete additional site investigation activities to further assess the vertical extent of sediments and PCB concentrations. This request was based on December 12, 2006 poling by WDNR, which suggested there were concerns regarding the following:

- That sediment was actually thicker in some areas than previously estimated based on historic investigation results;

- That elevated PCB concentrations, greater than 50 mg/kg, may not have been fully defined vertically in and through the sediment layer during previous investigations; and

- That insufficient sampling was previously conducted to adequately characterize the vertical distribution of PCB concentrations near the river.

Based on these concerns, NRT mobilized to the site on December 27, 2006 and collected additional sediment samples from five previously established sample locations, which included the following:

- EST 2-2;
- EST 2-4;
- EST 2-5;
- EST 2-6; and
- EST 2-9;

The new locations sampled by NRT were given the suffix "A" to differentiate the old and new analytical data (Figure 2). Sediment samples were collected as near as possible to the previous sampling locations through the use of a hand-held Trimble GPS unit, accurate to approximately 3 feet in the field. All of the new cores were collected less than five feet from the original sampling location with the exception of EST2-9A. The original location for EST2-9 was now in the river, so sample EST2-9A was collected approximately 25 feet from the original location. Sediment samples were also collected from two new locations identified as NRT-1 and NRT-2 along the eastern perimeter of the embayment (near the river) to better define this area (Figure 2).

Sediment samples were collected by coring through the sediment column. A core tube was manually pushed or driven with a hammer through the soft sediments to refusal. The core tube was removed and the sediments were extruded from the tube and subdivided into sample intervals for laboratory analysis of PCBs. The sediment was briefly described during sample collection to ensure that the presence of significant debris or non-native materials (i.e., clay, sand/gravel, or bedrock) was appropriately identified for remedial purposes. The overall sample interval submitted to the laboratory varied due to compaction of the sediment within the core tube during sampling and retrieval.

At previous locations where data was available, sampling began at the depth where the historic sampling ceased (e.g. EST2-5 extended only to a depth of 0.5 meters in 2002). This was accomplished by hand auguring to the total sample depth at the particular location and then sampling deeper sediments using the core tube. The additional core was then subdivided as described above for laboratory analysis of PCBs. This method of sampling at the former locations facilitated the collection of additional data while limiting unnecessary expenditures for analysis of previously collected sediment columns.

NRT also completed six test pits (TP-1 through TP-6) to evaluate the base of the retaining wall as well as verify the sediment thickness and lithology near a few of the sampling locations (Figure 2). The test pits were completed at depths ranging from two feet to six feet. Grab samples were collected from the lower clay layer for PCB testing from test pits TP-1, TP-2 and TP-5. In general, test pits were backfilled immediately with the exception of TP-1 which was allowed to remain open for approximately two hours to further assess surface water infiltration. A qualitative structural evaluation of the embayment wall was also completed through visual observations that focused on assessing the wall foundation and other factors that require consideration to minimize potential damage during remediation. NRT staff returned to the site on December 28, 2006 and completed a survey of the surface elevation at all of the boring and test pit locations. The laboratory analytical report for the PCB results is included in Appendix B.

Two samples were collected from core locations NRT -1 and NRT – 2, located near the river, for geotechnical testing to further differentiate index properties between the sediment and the lower clay till layer. One grab sample of sediment from NRT -1 and one grab sample of the lower clay from NRT-2 were collected at approximate depths below the top of the sediment of 23 to 42 and 33 to 36 inches, respectively. Samples were submitted to GESTRA Engineering's geotechnical laboratory for Atterberg Limits and Hydrometer testing. Geotechnical testing data are provided in Appendix C.

2.3 Summary of Hydrologic Conditions

Flow within this segment of the river is regulated by the Estabrook Dam as discussed in Section 1.3. The MCPD typically opens the dam (allowing unrestricted water flow) around October 1 and closes it around May 1. The target dates are sometimes shifted slightly to accommodate repairs, construction, or other events. The dam is closed in summer to fill the impoundment to a target elevation of 616 feet above msl. The Estabrook Impoundment has also been lowered in anticipation of high flow events. Opening the dam dewaters the embayment sediments which may induce some compaction due to dewatering.

Historic flow within in this segment of the river has been evaluated through review of historic flow data from the USGS gauging station that is located in Estabrook Park, approximately 1,200 feet downstream of the Estabrook Dam and about 6.6 miles upstream from mouth[2]. The drainage area for the river at this location is about 696 square miles and the period of record extends from April 1914 to the present. The site is operated in cooperation with the Milwaukee Metropolitan Sewerage District (MMSD) and the Southeastern Wisconsin Regional Planning Commission (SEWRPC). The gage datum is 607.23 feet above msl and according to the National Weather Service[3], a level of about 614 feet above msl (6.8 feet gage height) can be considered to be about a 5 year flood event. The 2-year storm discharge event is approximately 4,730 cubic feet per second (cfs); flow for the 100 year storm event is 14,770 cfs (Walker and Krug, 2003). Hydrologic data from the referenced sites is included in Appendix D.

The historic hydrograph shows the mean daily and mean monthly flow events for data collected between 1914 and 2005 (Figure 3). Peak flow events occur in March and April, when individual averages are as great as 1,300 cfs, and the historic monthly mean flows for March and April are 1,030 cfs and over 960 cfs, respectively.

The hydrograph also shows the influence of the dam on flow within the river. Typically, flow in unrestricted rivers generally mimics precipitation, which increases in summer. The plot showing the mean monthly precipitation (also tabulated below) indicates that river flows are lowest when precipitation is greatest (Figure 3). The hydrograph indicates that flow decreases significantly during late April and early May, corresponding with the dam closing and that it continues to decline until it ranges from about 210 cfs to 265 cfs between July and September. Annually, over 50% of precipitation occurs between May and September, yet flow declines throughout this period. The mean monthly flows during winter (from November through February) range from 300 cfs to 395 cfs, which suggests a more normative relationship between flow and precipitation in an unrestricted system.

Month	Average Precipitation (inches)	Month	Average Precipitation (inches)
January	1.85	July	3.58
February	1.65	August	4.03
March	2.59	September	3.3
April	3.78	October	2.49
May	3.06	November	2.7
June	3.56	December	2.22

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[2] February 22, 2006. Station 04087000 "Milwaukee River At Milwaukee, WI" USGS Stream Flow Website for Wisconsin. URL is http://waterdata.usgs.gov/wi/nwis/

[3] February 22, 2006. National Weather Service Advanced Hydrologic Prediction Service Website.
URL is http://www.crh.noaa.gov/ahps2/hydrograph.php?wfo=mkx&gage=meew3&group=256521&view=1,1,1,1,1,1

The 1981 Flood Insurance Rate Map (FIRM) published by the Federal Emergency Management Agency (FEMA) indicates that the 100 year flood event in the vicinity of the Blatz Pavilion occurs when the river is at an elevation of 621 feet to 622 feet above msl, which is five to six feet higher than the spillway elevation. However, due to the site geometry and setting, such flooding does not extend much beyond the vicinity of the pavilion itself, which would limit overall damage to private property.

The Milwaukee River is the primary source of water to the embayment. Additional contributions of surface and/or storm water runoff were noted from three other sources:

- Overland runoff directly from landscaped park areas north and south of the embayment;
- Observed surface water seepage directly through and at the base of the retaining wall along the western portion of the embayment; and
- Direct discharge from a storm sewer pipe constructed through the retaining wall located in the northwest portion of the embayment.

During the course of the investigative activates conducted during December 2006, sediment erosion and channeling was noted in the northern portion of the embayment due to various contributions of surface water runoff as indicated in photographs 1 and 2, Appendix A. During the period of observation, river water levels remained slightly lower than the top of the sediment in the embayment but it is suspected that during periods of heavy precipitation, flooding of the embayment could occur while the Estabrook dam is open. Regardless, surface water contributions of PCBs are essentially non-existent in winter, when the embayment is dewatered.

2.4 Geologic and River Bottom Observations

Regional geology in the site vicinity is characterized by ground and end moraine glacial deposits. These soils include till plain deposits of relatively uniform thickness which are characterized as clay, silt, sand and gravel. The unconsolidated materials are underlain by Devonian dolomite bedrock of the Milwaukee Formation (Skinner and Borman, 1973).

The *Soil Survey of Milwaukee and Waukesha Counties, Wisconsin* (United States Department of Agriculture [USDA], 1971) shows the site being underlain by soils of the Kewaunee-Manawa association. The soils of this association are characterized by having a subsoil of clay and silty clay, which generally formed in thin loess and/or silty clay glacial till on moraines and in depressed areas. Based on site observations, the sediments at the site are underlain by a medium gray glacial till, which generally corresponds to the description of the Kewaunee-Manawa association soils. The till is predominantly clay with minor amounts of sand and gravel, which vary throughout the formation.

Sediments observed at the site were generally comprised of silt and clay with organic material, and the color ranged from dark gray and dark brown to black. Observations regarding grain size from previous and recent sampling results are summarized below.

Material	Sample Location	Gravel	Sand	Silt	Clay	Fines	Total Organic Carbon
Sediment	4X8	0.0%	3.3%	53.8%	42.9%	96.7%	11.6%
	4X9	0.0%	5.7%	59.6%	34.7%	94.3%	9.1%
	4X10	0.0%	24.2%	42.9%	32.9%	75.8%	10.2%
	NRT-1	1.0%	19.0%	60.0%	21.0%	81.0%	Not analyzed
Averages (sediment)		0.3%	13.1%	54.1%	32.9%	87.0%	10.3%
Clay	NRT-2	6.0%	24.0%	54.0%	22.0%	73.0%	Not analyzed

Silt was the predominant grain size and, generally, it comprises more than half of the material within the sediment. The percentage of sand within the sediment ranged from about 3 to 24 percent, and it appears that the sand content increases moving south in the embayment. The total organic carbon (TOC) content of the sediments in the embayment averaged approximately 10 percent, which is typical for sediments.

The geotechnical testing data for NRT- 1 (sediment) and NRT-2 (clay) did not provide a distinctive geotechnical differentiation between the sediment and lower clay units that was initially anticipated. As indicated above, both samples contain the same relative percentages of clay although NRT-1 has a slightly higher percentage of silt. Based on the Atterberg testing results both NRT-1 and NRT-2 classify as CL material although the hydrometer analyses would suggest a classification closer to a CL-ML.

Sediment thickness observations from the December 2006 sampling locations are listed in the table below. The sediment thicknesses within the embayment, along with PCB concentrations (which will be discussed in Section 2.5), are shown on cross sections A-A' through E-E' (Plate 1); the thickness data have also been contoured (Figure 4). Points B-1 through B-16 are projected locations used to define the embayment boundary and provide control for the calculation and contouring of the sediment thickness data and related volumes. Data for these projected boundary points were developed by assuming that sediment conditions observed in field sampling locations closest to the boundary points were similar. Where possible, data were interpolated using more than one sampling location.

Location	**Sediment Thickness (feet)**	**Location**	**Sediment Thickness (feet)**
Cores		**Test Pits**	
EST 2-2A	3.7	TP-1	3.0
EST 2-4A	3.5	TP-2	3.5
EST 2-5A	2.8	TP-3	3.0
EST 2-6A	4.5	TP-4	4.5
EST 2-9A	3.2	TP-5	1.5
NRT-1	4.8	TP-6	2.0
NRT-2	2.8		

The average sediment thickness is slightly more than three feet and the maximum and minimum thickness observed at the site was 4.8 feet and 1.5 feet, respectively (Figure 4). Overall, the sediment is thinnest at the northern end and it thickens towards the south central portion of the embayment. A band of sediment exceeding four feet in thickness extends northeast from the southwest corner of the embayment to a location near the central portion of the site at the river. The sediment thickness then decreases moving towards the south, to just over two feet at the southeast corner (Figure 4). The overall volume of sediment within the embayment has been calculated to be approximately 4,700 cy (Table 2).

Previously, it was speculated that the site was underlain by weathered and competent bedrock. However, the 2006 test pits and cores did not reveal the presence of bedrock beneath the site. Rather, it appears that the gravel within the clay till may have been identified as weathered bedrock. Tests pits excavated near the wall did yield some large rack fragments; however, it could not be determined if these were weathered bedrock, glacial erratics, or simply retaining wall stones that had been buried over time. Also, it appears that the clay till is much more extensive and thicker than previously thought. These observed conditions are more favorable for limiting PCB migration, given the likelihood that the underlying clay till is far less permeable than would be a weathered bedrock surface.

2.5 Surface Water and Groundwater

During excavating of the test pits observations were made with respect to the presence of groundwater and/or infiltration of river water. The results of these observations indicated the following:

- In general saturated conditions were encountered throughout the depth of each of the test pits and into the clay till;

- Significant surface water infiltration was observed at TP-1 (closest to the river) where the test pit completely filled with water over approximately two hours;
- Surface water infiltration was observed in all of the test pits primarily along the clay/sediment interface;
- Surface water infiltration decreased in test pits excavated further from the river;
- In general, no free water was noted in excavated sediment that was temporarily stockpiled next to each test pit; and
- No discernable indication of groundwater infiltration was observed although the length of time the test pits were allowed to remain open was limited given the low permeability clay till.

2.6 PCB Distribution

PCBs are distributed fairly uniformly throughout the sediment of the embayment, and the PCB results for all the sample intervals are listed on Table 1. PCB concentrations are also plotted on five cross sections (Plate 1) and were used to delineate sediments containing various concentrations ranges of PCBs. For discussion purposes, reference concentration values for PCBs were established based on the following:

- Less than 1.0 mg/kg: This concentration generally reflects treatment goals established for other PCB sediment sites in Wisconsin such as the Lower Fox River and Hayton Area Remediation Project (HARP) in Pine Creek, a tributary to the South Branch of the Manitowoc River,
- 1.0 to less than 50 mg/kg: These concentrations reflect material that would require management as a non-Toxic Substance Control Act (TSCA) waste but would still require special handling and management, and,
- Greater than 50 mg/kg: This concentration reflects sediment that would require special handling and disposal at a licensed TSCA approved facility.

As previously discussed, there is as much as 4.8 feet of sediment overlying the clay till in the embayment, and the average sediment thickness is just over three feet. Total estimated volumes of sediment based on the reference values defined above are summarized in Table 2 and indicate the following:

- The total estimated volume of sediment with concentrations less than 1 mg/kg PCBs is approximately 800 cy. Sediment with these concentrations are generally located just above the lower clay although there are some limited areas at the sediment surface and are laterally discontinuous as suggested by the cross sections.
- The total estimated volume of sediment with concentrations between 1 to less than 50 mg/kg PCBs is 2,700 cy. This volume is generally divided into two distinct layers above and below the layer with concentrations greater than 50 mg/kg PCBs.

- The total estimated volume of sediment with concentrations greater than 50 mg/kg PCBs is 1,200 cy.

Figure 5 provides a plan view of the lateral extent of PCB impacted sediment with concentrations greater than 50 mg/kg near or at the sediment surface. In general, the lateral distribution of sediment with PCB concentrations greater than 50 mg/kg is relatively uniform but varies vertically as indicated on Plate 1. As indicated in Figure 5, sediment with greater than 50 mg/kg PCBs is present at the surface over most of the north end of the embayment and near the river at NRT-1[4]. At all other areas of the embayment, PCB concentrations at the sediment surface are less than 50 mg/kg. In general, areas where the PCB concentrations exceed 50 mg/kg at the surface have lower surface elevations than the remainder of the embayment, Also, the greater than 50 mg/kg PCB sediment layer does not extend all the way to the south end of the embayment; rather, this layer pinches out between sample core locations 4X10 and NRT-2.

[4]The PCB results from NRT-1 and EST2-8 were combined and treated as a single location on the cross-sections.

3 REMEDIAL ACTION OPTIONS

3.1 Conceptual Site Model

A Conceptual Site Model (CSM) for the embayment is provided in Figure 6. The CSM graphically illustrates possible exposure pathways by which human or ecological receptors could become exposed to the PCBs within the river sediments at the Blatz Pavilion (Figure 6). A review of the CSM indicates the following:

- Human Receptors: Exposure pathways for human receptors for such activities as recreational water use and fishing are complete with respect to the dermal and ingestion routes for sediment and the ingestion route for fish tissue. The sediment ingestion and inhalation route is predominantly present during winter, when the sediment can more readily be accessed because the embayment is dewatered and sediment can become airborne through desiccation.
- Ecological Receptors: Exposure pathways for ecological receptors affect primarily benthic invertebrates and are complete with respect to the dermal and ingestion routes for sediment. Although this pathway is considered complete, it is somewhat limited based on the fact that annual dewatering of the sediments exposes the benthic community to desiccating conditions and freezing. These seasonal conditions likely severely reduce the benthic population. The fish exposure is considered an incomplete pathway because the fish are completely absent during dewatered periods and have a large foraging range during summer, which limits their overall exposure to PCBs in the embayment sediments.

Although the fish exposure is presented as an incomplete pathway for the embayment, it is considered the most significant for human health due to the consideration that the embayment is extensively used for fishing during the summer when fish foraging in other impacted areas of the Estabrook Impoundment have access to embayment. Regardless, as bioaccumulation of PCBs in fish tissue is the primary transport mechanism for ingestion, a focus on the benthic exposure pathways should be included for assessment of risk. Therefore, possible sediment remedial alternatives will consider this risk to human health as well as the dermal and ingestion pathways summarized on the CSM.

3.2 Screening Level Risk Assessment

To further evaluate potentially acceptable risk-based exposure levels for PCB concentrations in the embayment sediment, consensus-based sediment quality guidelines (CBSQGs) were evaluated for exposure routes to benthic invertebrates as provided in the WDNR's December 2003 guidance document

(Publication WT-732 2003). This evaluation consisted of comparing PCB and total organic carbon (TOC) data for the embayment to the CBSQG midpoint effect concentration (MEC) for total PCBs of 368 µg/kg (0.368 mg/kg) normalized to 1 percent TOC. Previous TOC analyses for three sediment samples consisting of 4X8, 4X9 and 4X10 indicated respective concentrations of 11.6, 9.1 and 10.2 percent for an average of 10.3 percent. Normalizing the MEC of 0.368 mg/kg to 10.3 percent indicates a concentration of 3.68 mg/kg. Based on a range of TOC from 1 to 10.3 percent, consideration of preliminary remedial action goals in the range of 0.368 to 3.68 mg/kg could be appropriate.

3.3 Applicable Regulatory Requirements

Applicable regulatory requirements were evaluated with respect to previously identified exposure pathways and receptors identified on the basis of the CSM. The primary pathway of concern is human health with respect to ingestion of fish tissue. Other human receptors include dermal and ingestion through incidental contact with PCB contaminated sediment. Standards were also evaluated with respect to both state and local City and County permitting requirements for implementing remedial operations at the site. Applicable regulatory requirements identified to address these considerations and establish appropriate remedial action objectives for the site consist of the following:

- <u>NR 102 to 105, Surface Water Quality</u>: Reference surface water quality standards are established for protection of public health and enjoyment and protection of fish, shell fish and wildlife and are directly applicable to migration of contaminants to the Milwaukee River.
- <u>NR 140, Groundwater Quality</u>: Standards identify Preventive Action Limits (PALs) and Enforcement Standards (ESs) that are directly applicable to leaching of contaminants to groundwater.
- <u>NR 216</u>: Addresses permitting requirements for construction site storm water runoff under the Wisconsin Pollutant Discharge Elimination System (WPDES).
- <u>NR 157</u>: Standards address management of PCBs and products containing PCBs.
- <u>NR 700, Investigation and Remediation of Environmental Contamination</u>: Standards are directly applicable to identifying and implementing an appropriate remedial alternative for the site. They identify procedures that allow for site specific flexibility pertaining to the identification, investigation and remediation of sites and facilities.
- <u>Chapter 30</u>: Standards identify permitting requirements for minimizing adverse affects when performing work along navigable waterways.

- NR 322, Wisconsin General Permit Program: Standards address erosion control protection along a navigable waterway and are applicable for modifying the river bank or performing excavation.

- Local Ordinances: These would address local City and County permitting requirements for heavy equipment operation, construction traffic, noise, operational hours and other environmental controls during performance of remedial operations.

- TSCA Substances Control Act (TSCA): Establishes requirements for the handling, storage and disposal of PCB-containing materials in excess of 50 mg/kg.
- Clean Water Act: Standards are addressed under Section 304 where a state has not adopted standards.
- Section 10 – Rivers and Harbors Act: Section 404 – Clean Water Act: Addresses approval requirements from the United States Army Corps of Engineers (USACE) for discharges of dredged or fill material into water uses.
- National Historic Preservation Action (NHPA), 16U.S.C. 470 et seq: Provides protection for historic properties on or eligible for inclusion on the National Historic Register of Historic Places.
- Endangered Species: State and Federal statutory provisions intended to protect threatened or endangered species.

Other documents to be considered include:

- Great Lakes Water Quality Initiative: Set forth guidance to the states bordering the Great Lakes regarding their wastewater discharge programs.

- Sediment Remediation Implementation Guidance: Part of the Strategic Directions Report of WDNR addressing the sediment remediation approach to be followed by the WDNR.

- Great Lakes Water Quality Agreement: Agreement calls for the identification of "Areas of Concern" in ports, harbors and river mouths around the Great Lakes.

3.4 Remedial Action Objectives and General Response Actions

Based on the assessment of the CSM, the following remedial action objectives were established for the assessment of remedial options:

- Reduce the potential for ingestion of PCBs through fish tissue; and

- Reduce the potential for dermal contact or ingestion of PCB contaminated sediment.

Based on the range of preliminary remedial action goals established on the basis of the screening level risk assessment in Section 3.2, a remedial action goal of 1 mg/kg is recommended for the embayment sediment. This goal is consistent with what has been previously established at other PCB sediment project sites in Wisconsin such as the Lower Fox River and HARP (Pine Creek/Manitowoc River) and is considered to be protective to human health and the environment.

General response actions were identified that could potentially meet the selected remedial action objectives. Criteria for selection of technologies that could meet the general response actions included the following:

- Treatment that would reduce the toxicity, mobility or volume of PCB impacted sediment;
- Treatment that would reduce or mitigate the need for long-term management;
- Containment that does not include treatment as a principle element but is protective of human health and the environment; and
- Innovative technologies that could potentially achieve a greater level of remediation without unacceptable cost penalties as compared with more conventional or demonstrated approaches.

Based on these criteria, possible response technologies are divided into three general response options consisting of "No Action", and passive and active responses summarized below:

- No Action: The "No Action" response would rely primarily on long-term institutional controls and monitored natural recovery (MNR) processes to meet the remedial action objectives.
- Passive Responses: Passive technologies would include capping or containment combined with long term institutional controls and MNR.
- Active Responses: Active technologies would include excavation and removal, in-situ treatment such as stabilization/solidification and ex-situ treatment such as sediment washing or vitrification.

3.5 Site-Specific Remedial Parameters

Site specific remedial parameters that required consideration as part of the assessment of remedial options included the following:

- Structural Integrity of the Embayment Retaining Wall: Based on the qualitative structural assessment conducted as part of field activities in December 2006, the foundation for the wall appears to be constructed of concrete or stone blocks set directly on the clay till (see photographs 16 and 17, Appendix A). The overall condition of the foundation appeared to be sound with no visual evidence of structural degradation. Construction of the wall appears to be of grouted dolomite slabs (Lannon Stone) which may have been quarried on-site during construction in the 1930's. Overall, the condition of the wall is in a state of disrepair and shows evidence of significant deterioration at several locations consisting of spalling, loss of stone and penetration of root growth directly through the wall (see photograph 4, Appendix A). In addition, lateral earth pressures have resulted in movement of the wall particularly at the south end of the embayment. Further structural evaluation of the wall may be warranted depending on the location selected for possible access of heavy equipment. A preliminary retaining wall evaluation, prepared by GESTRA Engineering, is provided in Appendix E.

- <u>Site Access Constraints and Limitations:</u> The Blatz pavilion building is actively used as a community center and for offices by the MCPD. As such, uninterrupted access to the building will be required during the course of any remedial action. Access to the embayment could be achieved from either the north or south sides of the embayment although landscaped areas to the north consist of relatively steep grades from Hampton Avenue to the embayment. Access from the north would provide the shorter route for trucks or heavy equipment than from the south side that would require establishing transportation routes to Glendale Avenue or around the building to Hampton Avenue. Close coordination will be required with the MCPD to confirm final access requirements.

- <u>River Water Management During Remediation:</u> Observations made during excavation of the test pits indicated that if a removal action is selected a significant portion of the sediment could be removed with only minimal dewatering. However, as removal operations approach the river, appropriate measures will need to be in-place to actively dewater and manage water for either treatment or discharge back to the river under an approved WPDES permit or to a sanitary sewer as approved by MMSD. Other engineering measures may also be required such as sequencing the removal in small sections or installing a temporary dam to limit surface water infiltration.

- <u>PCB Impacted Sediment Re-deposition</u>: Selection of an appropriate remedial option will require consideration of the possibility of re-deposition of PCB laden sediment from other upriver impacted areas of the Estabrook Impoundment. This could be a significant consideration during periods of heavy precipitation. However, based on the vertical delineation of PCBs observed in the embayment, much of the most heavily impacted sediment is likely covered with sediment containing much lower or negligible concentrations that would pose a lower concern for re-deposition in the embayment.

- <u>Site Restoration Requirements for Future Use</u>: Restoration of the embayment following remedial action will require consideration for maintaining the structural integrity of the embayment retaining wall and future access for recreational use. Future use objectives will require further input from the MCPD but could include restoring the site with clean well graded sand that would maintain access for light water craft such as canoes or kayaks but provide adequate egress for park users from the embayment to address water safety concerns.

3.6 Identification and Initial Screening of Remedial Action Options

Four remedial action options were evaluated for potential consideration for the clean-up of the Blatz Pavilion sediments including:

- Option 1: Removal and Landfilling – This option includes removal of PCB impacted sediments to less than 1 mg/kg and off-site licensed landfill disposal. The removal operation would take place during the time period when the dam is open and sediments are exposed. The greater than 50 mg/kg material would be disposed in an approved out-of-state landfill and the less than 50 mg/kg material would be disposed of at a local landfill approved for special waste disposal. Shoring along the eastern boundary of the embayment would likely be necessary for removal and dewatering of the sediments near the water edge. Following removal, clean backfill material (i.e., sand type) would be placed to the previous sediment elevation to minimize sediment re-deposition.

- Option 2: Capping - This option includes placing a sand cap over the sediments which would remain in-place. Approximately one foot of sand would be placed over the sediment either during a frozen, exposed sediment time period or placed through the water with a barge operation when the dam is closed. This option involves long-term monitoring and maintenance of the sand cap.

- Option 3: In-situ or Ex-situ Treatment – This option could include several different technologies such as in-situ stabilization, ex-situ vitrification and ex-situ sediment washing. These technologies require bench-scale testing and subsequent pilot testing to determine their effectiveness in treating, immobilizing or destroying PCBs. The stabilization and vitrification technologies would transform the sediment into a hardened monolith, whereas the sediment washing would remove the PCBs from the sediments to an acceptable level. These technologies are further discussed below.

- Option 4 – No Action – This option would consist of implementing long term institutional controls to restrict access to the embayment and would be combined with MNR.

Initial screening of remedial action options was performed in general accordance with NR 722 criteria consisting of effectiveness, implementability, restoration time frame and cost. Specific considerations for each of these criteria consist of the following:

- Effectiveness: Key considerations include: 1) the extent the remedial option would be protective of human health and the environment; 2) the level of treatment/removal that could be achieved; and, 3) the extent to which the remedial option has been demonstrated at other similar sites. Protection of human health and the environment refers to both the construction and implementation (short-term) and operation and maintenance (long-term) considerations for reducing the toxicity and mobility. Level of treatment/removal refers to the degree to which the technology reduces contaminant mass.

- Implementability: Implementability refers to the feasibility and/or availability of a given process remedial option for the site. Feasibility is further delineated on the basis of technical and/or administrative considerations. Technical feasibility refers to the ability of the remedial option to adequately treat/remove the constituents of concern given site specific conditions. Certain options may be able to adequately address the constituents but cannot be implemented due to such factors as space limitations and unacceptable subsurface conditions. Administrative feasibility refers to the ability of the remedial option to meet such factors as local and state permitting requirements and regulatory reviews for approval. Availability refers to such factors as the geographic location of the site and the extent to which the remedial option is commercially available.

- Restoration Time Frame: The key consideration for this criterion is the time frame that would be required to meet the remedial action objectives and restore the site for future use.

- Economic Feasibility: For comparative purposes, the initial screening table presents relative differentials in cost magnitude (low, medium and high) taking into consideration anticipated capital and operation and maintenance costs for each technology. As such, cost considerations are provided for general assessment and were not used singly as a screening tool unless substantial cost differentials were identified that would immediately preclude the technology from further consideration.

3.6.1 Initial Screening Results

The four potential remedial options were initially screened for the above criteria. Two options were not selected for further evaluation based on one or more of the above screening criteria. The options not selected include Option 3 (In-Situ or Ex-Situ Treatment) and Option 4 (No Action). The basis for elimination of these options from further consideration is detailed below.

3.6.1.1 In-situ or Ex-Situ Treatment

In-situ or ex-situ treatment was eliminated from further consideration based on several criteria which are specific to the particular technology as discussed below:

In-situ Stabilization – This technology was eliminated from further consideration based on lack of demonstration of long-term effectiveness on sediments, implementability and cost concerns. The technology has been used primarily on soils with demonstrated effectiveness. Because the technology relies on stabilization with cement-based reagents, the long-term effectiveness (minimal leaching of PCBs from the stabilized sediment) with a submerged sediment scenario is less demonstrated. In addition, implementation of this technology would cause an undesirable expansion of the sediment volume, for which a substantial volume would require disposal. Based on these considerations, capital costs for implementation of this technology would likely be high in the range of $1,200,000 to $1,800,000.

Ex-situ Vitrification – This technology was eliminated from further consideration based on implementability, restoration time-frame and cost concerns. Sediments would be excavated and transported to a fixed vitrification facility, possibly in Neenah or Winneconne, Wisconsin. Equipment and utility requirements for this technology are substantial as the sediments are heated to a glass state, vaporizing the PCBs. Pilot-scale testing was previously conducted on PCB-contaminated sediments from the Fox River. Implementation of this technology requires off-gas collection and treatment, and high moisture content sediments are required to be dried out before the melting process can begin. This drying process requires large amounts of energy. Permits for the acceptance of PCB-contaminated sediments at these facilities are not known to be in-place. It is uncertain whether the facilities would pursue permitting the material, given the small volume of sediment to be excavated. The current permitted feedstock material is paper mill sludge, and additions or modifications to the current equipment may be necessary for full-scale treatment of high moisture content sediments. Based on these considerations, capital costs for implementation of this technology would likely be high in the range of $2,300,000 to $3,500,000.

Sediment Washing – This technology was eliminated from further consideration based on implementability, restoration time-frame and cost concerns. Equipment and utility requirements for this technology are substantial as the sediments are treated ex-situ with bioremediating surfactants. Implementation of this technology requires several washing units and tanks, shaker screens, sediment processor, hydrocyclones, water blasters, compressors, and water treatment equipment. The technology requires a considerable time-frame to complete as only small volumes of material can be treated at one time (typically 35 to 50 tons/hour). Costs would depend on the number of treatment cycles required to meet the target clean-up goal. Based on these considerations, capital costs for implementation of this technology would likely be high in the range of $1,500,000 to $1,800,000.

3.6.1.2 No Action

The No Action option was eliminated from further consideration based on the direct contact risk posed by PCB concentrations greater then 50 mg/kg existing at the sediment surface and that MNR processes would not effectively reduce contaminant mass or toxicity.

3.7 Detailed Analysis of Selected Remedial Option

Two remedial options for clean-up of the Blatz Pavilion sediments were analyzed in detail including Option 1 (Removal and Landfilling) and Option 2 (Capping). Table 3 identifies the key favorable and less-favorable points associated with the evaluation criteria for each option. Engineering and institutional controls were also evaluated for each option as detailed below.

3.7.1 Removal and Landfilling

Key points associated with each evaluation criterion for the Removal and Landfilling option are presented below:

Long-term Effectiveness – Favorable option for long-term effectiveness as all PCB impacted sediment greater than 1 mg/kg will be removed. Direct contact human exposure and fish/benthic community exposure would be eliminated with the removal of the sediment and backfilling with clean fill.

Short-term Effectiveness – The option poses limited short-term direct contact exposure to the embayment area during the project construction phase. However, only limited disturbance is expected to the river as shoring and erosion controls are planned to be in-place.

Implementability - Favorable option as excavation contractors, landfills and shoring equipment are readily available. Local landfills within the Milwaukee area are approved for special waste disposal of the less than 50 m/kg PCB material. Out-of-state landfills are relatively close and are approved for disposal of the greater than 50 mg/kg PCB material. The proposed shoring system is readily available and installation is feasible with a work platform, as discussed in detail in Section 3.8.3.6. Imported soil for backfill material is readily available.

Restoration Time-Frame – Favorable option as time-frame for completion of removal and backfilling expected within one month.

Engineering and Institutional Controls – Favorable option as no engineering or institutional controls are expected to be required.

Economic Feasibility - This option is expected to have moderate capital costs, but no annual operation and maintenance costs. In comparison to the others options considered, this option is estimated to have low to moderate relative total cost.

3.7.2 Capping

Key points associated with each evaluation criterion for the Capping option are presented below:

Long-term Effectiveness – Less-favorable option for long-term effectiveness as PCB impacted sediment remains in-place with potential future exposure if cap is breached or eroded. Regular cap inspection and maintenance is required for eroded or disturbed areas.

Short-term Effectiveness – Favorable option for short-term effectiveness as the option poses minimal short-term direct contact exposure and site disturbance during the project construction phase. Also, direct contact human exposure and fish/benthic community exposure is minimized in the short-term following placement of the cap.

Implementability - Favorable option as contractors and cap materials are readily available; less-favorable option due to the increased bottom elevation of the embayment (i.e. shallower water depth). Also, cap installation could only be performed during frozen, exposed sediment time periods or through the water with a barge operation when the dam is closed.

Restoration Time-Frame – Favorable option as time-frame for completion of capping expected in one to two weeks, as site conditions allow.

Engineering and Institutional Controls – Less-favorable option as institutional controls would be required to maintain cap integrity (i.e. prevent boat access to the embayment to protect cap).

Economic Feasibility - This option is expected to have low capital costs, but would have annual operation and maintenance costs to maintain cap. In comparison to the others options considered, this option is estimated to have low to moderate relative total cost.

3.7.3 Results of Detailed Option Analysis

The results of the detailed analysis indicate that the Capping option should be screened out due to the concerns with limited long-term effectiveness as annual monitoring and maintenance would be required to ensure its effectiveness. Also, the Capping option is undesirable for future recreational use of the embayment. A shallow water depth would be created from the cap installation, which would then require that an institutional control be utilized to prevent motorized boat access to the embayment.

3.8 Recommended Remedial Strategy

The recommended remedial option is Removal and Landfilling based on the above evaluation criteria. This option is most favorable for long-term effectiveness and implementability, does not require institutional controls, and has low to moderate relative costs. The planned approach for implementing the option is described in detail below, followed by estimated remedial costs.

3.8.1 Permitting and Approvals

Several permits and approvals are required prior to implementing the remedial action. These permits and approvals include, but may not be limited to, the following:

- A public approval will be obtained through a public meeting on April 17, 2007;
- Right of Entry permit from Milwaukee County;
- A Chapter 30 permit application package will be completed for proposed work within the embayment including sediment removal and backfilling with clean imported material to the previous sediment surface elevation;
- Section 404 permit from USACE;
- A Notice of Intent (NOI) form 3500-053 (Construction Project Consolidated Permit Application) will be completed to satisfy NR 216 requirements for construction site storm water runoff under the WPDES General Permit;
- A Notification to Treat or Dispose of Contaminated Soil & Water (Form 4500-168) will be provided to the WDNR at least 10 business days prior to commencement of remedial excavation activities;
- Review and approval of the cleanup plan by either United States Environmental Protection Agency’s (USEPA’s) Toxics or Superfund programs for compliance with TSCA regulations;
- Approval from the local special waste landfill for acceptance of the less than 50 mg/kg PCB sediment material and approval from the out-of-state landfill for acceptance of the greater than 50 mg/kg PCB sediment material; and
- A discharge permit for the treated water generated from the dewatering operations. Depending on the treatment processes used and expected effluent concentrations, the permit may be obtained from either MMSD or an individual WPDES permit from the WDNR for discharge to the river.

3.8.2 Site Preparation

Prior to commencement of sediment removal, site preparation activities will be performed, as shown on Figure 7, including:

- Mobilization of all equipment and materials;
- Construction of truck hauling road from the embayment directly north to Hampton Avenue is currently being considered. This will require removal of the topsoil material and placement of 2” stone at the base followed by traffic bond material at the surface. The topsoil will be stockpiled on-site for re-use. A tracking pad, consisting of 2”stone, will be placed at the Hampton Avenue entrance. Alternate routes, other than Hampton Avenue, will also be considered as part of the final design that could include truck access via Glendale Avenue;
- Construction of an access ramp and tracking pad to enter and exit the embayment area. This will be constructed following the removal of sediment in the ramp area;
- Construction of a silt curtain to prevent erosion of sediment into the river during the work; and
- An equipment laydown area will be designated for construction and dewatering equipment with a secure temporary fence as needed.

3.8.3 Excavation Procedures

The lateral limits of the sediment removal are shown on Figure 7 and include the embayment area only. The vertical limits will be based on the 1 mg/kg PCB limit, to be verified with sampling as further described in Section 3.8.3.5.

3.8.3.1 Phased Approach Plan

A two-phased approach for the sediment removal is planned. Also, each phase is further divided into a “cell” approach. Phase I consists of sediment removal from approximately twenty cells, each approximately 30 feet by 60 feet (Figure 8). The cell dimensions may be modified during field operations as recommended by the excavation contractor. Phase II consists of removal of the final five cells near the river, including proposed shoring along the eastern boundary (Figure 9). Based on the test pit observations, it is anticipated that sediment located within approximately 25 feet of the eastern boundary (near the river edge) will require dewatering. Limited dewatering may also be needed within the Phase I cells. Dewatering procedures will be discussed further below.

The initial removal of sediment from cells 1 and 2 will be performed with the backhoe on-land, as shown on Figure 8. Sediment removal, verification sampling, followed by backfilling of these cells will allow construction of the access ramp as mentioned above. Completion of sediment removal with the cell approach will allow the backhoe and trucks to be located on a completed “clean” cell work platform, as shown on Figure 8 (examples of removal of sediment in cells 4 and 9, with truck and backhoe located on completed cells 3 and 7, respectively).

3.8.3.2 Remedial Volumes and Sediment Segregation Strategy

As indicated above, volumes have been estimated for sediment greater than 50 mg/kg PCBs and sediment less than 50 mg/kg but greater than 1 mg/kg PCBs. For purposes of the remedial action, a 2-inch vertical buffer is proposed for excavation of the greater than 50 mg/kg PCBs. Because of the nature of the excavation (sediment is exposed and mostly dewatered), it is expected that an excavation contractor’s equipment and operator (i.e. using either Global Positioning System [GPS] equipment or typical surveying equipment) will be capable of segregating the sediments within this tolerance. The 2-inch vertical buffer includes:

- For locations where greater than 50 mg/kg PCBs exists at the surface, the buffer includes sediment 2 inches below the identified greater than 50 mg/kg PCB layer.
- For locations where greater than 50 mg/kg PCBs exists below the surface, the buffer includes sediment 2 inches above and 2 inches below the identified greater than 50 mg/kg PCB layer.

The remedial volumes were calculated to include the 2-inch buffer and are presented in Table 2. The volume of sediment greater than 50 mg/kg PCBs to be excavated is estimated to be 1,600 cy and the volume of sediment less than 50 mg/kg PCBs but greater than 1 mg/kg PCBs is estimated to be 2,300 cy. Total excavated volume is estimated at 3,900 cy.

Before removal of sediment begins in a cell, the top and bottom elevations for removal of the greater than 50 mg/kg PCB layer (including 2-inch buffer) in addition to the sediment bottom elevation (less than 1 mg/kg PCBs), will be staked out in a grid fashion. During excavation of the cell, the contractor will continually check elevations to verify the layers are segregated properly.

3.8.3.3 Sediment Management and Dewatering

If possible, sediment will be loaded directly from the cell excavation area into the truck. Stockpiling of sediment, if necessary, will be allowed within the limits of the embayment. The contractor will be required to adhere to an approved staging and stockpiling plan, which will include protective liners and covers. Trucks will be dedicated as either hauling the greater than 50 mg/kg PCB material to the TSCA-licensed landfill or hauling the less than 50 mg/kg PCB material to the local special waste approved landfill. Each truck will only haul one type of material in any one day.

Dewatering of cells will be performed as necessary with constructed sumps, to include gravel and/or filter packs to minimize sediment. Dewatering pumps will pump the water to treatment equipment located on-land, which would include tanks for sediment settling or directly to bag filters for sediment removal. The water may be further treated with granular activated carbon for PCB removal, which will likely depend on the ultimate discharge location (either sanitary sewer or back into the river). Appropriate permitting will be complete for the treated discharge, which will include either an MMSD permit or an individual WDPES surface water discharge permit for dewatering purposes. Effluent sampling will be completed in accordance with the permit requirements.

3.8.3.4 Off-site Disposal

All necessary sampling and analysis will be performed to profile and obtain approval for disposal of the wastes at the landfills. A Protocol B/II analysis is expected to be needed for special waste landfill approval of the less than 50 mg/kg PCB material. Additional analytical may be needed for profiling and approval of the greater than 50 mg/kg PCB material at the TSCA-licensed landfill.

Specific landfills for disposal of the wastes will be chosen following WDNR’s review of the landfill’s background information, licensing and credentials. It is anticipated that the less than 50 mg/kg PCB material will be disposed at a landfill approved for special waste disposal in the Milwaukee area. The greater than 50 mg/kg PCB material will be disposed at a TSCA-licensed landfill out-of-state, as there are no landfills licensed to accept greater 50 mg/kg PCBs in Wisconsin.

3.8.3.5 Verification Sampling and Analysis

Following removal of the sediment to the planned bottom elevation set by the 1 mg/kg clean-up goal, a post-remedial verification (PRV) sample will be collected to verify that sediment has been removed to clean-up goal of less than 1 mg/kg PCBs. A PRV sample is proposed to be collected for each cell (approximately 25 samples), which is approximately 1 sample every 1,500 to 1,800 square feet. A mobile laboratory is proposed for analysis of the PRV samples to achieve quick-turn around of the PCB results (within 1 hour of collection). This will allow the cells to be backfilled shortly after completion of sediment removal.

3.8.3.6 Backfilling and Shoring

Prior to backfilling, the final bottom elevation will be surveyed for documentation purposes. The cells will then be backfilled with clean imported material, most likely consisting of tunnel spall material (or approved equivalent material) at the base followed by a well-graded sand (i.e. bank run sand and gravel) for the final surface. This backfill design would provide a stable subbase for truck and backhoe movement and also provide a sand surface for recreational use. A well-graded sand should compact sufficiently to minimize erosion in the area. The fill surface elevation will be the approximate previous sediment surface elevation.

Following completion of the Phase I cells (cells 1 through 20), a work platform will be established such that the temporary sheet pile shoring system can be installed (Figure 9). The shoring system is anticipated to consist of steel or vinyl sheet pile in 8 to 10 foot lengths. Backhoe methods are proposed to install the sheet pile into the clay till material below sediment. Based on field conditions and if approved by WDNR, the shoring system may not be installed or be only partially installed depending dewatering or stability needs.

3.8.4 Site Restoration

As mentioned above, the embayment will be restored with fill to protect the stone walls, restore habitat, manage residuals, prevent fish trapping, and reduce future deposition of sediments carried by the river.

Following completion of backfilling, the temporary sheet pile and silt curtain will be removed and all equipment will be demobilized. The access ramp to the embayment will be removed, along with the surface tracking pad and haul road materials. As the contractor will be required to maintain a clean work platform in the embayment area, these materials are not anticipated to be PCB-impacted and therefore would not require landfill disposal. If field conditions indicate these materials may be impacted, the materials will be sampled to determine the concentration of PCBs (if any). Based on these results, the disposal location of the haul road/tracking pad materials will be determined.

The haul road and equipment laydown areas will be restored by replacing the original topsoil removed from these areas. If weather allows, the areas will be seeded and mulched immediately following topsoil placement. If not, the areas will be seeded and mulched the following Spring.

3.8.5 Estimated Remedial Costs

A summary of estimated remedial costs for the Removal and Landfilling option is presented on Table 4, with a detailed cost estimate and assumptions provided in Appendix F. The total estimated capital cost is $1,140,000 using a 20 percent contingency.

3.8.6 Schedule

The remedial action is expected to be completed within one month, including mobilization and site restoration. The construction time period is expected to be October/November 2007 when the dam is normally open.

4 REFERENCES

Federal Emergency Management Agency (FEMA). June 19, 1981. *Flood Insurance Rate Map, City of Glendale, Wisconsin, Milwaukee County*. Revised. Community-Panel Number 550275 0005 C. National Flood Insurance Program.

Skinner, E. L. and R. G. Borman. 1973. *Water Resources of Wisconsin – Lake Michigan Basin.* USGS Hydrologic Investigations Atlas HA-432. Four plates.

Steuer, Jeffery S., Sharon A. Fitzgerald, and David W. Hall. 1999. *Distribution and transport of Polychlorinated Biphenyls and Associated Particles in the Milwaukee River System, Wisconsin, 1993-95*. USGS Water-Resource Investigations Report 99-4100. Prepared in Cooperation with Wisconsin Department of Natural Resource and Milwaukee Metropolitan Sewerage District.

United States Department of Agriculture (USDA). 1971. *Soil Survey of Milwaukee and Waukesha Counties Wisconsin*. Soil Conservation Service.

United States Geological Survey (USGS). 1958. *Milwaukee Quadrangle*. 7.5 Minute Series (Topographic). United States Department of the Interior. Photo revised in 1971.

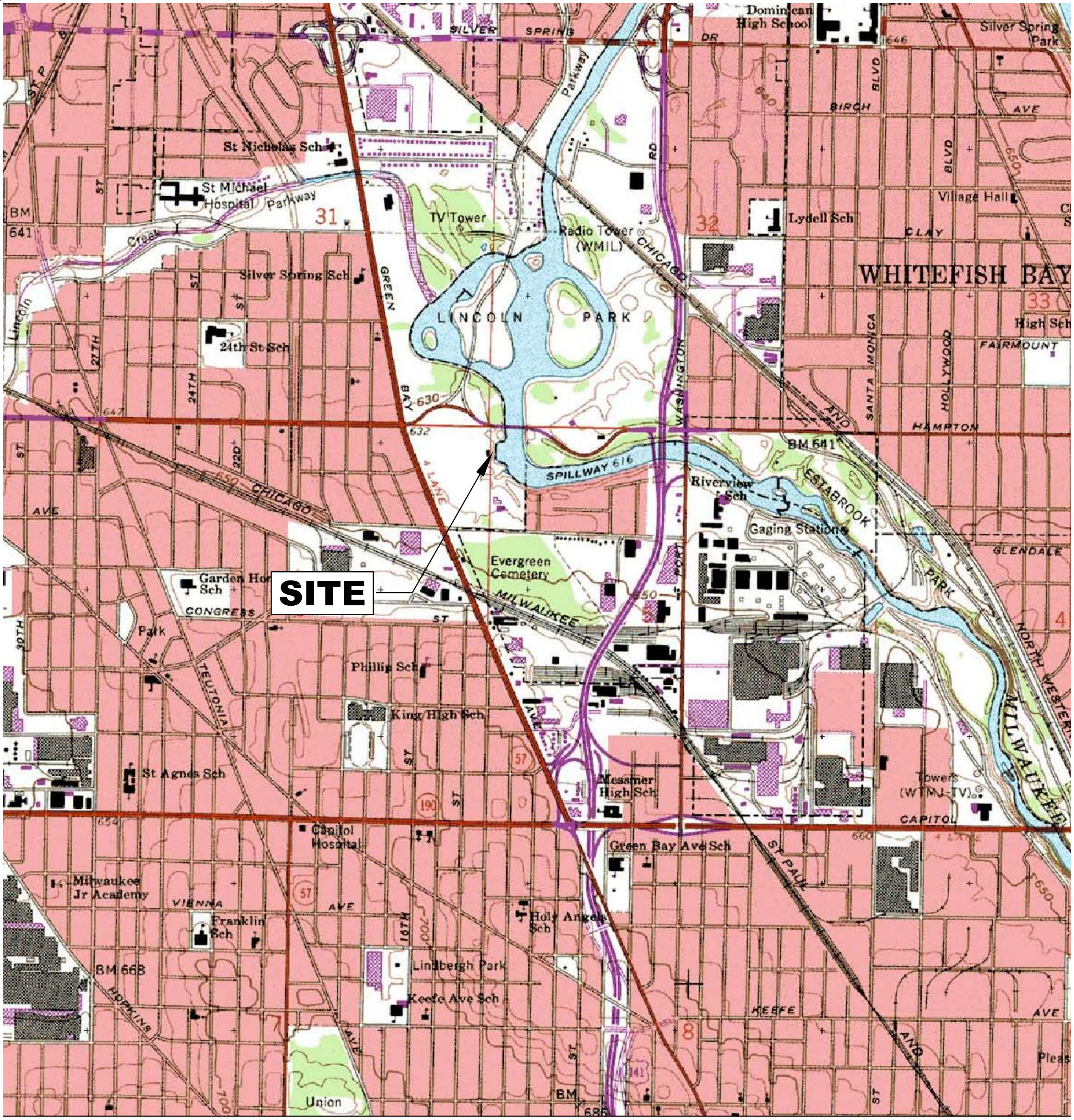
Walker, J.F. and W.R. Krug. 2003. *Flood-Frequency Characteristics of Wisconsin Streams*. USGS Water-Resource Investigations Report 03-4250.

Wisconsin Department of Natural Resources (WDNR). December 2003. *Consensus-Based Sediment Quality Guidelines, Recommendations for Use and Application, Interim Guidance.* Publication WT-732 2003.

Wisconsin Department of Natural Resource (WDNR). August 2005. *Estabrook Impoundment Sediment Remediation Pre-Design Study*. Project Completion Report to USEPA, GLNPO Grant ID GL2000-82. Publication PUBL-WT 826.

Wisconsin Department of Natural Resources (WDNR). May 2006. *Lincoln Park/Blatz Pavilion Site Remedial Investigation/Feasibility Study Scope of Work.*

FIGURES



SOURCE: EARTHVISIONS U.S. TERRAIN SERIES,
© EARTHVISIONS, INC. 603-433-8500.
USGS 7.5 MINUTE QUADRANGLE,
City. DATED 1958.
PHOTOREVISED 1971.

QUADRANGLE LOCATION

N

0 2000 4000

SCALE IN FEET

CONTOUR INTERVAL 10 FEET

NATURAL RESOURCE TECHNOLOGY

SITE LOCATION MAP

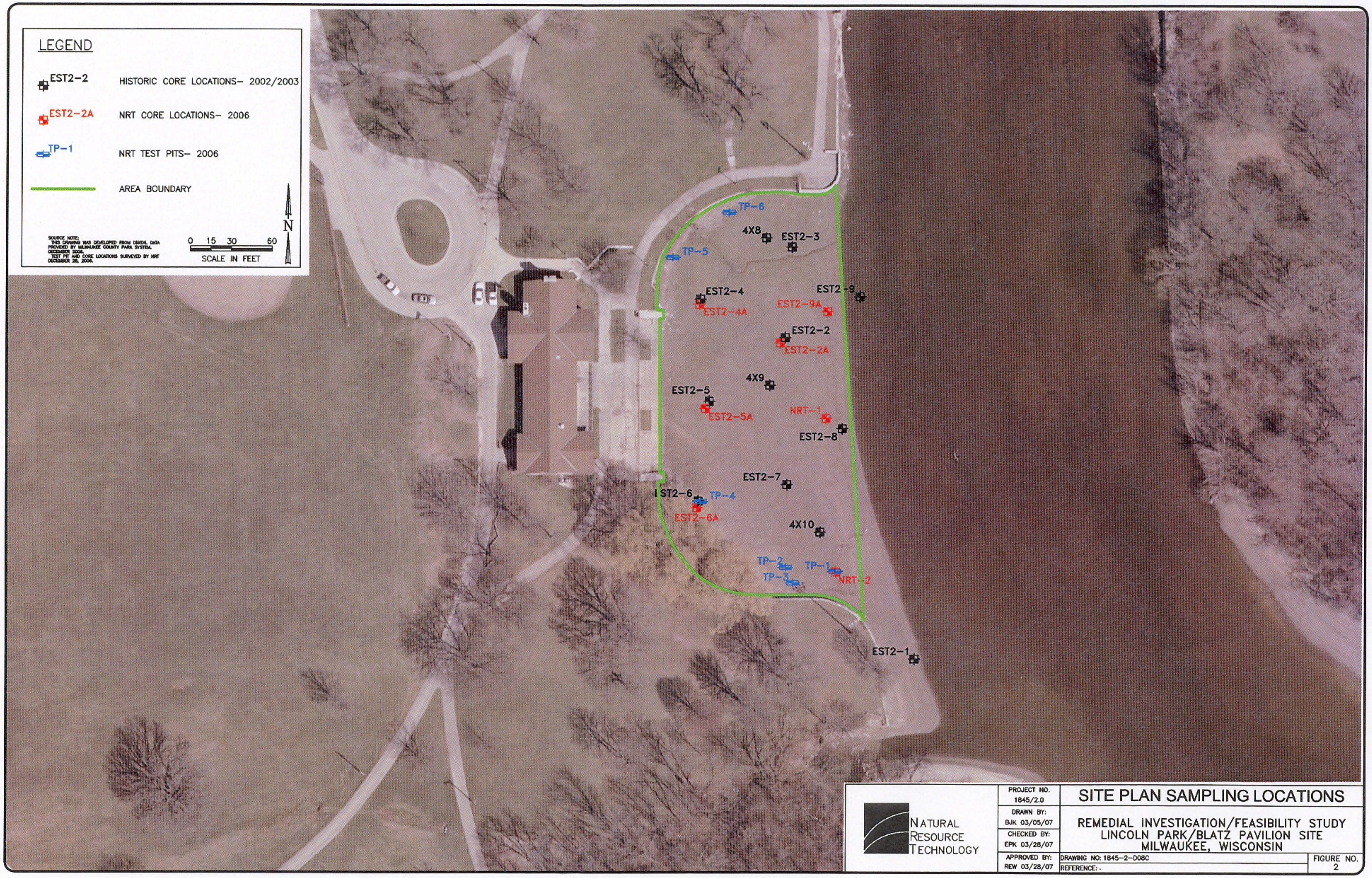
REMEDIAL INVESTIGATION/FEASABILITY STUDY
LINCOLN PARK/BLATZ PAVILION
MILWAUKEE, WISCONSIN

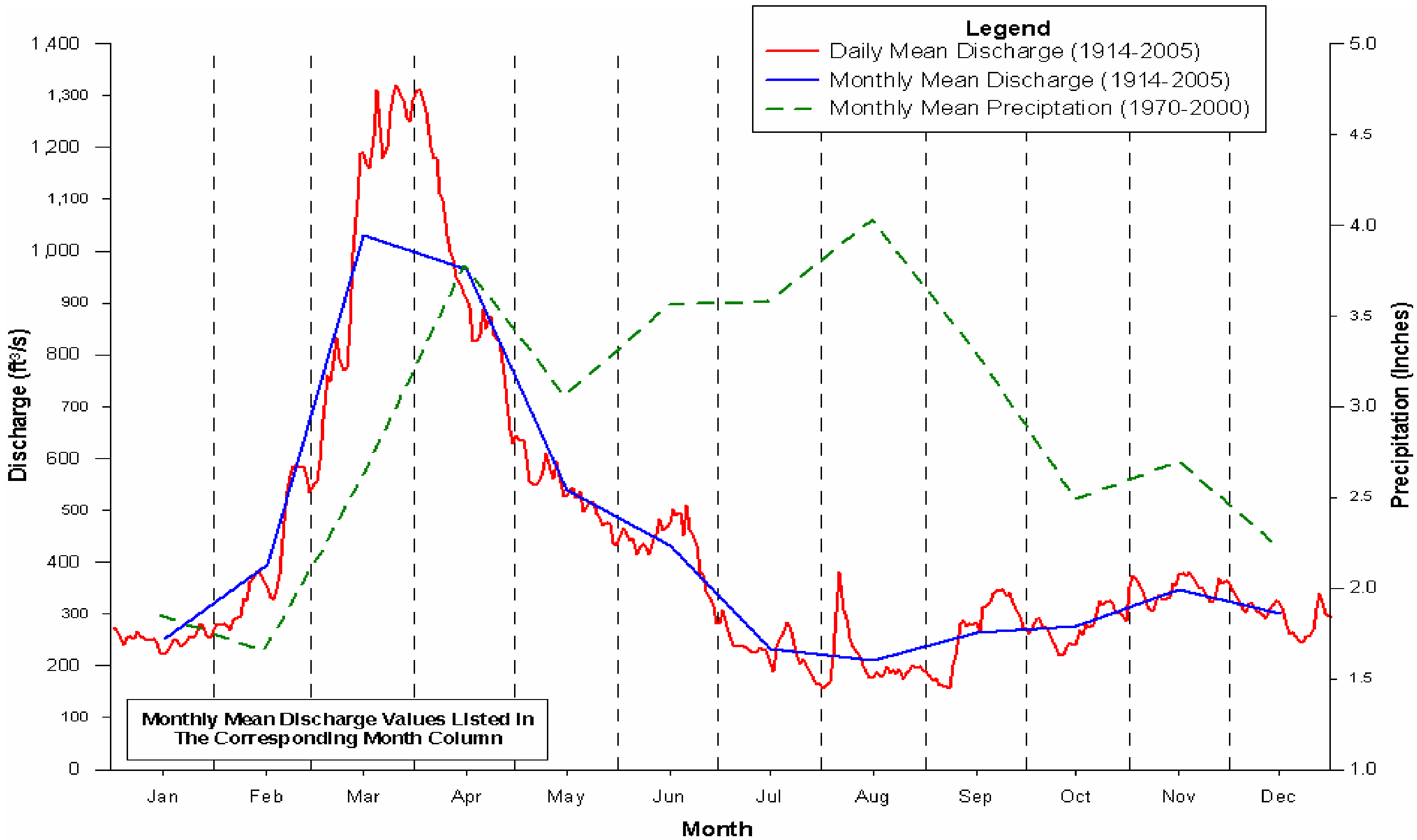
DRAWN BY: BJK 02/27/07 APP'D BY: EPK DATE: 03/28/07

PROJECT NO.
1845

DRAWING NO.
1845-A01

FIGURE NO.
1


LEGEND
EST2-2
HISTORIC CORE LOCATIONS– 2002/2003
EST2-2A
NRT CORE LOCATIONS– 2006
TP-1
NRT TEST PITS– 2006
AREA BOUNDARY
SOURCE NOTE:
THIS DRAWING WAS DEVELOPED FROM DIGITAL DATA PROVIDED BY MILWAUKEE COUNTY PARK SYSTEM, DECEMBER 2006.
TEST PIT AND CORE LOCATIONS SURVEYED BY NRT DECEMBER 28, 2006.
0 15 30 60
SCALE IN FEET
N
TP-6
4X8
EST2-3
TP-5
EST2-4
EST2-4A
EST2-9
EST2-9A
EST2-2
EST2-2A
4X9
EST2-5
EST2-5A
NRT-1
EST2-8
EST2-7
EST2-6
TP-4
EST2-6A
4X10
TP-2
TP-1
TP-3
NRT-2
EST2-1
NATURAL RESOURCE TECHNOLOGY
PROJECT NO. 1845/2.0
DRAWN BY: BJK 03/05/07
CHECKED BY: EPK 03/28/07
APPROVED BY: REW 03/28/07
SITE PLAN SAMPLING LOCATIONS
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
LINCOLN PARK/BLATZ PAVILION SITE
MILWAUKEE, WISCONSIN
DRAWING NO: 1845-2-D08C
REFERENCE: -
FIGURE NO. 2



MILWAUKEE RIVER HYDROGRAPH AND PRECIPITATION PLOT

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
LINCOLN PARK/BLATZ PAVILION
MILWAUKEE, WISCONSIN

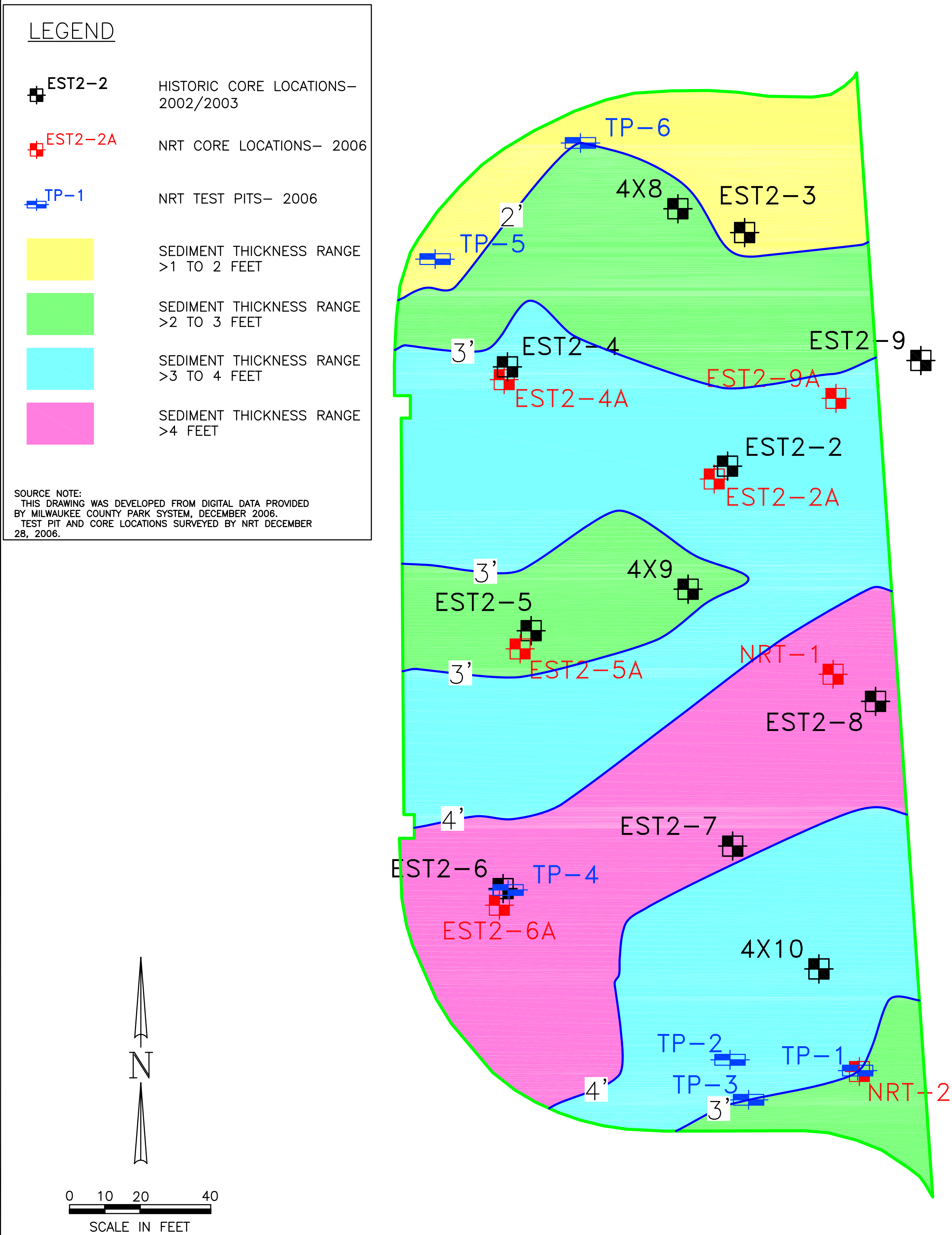
NATURAL RESOURCE TECHNOLOGY

DRAWN BY: BJK 03/05/07 APP'D BY: EPK DATE: 03/05/07

PROJECT NO. 1845/2.0

DRAWING NO. 1845-3-A03C

FIGURE NO. 3



SEDIMENT THICKNESS CONTOUR MAP

NATURAL RESOURCE TECHNOLOGY

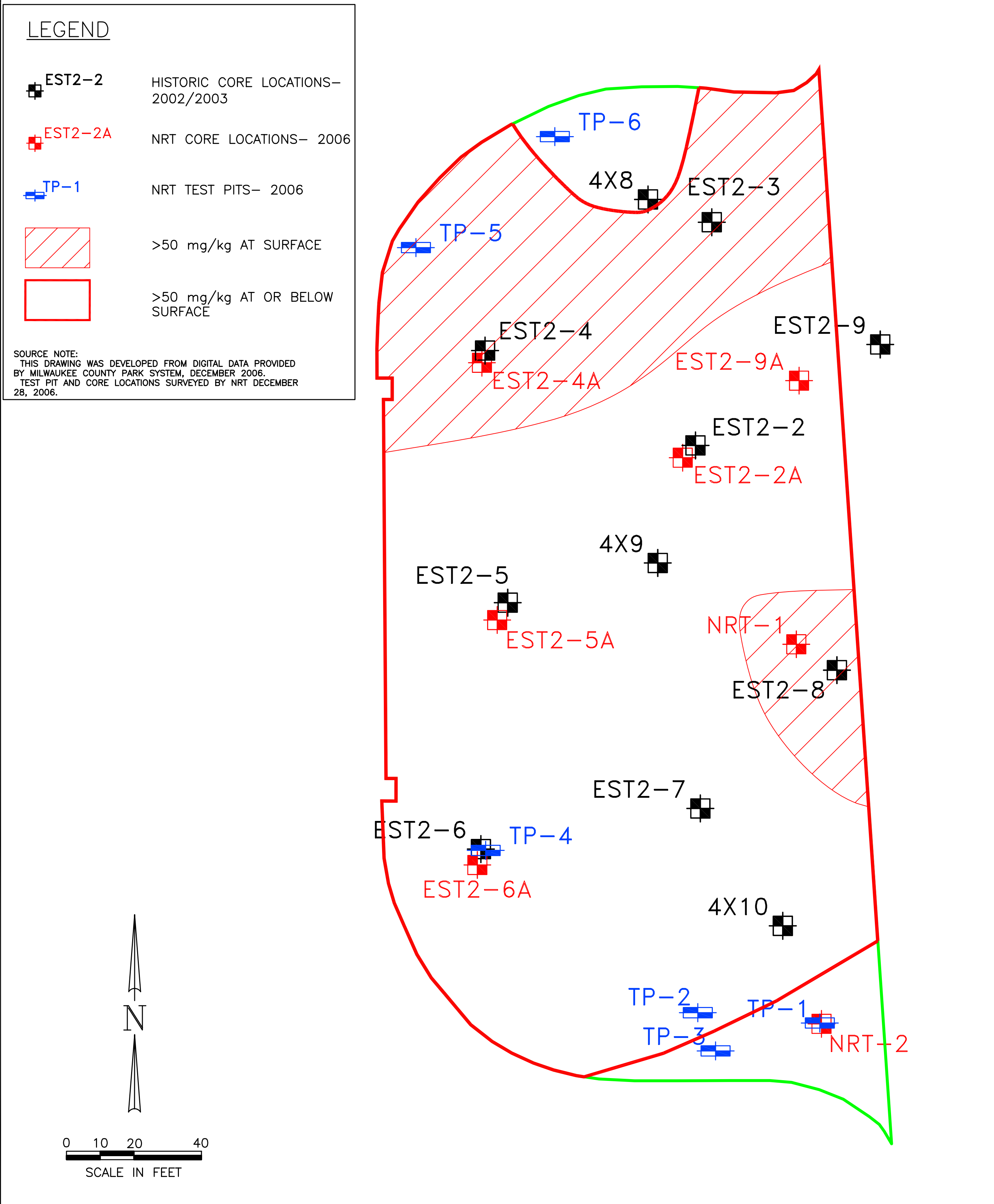
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
LINCOLN PARK/BLATZ PAVILION
MILWAUKEE, WISCONSIN

DRAWN BY: BJK 02/28/07 APP'D BY: EPK DATE: 03/28/07

PROJECT NO.
1845/2.0

DRAWING NO.
1845-2-A01C

FIGURE NO.
4



NATURAL RESOURCE TECHNOLOGY

LATERAL EXTENT OF SEDIMENT GREATER THAN 50 mg/kg

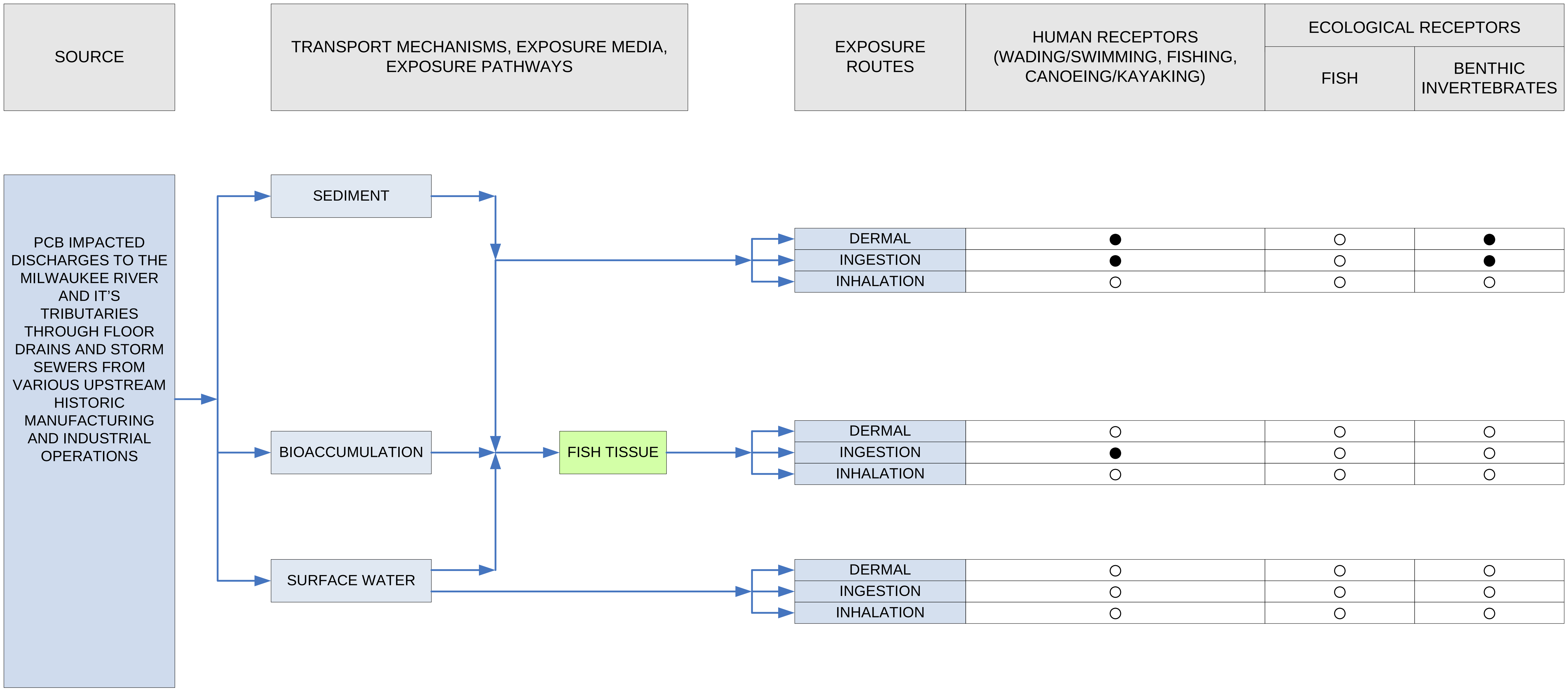
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
LINCOLN PARK/BLATZ PAVILION
MILWAUKEE, WISCONSIN

DRAWN BY: BJK 02/28/07 APP'D BY: JAZ DATE: 03/28/07

PROJECT NO.
1845/2.0

DRAWING NO.
1845-2-A02C

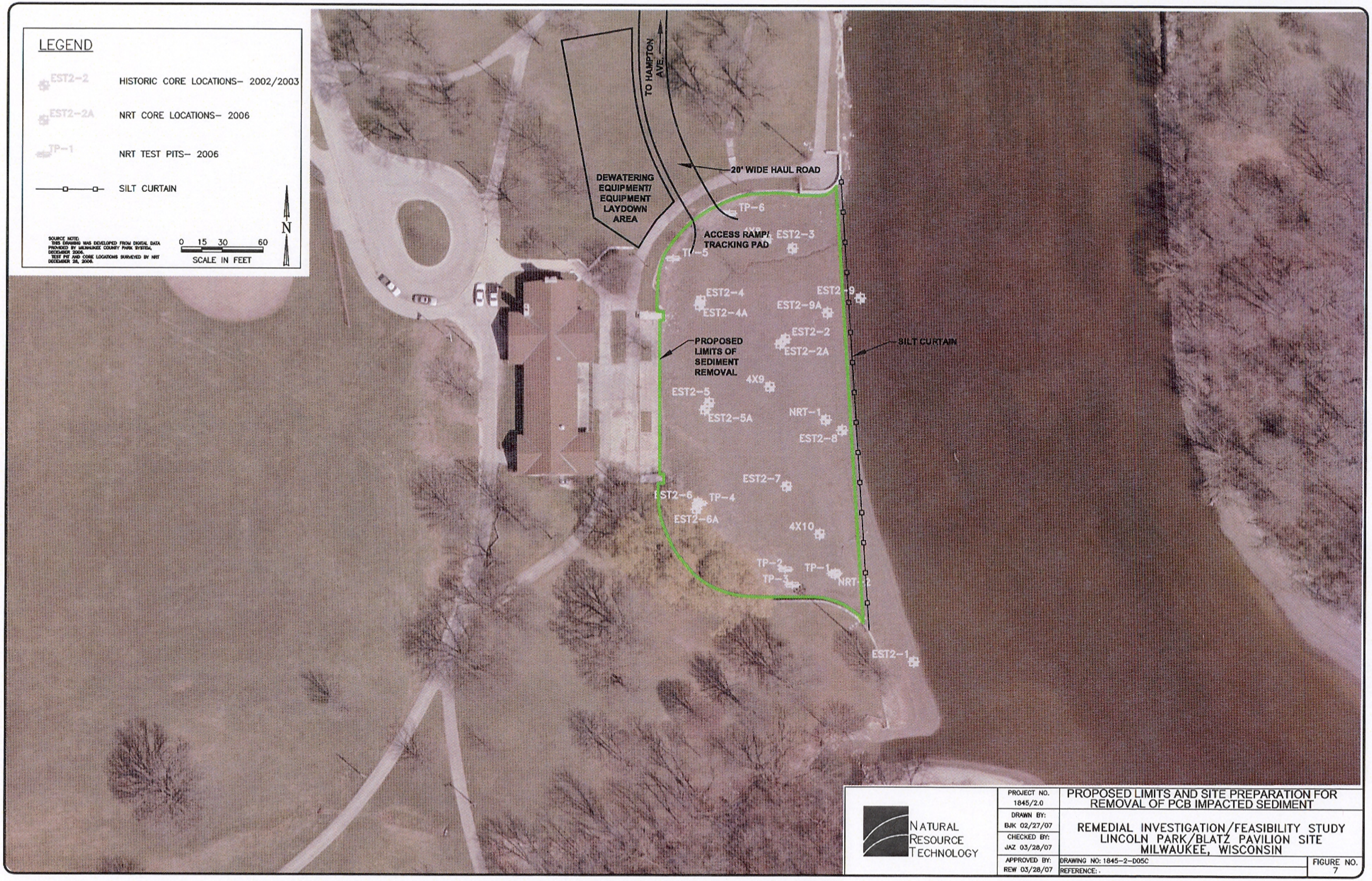
FIGURE NO.
5

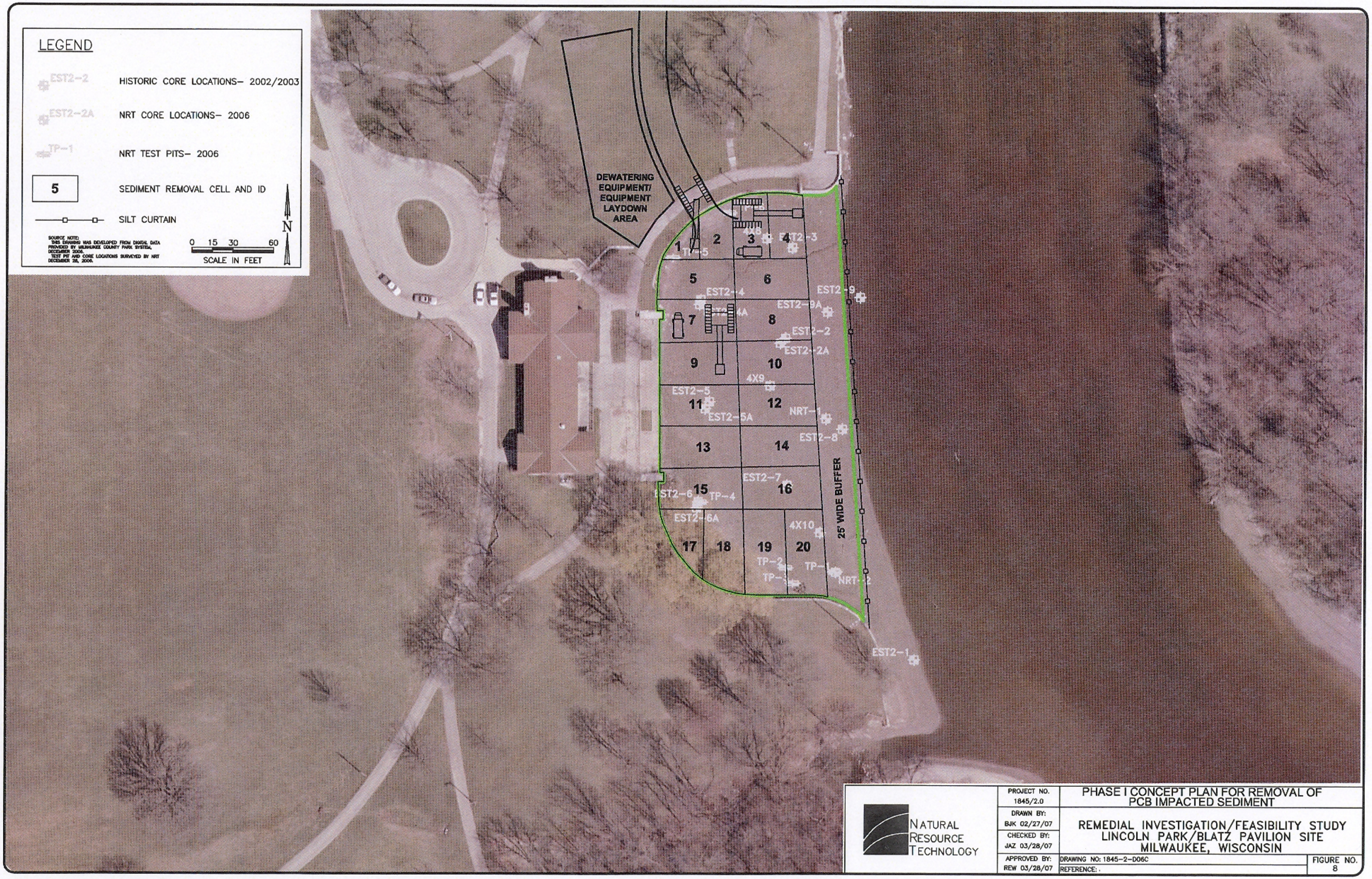


LEGEND:

- ● Complete or possibly complete exposure route.
- ○ Pathway not complete or considered less significant.

PROJECT No. 1845	NATURAL RESOURCE TECHNOLOGY	**CONCEPTUAL SITE MODEL REMEDIAL INVESTIGATION / FEASABILITY STUDY LINCOLN PARK / BLATZ PAVILION MILWAUKEE, WISCONSIN**	Drawn By: JTB	Date 01/19/2007
			Checked: EPK	Date 01/22/2007
Figure 6			Approved: REW	Date 01/22/2007


LEGEND
EST2-2
HISTORIC CORE LOCATIONS- 2002/2003
EST2-2A
NRT CORE LOCATIONS- 2006
TP-1
NRT TEST PITS- 2006
SILT CURTAIN
N
0 15 30 60
SCALE IN FEET
TO HAMPTON AVE.
20' WIDE HAUL ROAD
DEWATERING EQUIPMENT/ EQUIPMENT LAYDOWN AREA
ACCESS RAMP/ TRACKING PAD
PROPOSED LIMITS OF SEDIMENT REMOVAL
SILT CURTAIN
TP-6
TP-5
EST2-3
EST2-4
EST2-4A
EST2-9
EST2-9A
EST2-2
EST2-2A
4X9
EST2-5
EST2-5A
NRT-1
EST2-8
EST2-7
EST2-6
TP-4
EST2-6A
4X10
TP-2
TP-3
TP-1
NRT-2
EST2-1
NATURAL RESOURCE TECHNOLOGY
PROJECT NO. 1845/2.0
DRAWN BY: BJK 02/27/07
CHECKED BY: JAZ 03/28/07
APPROVED BY: REW 03/28/07
PROPOSED LIMITS AND SITE PREPARATION FOR REMOVAL OF PCB IMPACTED SEDIMENT
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
LINCOLN PARK/BLATZ PAVILION SITE
MILWAUKEE, WISCONSIN
DRAWING NO: 1845-2-D05C
REFERENCE: -
FIGURE NO. 7


LEGEND
EST2-2 HISTORIC CORE LOCATIONS– 2002/2003
EST2-2A NRT CORE LOCATIONS– 2006
TP-1 NRT TEST PITS– 2006
5 SEDIMENT REMOVAL CELL AND ID
SILT CURTAIN
N
SOURCE NOTE:
THIS DRAWING WAS DEVELOPED FROM DIGITAL DATA PROVIDED BY MILWAUKEE COUNTY PARK SYSTEM, DECEMBER 2006.
TEST PIT AND CORE LOCATIONS SURVEYED BY NRT DECEMBER 28, 2006.
0 15 30 60
SCALE IN FEET
DEWATERING EQUIPMENT/ EQUIPMENT LAYDOWN AREA
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
EST2-3
EST2-4
EST2-9
EST2-9A
EST2-2
EST2-2A
4X9
EST2-5
EST2-5A
NRT-1
EST2-8
EST2-7
EST2-6
TP-4
EST2-6A
4X10
TP-2
TP-1
NRT-2
EST2-1
25' WIDE BUFFER
NATURAL RESOURCE TECHNOLOGY
PROJECT NO. 1845/2.0
DRAWN BY: BJK 02/27/07
CHECKED BY: JAZ 03/28/07
APPROVED BY: REW 03/28/07
PHASE I CONCEPT PLAN FOR REMOVAL OF PCB IMPACTED SEDIMENT
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
LINCOLN PARK/BLATZ PAVILION SITE
MILWAUKEE, WISCONSIN
DRAWING NO: 1845-2-D06C
REFERENCE:
FIGURE NO. 8

NATURAL RESOURCE TECHNOLOGY	PROJECT NO. 1845/2.0	PHASE II CONCEPT PLAN FOR REMOVAL OF PCB IMPACTED SEDIMENT
	DRAWN BY: BJK 02/27/07	REMEDIAL INVESTIGATION/FEASIBILITY STUDY LINCOLN PARK/BLATZ PAVILION SITE MILWAUKEE, WISCONSIN
	CHECKED BY: JAZ 03/28/07	
	APPROVED BY: REW 03/28/07	DRAWING NO: 1845-2-D07C REFERENCE: .
		FIGURE NO. 9

TABLES

Table 1 - Total PCB Results
Lincoln Park/Blatz Pavilion Site
Milwuakee, Wisconsin

Location	Sample Date	X (WTM)[A] (meters)	Y (WTM)[A] (meters)	Surface Elevation[B] (feet)	Sampling Depth Top (feet)	Sampling Depth Bottom (feet)	Sample Elevation[B] Top (feet)	Sample Elevation[B] Bottom (feet)	Total PCB Concentration (ppm)[C]
Core Samples									
4X8	08/06/03	688742.3588	294405.539	614.4	0.0	0.6	614.4	613.8	2.60
					0.6	1.2	613.8	613.2	42.00
					1.2	1.9	613.2	612.5	0.70
					1.9	2.6	612.5	611.8	0.27
4X9	08/06/03	688743.2362	294372.7265	614.8	0.0	0.6	614.8	614.2	1.50
					0.6	1.2	614.2	613.6	2.20
					1.2	1.8	613.6	613.0	210.00
					1.8	2.4	613.0	612.4	5.40
					2.4	2.7	612.4	612.1	0.84
4X10	08/06/03	688754.5266	294339.9763	615.2	0.0	0.6	615.2	614.6	2.50
					0.6	1.2	614.6	614.0	16.00
					1.2	1.8	614.0	613.4	170.00
					1.8	2.4	613.4	612.8	6.20
					2.4	3.2	612.8	612.0	1.10
EST 2-1	09/25/02	688775.6659	294311.6702	613.6	0.0	0.3	613.6	613.3	1.70
EST 2-2	10/10/02	688746.6426	294383.3368	614.72	0.0	1.0	614.7	613.7	1.50
					1.0	1.8	613.7	612.9	160.00
EST2-2A	12/27/06	688745.491	294382.229	614.72	2.3	3.4	612.4	611.3	3.20
					3.4	3.9	611.3	610.8	<0.015
					3.9	4.4	610.8	610.3	<0.014
EST 2-3	10/10/02	688748.1217	294403.4809	614.4	0.0	1.0	614.4	613.4	55.00
					1.0	1.8	613.4	612.6	1.20
EST 2-4	10/10/02	688,727.642	294,391.902	614.56	0.0	1.0	614.6	613.6	56.00
					1.0	1.5	613.6	613.1	20.00
EST2-4A	12/27/06	688,727.355	294,390.804	614.56	1.7	2.0	612.9	612.6	10.00
					2.0	2.5	612.6	612.1	0.64
					2.5	3.0	612.1	611.6	<0.015
					3.3	3.7	611.2	610.9	0.049
EST 2-5	10/10/02	688,728.769	294,369.146	614.85	0.0	1.0	614.9	613.9	3.20
					1.0	1.6	613.9	613.3	150.00
EST2-5A	12/27/06	688,728.731	294,367.581	614.85	1.7	2.4	613.2	612.4	1.80
					2.4	3.2	612.4	611.7	0.19
					3.2	3.7	611.7	611.2	0.39
EST 2-6	10/10/02	688,727.261	294,346.906	615.53	0.0	1.0	615.5	614.5	3.30
					1.0	1.8	614.5	613.7	110.00
EST2-6A	12/27/06	688,726.938	294,345.473	615.53	2.0	2.8	613.5	612.7	8.70
					2.8	3.7	612.7	611.9	0.90
					3.7	4.5	611.9	611.0	<0.017
					4.5	5.0	611.0	610.5	0.065 (0.12)[D]
EST 2-7	10/10/02	688,747.080	294,350.570	614.9	0.0	1.0	614.9	613.9	2.70
					1.0	2.0	613.9	612.9	170.00
					2.0	2.4	612.9	612.5	2.10
EST 2-8	10/10/02	688,759.418	294,363.051	614.1	0.0	1.0	614.1	613.1	56.00
					1.0	2.0	613.1	612.1	2.80
					2.0	2.2	612.1	611.9	0.75
EST 2-9	10/10/02	688,763.334	294,392.448	613.84	0.0	0.8	613.8	613.0	1.30
EST2-9A	12/27/06	688,756.003	294,389.184	613.84	1.0	1.8	612.8	612.1	51.00
					1.8	2.5	612.1	611.3	1.70
					2.5	3.3	611.3	610.5	0.15 (0.045)[D]
					3.3	3.5	610.5	610.3	0.31
NRT-1	12/27/06	688,755.751	294,365.388	613.92	0.0	1.2	614.1	612.9	6.90
					1.2	2.3	612.9	611.8	91.00
					2.3	3.5	611.8	610.6	3.00
					3.5	4.8	610.6	609.3	1.40
					4.8	5.3	609.3	608.8	0.16
					5.3	5.8	608.8	608.3	0.07
					5.8	6.3	608.3	607.8	<0.015
NRT-2	12/27/06	688,758.021	294,331.129	614.77	0.0	0.5	614.7	614.2	2.20
					0.5	1.0	614.2	613.7	6.90
					1.0	1.5	613.7	613.2	4.90
					1.5	2.0	613.2	612.7	1.70
					2.0	2.8	612.7	612.0	0.06
					2.8	3.0	612.0	611.7	<0.015
Test Pit Samples (These were all from the underlying till)									
TP-1	12/27/06	688,757.868	294,331.204	614.77	3.0	3.5	611.8	611.3	0.46
TP-2	12/27/06	688,746.848	294,332.139	615.06	5.0	6.0	610.1	609.1	0.14
TP-3	12/27/06	688,748.455	294,328.690	614.77					ns
TP-4	12/27/06	688,727.693	294,346.789	615.44					ns
TP-5	12/27/06	688,721.395	294,401.196	614.91	1.5	2.0	613.4	612.9	0.15
TP-6	12/27/06	688,733.947	294,411.213	614.40					ns
Quality Assurance/Quality Control Sample[E]									
NRT-Comp 1	12/27/06								0.85
NRT-1A	12/27/06								0.87
NRT-2A	12/27/06								0.87

Notes:
A) WTM is the Wisconsin Transverse Mercator projection.
B) Elevations rounded to the tenth of a foot (0.1) were estimated based on the elevation results for locations surveyed on December 28, 2006.
C) All concentration results taken to two decimal places to assist evaluation of data and identification of elevated results.
D) Split sample results listed in parentheses.
E) QA/QC samples collected in general accordance with the Quality Assurance Project Plan (QAPP) Version 2, Estabrook Impoundment Sediment Remediation Pre-Design Study.
"ns" - No sample collected from this location.

Table 2 - Summary of Volumes of PCB Impacted Sediment
Lincoln Park/Blatz Pavilion Site
Milwaukee, Wisconsin

Sediment	Volume (cu yds)	Remedial Sediment Volumes with 2" Buffer [1] (cu yds)
PCB >50 ppm	1,200	1,600
PCB >1 & <50 ppm	2,700	2,300
PCB <1 ppm	800	0
Total Sediment	**4,700**	**3,900**

[O-JAZ, C- EPK]

Notes:
1. Where >50 ppm sediment is at surface, buffer includes sediment 2" below >50 ppm layer.
Where >50 ppm sediment layer is below the surface, buffer includes sediment 2" below and 2" above >50 ppm layer.

Table 3 - Remedial Options Screening Summary
Lincoln Park/Blatz Pavilion Site
Milwaukee, Wisconsin

REMEDIAL OPTION	DESCRIPTION	TECHNICAL FEASIBILITY				ENGINEERING AND INSTITUTIONAL CONTROLS	ECONOMIC FEASIBILITY	SCREENING RECOMMENDATION
		LONG TERM EFFECTIVENESS	SHORT TERM EFFECTIVENESS	IMPLEMENTABILITY	RESTORATION TIME FRAME			
1 - Removal and Landfilling	• Removal of <50 ppm and >50 ppm sediment using conventional excavation equipment • Local landfill disposal of <50 ppm material (special waste), disposal of >50 ppm material out-of-state • Install a shoring system along the eastern boundary. • Import and place clean backfill.	+ All PCB impacts >1 ppm would be removed + Direct contact human exposure would be eliminated. + Fish/Benthic community exposure eliminated	- Short-term disturbance/direct contact exposure to embayment area during project + Only limited disturbance to river	+ Excavation contractors and shoring equipment are readily available. + Local special waste landfill within Milwaukee area, >50 ppm disposal landfill relatively close (Michigan). + Shoring system installation feasible with a backfilled work platform. + Imported soil for backfill material readily available.	+ Removal of sediment and backfilling expected to be complete within 1 month	+ None	**LOW TO MODERATE RELATIVE TOTAL COST** • Moderate Capital Costs • No Annual Maintenance Costs	RECOMMENDED APPROACH
2 - Capping	• Sediment remains in-place • Sand Cap installed on top of sediment (approx. 1 ft thick)	- PCB Impacts remain in-place with potential future exposure if cap is breached/eroded - Regular cap inspection and maintenance required for eroded/disturbed areas	+ Relatively low disturbance/direct contact exposure during cap installation. + Human/benthic/fish exposure minimized with new cap.	- Undesirable increased in bottom elevation of embayment (shallow water depth) - Capping required to be performed under frozen sediment conditions or placed through water. + Materials and contractors are readily available.	+ Capping expected to be completed in 1-2 Weeks, as site conditions allow	- Institutional controls required to maintain cap integrity (e.g., prevent boats from disturbing cap)	**LOW TO MODERATE RELATIVE TOTAL COST** • Low capital costs • Annual Maintenance Costs	SCREENED OUT DUE TO LIMITED LONG-TERM EFFECTIVENESS - MAINTENANCE AND INSTITUTIONAL CONTROLS
3 - In-situ or Ex-Situ Treatment	Could include a number of technologies such as in-situ stabilization, ex-situ vitrification, and ex-situ sediment washing	Not Considered Due to Relative High Cost, Less Certain Long-Term Effectiveness and Greater Potential for Direct Contact Exposure and Disruption to Community During Implementation Refer to Report Text for Detailed Discussion					**HIGH RELATIVE TOTAL COST**	SCREENED OUT
4 - No Action	Site conditions would remain at the current status coupled with a monitored natural recovery program	Not Considered Due to Presence of Greater than 50 ppm PCB Concentrations at Sediment Surface and Inability to Achieve Remediation Through Monitored Natural Recovery Processes					**NOT APPLICABLE**	SCREENED OUT

+ Favorable, - Less Favorable

(O-JAZ 2/22/07)

3/9/2007
Natural Resource Technology, Inc.

Table 4 - Summary of Estimated Costs
Lincoln Park/Blatz Pavilion Site
Milwaukee, Wisconsin

Cost Category	**Removal & Landfilling (3,900 cy)**
Mob./Demob.	$25,000
Site Preparation	$13,100
Temporary Shoring along Eastern Boundary	$80,000
Excavation, Disposal, and Dewatering	$553,300
Backfilling	$87,500
Site Restoration	$6,600
Construction Quality Control	$24,000
Consulting - Design, Permitting, Bidding, Oversight	$160,000
Total	$950,000
Total with 20% Contingency	**$1,140,000**

Notes:
1. Greater than 50 mg/kg volume estimated at 1,600 cy (2" buffer).
2. Greater than 50 mg/kg landfill is asummed to be EQ Michigan.
3. Estimated density of 1.5 tons/cy x 3,900 cy = 5850 tons.