AECOM

Environment

Submitted to
City of Oshkosh
Oshkosh, Wisconsin

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AECOM
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60278531

Analysis of Brownfield Cleanup Alternatives

Redevelopment of the Former Boat Works Property
362 Michigan Street
Oshkosh, Wisconsin

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November 2, 2012

Ms. Darlene Brandt
Department of Community Development
City of Oshkosh
215 Church Avenue
Oshkosh, Wisconsin 54903-1130

Subject: **Analysis of Brownfield Cleanup Alternatives, City of Oshkosh EPA Brownfields Cleanup Grant, Redevelopment of the former Boat Works Property, City of Oshkosh, Wisconsin -- AECOM Project No. 60278531**

Dear Ms. Brandt,

AECOM Technical Services (AECOM) is pleased to present this Analysis of Brownfield Cleanup Alternatives (ABCA) consistent with requirements of the Environmental Protection Agency (EPA), Brownfields Cleanup Grant. This ABCA has been prepared for Redevelopment of the former Boat Works Property located at 362 Michigan Street, Oshkosh, Wisconsin. This ABCA provides an overview of site conditions, site cleanup objectives, and provides a review of remedial options for the proposed upland redevelopment project. In addition, this ABCA includes an analysis of green and sustainable remediation/redevelopment which generally follows the WDNR Wisconsin Initiative for Sustainable Remediation and Redevelopment (WISRR) technical guidance.

If you have any questions regarding the ABCA, please contact Mr. Andrew Mott (920.235.0270). We appreciate your review of this document and support of the redevelopment efforts of the City of Oshkosh.

Respectfully,

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1 Introduction

On behalf of the City of Oshkosh, Wisconsin (City), AECOM, Inc. (AECOM) has prepared this Analysis of Brownfield Cleanup Alternatives (ABCA) for Redevelopment of the former Boat Works property located at 362 Michigan Street in Oshkosh, Wisconsin (site) generally consistent with requirements of the Environmental Protection Agency (EPA), Brownfields Cleanup Grant. This ABCA provides an overview of site conditions, site cleanup objectives, and provides a review of remedial options for the proposed upland redevelopment project. In addition, this ABCA includes an analysis of green and sustainable remediation/redevelopment which generally follows the WDNR Wisconsin Initiative for Sustainable Remediation and Redevelopment (WISRR) technical guidance.

2 Site Description and History

2.1 Site Location and Description

The former Boat Works property is located at 362 Michigan Street in the City of Oshkosh, Wisconsin. The site encompasses approximately 5 acres and is located in the Southeast ¼ of the Northeast ¼ of Section 23, Township 18 North, Range 16 East, in the City of Oshkosh, Winnebago County, Wisconsin. The property is owned by the City Redevelopment Authority (RDA). The project site can be located on the attached Figure 1.

The former Boat Works property redevelopment area is located along the south shore of the Fox River in the central part of the city of Oshkosh and played an important part in the community's long industrial history. The property was utilized as a lumber mill and for lumber storage, the manufacturing of boats, a marina, and the storage of boats. The Boat Works property is located within the South Side Redevelopment area which has significant redevelopment potential, but is hindered by the challenges related to environmental contamination and unsuitable nature of fill material to support surface features. The City of Oshkosh identified the Boat Works property as a key property in the City's Fox River Corridor Riverwalk Plan. The City of Oshkosh Redevelopment Authority (RDA) acquired the property in 2005. At the time of the acquisition, a total of five buildings occupied the 5 acre property. The buildings were built on the subject property from 1948 to 1963. The remaining area is covered with grass and a few trees. There are boat slips present on the east, west, and southwest banks of the lagoon. There is sheet piling along the lagoon and Fox River. The sheet piles and docks are deteriorated, and the surrounding soils are eroded. The lagoon connects to the Fox River. An island is located in the middle of the lagoon. Historically, the surrounding property uses included residential and industrial. The buildings were razed by the City in 2005. The current site conditions are depicted on Sheet 1.

2.2 Site History

The Boat Works property was historically used for a variety of industrial and commercial purposes dating back to at least 1903. The historical use of the subject property prior to 1903 could not be determined. The former Boat Works property was historically used by a lumber mill in the early 1900's and then was developed for the manufacturing of boats that were used for the transportation of goods along the Fox River. From the early 1970's the property was then used as a marina until the 2000's which up to 2004 was used only for the storage of boats. The City of Oshkosh Redevelopment Authority (RDA) acquired the property in 2005 and razed all five buildings.

2.3 Environmental Assessment Findings

To facilitate redevelopment of the site, the City conducted a Phase I Environmental Site Assessment (ESA) in September 2004 to evaluate the site's history and determined what potential Recognized Environmental Concerns (RECs) existed under the City's EPA Assessment Grant. The following RECs were identified at or in connection to the site:

- Fill soils are known to be present on the site including rubbish, sawdust, other wood products, glass, and cinders.
- Paint/varnish remover containing 1,1,1-trichloroethane was available on the site for customer use as well as Boat Works personnel use. Elevated 1,1,1,-trichloroethane concentrations were identified in a soil sample analyzed in 1990. Past use and disposal practices for 1,1,1-trichloroethane are unknown.
- Two 250-gallon capacity ASTs containing fuel oil were present in the boat maintenance building (Building 4). The tanks did not have spill containment measures. Past overfills potentially could have impaired the subsurface of the site.
- One historical REC was identified for the site. Records indicate there is petroleum-impacted soil present associated with a former Leaking Underground Storage Tank (LUST) case. The LUST case has been closed by the WDNR; however, impacted soil remains on site. If the impacted soil is disturbed, it would pose an REC to the site.

To assess the identified Phase I ESA RECs, a Phase II ESA was performed in under the City's EPA Assessment Grant in January 2005. The Phase II conclusions indicated site is underlain by solid waste materials consisting of rubbish, sawdust, other wood products, glass, and cinders. The fill material extended to depths of 4 to 10 feet below ground surface and is depicted on the attached Sheet 2. Analytical soil sampling detected PAHs, arsenic and lead above State of Wisconsin direct contact and soil to groundwater pathways RCLs. VOCs were also detected in the soils but below State Standards. Arsenic was detected in the groundwater above its State of Wisconsin Preventative Action Limit (PAL). Because of the detected VOCs, PAHs and metals and the proposed use of the lagoon as a marina, the Phase II ESA study under the EPA Assessment Grant was expended to assess the lagoon. In March 2005, sediment samples were collected in the lagoon. Arsenic, lead and PAHs were detected above State of Wisconsin direct contact RCLs in the sediments. PCBs were also detected in the sediments but below State of Wisconsin cleanup levels. Results of the Phase II ESA and historic data associated with the closed LUST site are summarized on the attached Sheet 3.

3 Potential Exposure Pathways

3.1 Soil

Potential exposure pathways were evaluated by comparing analytical data collected at the site with Soil Cleanup Standards established under Chapter NR 720, Wisconsin Administration Code. These standards were established for the remediation of soil contamination, which result in restoration of the environment to the extent practicable; minimize harmful effects to the air, lands, and waters of the state; and are protective of public health, safety and welfare, and the environment. These soil cleanup standards apply to all remedial actions taken by responsible parties to address soil contamination after an investigation has been conducted at a site that is subject to regulation.

Soil cleanup standards are established based on one of the following controlling criteria:

1. Soil quality that would cause a violation of a groundwater quality standards;
2. An impact on soil quality or groundwater quality that would cause a violation of a surface water quality standard contained in Chapters NR 102 to 106,
3. Soil quality that would cause a violation of an air quality standard contained in Chapters NR 400 to 499, and
4. Soil quality that represents a risk to human health as a result of direct contact, including ingestion. The controlling criteria depend, in part, on the physical and toxicological characteristics of the chemicals of concern. For the chemicals of concern identified at the site, Non-industrial Direct Contact Residual Contaminate Levels (RCLs) were used as soil cleanup objectives for this site.

Based on soil analytical results from previous subsurface investigations at the site, a potential exposure pathway for direct contact exists at the site. The soil analytical test results are included in Table 1.

3.2 Groundwater

Chapters NR 140 and NR 160 of the Wisconsin Administrative Code establish groundwater quality standards for substances detected in or having a reasonable probability of entering the groundwater resources of the state. Two sets of standards are established: 1) enforcement standard (ES) and 2) Preventive Action Limit (PAL). The ES is a health-risk based concentration and when exceeded, usually results in further subsurface investigation, remedial action requirements, or monitoring. ES concentrations are generally based on federal drinking water quality standards. The PAL is typically established at 10% of the ES for substance with carcinogenic, mutageneric, or teratogenic properties. The PAL is established at 20% of the ES for substances of public health concern. Groundwater quality ES concentrations outlined in Chapter NR 140 represents groundwater cleanup criteria for this site.

Based on results of groundwater samples collected from monitoring wells at the former Boat Works property indicate arsenic at concentrations below the ES. The low arsenic concentrations are typical of sites with fill material. A limited area of petroleum impacted groundwater associated with the former Boat Works closed LUST site is located in the northeast corner of the site. The extents of the impacts are limited and the site has been closed by the WDNR. The WDNR has not required any additional remediation of this area. Groundwater data is summarized on Table 2.

It is anticipated that impacts will not limit redevelopment of the site but groundwater will need to be managed properly during construction. Accordingly, this ABCA is limited to soil cleanup alternatives, with the understanding that by addressing impacted soil, the source of groundwater quality degradation will be mitigated and environmental closure can be granted.

3.3 Vapor Intrusion

Vapor intrusion or the migration of volatile chemicals from the subsurface has not been evaluated. Due to the presence of biodegradable materials (i.e. wood) encountered in the fill soils at the site, the potential exists for methane gas to be generated during decomposition. However, it is anticipated that vapor intrusion will not be an issue because the proposed development will include performance barriers and a cap.

4 Analysis of Soil Cleanup Alternatives

4.1 Site Redevelopment Plans

The City Redevelopment Authority (RDA) has identified the Boat Works property as a key property in the City's Fox River Corridor Riverwalk Plan. Specifically, development plans for the site include a public boat launch, boat slips, and associated parking lot with public restrooms and a picnic area. Conceptual redevelopment plans for the site are indicated on Sheet 4. Oshkosh River Development anticipates initiating construction by Mid-Summer 2013.

The City RDA proposes to implement corrective action concurrent with site redevelopment. In this manner, constructed features (i.e. buildings, parking areas, and landscape features) can be integral components of the remedy.

Three potential cleanup alternatives were selected for the site. These alternatives are subsequently discussed in the EPA Citizen Guides, which provide general information on the different alternatives is appended to this report.

4.2 Potential Cleanup Alternatives

4.2.1 No Action

The No Action Alternative would involve no remedial activities at the site and leave the site in its current condition. This alternative is not practical because it constrains and potentially eliminates any practical redevelopment of this property. The site is a river front property which, if developed, would be considered to be of high value.

4.2.2 On Site Reuse with Performance Barriers and Limited Offsite Landfilling

This alternative would involve reusing soil excavated during construction as fill material in other areas of the site and utilizing performance barriers over impacted soils at the site to address direct contact concerns. It is anticipated that the excavation of impacted fill material will be primarily limited to the top 18 inches below grade. The bulk of the remaining impacted soils are expected to be covered with imported fill material to raise grade of the site. Performance barriers would include the proposed restroom building, parking lot, and imported soil fill in landscaped areas. Performance barriers that do not consist of hardscape (pavement or building components) will be constructed with an engineered barrier consisting of a geotextile warning layer, 6 inches of clean soil, and at least 12 inches of topsoil. The barriers would substantially reduce the potential for the public to come into contact with the underlying impacted soil. Off-site landfilling may be required for excess impacted soils that would be excavated during construction and could not be reused on site due to space or structural suitability limitations. Any excess material could be used in landscaping berms and covered with a warning barrier and clean top soil. Excess excavated soil not reused on site will be transferred off site to a licensed landfill.

Under this alternative, the restroom building would be constructed over an alternative foundation, likely a deep pile or aggregate pier foundation. As indicated on the fill Isopach map, there may be over 5 feet of fill in some areas below the building footprint. Use of an alternative foundation would allow most of the material to stay in place and the building would essentially span the impacted soil. The cost of the deep foundation exceeds that of the conventional foundation in the previous alternative; however, this cost is offset by the reduced volume of soil, which would require transportation and landfilling.

4.2.3 Offsite Landfilling

The offsite landfilling alternative would involve the transfer of all impacted soil to an offsite licensed landfill. The impacted soil at the site would be excavated, temporarily stockpiled if necessary, loaded into trucks, and transported to a landfill. Backfill from offsite sources would be brought into the site to raise the grade following removal of impacted soils. Historical borings logs suggest an average excavation depth of 5 to 10 feet would be required to remove all impacted soil.

Under this alternative, the proposed restroom building would be constructed over a conventional foundation. Building footings would be constructed to design depth and width along the perimeter and along load-bearing areas of the building footprint. All fill material generated during construction would be managed as a solid waste. Samples of fill would be collected and analyzed for waste characteristics, as necessary, to obtain landfill approval. Potential solid waste disposal facilities include the Waste Management Valley Trail Landfill located in Berlin, Wisconsin.

4.3 Carbon Footprint Analysis

An analysis of the site for each alternative was analyzed for the carbon footprint created during redevelopment. An analysis of carbon footprint takes into consideration three different factors: Scope 1 (indirect discharge), Scope 2 (electricity), and Scope 3 (other indirect). During redevelopment of the site, Scope 1 and Scope 2 are not applicable.

Scope 3 items consist of diesel fuel used in trucks used to haul contaminated soil, structural fill, asphalt, and concrete, diesel fuel used in construction equipment for the excavation of contaminated soil, preparing the site and placing the structural fill, placing the asphalt, and placing the concrete, and unleaded gasoline used by construction oversight personnel during redevelopment at the site.

For scope 3, it was assumed that the contaminated soil would be disposed of at the Valley Trail landfill in Berlin, Wisconsin located 42 miles roundtrip from the site, structural fill material would be from the Oshkosh Vulcan Quarry in Oshkosh, Wisconsin located 3 miles roundtrip from the site, asphalt would be from the Northeast Asphalt plant in Larson, Wisconsin located 40 miles roundtrip from the site, and concrete would be from the Carew Concrete plant in Oshkosh, Wisconsin located 8 miles roundtrip from the site. In addition, the assumption was made that AECOM personnel would perform the construction oversight and would drive 4 miles roundtrip from the AECOM Oshkosh office to the site. The assumption was made that the construction oversight personnel’s field vehicle averages 18 miles to the gallon, heavy duty hauling vehicles average 8 miles to the gallon, and heavy duty equipment averages 4 gallons per hour. The number of trips for excavating contaminated soil, hauling in structural fill and construction oversight varies for each alternative. The assumption was made that it would take approximately three 8-hour days to place the asphalt parking lot, twenty 8-hour days to place the concrete sidewalk, and five 8-hour days to construct the bioswale.

Total carbon emissions for each option are presented in Table 3 and are further discussed in the following sections of this report. The carbon emissions were calculated assuming the project is constructed continuously and assumes waste is directed loaded into trucks.

4.3.1 Option 1 – Do Nothing

Under the Do Nothing Option, there would be no carbon emissions created. Although there are no carbon emissions, this is not a sustainable option because the site would remain an unusable Brownfield site.

4.3.2 Option 2 – On Site Reuse with Performance Barriers and Limited Offsite Landfilling

As previously stated, additional soil borings would need to be conducted to determine the extent of contamination in the soil across the site. Due to the limited soil data, the assumption was made that the existing site would need the top 1.5 feet of contaminated soil to be removed across the site and disposed of in a landfill. Actual quantities may vary depending on further soil exploration results, the final design plan, and final grades.

The assumption was made that fifteen 8-hour days would be required to remove the 1.5 feet of contaminated soil in the parking lot and sidewalk area and 150 truckloads would be required to haul the contaminated soil to the landfill. In addition, six trucks would be required to haul the contaminated soil from the bioswale to the landfill. 150 truckloads would be required to haul in structural fill and ten 8-hour days would be required to grade the site, place, and compact the structural fill. Personnel would be required for 53 days for construction oversight.

The total emissions for Option 2 are 32.7 tons of carbon dioxide (ton CO_2e).

4.3.3 Option 3 – Offsite Landfilling

Due to the limited soil data, the assumption was made that the existing site has on average 5 feet of contaminated soil that would need to be removed across the site and disposed of in a landfill. Actual quantities may vary depending on further soil exploration results, the final design plan, and final grades.

The assumption was made that fifty 8-hour days would be required to remove the five feet of contaminated soil in the parking lot and sidewalk area and 500 truckloads would be required to haul the contaminated soil to the landfill. In addition, fourteen trucks would be required to haul the contaminated soil from the bioswale to the landfill. 500 truckloads would be required to haul in structural fill and 33 8-hour days would be required to grade the site, place, and compact the structural fill. Personnel would be required for 111 days for construction oversight.

The total emissions for Option 3 are 76.5 ton CO_2e.

4.4 Sustainability Matrix

A sustainability matrix was created that compared sustainability metrics for the three redevelopment options. The selected options were Do Nothing, On-Site Reuse with Performance Barriers and Limited Offsite Landfilling, and Off Site Landfilling. The sustainability matrix for the Boat Works redevelopment site is presented in Table 4.

It should be noted that the best or most applicable sustainable alternative at the site may be a combination of the proposed options.

4.5 Potential Sustainable Activities

To minimize our environmental footprint during execution of our proposed remedial actions, the AECOM Team will develop a sustainability strategy for the project that will be incorporated into the project execution plans. Examples of sustainable operations are discussed in the following sections of this report.

4.5.1 Planning

Our programmatic approach will include establishing electronic networks for data transfers and deliverables, team decisions, and document preparation, as well as reducing travel through increased teleconferencing, where appropriate. This approach not only reduces the greenhouse gas (GHG) emissions associated with travel, but it increases the efficiency with which project activities are completed. Long-term monitoring and maintenance includes various recurring events and some opportunity for incorporating sustainable operations through efficiencies, such as grouping tasks together and optimizing existing systems.

4.5.2 Energy Use and Renewable Energy

Diesel fuel consumption by construction machinery and equipment will be conserved by selecting suitably sized and typed equipment; using auxiliary power units to power cab heating and air conditioning when a machine is unengaged; and by performing routine, on-time maintenance to improve fuel efficiency. Our fuel consumption strategy will also include use of local contractors to minimize transport of equipment and reduce fuel consumption and associated air emissions.

4.5.3 Air Pollutants and Green House Gas (GHG) Emissions

Excavation associated with contaminated soil removal could generate contaminated or uncontaminated dust and potential mobilization of impacts during field operations. Therefore, AECOM will implement dust suppression activities during excavation and hauling activities and the excavated area will be quickly re-vegetated. We will also evaluate the availability and use of cleaner fuels, such as ultra-low sulfur diesel, to reduce greenhouse gas and particulate matter emissions from site vehicles.

4.5.4 Water Use and Impacts on Water Resources

The AECOM Team will implement Best Management Practice (BMP) strategies to help reduce consumption of potable water, minimize potential for waterborne contamination, and minimize introduction of toxic materials to surface water bodies. Our team will quickly restore any vegetated areas disrupted by equipment or vehicles to control stormwater runoff and avoid soil transport to surface water bodies. We will use an appropriate grass mixture for its drought-tolerant characteristics to limit the amount of watering and ability to germinate better in the summer months.

4.5.5 Material Consumption and Waste Reduction

Numerous manmade products are purchased and used during remediation activities, such as personal protective equipment, synthetic sheeting, disposable sampling equipment, and routine business materials. Our team will consider product life cycles and give preference to products with recycled and bio-based contents; products, packing material, and disposable equipment with reuse or recycling potential; and product contents and manufacturing processes involving nontoxic chemical alternatives. All on-site activities will also be subjected to a recycling program to divert waste from the landfill.

4.6 Evaluation of Cleanup Alternatives

4.6.1 Evaluation Criteria

Potential cleanup alternatives to mitigate the risk to human health and environment due to chemical characteristics of the subsurface fill material present throughout the redevelopment site were comparatively evaluated based on the following criteria:

- Technical simplicity
- Effectiveness in protecting human health and the environment
- Cost of implementation including costs related to long-term monitoring or any operating and maintenance costs
- Implementation schedule

Each alternative was compared to the evaluating criteria and a numerical score assigned. Results of comparative scoring are summarized on Table 5. On the basis of technical simplicity, all alternatives rated equal. In terms of effectiveness and protecting human health and the environment, the No Action Alternative rated lowest while the other two alternatives were equally effective. Arguably, the use of performance barriers may not be as effective as offsite landfilling. Under the landfilling alternatives, impacted fill material would be excavated and removed from the site; while with the limited landfilling and performance barrier alternative; engineering controls are being used to reduce direct contact and environmental risk while leaving material in place.

The anticipated schedule to implement each of the cleanup alternatives will depend, in part, on the volume of soil required to be excavated and transported offsite. We anticipate that offsite landfilling, which largely consists of mass excavation and backfilling, could be accomplished in less time than constructing performance barriers and limiting offsite landfilling. Excavation and landfilling would largely occur prior to any significant construction effort while performance barriers would be constructed concurrent with other site improvements.

4.6.2 Green Remediation Criteria

Green Remediation is defined by the US EPA as the practice of considering all environmental effects of remedy implementation and incorporating options to maximize net environmental benefit of cleanup actions. Green Remediation focuses on establishing and utilizing management practices which consider the broader impact of proposed environmental mitigation, including societal benefits, while preserving the effectiveness of the selected remedy. The following six core elements of green remediation have been established by the US EPA:

1. Minimize total energy use and maximum use of renewable energy
2. Minimize air pollutants and greenhouse gas emissions
3. Minimize water use and impacts to water resources
4. Optimize future land use and enhance ecosystem
5. Reduce, reuse, and recycle materials of waste
6. Optimize sustainable management practices during stewardship

In general, these green remediation core elements have been established to evaluate the net environmental impact of remediation by recognizing collateral impact to air, water, land, and social systems. Potential management practices, which can be included as elements of proposed cleanup alternatives, are incorporated into the sustainability matrix summarized on Table 4. As indicated on Table 4, there are several practices that could be employed or modified to enhance green remediation and sustainable concepts. Some of these practices may influence other evaluation criteria such as technical practicability, effectiveness, cost, and implementation schedule. Occasionally, practices have competing influences on core elements and other evaluation criteria. For example, the use of low sulfur diesel fuel will reduce air emissions but may increase total energy usage and total project cost.

Estimated carbon dioxide emissions are calculated from emissions factors for specific equipment and processes along with estimated activity data such as hours of operation. These worksheets include emissions factors and activity data for three different types of sources; diesel fuel consumption of heavy duty haul trucks, diesel fuel consumption of heavy duty construction equipment, and unleaded gasoline consumption of a field vehicle. Energy consumption results are based on the average heating value for diesel and unleaded gasoline fuel and the amount of diesel and unleaded gasoline fuel consumed during each activity.

4.7 Comparative Results

As discussed previously, the No Action Alternative is not considered practical because it does not prepare the site for redevelopment or achieve the objectives of the City and other stakeholders.

The on-site reuse with performance barriers and limited offsite landfilling alternative would address hazards to the public and environment at the site. This alternative would reduce soil excavation and offsite landfilling activities, thereby reducing air emissions. Performance barriers will be required to address direct contact issues with the impacted soils. These barriers will require future maintenance.

The offsite landfilling alternative would remove all of the impacted soil from the site, thereby reducing risk to the public and environment. A licensed landfill (Valley Trail Landfill) is located approximately 21 miles northwest of the site. The proximity of the landfill to the site reduces trucking costs and associated air emissions from the trucks. Disadvantages of offsite landfilling the entire mass of impacted soils at the site include high costs, fugitive air emissions during operations, and potential community concerns regarding trucking large quantities of impacted soil through downtown Oshkosh.

4.8 Recommended Cleanup Alternative

The on-site reuse with performance barriers and limited offsite landfilling alternative is the preferred remedy for achieving site redevelopment at the former Boat Works property due to the effectiveness, implementation feasibility, carbon footprint, sustainability, and cost. This alternative consists of managing as much of the impacted fill material on site as practical and disposing the remainder of the material at a licensed solid waste landfill. Cross sections of the site in existing and proposed conditions assuming on-site reuse with performance barriers and limited offsite landfilling are depicted on Sheet 7.

A key element of this alternative is the use of the parking lot and sidewalk as a cap and using performance barriers such as a geo-grid under the parking areas, a warning barrier under green space, and a geomembrane under the bioswale. Site grading plans, utility plans, and paving plans should be prepared recognizing the characteristics of the fill materials. Landscaping berms, stormwater infiltration areas, and other green space areas should incorporate the fill material to the extent practical. Utility corridors should include barriers where they enter and exit the site to control potential vapor migration through the granular backfill. To the extent the fill material can be used as structural fill, it should be considered to raise grades below parking areas and other proposed pavement. The use of performance barriers, a cap, and limited landfilling supports the core elements of sustainable remediation largely because components of the environmental remedy leverage site improvements and infrastructure needs of the new development.

Tables

TABLE 1
SOIL ANALYTICAL RESULTS
PROPOSED BOAT WORKS REDEVELOPMENT
FORMER BOAT WORKS PROPERTY
OSHKOSH, WISCONSIN

	Generic RCLs$^{(1)(3)}$					EPA - 40CFR 761.125 Cleanup Values	NR 746 Criteria$^{(2)}$ Table 1 Indicator of Residual Petroleum Product in Soil Pores	Boring	BW-SB1		BW-SB2		BW-SB3		BW-SB4		BW-SB5		BW-SB6		BW-SB-7		BW-SB-8		BW-SB-9		BW-SB-10		BW-SB-11		BW-SB-12		BW-SB-13		BW-SB-14		BWSB-15	BWSB-16	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	MW1	MW2	MW2	MW3	MW4	MW5	B1	B2	B3
	Protection of Groundwater $^{(A)}$	Direct Contact		Volatile Inhalation				Sample	S02	S05	S02	S05	S02	S05	S02	S05	S02	S05	S02	S05	SO-1	SO-2	SO-1	SO-2	SO-1	SO-2	SO-1	SO-2	SO-1	SO-2	SO-1	SO-2	SO-1	SO-2	SO-1	SO-2	SO-1	SO-1	BTWS-1	BTWS-2	BTWS-3	BTWS-4	BTWS-5	BTWS-6	BWS-1	BWS-2	BWS-3	BWS-4	BWS-5	BWS-6	BWRS-1	BWRS-2	BWRS-3	BWRS-4	1	2	6	2	1	2	2	1	2
		Non-Industrial $^{(B)}$	Industrial $^{(C)}$	Non-Industrial	Industrial			Date Sampled	11/09/04	11/09/04	11/09/04	11/09/04	11/09/04	11/09/04	11/08/04	11/08/04	11/08/04	11/08/04	11/08/04	11/08/04	3/1/05	3/21/05	3/1/05	3/21/05	3/1/05	3/21/05	3/1/05	3/21/05	3/1/05	3/21/05	3/1/05	3/21/05	3/1/05	3/21/05	3/1/05	3/21/05	3/1/05	3/1/05	9/22/89	9/22/1989	9/22/1989	9/22/1989	9/22/1989	9/22/1989	9/22/1989	9/22/1989	12/14/1989	12/14/1989	12/14/1989	12/14/1989	4/5/1990	4/5/1990	4/5/1990	4/5/1990	5/25/1993	5/25/1993	5/25/1993	5/25/1993	5/25/1993	5/25/1993	5/25/1993	5/25/1993	5/25/1993
								Depth (feet)	Fill: Clay	Fill: Clay	Fill: Clay	Clay	Fill: Silt	Clay	Fill: Wood	Clay	Fill: Clay	Clay	Fill: Clay	Clay	2.0' to 7.0'	7.0' to 10.0'	2.0' to 7.2'	7.2' to 10.0'	2.0' to 6.1'	6.1' to 9.0'	2.0' to 5.2'	5.2' to 9.0'	2.0' to 5.7'	5.7' to 9.0'	2.0' to 7.0'	7.0' to 11.0'	2.0' to 6.5'	6.5' to 11.0'	2.0' to 7.0'	7.0' to 11.0'	2.0' to 6.5'	2.0' to 7.5'	1.5	0.5	6.5	5	6.5	0.5	12	12	10	3	3	3	2.5	3	5	5	0-2	2-4	12-14	2-4	0-2	2-4	2-4	0-2	2-4
Nitrogen-Ammonia (%)	--	--	--	--	--	--	--														1,200	132	1,100	284	1,100	398	782	231	475	106	740	175	775	164	1,450	229	987	1,110																									
Nitrogen-Kjeldahl (%)	--	--	--	--	--	--	--														7,600	611	6,430	698	6,580	1,320	5,300	457	2,560	313	3,640	365	5,060	571	7,630	641	8520	6,910																									
Oil & Grease (mg/kg)	--	--	--	--	--	--	--														2,290	<370	960	<353	1,470	<397	2,080	<308	448	<298	1,410	<295	1,020	<351	1,540	<302	603	1,570																									
pH	--	--	--	--	--	--	--														7.47	8.22	7.42	8.47	7.38	8.27	7.50	8.02	7.47	8.33	7.49	8.46	7.32	8.19	7.41	8.69	7.39	7.44																									
Total Phosphorous (%)	--	--	--	--	--	--	--														1,160	731	1,090	744	1,220	762	1,060	587	640	516	9,490	512	733	686	1,290.0	414	976	1,040																									
Total Solids (%)	--	--	--	--	--	--	--														36.7	67.6	35.3	70.8	26.6	63	28.5	81.1	46.9	83.8	39.6	84.7	36	71.3	30.8	82.8	29.7	35																									
Total Volatile Solids (%)	--	--	--	--	--	--	--														12.9	3.64	14.0	2.77	14.0	2.97	12.7	1.29	6.33	1.10	10.3	0.97	15.6	2.83	16.0	1.06	18	18.3																									
Total Organic Carbon (mg/k	--	--	--	--	--	--	--														90,000	4,400	71,000	4,200	72,000	5,100	50,000	12,000	32,000	23,000	61,000	15,000	59,000	6,700	73,00	3,500	88,000	86,000																									
PCBs(µg/kg)																																																															
Aroclor 1016	--	--	--	--	--	***10***	--														<0.016	<7.6	<0.015	<7.6	<0.018	<8.3	<0.017	<6.7	<0.013	<6.7	<0.019	<6.6	<0.017	<7.8	<0.016	<6.6	<0.018	<0.018																									
Aroclor 1221	--	--	--	--	--	***10***	--														<0.013	<6.2	<0.012	<6.2	<0.015	<6.8	<0.014	<5.5	<0.010	<5.5	<0.016	<5.4	<0.014	<6.4	<0.013	<5.4	<0.015	<0.015																									
Aroclor 1232	--	--	--	--	--	***10***	--														<0.013	<6.1	<0.012	<6.1	<0.014	<6.7	<0.013	<5.4	<0.010	<5.4	<0.016	<5.3	<0.014	<6.3	<0.013	<5.3	<0.014	<0.015																									
Aroclor 1242	--	--	--	--	--	***10***	--														<0.014	<6.7	<0.013	<6.6	<0.015	<7.3	<0.014	<5.9	<0.011	<5.9	<0.017	<5.8	<0.015	<6.9	<0.014	<5.7	<0.016	<0.016																									
Aroclor 1248	--	--	--	--	--	***10***	--														0.27	<4.9	0.18	<4.9	0.16	<5.4	0.038	<4.3	0.046	<4.3	0.045	<4.2	0.2	<5.0	0.14	<4.2	0.16	0.39																									
Aroclor 1254	--	--	--	--	--	***10***	--														0.6	<5.0	0.39	<5.0	0.29	<5.5	0.063	<4.4	0.084	<4.4	0.06	<4.4	0.33	<5.2	0.16	<4.3	0.29	0.62																									
Aroclor 1260	--	--	--	--	--	***10***	--														<0.0096	<4.5	<0.0086	<4.5	<0.010	<4.9	<0.0097	<4.0	<0.0075	<4.0	<0.011	<3.9	<0.010	<4.6	<0.0094	<3.9	<0.010	<0.011																									
PCB Total	--	--	--	--	--	--	--														0.87^{B}		0.57^{A}		0.45^{A}		0.101^{A}		0.13^{A}		0.105^{A}		0.53^{A}		0.3^{A}		0.45^{A}	1.01^{B}																									
Metals																																																															
Arsenic	--	**0.039**	**1.6**	--	--	--	--		**4.1**	**3.07**	**3.25**	**3.37**	**2.94**	**2.91**	**5.6**	1.12	**2.56**	**2.52**	**8.43**	**9.62**	**5.75**	**3.08**	**4.84**	**10.7**	**7.82**	**3.16**	**7.26**	**2.21**	**4.24**	**3.01**	**4.02**	**2.90**	**4.83**	**4.14**	**5.1**	**1.67**	**5.86**	**4.69**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Barium	--	--	--	--	--	--	--		195	119	105	73.5	23.6	80.4	70.3	69.1	109	84.4	223	108	101	141	97.2	137	135	149	132	78.9	101	68.6	96	80.4	102	98.2	113	36.2	113	97.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	--	**8**	**510**	--	--	--	--		0.251	0.158	0.175	0.0739	0.119	0.0833	0.269	0.0608	0.247	0.0828	0.731	0.184	0.839	0.191	0.649	0.147	0.865	0.16	0.698	0.0838	0.373	0.0955	0.831	0.145	0.622	0.198	0.919	0.0531	0.737	0.834	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	--	**16,000**	---	--	--	--	--		41.3	35.8	26.3	22	5.5	21.1	13	18.1	27.4	19.7	15.4	32.4	83.1^{A}	36.5	62.3^{A}	35.3	62.8^{A}	39.2	63.5^{A}	16.6	36.5	18.1	87.9^{A}	16.6	38.3	28.3	103^{A}	13	63^{A}	77.4^{A}	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper						--			--	--	--	--	--	--	--	--	--	--	--	--	47.7^{A}	38.9	46.7^{A}	38.3	46.2^{A}	41.6	49.1^{A}	23.3	31.1	22.7	61.5^{A}	21.4	36.9^{A}	30.3	59.1^{A}	12	47.8^{A}	48.9^{A}																									
Lead	--	**50**	**500**	--	--	--	--		**57.4**	11	13.3	6.6	28.7	6.67	125	5.65	39.8	6.49	**310**	10.2	**56.4**^{A}	11.1	**61.2**^{A}	10.4	**80.1**^{A}	11.9	**73.3**^{A}	6.89	44.6^{A}	7.04	**74.5**^{A}	6.26	**61.9**^{A}	9.85	**73.4**^{A}	4.86	**58.6**^{A}	**55.7**^{A}	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**135**	**108**	2	19	6	**156**	30	**94**	43
Mercury						--			0.0451	<0.0199	<0.0212	<0.0212	<0.0799	<0.0161	0.422	<0.1165	<0.0999	<0.0163	0.106	<0.022	0.286^{A}	0.0488	0.21^{A}	0.0466	0.237^{A}	0.0556	0.242^{A}	0.0456	0.0576^{A}	0.0406	0.232^{A}	0.0319	0.0833^{A}	0.0505	0.13^{A}	0.0314	0.135^{A}	0.114^{A}	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel						--			--	--	--	--	--	--	--	--	--	--	--	--	19.1	26.6	18.4	25.3	28.1^{A}	32.2	22.7^{A}	15.8	18.8	15	16.3	13.8	19	24.5	20.6	8.6	21	19.4																									
Selenium	--	--	--	--	--	--	--		<0.872	<0.852	<0.908	<0.697	<0.694	<0.692	<1.21	<0.705	<0.768	<0.7	<0.697	1.11	<1.63	<0.888	<1.70	<0.847	<2.26	<0.952	<2.11	<0.74	<1.28	<0.716	<1.52	<0.708	<1.67	<0.842	<1.95	<0.725	<2.02	<1.71	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silver	--	--	--	--	--	--	--		<0.291	<0.284	<0.303	<0.232	<0.231	<0.231	<0.404	<0.235	<0.256	<0.233	1.2	<0.315	<0.545	<0.296	<0.567	<0.282	<0.752	<0.317	<0.702	<0.247	<0.426	<0.239	<0.505	<0.236	<0.566	<0.281	<0.649	<0.242	<0.673	<0.571	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	--	--	--	--	--	--	--		--	--	--	--	--	--	--	--	--	--	--	--	144^{A}	52.2	139^{A}	51	183^{A}	60.2	175^{A}	30.6	93	31.6	135^{A}	28.6	129^{A}	44.5	160^{A}	20.8	136^{A}	137^{A}	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Detected Volatile Organic Compounds (µg/kg):																																																															
1,1,1-Trichloroethane	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	7,573	782,000	51,100,000	47,000	330,000	--	83,000		--	--	--	--	--	--	--	--	--	--	--	--																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropan	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane (EDB)	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	1,410,000	92,000,000	600000 *	600000 *	--	1,800		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	3,520	782,000	51,100,000	--	--	--	11,000		--	--	--	--	--	--	--	--	--	--	--	--																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropane	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2-Dichloropropane	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chlorotoluene	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chlorotoluene	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzene	5.5	1,100	52,000	160	2,700	--	8,500		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	88600	336	ND	3390	ND	ND	ND	ND	ND	ND	ND	ND	0.19
Bromobenzene	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon tetrachloride	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorodibromomethane	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	2,900	1,560,000	102,000,000	400,000	400,000	--	4,600		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	130400	ND	ND	4630	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloro-1,3-butadiene	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene (Cumene)	37,000	1,560,000	102,000,000	--	860,000	--	--		<25	74.1	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropyl ether	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl-tert-butyl ether	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Butylbenzene	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Propylbenzene	--	--	--	--	460,000	--	--		<25	<25	<25	<25	<25	<25	<25	<25	48.8	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	400	30,000	4,000,000	65,000	440,000	--	--		<25	<25	<25	<25	<25	<25	55.4	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ND	0.17	0.17	ND	ND	ND	ND	ND	ND
p-Isopropyltoluene	--	--	--	--	--	--	--		<25	11800	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
sec-Butylbenzene	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	284	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
tert-Butylbenzene	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	1,500	1,250,000	81,800,000	670,000	670,000	--	38,000		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	142900	716	335	78500	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total-Trimethylbenzene	--	--	--	--	--	--	94,000		<50	<50	<50	<50	<50	<50	<50	<50	169.7	<50	<50	<50																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	--	--	--	--	--	--	--		<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25																			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene (total)	4,100	3,130,000	204,000,000	270,000	1,900,000	--	--		41	<50	<50	<50	<50	<50	<50	<50	35.7	<50	<50	<50																			--	--	--	--	--	--	--	--	--	--	--	--	223000	2240	1800	129870	ND	ND	ND	ND	ND	ND	ND	ND	ND
PAH (µg/kg):																																																															
1-methyl naphthalene	23,000	1,100,000	70,000,000	--	--	--	--		<50.9	<24.9	<106	<4.07	<40.5	<40.4	<141	<4.11	<89.6	<4.08	<40.7	<5.51	<47.7	<5.18	<49.6	<4.94	<65.8	<5.56	<61.4	<4.32	<37.3	<4.18	<44.2	<4.13	<48.6	<4.91	<56.8	<4.23	<58.9	<50	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-methyl naphthalene	20,000	600,000	40,000,000	--	--	--	--		<59.6	<29.1	<124	<4.76	<47.5	<47.3	<166	<4.82	19.6	<4.78	<47.6	<6.46	<55.9	<6.07	<58.1	<5.79	<77.1	<6.51	<71.9	<5.06	<43.7	<4.89	<51.8	<4.84	<56.9	<5.75	<66.6	<4.95	<69	<58.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	38,000	900,000	60,000,000	--	--	--	--		<68.3	<33.4	<142	<5.46	<54.4	<54.2	<190	<5.52	<120	<5.48	<54.6	<7.4	<64	<6.95	<66.6	<6.64	<86.3	<7.46	<82.5	<5.80	<50.1	<5.61	<59.3	<5.55	<65.3	<6.59	<76.3	<5.68	<79.1	<67.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthylene	700	18,000	360,000	--	--	--	--		<95.9	<46.9	<200	<7.67	<76.4	<76.1	<267	<7.76	<169	<7.7	<76.7	<10.4	<89.9	<9.76	<93.5	<9.32	<124	<10.5	<116	<8.14	<70.4	<7.88	<83.3	<7.79	<91.7	<9.26	<107	<7.97	<111	<94.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	3,000,000	5,000,000	300,000,000	--	--	--	--		<14.5	<7.1	109	<1.16	<11.6	<11.5	499	<1.18	<25.6	<1.17	<11.6	<1.57	<28.6	<3.11	<29.7	<2.97	<39.5	<3.33	<36.8	<2.59	<22.4	<2.51	<26.5	<2.48	<29.2	<2.95	<34.1	<2.54	<35.4	<30	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	17,000	880**	3,900	--	--	--	--		**240**	<29.1	**303**	<4.76	64	<47.3	**1810**	<4.82	<106	<4.78	<47.6	<6.46	<55.9	<6.07	<58.1	<5.79	77.1	<6.51	<71.9	<5.06	<43.7	<4.89	<51.8	<4.84	<56.9	<5.75	<66.6	<4.95	<69.	<58.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	48,000	88**	390	--	--	--	--		**406**	<16.3	**352**	<2.67	<26.6	<26.5	**1850**	8.88	<58.9	<2.68	**84.7**	<3.62	<31.3	<3.40	228^{A}	<3.25	245^{A}	<3.65	<40.4	<2.84	<24.5	<2.74	<29	<2.72	131	<3.23	<37.3	<2.78	<38.7	<32.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	360,000	880**	3,900	--	--	--	--		**257**	**108**	**297**	<2.44	**205**	80.7	**2010**	<2.47	40.2	<2.45	36.1	<3.31	74.9	<3.11	122	<2.97	214	<3.33	130	<2.59	106	<2.51	<26.5	<2.48	<29.2	<2.95	75	<2.54	285	<30	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	6,800,000	1,800	39,000	--	--	--	--		385	<14.9	290	<2.44	117	<24.2	1490	3.88	<53.8	<2.45	107	<3.31	<39.5	<4.29	<41.1	<4.10	<54.5	<4.6	<50.9	<3.58	<30.9	<3.46	<36.6	<3.42	<40.3	<4.07	<47.1	<3.50	<48.8	<41.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(k)fluoranthene	870,000	880	39,000	--	--	--	--		92	<20.6	101	<3.37	<33.6	<33.4	842	<3.41	<44.3	<3.38	<33.7	<4.57	<28.6	<3.11	<29.7	<2.97	<39.5	<3.33	<36.8	<2.59	<22.4	<2.51	<26.5	<2.48	<29.2	<2.95	<34.1	<2.54	<35.4	<30	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	37,000	8,800	390,000	--	--	--	--		326	<16.3	416	<2.67	<26.6	77.7	2300	<2.7	<58.9	<2.68	<26.7	<3.62	<31.3	<3.4	173^{A}	<3.25	192^{A}	<3.65	115	<2.84	93.6	<2.74	<29	<2.72	<31.9	<3.23	<37.3	<2.78	<38.7	<32.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	38,000	88**	390	--	--	--	--		<20.3	<9.94	**107**	<1.63	<16.2	<16.1	<56.6	<1.65	<35.9	<1.63	<16.3	<2.2	<19.1	<2.07	<19.8	<1.98	<26.3	<2.22	<24.6	<1.73	<14.9	<1.67	<17.7	<1.65	<19.4	<1.96	<22.7	<1.69	<23.6	<20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	500,000	600,000	40,000,000	--	--	--	--		1280	<7.1	1330	<1.16	334	82.7	6670	5.84	<25.6	<1.17	195	<1.57	433^{A}	<3.25	711^{A}	<3.11	827^{A}	<3.49	526^{A}	<2.71	394	<2.63	263	<2.6	300	<3.09	445^{A}	<2.66	529^{A}	183	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluorene	100,000	600,000	40,000,000	--	--	--	--		<29.1	<14.2	<60.5	<2.32	<23.1	<23.1	<80.8	<2.35	<51.2	<2.33	<23.2	<3.15	<27.2	<2.96	<28.3	<2.82	<3.76	<3.17	<35.1	<2.47	<21.3	<2.39	<25.3	<2.36	<27.8	<2.81	<32.5	<2.42	<33.7	<28.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	680,000	880**	3,900	--	--	--	--		**349**	<11.4	**186**	<1.86	**105**	<18.5	**1370**	<1.88	15	<1.87	38.9	<2.52	<21.8	<2.37	<22.7	<2.26	<30.1	<2.54	<28.1	<1.97	45.6	<1.91	<20.2	<1.89	<22.2	<2.24	<26.	<1.93	<26.9	<22.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	400	20,000	110,000	65,000	440,000	--	--		<23.3	<11.4	<48.4	<1.86	<18.5	<18.5	<64.6	<1.88	<41	<1.87	<18.6	<2.52	52	<2.37	<22.7	<2.26	46.2	<2.54	38.9	<1.97	<17.1	<1.91	45.7	<1.89	<22.2	<2.24	76.9	<1.93	<26.9	264^{A}	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	1,800	18,000	390,000	--	--	--	--		336	<16.3	578	<2.67	91.4	<26.5	***1840***	<2.7	<58.9	<2.68	61.1	<3.62	204^{A}	<3.40	346	<3.25	243	<3.65	203	<2.84	172	<2.74	88.4	<2.72	86.1	<3.23	108	<2.78	99.3	57.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	8,700,000	500,000	30,000,000	--	--	--	--		929	<7.1	1140	<1.16	294	7.07	5660	12	<2.56	<1.17	181	<1.57	36.5	<3.11	541	<2.97	635^{A}	<3.33	332^{A}	<2.59	294^{A}	<2.51	194	<2.48	187	<2.95	<34.1	<2.54	451^{A}	174	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Petroleum Hydrocarbons (mg/kg)																																																															
Gasoline Range Organics	100	--	--	--	--	--	--																																																ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Petroleum Hydrocarbo	10	--	--	--	--	--	--																																**2.75**	**30**	2.2	**28**	**38**	**22**	ND	ND	ND	**2600**	**410**	ND	**2240**	**14**	**13**	**5250**									

NOTES:
(1) Wisconsin Administrative Code Chapter NR 720, September 2007 - RCLs based on Table 1 (groundwater protection) or Table 2 (direct contact) values
(2) NR 746 - Wisconsin Administrative Code Chapter NR 746, September 2007.
(3) Interim PAH RCLs from "Soil Cleanup Levels for Polycyclic Aromatic Hydrocarbons (PAHs) Interim Guidance," Wisconsin Department of Natural Resources, April 1997 (corrected).
**Non-industrial direct contact standard adjusted to reflect exposure risk of 1x10^{-6} in accordance with NR 720.19(5)(a).
Generic RCLs not included in Wisconsin Administrative Code or Guidance are calculated from the US EPA Soil Screening Level Residual Contaminant Levels using the EPA Soil Screening Level Web Site - WDNR PUB-RR-682, dated May 12, 2006
* - Value is soil saturation concentration
Blank cell indicates regulatory criteria have not been established.
bgs - below ground surface.
mg/kg - milligrams per kilogram.
µg/kg - micrograms per kilogram.
PAH - Polynuclear Aromatic Hydrocarbons
RCL - Residual Contaminant Level
NA - Not Analyzed
(J) - The analyze has been detected between the limit of detection and limit of quantitation. The results are qualified due to the uncertainty of concentrations in this range.
Bolded = Exceeds NR 720 Industrial Direct Contact RCL
^{A} = Exceeds NR 720 Groundwater Pathway RCL
^{B} = Exceeds NR 720 Non Industrial Direct Contact RCL
^{C} = Exceeds NR720 Industrial Direct Contact RCL
10 - Concentration exceeds EPA Clean up Value
^{A} - Concentration exceeds TECs
^{B} - Concentration exceeds PECs
*1 - Cleanup concentration for a non-industrial site per the June 2011 MDA betewen the EPA and WNDR
TEC-Threshold Effect Concentrations, Table 1, *A Guidance Manual to Support the Assessment of Contaminated Sedieuments in Freshwater Ecosystems,* Volume II, EPA 2002.
PEC-Probable Effect Concentrations, Table 2, *A Guidance Manual to Support the Assessment of Contaminated Sedieuments in Freshwater Ecosystems,* Volume II, EPA 2002.

TABLE 2
GROUNDWATER ANALYTICAL RESULTS
PROPOSED BOAT WORKS REDEVELOPMENT
FORMER BOAT WORKS PROPERTY
OSHKOSH, WISCONSIN

	NR 140 Standards		**BWSB1W**	**BWSB2W**	**BWSB3W**	**BWSB5W**	**W1**	**W2**	**W3**	**W4**	**W5**	**W6**	**W7**	**W8**	**W9**	**MW1**			**MW2**			**MW3**			**MW4**			**MW5**		
							BTWW-1	BTWW-2	BWW-1	BWW-2	BWW-3	BWW-4	BWW-5A	BWW-6A	BWRW-1															
Parameters	**ES**	*PAL*	11/23/04	11/23/04	11/23/04	11/23/04	9/22/1989	9/22/1989	12/14/1989	12/14/1989	12/14/1989	12/14/1989	1/30/1990	1/30/1990	4/5/1990	6/23/1993	8/29/1994	11/29/1994	6/23/1993	8/29/1994	11/29/1994	6/23/1993	8/29/1994	11/29/1994	6/23/1993	8/29/1994	11/29/1994	6/23/1993	8/29/1994	11/29/1994
Metals (µg/L)																														
Arsenic	**10**	*1.0*	*2.0*	*6.7*	*2.8*	*2.8*	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Barium	**2000**	*400*	175	81.2	112	47.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	**5.0**	*0.5*	<0.2	<0.2	<0.2	<0.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	**100**	*10*	2.7	1.9	2.4	3.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	**15**	*1.5*	<0.3	<0.3	<0.3	<0.3	--	--	--	--	--	--	--	--	--	**50**	NA	NA	**9**	NA	NA	**39**	NA	NA	540	NA	NA	**19**	NA	NA
Selenium	**50**	*10*	<0.6	<0.6	<0.6	0.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silver	**50**	*10*	<0.2	<0.2	<0.2	<0.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	**2.0**	*0.2*	<0.07	<0.07	<0.07	<0.07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VOCs (µg/L)																														
Benzene	**5.0**	*0.5*	<0.31	<0.31	<0.31	<0.31	**76**	**408**	ND	ND	ND	**2.5**	ND	ND	**835**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromobenzene	**--**	--	<0.41	<0.41	<0.41	<0.41	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	**0.6**	*0.06*	<0.83	<0.83	<0.83	<0.83	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
tert-Butylbenzene	**--**	--	<0.4	<0.4	<0.4	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
sec-Butylbenzene	**--**	--	<0.4	<0.4	<0.4	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Butylbenzene	**--**	--	<0.36	<0.36	<0.36	<0.36	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon tetrachloride	**5.0**	*0.5*	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	**--**	--	<0.7	<0.7	<0.7	<0.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	**400**	*80*	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	**6.0**	*0.6*	<0.4	<0.4	<0.4	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	**3.0**	*0.3*	<0.29	<0.29	<0.29	<0.29	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chlorotoluene	**--**	--	<0.6	<0.6	<0.6	<0.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chlorotoluene	**--**	--	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	**0.2**	*0.02*	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromochloropropane	**--**	--	<1.3	<1.3	<1.3	<1.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromochloromethane	**60**	*6.0*	<0.87	<0.87	<0.87	<0.87	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	**75**	*15*	<0.6	<0.6	<0.6	<0.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	**1250**	*125*	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	**600**	*6.0*	<0.6	<0.6	<0.6	<0.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	**1000**	*200*	<0.7	<0.7	<0.7	<0.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	**5.0**	*0.5*	<0.4	<0.4	<0.4	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	**850**	*85*	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	**7.0**	*0.7*	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	**--**	--	<0.4	<0.4	<0.4	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	**--**	--	<0.39	<0.39	<0.39	<0.39	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	**5.0**	*0.5*	<0.4	<0.4	<0.4	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2-Dichloropropane	**--**	--	<1.5	<1.5	<1.5	<1.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropane	**--**	--	<0.9	<0.9	<0.9	<0.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane	**0.05**	*0.005*	<1.1	<1.1	<1.1	<1.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	**700**	*140*	<0.5	<0.5	<0.5	<0.5	47	52	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	**--**	--	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	**--**	--	<0.31	<0.31	<0.31	<0.31	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropyl Ether	**--**	--	<0.6	<0.6	<0.6	<0.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
p-Isopropyltoluene	**--**	--	1.44	<0.5	1.13	<0.5	--	--	--	--	--	--	--	--	--	ND	ND	NA	ND	ND	NA	4.2	ND	NA	ND	ND	NA	ND	ND	NA
Methylene chloride	**5.0**	*0.5*	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl-tert-butyl-ether	**60**	*12*	1.77	5.94	<0.3	<0.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	**40**	*8.0*	<0.8	<0.8	<0.8	<0.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Propylbenzene	**--**	--	<0.3	<0.3	<0.3	<0.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	**0.2**	*0.02*	<0.61	<0.61	<0.61	<0.61	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	**5.0**	*0.5*	<0.45	<0.45	<0.45	<0.45	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	**1000**	*200*	<0.3	<0.3	<0.3	<0.3	**231**	**899**	ND	ND	ND	ND	ND	ND	**2220**	ND	ND	NA	ND	ND	NA	ND	ND	NA	ND	ND	NA	3.1	ND	NA
1,2,4-Trichlorobenzene	**--**	--	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	**--**	--	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	**200**	*40*	<0.42	<0.42	<0.42	<0.42	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	**5.0**	*0.5*	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	**5.0**	*0.5*	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	--	--	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene[1]	**480**	*96*	<0.4	<0.4	<0.4	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene[1]	**480**	*96*	<0.31	<0.31	<0.31	<0.31	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	**0.2**	*0.02*	<0.2	<0.2	<0.2	<0.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylenes, total	**10,000**	*1000*	<0.92	<0.92	<0.92	<0.92	**268**	**2240**	ND	ND	ND	ND	ND	ND	**5530**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PAHs (µg/L)																														
Acenaphthene	**--**	--	<0.066	<0.084	<0.078	<0.066	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthylene	**--**	--	<0.066	<0.084	<0.078	<0.066	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	**3000**	*600*	<0.055	<0.07	<0.065	<0.055	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	**--**	--	<0.044	<0.056	<0.052	<0.044	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	**0.2**	*0.02*	<0.0187	<0.0238	<0.0221	<0.0187	--	--	--	--	--	--	--	--	--	NA	ND	NA	NA	ND	NA	NA	0.05	NA	NA	ND	NA	NA	ND	NA
Benzo(b)fluoranthene	**0.2**	*0.02*	<0.044	<0.056	<0.052	<0.044	--	--	--	--	--	--	--	--	--	NA	ND	NA	NA	ND	NA	NA	0.1	NA	NA	ND	NA	NA	0.05	NA
Benzo(ghi)perylene	**--**	--	<0.05	<0.07	0.173	<0.055	--	--	--	--	--	--	--	--	--	NA	ND	NA	NA	ND	NA	NA	ND	NA	NA	0.2	NA	NA	ND	NA
Benzo(k)fluoranthene	**--**	--	<0.044	<0.056	<0.052	<0.044	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	**0.2**	*0.02*	<0.055	<0.07	<0.065	<0.055	--	--	--	--	--	--	--	--	--	NA	ND	NA	NA	ND	NA	NA	1.5	NA	NA	0.5	NA	NA	3.4	NA
Dibenzo(a,h,)anthracene	**--**	--	<0.066	<0.084	<0.078	<0.066	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluroanthene	**400**	*80*	<0.066	<0.084	0.226	<0.066	--	--	--	--	--	--	--	--	--	NA	ND	NA	NA	ND	NA	NA	ND	NA	NA	0.7	NA	NA	ND	NA
Fluorene	**400**	*80*	<0.132	<0.168	<0.156	<0.132	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	**--**	--	<0.055	<0.07	<0.065	<0.055	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1-Methylnaphthalene	**--**	--	0.169	<0.112	<0.104	<0.088	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	**--**	--	<0.121	<0.154	<0.143	<0.121	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	**40**	*8.0*	<0.11	<0.14	<0.13	<0.11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	**--**	--	<0.088	<0.112	<0.104	<0.088	--	--	--	--	--	--	--	--	--	NA	ND	NA	NA	ND	NA	NA	0.08	NA	NA	0.11	NA	NA	ND	NA
Pyrene	**250**	*50*	<0.099	<0.126	0.307	0.126	--	--	--	--	--	--	--	--	--	NA	ND	NA	NA	ND	NA	NA	0.1	NA	NA	0.12	NA	NA	0.09	NA
Gasoline Range Organics (µg/L)			--	--	--	--	--	--	--	--	--	--	--	--	--	ND	NA	NA	ND	NA	NA	ND	NA	NA	ND	NA	NA	ND	NA	NA
Dissolved Lead (µg/L)	**15**	*1.5*	--	--	--	--	--	--	--	--	--	--	--	--	--	NA	**10**	NA	NA	**2**	NA	NA	**3**	NA	NA	8	NA	NA	**7**	NA

Notes:

VOCs = Volatile Organic Compounds
PAHs = Polynuclear Aromatic Hydrocarbons
[1] Standards are for 1,2,4- and 1,3,5-Trimethylbenzene combined.
[2] Standards are for Total Xylenes (-m, -p and -o).
Bold value = NR 140 Enforcement Standard Exceedance
Italic value = NR 140 WAC Preventive Action Limit Exceedance
-- No NR 140 ES or PAL established.
NA = Not analyzed
ND = Not detected

TABLE 3
CARBON FOOTPRINT ANALYSIS
PROPOSED BOAT WORKS REDEVELOPMENT
FORMER BOATWORKS PROPERTY
OSHKOSH, WISCONSIN

Carbon Footprint Calculations -Option 1 - Do Nothing

Scope 1

None

Scope 2

None

Scope 3

										CO_2e Greenhouse Gas Potentials			Total		
										1	25	296			
Sampling/O&M/ Vehicle Usage/Waste Disposal	**Year**	**Usage (miles/yr)**	**Usage (gal/yr)**	kg CO_2/gallon	kg CH_4/gallon	kg N_2O/gallon	kg CO_2	kg CH_4	kg N_2O	kg CO_2e/kg CO_2	kg CO2e/kg CH_4	kg CO2e/kg N_2O	kg CO_2e	lb CO_2e	ton CO_2e
Unleaded Gasoline - Construction Oversight	**2013**	**0**	**0**	8.81	0.0036	0.0004	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel - Excavation of Contaminated Soil (parking lot and sidewalk)	**2013**	**0**	**0**	10.15	0.0000	0.0000384	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel - Disposal of Contaminated Soil (parking lot and sidewalk)	**2013**	**0**	**0**	10.15	0.0000	0.0000384	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel - Hauling in Structural Fill (parking lot and sidewalk)	**2013**	**0**	**0**	10.15	0.0000	0.0000384	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel - Placing Structural Fill (parking lot and sidewalk)	**2013**	**0**	**0**	10.15	0.0000	0.0000384	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel - Hauling in Asphalt (parking lot)	**2013**	**0**	**0**	10.15	0.0000	0.0000384	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel - Placing Asphalt (parking lot)	**2013**	**0**	**0**	10.15	0.0000	0.0000384	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel - Hauling in Concrete (sidewalk)	**2013**	**0**	**0**	10.15	0.0000	0.0000384	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel - Placing Concrete (sidewalk)	**2013**	**0**	**0**	10.15	0.0000	0.0000384	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel - Excavation of Contaminated Soil (bioswale)	**2013**	**0**	**0**	10.15	0.0000	0.0000384	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel - Disposal of Contaminated Soil (bioswale)	**2013**	**0**	**0**	10.15	0.0000	0.0000384	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel - Constructing Bioswale	**2013**	**0**	**0**	10.15	0.0000	0.0000384	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
				See Note 2	*See Note 2*	*See Note 2*					*See Note 1*	*See Note 1*			

Assumptions: *Unleaded gasoline used for consultant transport to conduct O&M activities.*
18 miles/gallon of for field vehicle and 8 miles/gallon for Heavy Duty Hauling Vehicle.
4 gallons/hour for heavy equipment

Totals		
kg CO_2e	lb CO_2e	ton CO_2e
0.00	0.00	0.00

Conversions/Factors: *1,000 kWh = 1.0E+6 GWh*
Density of methane = 0.717 kg/m^3 (gas)
Density of propane= 1.83 kg/m^3 (gas)

Source Notes: *Assessment Report (2001).*
Emissions from Mobil Combustion Sources, Section 3, Table 2: CH_4 and N_2O Emission Factors for Highway Vehicles, Gasoline Light-Duty Trucks, and Section 4, Table 5: Factors for Gasoline and On-Road Diesel Fuel, May 2008.

TABLE 3
CARBON FOOTPRINT ANALYSIS
PROPOSED BOAT WORKS REDEVELOPMENT
FORMER BOATWORKS PROPERTY
OSHKOSH, WISCONSIN

Carbon Footprint Calculations - Option 2 - Strip 1.5 feet of Contaminated Soil from the Site and Use Performance Barriers

Scope 1

None

Scope 2

None

Scope 3

										CO$_2$e					
										Greenhouse Gas Potentials					
										1	25	296	Total		
Sampling/O&M/ Vehicle Usage/Waste Disposal	**Year**	**Usage (miles/yr) or (hours/yr)**	**Usage (gal/yr)**	kg CO$_2$/gallon	kg CH$_4$/gallon	kg N$_2$O/gallon	kg CO$_2$	kg CH$_4$	kg N$_2$O	kg CO$_2$e/kg CO$_2$	kg CO2e/kg CH$_4$	kg CO2e/kg N$_2$O	kg CO$_2$e	lb CO$_2$e	ton CO$_2$e
Unleaded Gasoline - Construction Oversight	**2013**	**212**	**26.50**	8.81	0.0036	0.0004	233.465	0.10	0.01	233.47	2.41	3.11	238.98	526.96	0.26
Diesel - Excavation of Contaminated Soil (parking lot and sidewalk)	**2013**	**120**	**480.00**	10.15	0.0000	0.0000384	4872	0.02	0.02	4872.00	0.49	5.46	4,877.95	10,755.87	5.38
Diesel - Disposal of Contaminated Soil (parking lot and sidewalk)	**2013**	**6300**	**787.50**	10.15	0.0000	0.0000384	7993.125	0.03	0.03	7993.13	0.80	8.95	8,002.88	17,646.35	8.82
Diesel - Hauling in Structural Fill (parking lot and sidewalk)	**2013**	**450**	**56.25**	10.15	0.0000	0.0000384	570.9375	0.00	0.00	570.94	0.06	0.64	571.63	1,260.45	0.63
Diesel - Placing Structural Fill (parking lot and sidewalk)	**2013**	**80**	**320.00**	10.15	0.0000	0.0000384	3248	0.01	0.01	3248.00	0.33	3.64	3,251.96	7,170.58	3.59
Diesel - Hauling in Asphalt (parking lot)	**2013**	**1142**	**142.71**	10.15	0.0000	0.0000384	1448.489583	0.01	0.01	1448.49	0.15	1.62	1,450.26	3,197.82	1.60
Diesel - Placing Asphalt (parking lot)	**2013**	**24**	**96.00**	10.15	0.0000	0.0000384	974.4	0.00	0.00	974.40	0.10	1.09	975.59	2,151.17	1.08
Diesel - Hauling in Concrete (sidewalk)	**2013**	**207**	**25.93**	10.15	0.0000	0.0000384	263.1481481	0.00	0.00	263.15	0.03	0.29	263.47	580.95	0.29
Diesel - Placing Concrete (sidewalk)	**2013**	**160**	**640.00**	10.15	0.0000	0.0000384	6496	0.03	0.02	6496.00	0.65	7.27	6,503.93	14,341.16	7.17
Diesel - Excavation of Contaminated Soil (bioswale)	**2013**	**40**	**160.00**	10.15	0.0000	0.0000384	1624	0.01	0.01	1624.00	0.16	1.82	1,625.98	3,585.29	1.79
Diesel - Disposal of Contaminated Soil (bioswale)	**2013**	**241**	**30.12**	10.15	0.0000	0.0000384	305.7123611	0.00	0.00	305.71	0.03	0.34	306.09	674.92	0.34
Diesel - Constructing Bioswale	**2013**	**40**	**160.00**	10.15	0.0000	0.0000384	1624	0.01	0.01	1624.00	0.16	1.82	1,625.98	3,585.29	1.79
				See Note 2	*See Note 2*	*See Note 2*					*See Note 1*	*See Note 1*			

Totals		
kg CO$_2$e	lb CO$_2$e	ton CO$_2$e
29,694.70	**65,476.81**	**32.74**

Assumptions: *Unleaded gasoline used for consultant transport to conduct Construction Oversight Activities.*
18 miles/gallon for field vehicle and 8 miles/gallon for Heavy Duty Hauling Vehicle.
4 gallons/hour for heavy equipment
18 miles/gallon of for field vehicle and 8 miles/gallon for Heavy Duty Hauling Vehicle.
10 days to place structural fill
3 days to place asphalt parking lot
20 days to place concrete sidewalk
5 days to construct bioswales
53 days of Construction Oversight

Conversions/Factors: *1,000 kWh = 1.0E+6 GWh*
Density of methane = 0.717 kg/m^3 (gas)
Density of propane= 1.83 kg/m^3 (gas)

Source Notes: *Assessment Report (2001).*
Direct Emissions from Mobil Combustion Sources, Section 3, Table 2: CH$_4$ and N$_2$O Emission Factors for Highway Vehicles, Gasoline Light-Duty Trucks, and Section 4, Table 5: Factors for Gasoline and On-Road Diesel Fuel, May 2008.

TABLE 3
CARBON FOOTPRINT ANALYSIS
PROPOSED BOAT WORKS REDEVELOPMENT
FORMER BOATWORKS PROPERTY
OSHKOSH, WISCONSIN

Carbon Footprint Calculations - Option 3 - Remove all Contaminated Soil from Site and Dispose of Material at a Landfill

Scope 1

None

Scope 2

None

Scope 3

										CO_2e					
										Greenhouse Gas Potentials					
										1	25	296	Total		
Sampling/O&M/ Vehicle Usage/Waste Disposal	**Year**	**Usage (miles/yr)**	**Usage (gal/yr)**	kg CO_2/gallon	kg CH_4/gallon	kg N_2O/gallon	kg CO_2	kg CH_4	kg N_2O	kg CO_2e/kg CO_2	kg CO2e/kg CH_4	kg CO2e/kg N_2O	kg CO_2e	lb CO_2e	ton CO_2e
Unleaded Gasoline - Construction Oversight	**2013**	**444**	**55.50**	8.81	0.0036	0.0004	488.955	0.20	0.02	488.96	5.05	6.51	500.52	1,103.64	0.55
Diesel - Excavation of Contaminated Soil (parking lot and sidewalk)	**2013**	**400**	**1600.00**	10.15	0.0000	0.0000384	16240	0.07	0.06	16240.00	1.63	18.19	16,259.82	35,852.90	17.93
Diesel - Disposal of Contaminated Soil (parking lot and sidewalk)	**2013**	**21000**	**2625.00**	10.15	0.0000	0.0000384	26643.75	0.11	0.10	26643.75	2.68	29.84	26,676.26	58,821.16	29.41
Diesel - Hauling in Structural Fill (parking lot and sidewalk)	**2013**	**1500**	**187.50**	10.15	0.0000	0.0000384	1903.125	0.01	0.01	1903.13	0.19	2.13	1,905.45	4,201.51	2.10
Diesel - Placing Structural Fill (parking lot and sidewalk)	**2013**	**267**	**1066.67**	10.15	0.0000	0.0000384	10826.66667	0.04	0.04	10826.67	1.09	12.12	10,839.88	23,901.93	11.95
Diesel - Hauling in Asphalt (parking lot)	**2013**	**1142**	**142.71**	10.15	0.0000	0.0000384	1448.489583	0.01	0.01	1448.49	0.15	1.62	1,450.26	3,197.82	1.60
Diesel - Placing Asphalt (parking lot)	**2013**	**24**	**96.00**	10.15	0.0000	0.0000384	974.4	0.00	0.00	974.40	0.10	1.09	975.59	2,151.17	1.08
Diesel - Hauling in Concrete (sidewalk)	**2013**	**207**	**25.93**	10.15	0.0000	0.0000384	263.1481481	0.00	0.00	263.15	0.03	0.29	263.47	580.95	0.29
Diesel - Placing Concrete (sidewalk)	**2013**	**160**	**640.00**	10.15	0.0000	0.0000384	6496	0.03	0.02	6496.00	0.65	7.27	6,503.93	14,341.16	7.17
Diesel - Excavation of Contaminated Soil (bioswale)	**2013**	**40**	**160.00**	10.15	0.0000	0.0000384	1624	0.01	0.01	1624.00	0.16	1.82	1,625.98	3,585.29	1.79
Diesel - Disposal of Contaminated Soil (bioswale)	**2013**	**602**	**75.30**	10.15	0.0000	0.0000384	764.2809028	0.00	0.00	764.28	0.08	0.86	765.21	1,687.30	0.84
Diesel - Constructing Bioswale	**2013**	**40**	**160.00**	10.15	0.0000	0.0000384	1624	0.01	0.01	1624.00	0.16	1.82	1,625.98	3,585.29	1.79
				See Note 2	*See Note 2*	*See Note 2*					*See Note 1*	*See Note 1*			

Totals		
kg CO_2e	lb CO_2e	ton CO_2e
69,392.34	**153,010.12**	**76.51**

Assumptions: *Unleaded gasoline used for consultant transport to conduct Construction Oversight Activities.*
18 miles/gallon for field vehicle and 8 miles/gallon for Heavy Duty Hauling Vehicle.
4 gallons/hour for heavy equipment
18 miles/gallon of for field vehicle and 8 miles/gallon for Heavy Duty Hauling Vehicle.
33 days to place structural fill
3 days to place asphalt parking lot
20 days to place concrete sidewalk
5 days to construct bioswales
111 days of Construction Oversight

Conversions/Factors: *1,000 kWh = 1.0E+6 GWh*
Density of methane = 0.717 kg/m^3 (gas)
Density of propane= 1.83 kg/m^3 (gas)

Source Notes: *Assessment Report (2001).*
Direct Emissions from Mobil Combustion Sources, Section 3, Table 2: CH_4 and N_2O Emission Factors for Highway Vehicles,
Gasoline Light-Duty Trucks, and Section 4, Table 5: Factors for Gasoline and On-Road Diesel Fuel, May 2008.

TABLE 4
SUSTAINABILITY MATRIX
PROPOSED BOAT WORKS REDEVELOPMENT
FORMER BOATWORKS PROPERTY
OSHKOSH, WISCONSIN

Sustainability Matrix Boat Works Redevelopment Site

	Option 1 - Do Nothing	**Option 2 - On Site Reuse with Performance Barriers and Limited Offsite Landfilling**	**Option 3 - Off Site Landfilling**
Sustainability Metrics[1,2]	**Life Cycle**	**Life Cycle**	**Life Cycle**
Stewardship			
System Optimization (Qualitative)	The site will remain an unusable Brownfield site until development	The site will prevent direct contact with waste with the use of performance barriers	The site will remove all direct contact with waste
Restoration Timeframe (yrs)	NA	1	1
Carbon Footprint/Air Emissions			
Tons CO_2e	0	33	77
Cost			
O&M Cost (dollars)	$5,000 a year	$5,000 a year	$5,000 a year
Cost of Modification (dollars)	$0.00	$4,969,000.00	$6,011,000.00
Land & Ecosystems			
Community Benefits (qualitative)	Site remains undeveloped and will have negative effect on community	Provide barrier and prevent contact between waste and general public	Waste is completely removed from site resulting in no contact between waste and general public
	Site is a river front property which wouldn't be able to be redeveloped	Connects the Fox River Riverwalk	Connects the Fox River Riverwalk
	River front properties are considered high value properties, but in current condition the site can not be redeveloped	Recreational area	Recreational area
		Increase property value	Increase property value
		Decreased sediment load to the Fox River	Decreased sediment load to the Fox River
		Accessible boat launch facilities	Accessible boat launch facilities
Materials & Waste Generation			
Waste Generation (cubic yards)	0	3,115	10,287

Note: waste will be landfilled

[1] Metrics may be either qualitative not applicable (NA) or quantitative based on available information and scope of project.

[2] Metrics may be added or deleted based on site specific conditions.

* Assume upper limit costs are used for cost per ton CO_2e reduced.

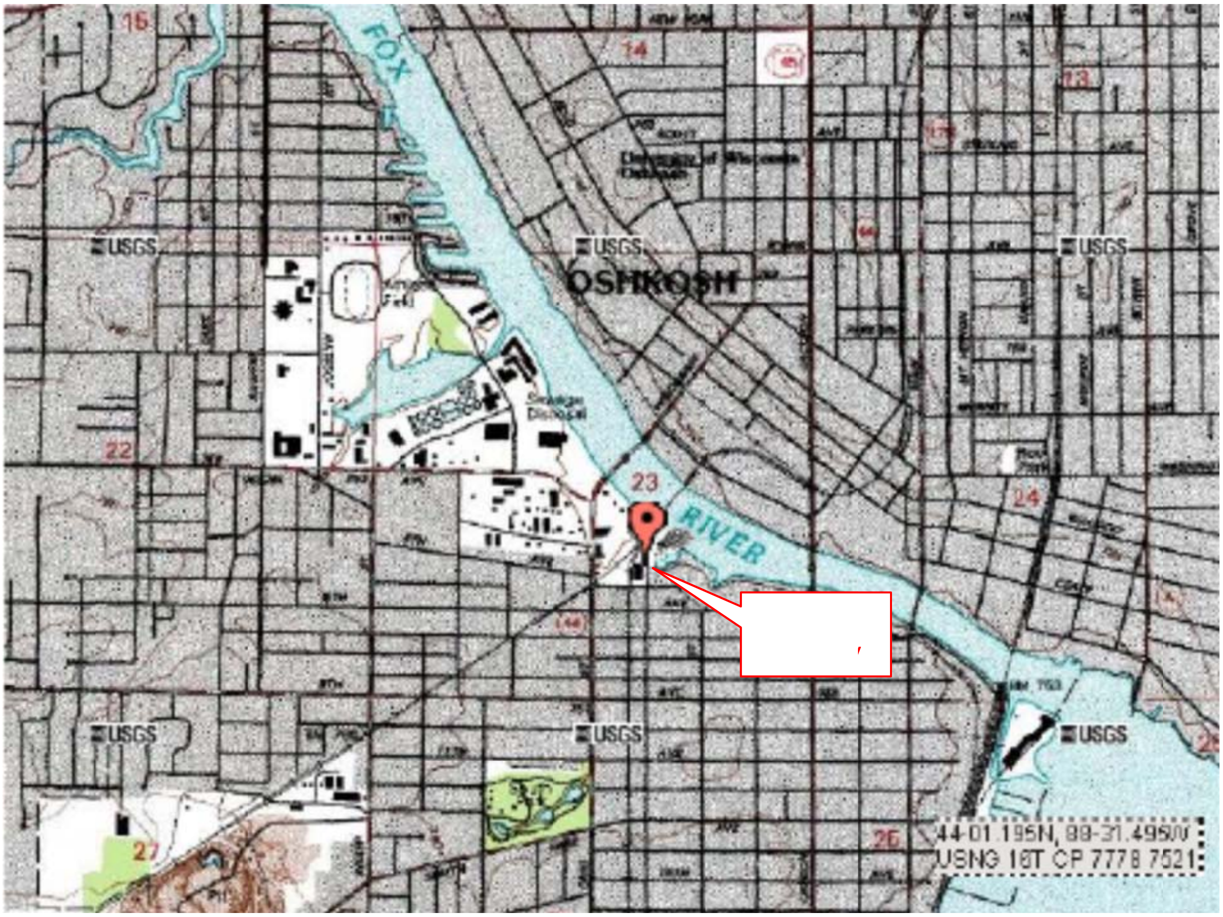
Table 5

EVALUATION OF POTENTIAL SOIL REMEDIAL ALTERNATIVES
PROPOSED BOAT WORKS REDEVELOPMENT
FORMER BOAT WORKS PROPERTY
OSHKOSH, WISCONSIN

Feasibility Criteria		Weight	No Action	On-site Reuse with Performance Barriers and Limited Off-Site Landfilling	Off-Site Landfilling
Technical Simplicity		5	3	3	3
Effectiveness in Protecting Human Health and the Environment		7	1	3	3
Affordability		6	3	2	1
Implementation Time Frame Savings		6	3	2	3
Green Cleanup Evaluation	Maximizes Total Energy Use and Maximizes use of Renewable Energy	1	3	2	1
	Minimizes Air Pollutants and Greenhouse Gas Emissions	1	3	3	1
	Minimizes Water Use and Impacts to Water Resources	1	1	2	2
	Reduces, Reuses, and Recycles Material and Waste	1	0	3	1
	Optimizes Future Land Use and Enhances Ecosystems	1	0	2	2
	Optimizes Sustainable Management Practices During Stewardship	1	0	2	1
TOTAL UNWEIGHTED SCORE			17	24	18
TOTAL WEIGHTED SCORE			65	74	68

Scoring
1 = Low
2 = Medium
3 = High

Figures



AECOM

Proposed Boat Works Redevelopment
Former Boat Works Property
Oshkosh, Wisconsin

Property Location Map

Figure 1

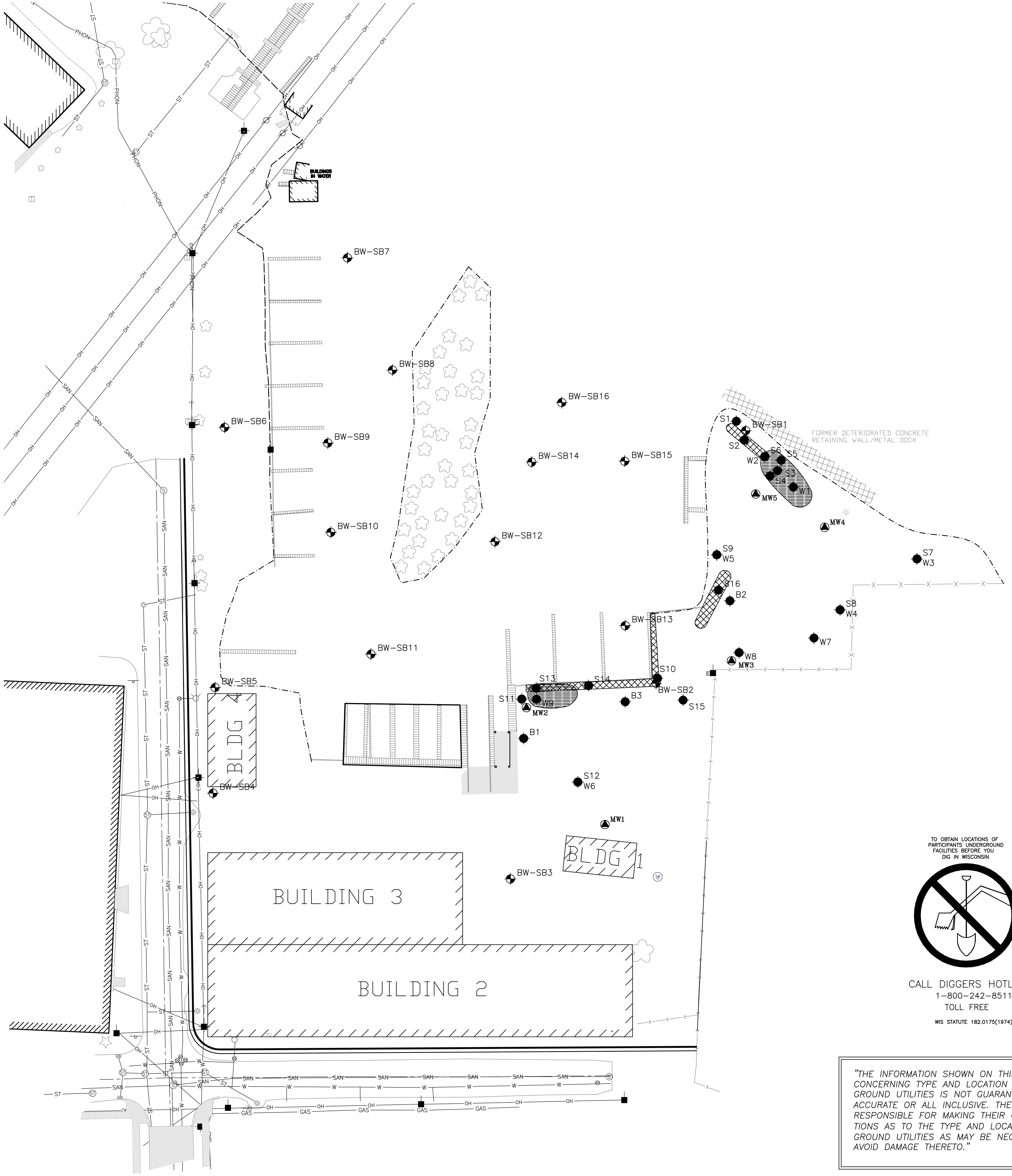
K:\Projects\60278531\7.0 DELIVERABLES\7.6 REPORTS\Boat Works ABCA\Figure 1 Site Location Diagram.docx

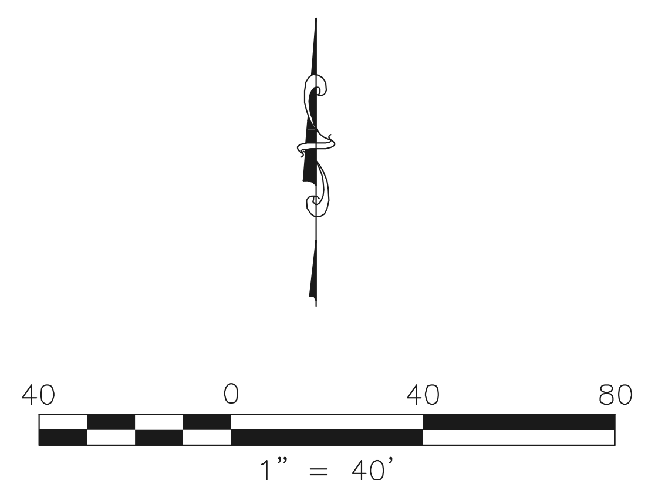
October 2012

LEGEND

LAN.	Landscape
⊤	Telephone Pedestal
Ⓖ	Gas Meter
◇	Gas Post Fiberglass
Ⓤ	Unkown Manhole
ⓈⓉ	Storm Manhole
▦	Inlet
⊡	Rectangular Catch Basin
⊸	Sign
Ⓔ	Electric Manhole
¤	Light Pole
■	Power-Light Pole
⌀	Transmission Pole
🄴	Electric Pedestal
→	Guy Wire
✿	Deciduous Tree or Stumps
☆	Coniferous Tree
◐ SB–13	Approximate Soil or Sediment Boring Location (STS)
▲ MW5	Approximate Well Location (1993 Investigation)
● B3	Approximate Soil Boring Location (1993 Investigation)
● S3	Approximate Soil Sample Location (1989-1990 Investigation)
● W1	Approximate Water Sample Location (1989-1990 Investigation)

—— ST ——	Storm Sewer Line
—— SAN ——	Sanitary Sewer Line
—x—x—x—x—	Fence
—— GAS ——	Underground Gas Line
—— ELEC ——	Underground Electric Line
—— OH ——	Overhead Electric Line
—— PHON ——	Underground Telephone Line
—·—·—·—	Top of River Bank
——	Centerline Road
——	Building
░	Concrete
▨	Pier Remains and Former Concrete Retaining Wall in Water
▨	Razed Buildings
▩	Petroleum Impacted Soil
▤	Petroleum Impacted Groundwater Above ES





1" = 40'

NOTES:

1. Site surveyed by AECOM on July 19-20 & 25, 2011, March 1, 2012 and May 7-9, 2012.
2. Horizontal coordinates are referenced to Wisconsin State Plane NAD83, South Zone.
3. Elevations are referenced to benchmark's provided by the City of Oshkosh Engineering Department and are on the North American Vertical Datum of 1988 (NAVD88) per the City of Oshkosh Engineering Department.
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5. The contractor/owner is responsible for making his/her own determination as to the type and location of underground utilities that may be necessary to avoid damage thereto. Contractor/owner shall be responsible to contact Digger's Hotline prior to start of any construction.
6. Water elevation at the time of Survey: July 20, 2011 = 747.3'
   March 1, 2012 = 746.2'
   May 9, 2012 = 747.8'
7. River bottom elevations were surveyed on May 9, 2012 using a Sonarmite v3.0 Echo Sounder.

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TOLL FREE

WIS STATUTE 182.0175(1974)

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558 North Main Street
Oshkosh, WI 54901

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EXISTING SITE CONDITIONS
PROPOSED BOAT WORKS REDEVELOPMENT
FORMER BOAT WORKS PROPERTY
OSHKOSH, WISCONSIN

Issued

Rev Date
Description

Designed:		
Drawn:	SRK	10/18/2012
Checked:	AM	10/18/2012
Approved:	AM	10/18/2012

PROJECT NUMBER
60278531

SHEET REFERENCE NUMBER

1

LEGEND

LAN.	Landscape
🅃	Telephone Pedestal
Ⓖ	Gas Meter
◇G	Gas Post Fiberglass
Ⓤ	Unkown Manhole
(ST)	Storm Manhole
⊞	Inlet
⊡	Rectangular Catch Basin
—o—	Sign
Ⓔ	Electric Manhole
¤	Light Pole
■	Power-Light Pole
⌀	Transmission Pole
🄴	Electric Pedestal
→	Guy Wire
✿	Deciduous Tree or Stumps
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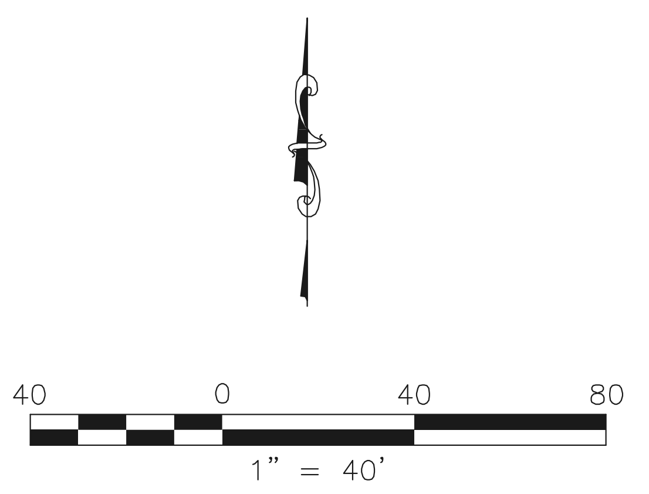
—— ELEC ——	Underground Electric Line
—— OH ——	Overhead Electric Line
—— PHON ——	Underground Telephone Line
—·—·—·—	Top of River Bank
———	Centerline Road
—— 4 ——	Approximate Isopach Depth of Fill Contour
———	Building
▒	Concrete
▨	Pier Remains and Former Concrete Retaining Wall in Water
▧	Razed Buildings
▩	Petroleum Impacted Soil
▤	Petroleum Impacted Groundwater Above ES



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FILL ISOPACH MAP
PROPOSED BOAT WORKS REDEVELOPMENT
FORMER BOAT WORKS PROPERTY
OSHKOSH, WISCONSIN

Issued

Rev Date
Description

Designed:		
Drawn:	SRK	10/18/2012
Checked:	AM	10/18/2012
Approved:	AM	10/18/2012

PROJECT NUMBER
60278531

SHEET REFERENCE NUMBER
2

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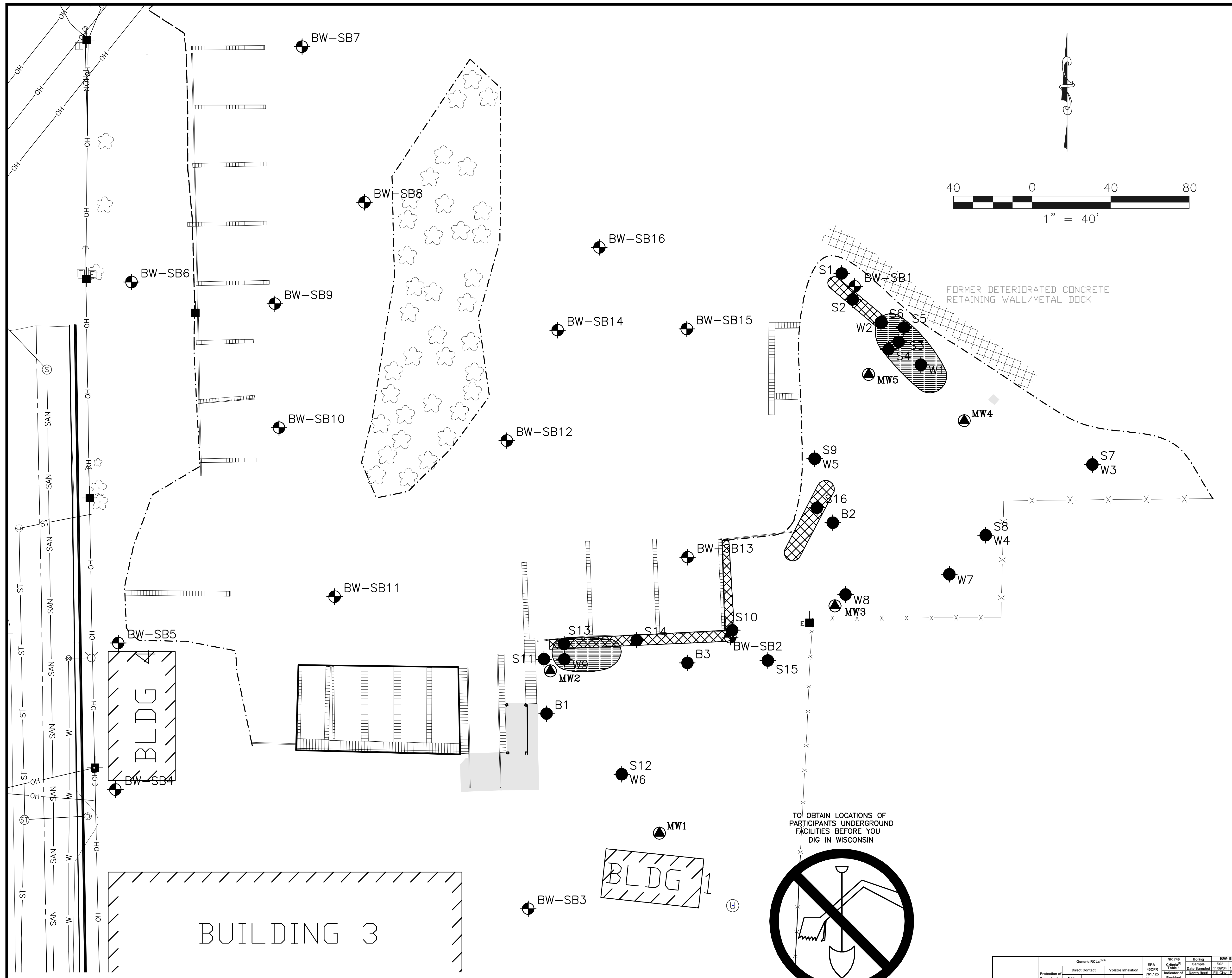

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LEGEND

LAN.	Landscape	——ST——	Storm Sewer Line
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Ⓔ	Electric Manhole	——	Building
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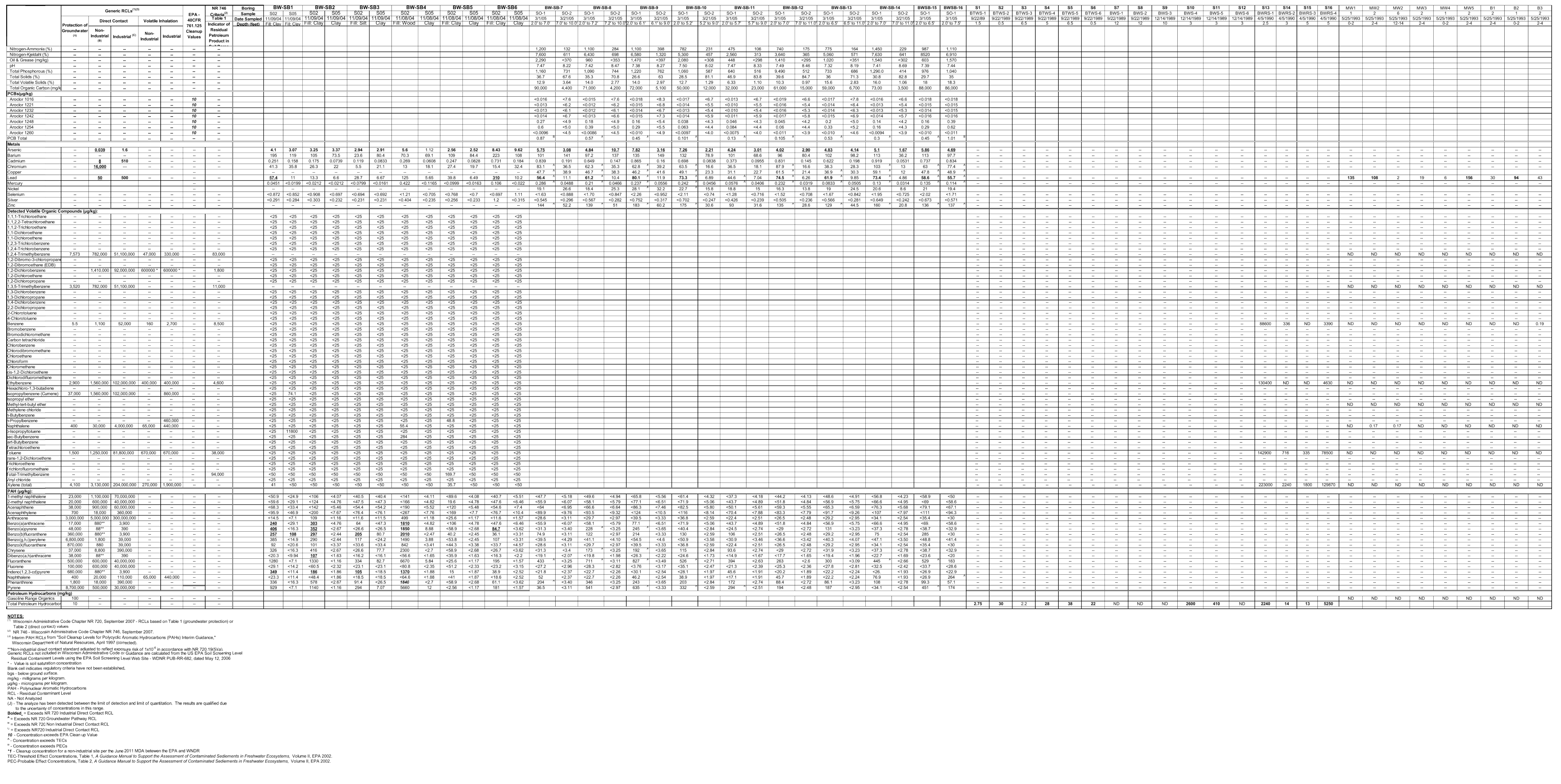
HISTORIC GROUNDWATER ANALYTICAL RESULTS

	NR 140 Standards		BWSB1W	BWSB2W	BWSB3W	BWSB5W	W1	W2	W3	W4	W5	W6	W7	W8	W9	MW1			MW2			MW3			MW4			MW5		
Parameters	ES	PAL	11/23/04	11/23/04	11/23/04	11/23/04	BTWW-1 9/22/1989	BTWW-2 9/22/1989	BWW-1 12/14/1989	BWW-2 12/14/1989	BWW-3 12/14/1989	BWW-4 12/14/1989	BWW-5A 1/30/1990	BWW-6A 1/30/1990	BWRW-1 4/5/1990	6/23/1993	8/29/1994	11/29/1994	6/23/1993	8/29/1994	11/29/1994	6/23/1993	8/29/1994	11/29/1994	6/23/1993	8/29/1994	11/29/1994	6/23/1993	8/29/1994	11/29/1994
Metals (µg/L)																														
Arsenic	**10**	*1.0*	*2.0*	*6.7*	*2.8*	*2.8*	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Barium	**2000**	*400*	175	81.2	112	47.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	**5.0**	*0.5*	<0.2	<0.2	<0.2	<0.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	**100**	*10*	2.7	1.9	2.4	3.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	**15**	*1.5*	<0.3	<0.3	<0.3	<0.3	--	--	--	--	--	--	--	--	--	**50**	NA	NA	**9**	NA	NA	**39**	NA	NA	540	NA	NA	**19**	NA	NA
Selenium	**50**	*10*	<0.6	<0.6	<0.6	0.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silver	**50**	*10*	<0.2	<0.2	<0.2	<0.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	**2.0**	*0.2*	<0.07	<0.07	<0.07	<0.07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VOCs (µg/L)																														
Benzene	**5.0**	*0.5*	<0.31	<0.31	<0.31	<0.31	**76**	**408**	ND	ND	ND	**2.5**	ND	ND	**835**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromobenzene	--	--	<0.41	<0.41	<0.41	<0.41	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	**0.6**	*0.06*	<0.83	<0.83	<0.83	<0.83	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
tert-Butylbenzene	--	--	<0.4	<0.4	<0.4	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
sec-Butylbenzene	--	--	<0.4	<0.4	<0.4	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Butylbenzene	--	--	<0.36	<0.36	<0.36	<0.36	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon tetrachloride	**5.0**	*0.5*	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	--	--	<0.7	<0.7	<0.7	<0.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	**400**	*80*	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	**6.0**	*0.6*	<0.4	<0.4	<0.4	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	**3.0**	*0.3*	<0.29	<0.29	<0.29	<0.29	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chlorotoluene	--	--	<0.6	<0.6	<0.6	<0.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chlorotoluene	--	--	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	**0.2**	*0.02*	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromochloropropane	--	--	<1.3	<1.3	<1.3	<1.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromochloromethane	**60**	*6.0*	<0.87	<0.87	<0.87	<0.87	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	**75**	*15*	<0.6	<0.6	<0.6	<0.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	**1250**	*125*	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	**600**	*6.0*	<0.6	<0.6	<0.6	<0.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	**1000**	*200*	<0.7	<0.7	<0.7	<0.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	**5.0**	*0.5*	<0.4	<0.4	<0.4	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	**850**	*85*	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	**7.0**	*0.7*	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	<0.4	<0.4	<0.4	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	--	--	<0.39	<0.39	<0.39	<0.39	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	**5.0**	*0.5*	<0.4	<0.4	<0.4	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2-Dichloropropane	--	--	<1.5	<1.5	<1.5	<1.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropane	--	--	<0.9	<0.9	<0.9	<0.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane	**0.05**	*0.005*	<1.1	<1.1	<1.1	<1.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	**700**	*140*	<0.5	<0.5	<0.5	<0.5	47	52	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	--	--	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	--	--	<0.31	<0.31	<0.31	<0.31	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropyl Ether	--	--	<0.6	<0.6	<0.6	<0.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
p-Isopropyltoluene	--	--	1.44	<0.5	1.13	<0.5	--	--	--	--	--	--	--	--	--	ND	ND	NA	ND	ND	NA	4.2	ND	NA	ND	ND	NA	ND	ND	NA
Methylene chloride	**5.0**	*0.5*	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl-tert-butyl-ether	**60**	*12*	1.77	5.94	<0.3	<0.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	**40**	*8.0*	<0.8	<0.8	<0.8	<0.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Propylbenzene	--	--	<0.3	<0.3	<0.3	<0.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	**0.2**	*0.02*	<0.61	<0.61	<0.61	<0.61	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	**5.0**	*0.5*	<0.45	<0.45	<0.45	<0.45	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	**1000**	*200*	<0.3	<0.3	<0.3	<0.3	**231**	**899**	ND	ND	ND	ND	ND	ND	**2220**	ND	ND	NA	ND	ND	NA	ND	ND	NA	ND	ND	NA	3.1	ND	NA
1,2,4-Trichlorobenzene	--	--	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	--	--	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	**200**	*40*	<0.42	<0.42	<0.42	<0.42	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	**5.0**	*0.5*	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	**5.0**	*0.5*	<0.5	<0.5	<0.5	<0.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	--	--	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene[1]	**480**	*96*	<0.4	<0.4	<0.4	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene[1]	**480**	*96*	<0.31	<0.31	<0.31	<0.31	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	**0.2**	*0.02*	<0.2	<0.2	<0.2	<0.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylenes, total	**10,000**	*1000*	<0.92	<0.92	<0.92	<0.92	**268**	**2240**	ND	ND	ND	ND	ND	ND	**5530**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PAHs (µg/L)																														
Acenaphthene	--	--	<0.066	<0.084	<0.078	<0.066	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthylene	--	--	<0.066	<0.084	<0.078	<0.066	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	**3000**	*600*	<0.055	<0.07	<0.065	<0.055	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	<0.044	<0.056	<0.052	<0.044	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	**0.2**	*0.02*	<0.0187	<0.0238	<0.0221	<0.0187	--	--	--	--	--	--	--	--	--	NA	ND	NA	NA	ND	NA	NA	0.05	NA	NA	ND	NA	NA	ND	NA
Benzo(b)fluoranthene	**0.2**	*0.02*	<0.044	<0.056	<0.052	<0.044	--	--	--	--	--	--	--	--	--	NA	ND	NA	NA	ND	NA	NA	0.1	NA	NA	ND	NA	NA	0.05	NA
Benzo(ghi)perylene	--	--	<0.05	<0.07	0.173	<0.055	--	--	--	--	--	--	--	--	--	NA	ND	NA	NA	ND	NA	NA	ND	NA	NA	0.2	NA	NA	ND	NA
Benzo(k)fluoranthene	--	--	<0.044	<0.056	<0.052	<0.044	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	**0.2**	*0.02*	<0.055	<0.07	<0.065	<0.055	--	--	--	--	--	--	--	--	--	NA	ND	NA	NA	ND	NA	NA	1.5	NA	NA	0.5	NA	NA	3.4	NA
Dibenzo(a,h,)anthracene	--	--	<0.066	<0.084	<0.078	<0.066	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluroanthene	**400**	*80*	<0.066	<0.084	0.226	<0.066	--	--	--	--	--	--	--	--	--	NA	ND	NA	NA	ND	NA	NA	ND	NA	NA	0.7	NA	NA	ND	NA
Fluorene	**400**	*80*	<0.132	<0.168	<0.156	<0.132	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	--	--	<0.055	<0.07	<0.065	<0.055	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1-Methylnaphthalene	--	--	0.169	<0.112	<0.104	<0.088	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	--	--	<0.121	<0.154	<0.143	<0.121	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	**40**	*8.0*	<0.11	<0.14	<0.13	<0.11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	--	--	<0.088	<0.112	<0.104	<0.088	--	--	--	--	--	--	--	--	--	NA	ND	NA	NA	ND	NA	NA	0.08	NA	NA	0.11	NA	NA	ND	NA
Pyrene	**250**	*50*	<0.099	<0.126	0.307	0.126	--	--	--	--	--	--	--	--	--	NA	ND	NA	NA	ND	NA	NA	0.1	NA	NA	0.12	NA	NA	0.09	NA
Gasoline Range Organics (µg/L)			--	--	--	--	--	--	--	--	--	--	--	--	--	ND	NA	NA	ND	NA	NA	ND	NA	NA	ND	NA	NA	ND	NA	NA
Dissolved Lead (µg/L)	**15**	*1.5*	--	--	--	--	--	--	--	--	--	--	--	--	--	NA	**10**	NA	NA	**2**	NA	NA	**3**	NA	NA	8	NA	NA	**7**	NA

Notes:
VOCs = Volatile Organic Compounds
PAHs = Polynuclear Aromatic Hydrocarbons
[1] Standards are for 1,2,4- and 1,3,5-Trimethylbenzene combined.
[2] Standards are for Total Xylenes (-m, -p and -o).
Bold value = NR 140 Enforcement Standard Exceedance
Italic value = NR 140 WAC Preventive Action Limit Exceedance
-- No NR 140 ES or PAL established.
NA = Not analyzed
ND = Not detected

HISTORIC SOIL ANALYTICAL RESULTS



558 North Main Street
Oshkosh, WI 54901

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SOIL AND GROUNDWATER ANALYTICAL RESULTS
PROPOSED BOAT WORKS REDEVELOPMENT
FORMER BOAT WORKS PROPERTY
OSHKOSH, WISCONSIN

Issued

Rev Date Description

Designed:		
Drawn:	SRK	10/18/2012
Checked:	AM	10/18/2012
Approved:	AM	10/18/2012

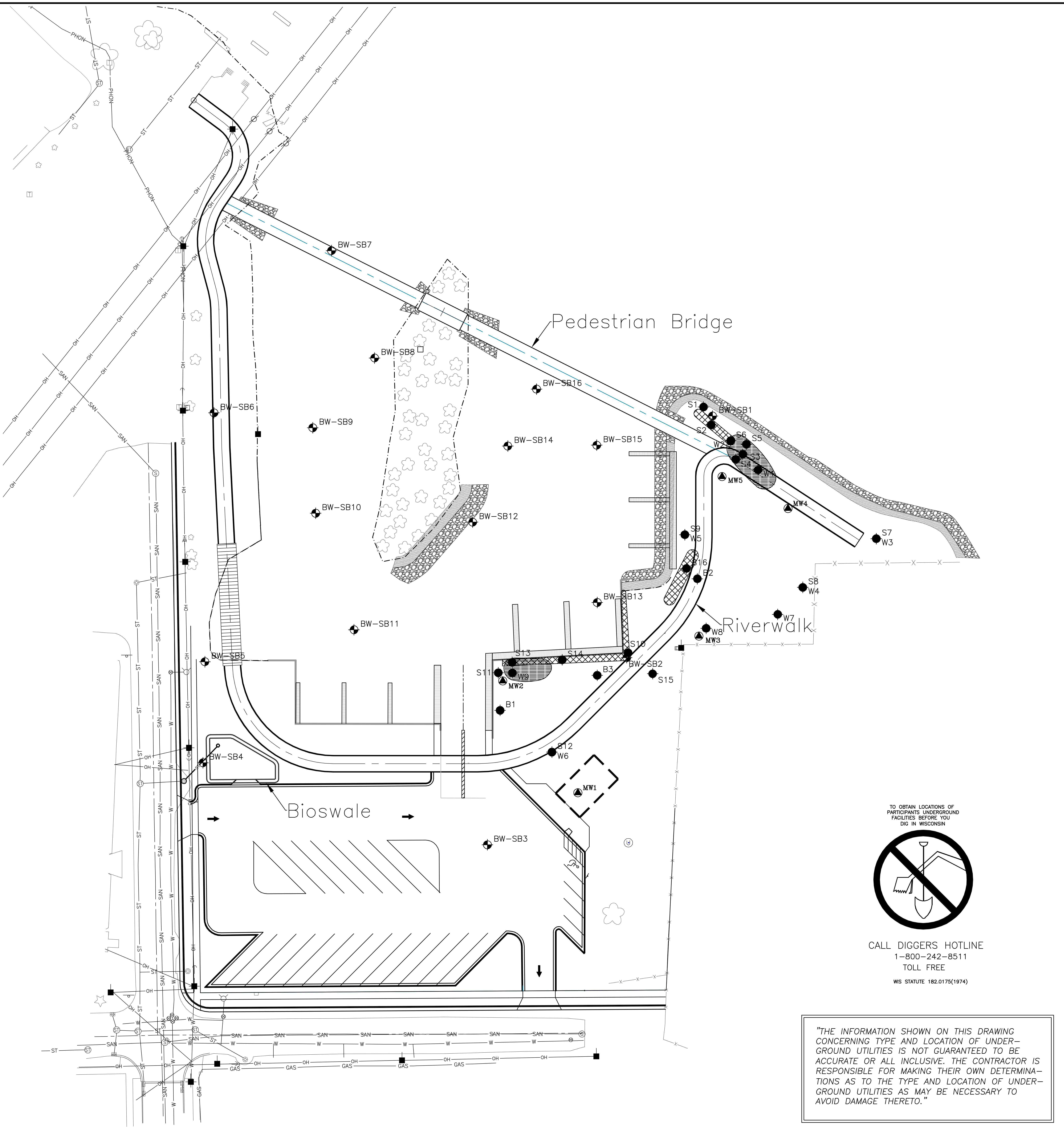
PROJECT NUMBER
60278531

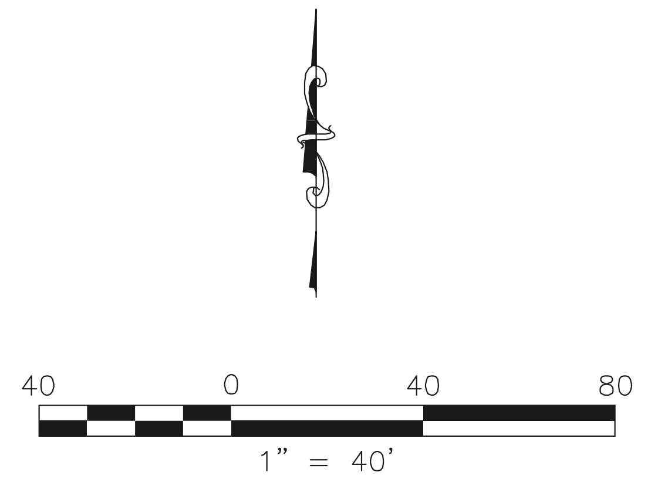
SHEET REFERENCE NUMBER
3

LEGEND

LAN.	Landscape
Ⓣ	Telephone Pedestal
Ⓖ	Gas Meter
◇	Gas Post Fiberglass
Ⓤ	Unkown Manhole
(ST)	Storm Manhole
⊞	Inlet
⊡	Rectangular Catch Basin
–o–	Sign
Ⓔ	Electric Manhole
¤	Light Pole
■	Power-Light Pole
∅	Transmission Pole
Ⓔ	Electric Pedestal
→	Guy Wire
✿	Deciduous Tree or Stumps
☆	Coniferous Tree
□	Osprey Nest
⊕ SB–13	Approximate Soil or Sediment Boring Location (STS)
▲ MW5	Approximate Well Location (1993 Investigation)
● B3	Approximate Soil Boring Location (1993 Investigation)
● S3	Approximate Soil Sample Location (1989-1990 Investigation)
● W1	Approximate Water Sample Location (1989-1990 Investigation)

—ST—	Storm Sewer Line
—SAN—	Sanitary Sewer Line
–x–x–x–x–	Fence
—GAS—	Underground Gas Line
—ELEC—	Underground Electric Line
—OH—	Overhead Electric Line
—PHON—	Underground Telephone Line
—·—·—·—	Top of River Bank
———	Centerline Road
▬ ▬	Restroom
▨	Riprap (New)
▨	Riprap w/. Coconut Logs (New)
▩	Petroleum Impacted Soil
▤	Petroleum Impacted Groundwater Above ES





1" = 40'

NOTES:

1. Site surveyed by AECOM on July 19-20 & 25, 2011, March 1, 2012 and May 7-9, 2012.
2. Horizontal coordinates are referenced to Wisconsin State Plane NAD83, South Zone.
3. Elevations are referenced to benchmark's provided by the City of Oshkosh Engineering Department and are on the North American Vertical Datum of 1988 (NAVD88) per the City of Oshkosh Engineering Department.
4. Underground utility lines shown are based on markings by Diggers Hotline per ticket numbers 20112903798, 20121000533, 20121809964.
5. The contractor/owner is responsible for making his/her own determination as to the type and location of underground utilities that may be necessary to avoid damage thereto. Contractor/owner shall be responsible to contact Digger's Hotline prior to start of any construction.
6. Water elevation at the time of Survey: July 20, 2011 = 747.3'
   March 1, 2012 = 746.2'
   May 9, 2012 = 747.8'
7. River bottom elevations were surveyed on May 9, 2012 using a Sonarmite v3.0 Echo Sounder.

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AECOM

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Oshkosh, WI 54901

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PROPOSED SITE CONDITIONS
PROPOSED BOAT WORKS REDEVELOPMENT
FORMER BOAT WORKS PROPERTY
OSHKOSH, WISCONSIN

Issued

Rev Date
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60278531

SHEET REFERENCE NUMBER
4

LEGEND

Symbol	Description
LAN.	Landscape
◫	Telephone Pedestal
⬡	Gas Meter
◇	Gas Post Fiberglass
Ⓤ	Unkown Manhole
ⓈⓉ	Storm Manhole
⊞	Inlet
⊡	Rectangular Catch Basin
—o—	Sign
Ⓔ	Electric Manhole
☒	Light Pole
■	Power-Light Pole
⌀	Transmission Pole
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Symbol	Description
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—— SAN ——	Sanitary Sewer Line
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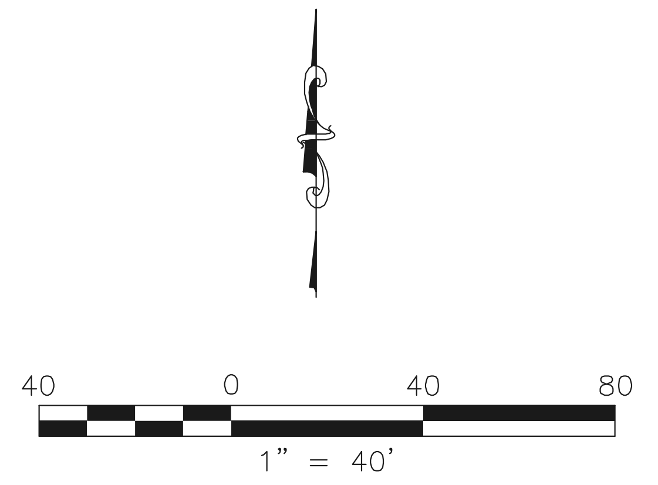
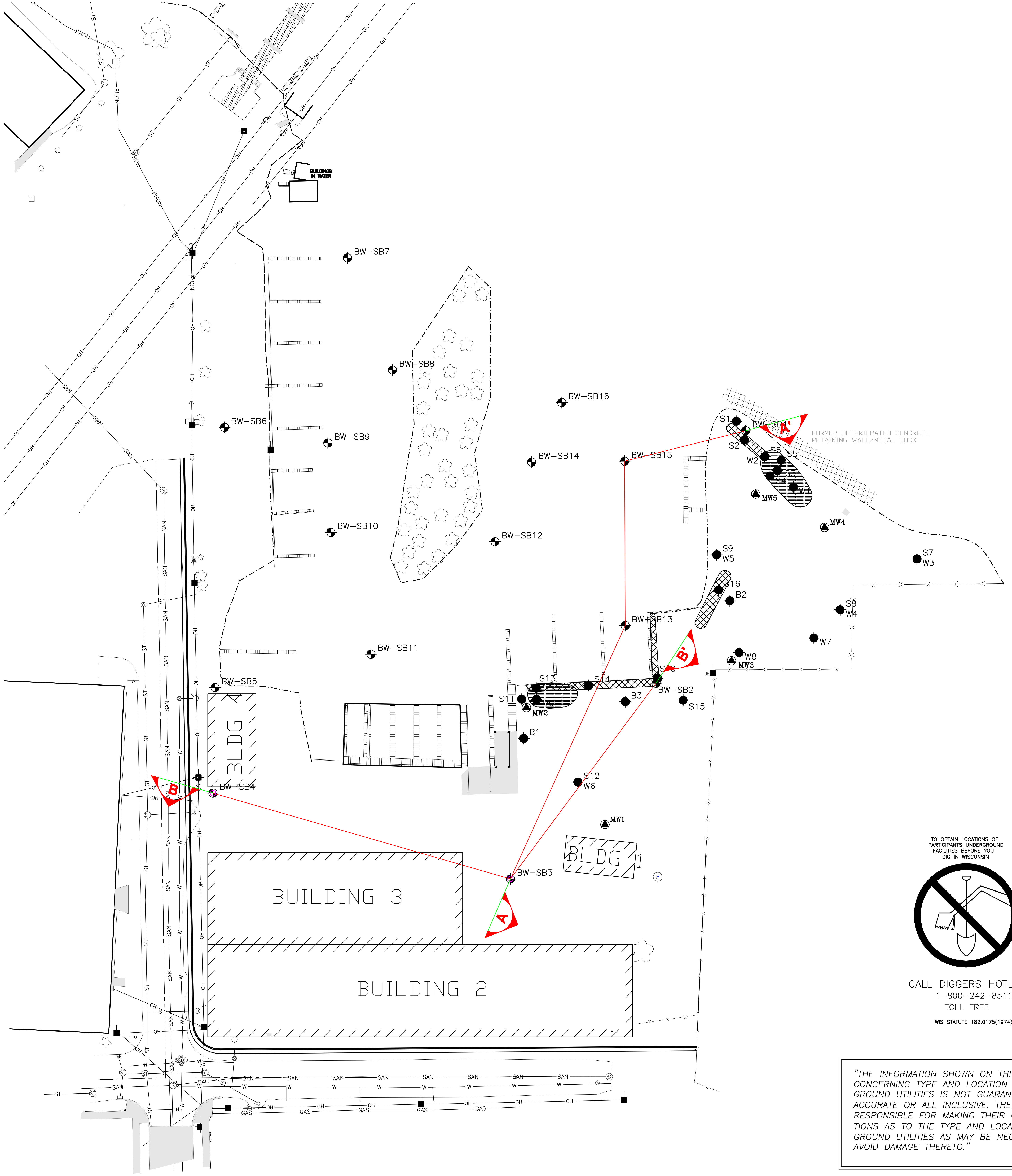
—— GAS ——	Underground Gas Line
—— ELEC ——	Underground Electric Line
—— OH ——	Overhead Electric Line
—— PHON ——	Underground Telephone Line
—·—·—·—	Top of River Bank
━━━	Centerline Road
———	Cross Section Location
━━━	Building
▨	Pier Remains and Former Concrete Retaining Wall in Water
▨	Razed Buildings
▩	Petroleum Impacted Soil
▤	Petroleum Impacted Groundwater Above ES





NOTES:

1. Site surveyed by AECOM on July 19-20 & 25, 2011, March 1, 2012 and May 7-9, 2012.
2. Horizontal coordinates are referenced to Wisconsin State Plane NAD83, South Zone.
3. Elevations are referenced to benchmark's provided by the City of Oshkosh Engineering Department and are on the North American Vertical Datum of 1988 (NAVD88) per the City of Oshkosh Engineering Department.
4. Underground utility lines shown are based on markings by Diggers Hotline per ticket numbers 20112903798, 20121000533, 20121809964.
5. The contractor/owner is responsible for making his/her own determination as to the type and location of underground utilities that may be necessary to avoid damage thereto. Contractor/owner shall be responsible to contact Digger's Hotline prior to start of any construction.
6. Water elevation at the time of Survey:
   July 20, 2011 = 747.3'
   March 1, 2012 = 746.2'
   May 9, 2012 = 747.8'
7. River bottom elevations were surveyed on May 9, 2012 using a Sonarmite v3.0 Echo Sounder.

TO OBTAIN LOCATIONS OF
PARTICIPANTS UNDERGROUND
FACILITIES BEFORE YOU
DIG IN WISCONSIN

CALL DIGGERS HOTLINE
1–800–242–8511
TOLL FREE

WIS STATUTE 182.0175(1974)

"THE INFORMATION SHOWN ON THIS DRAWING CONCERNING TYPE AND LOCATION OF UNDERGROUND UTILITIES IS NOT GUARANTEED TO BE ACCURATE OR ALL INCLUSIVE. THE CONTRACTOR IS RESPONSIBLE FOR MAKING THEIR OWN DETERMINATIONS AS TO THE TYPE AND LOCATION OF UNDERGROUND UTILITIES AS MAY BE NECESSARY TO AVOID DAMAGE THERETO."

AECOM

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Oshkosh, WI 54901

920.235.0270

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CROSS SECTION LOCATION DIAGRAM-EXISTING CONDITIONS
PROPOSED BOAT WORKS REDEVELOPMENT
FORMER BOAT WORKS PROPERTY
OSHKOSH, WISCONSIN

Issued

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5

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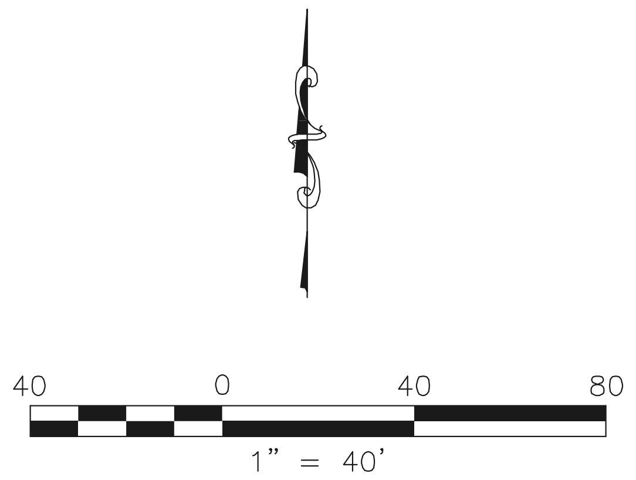
LEGEND

LAN.	Landscape
T	Telephone Pedestal
G	Gas Meter
G	Gas Post Fiberglass
U	Unkown Manhole
ST	Storm Manhole
⊞	Inlet
⊡	Rectangular Catch Basin
-o-	Sign
E	Electric Manhole
¤	Light Pole
■	Power-Light Pole
∅	Transmission Pole
E	Electric Pedestal
→	Guy Wire
✿	Deciduous Tree or Stumps
☆	Coniferious Tree
☐	Osprey Nest
◐ SB–13	Approximate Soil or Sediment Boring Location (STS)
▲ MW5	Approximate Well Location (1993 Investigation)
● B3	Approximate Soil Boring Location (1993 Investigation)
● S3	Approximate Soil Sample Location (1989-1990 Investigation)
● W1	Approximate Water Sample Location (1989-1990 Investigation)

―	1' Contour
―	5' Contour
―ST―	Storm Sewer Line
―SAN―	Sanitary Sewer Line
―x―x―x―x―	Fence
―GAS―	Underground Gas Line
―ELEC―	Underground Electric Line
―OH―	Overhead Electric Line
―PHON―	Underground Telephone Line
―·―·―·―	Top of River Bank
━	Centerline Road
―	Cross Section Location
▬ ▬	Restroom
▨	Riprap (New)
▨	Riprap w/. Coconut Logs (New)
▩	Petroleum Impacted Soil
▤	Petroleum Impacted Groundwater Above ES



1" = 40'

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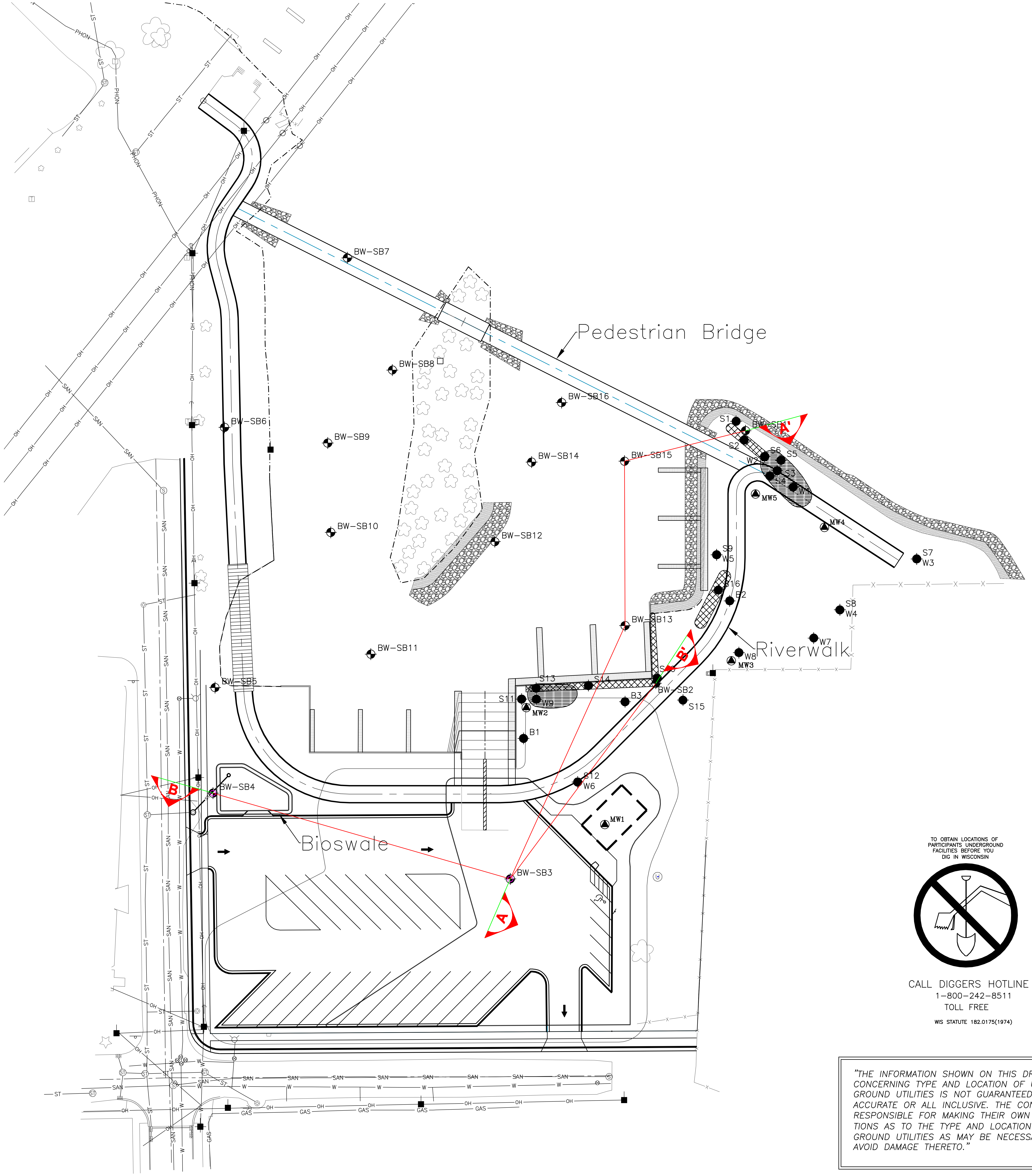

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CROSS SECTION LOCATION DIAGRAM-PROPOSED SITE CONDITIONS
PROPOSED BOAT WORKS REDEVELOPMENT
FORMER BOAT WORKS PROPERTY
OSHKOSH, WISCONSIN

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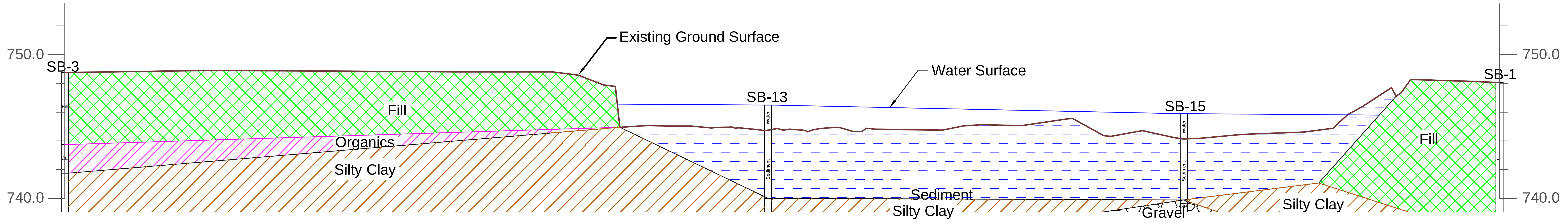
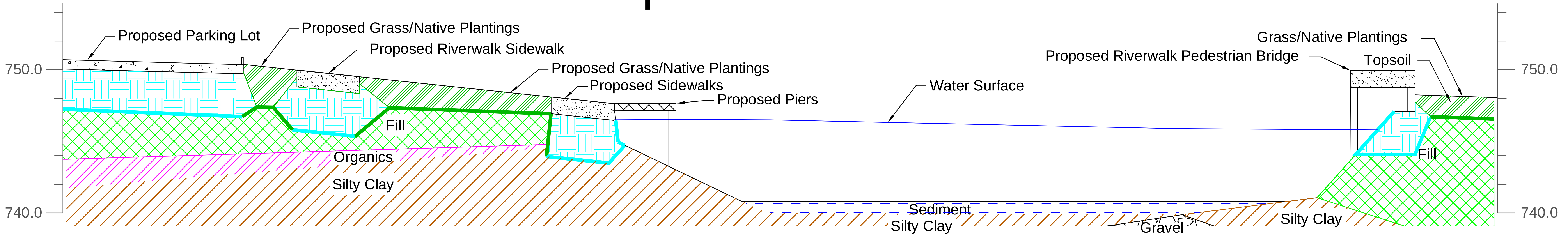
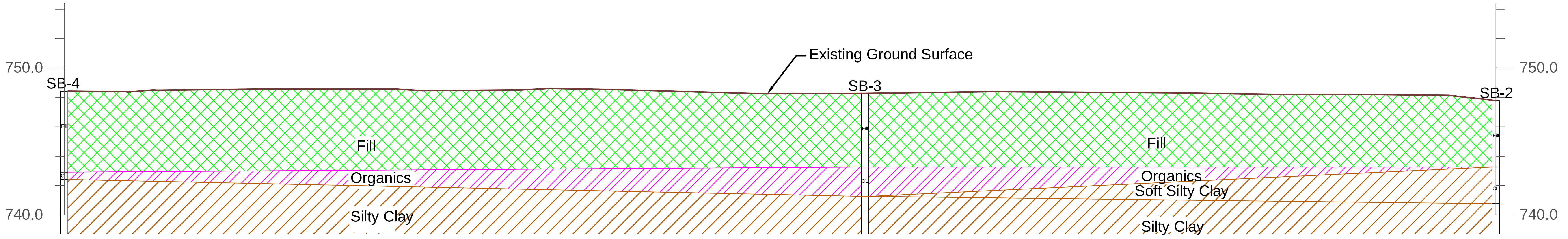
Cross Section A-A'
Existing Conditions



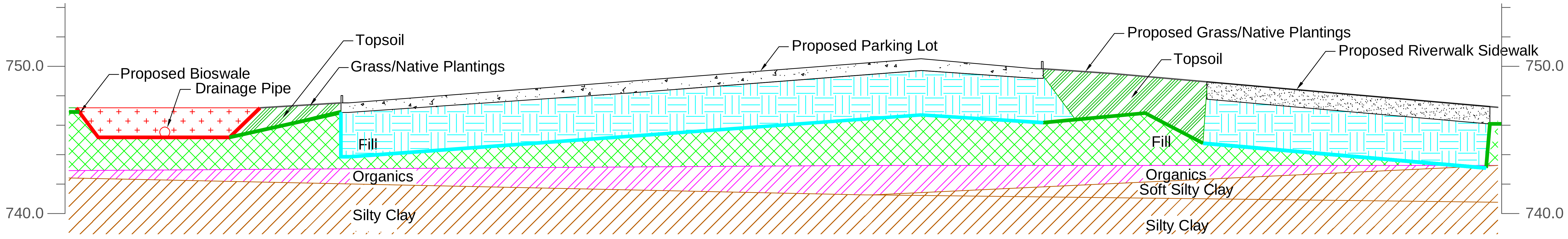
Cross Section A-A'
Proposed Conditions



Cross Section B-B'
Existing Conditions

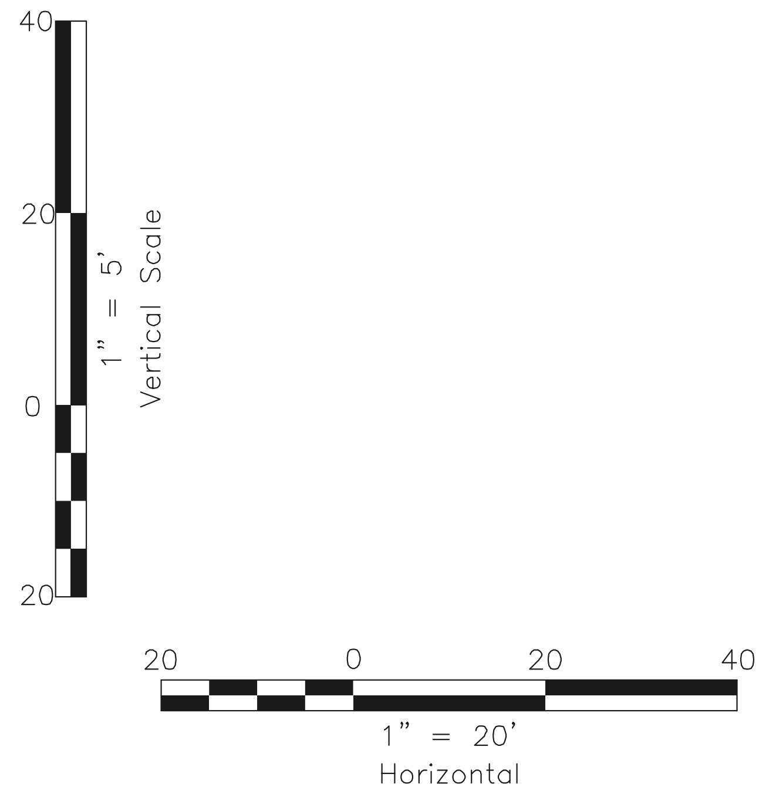


Cross Section B-B'
Proposed Conditions



LEGEND

- ▨ FILL SOILS
- ▨ ORGANIC SOILS
- ▨ SILTY CLAY SOILS
- ▭ SEDIMENT MATERIAL
- ▦ GRAVEL SOILS
- ▭ PAVEMENT
- ▭ SIDEWALK
- ▦ ENGINEERED FILL SOILS
- ▭ BIOSWALE ORGANIC MEDIUM
- ▨ TOPSOIL
- ▨ PIER
- — GEOGRID
- — GEOMEMBRANE LINER
- — WARNING BARRIER



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CROSS SECTIONS
PROPOSED BOAT WORKS REDEVELOPMENT
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Appendix A.

EPA Citizens Guides

United States
Environmental Protection
Agency

Office of Solid Waste and
Emergency Response
(5102G)

EPA 542-F-01-022
December 2001
www.epa.gov/superfund/sites
www.cluin.org

A Citizen's Guide to Capping

The Citizen's Guide Series

EPA uses many methods to clean up pollution at Superfund and other sites. If you live, work, or go to school near a Superfund site, you may want to learn more about these methods. Perhaps they are being used or are proposed for use at your site. How do they work? Are they safe? This Citizen's Guide is one in a series to help answer your questions.

What is capping?

Capping involves placing a cover over contaminated material such as the waste buried at a landfill. Such covers are called "caps." Caps do not clean up the contaminated material. They just keep it in place so it will not come into contact with people or the environment.

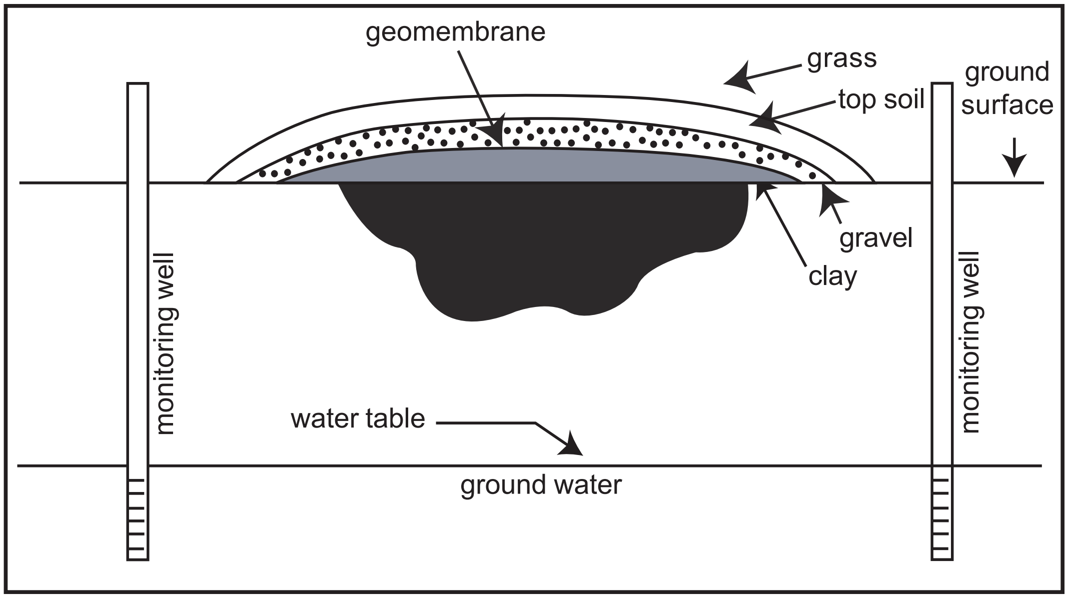
How does it work?

Sometimes digging up and removing contaminated material can be difficult or expensive. Instead, a cap will be placed over it to keep it in place. A cap works in three main ways:

1) It stops rainwater from seeping through the hazardous material and carrying the pollution into the groundwater, lakes or rivers.

2) It stops wind from blowing away the hazardous material.

3) It keeps people and animals from coming into contact with the contaminated material and tracking it off the site.



Constructing a cap can be as simple as placing a single layer of asphalt on top of the contaminated material. More often, however, caps are made of several layers. The top layer at the ground surface is usually soil with grass or other plants. Plants take up rainwater with their roots and help prevent it from soaking down into the next layer. They also keep the topsoil from eroding. The second layer down drains any water that comes through the first layer. It is usually constructed of gravel and pipes. A third layer may be added to control gasses that come from the hazardous material. The bottom layer lies directly on the contaminated material. It is usually made of clay. The clay is covered by a sheet of strong synthetic material called a *geomembrane*. Together the clay and the geomembrane help stop further flow of water downward.

Is capping safe?

When properly built and maintained, a cap is a safe method for keeping contaminated material in place. A cap will continue to work safely as long as it is not broken or eroded. Regular inspections are made to make sure that the weather, plant roots or some human activity have not damaged the cap. Also, groundwater monitoring wells are placed around the edges of the cap so that any leakage from the site can be found and fixed.

How long will it take?

Building a cap can take a few days up to several months.

The length of time depends on several factors that vary from site to site:

- size of the area
- thickness and design of the cap
- availability of clean topsoil and clay

Caps can be effective for many years as long as they are properly maintained.

Why use capping?

Caps have been used at hundreds of sites because they are an effective method for keeping wastes contained. Caps are usually only part of a cleanup remedy. Often they are used with pump and treat systems (See *A Citizen's Guide to Pump and Treat* [EPA 542-01-025]). The pumping and treating cleans up polluted groundwater, while the cap prevents contaminated materials from reaching the groundwater.

For more information

write the Technology Innovation Office at:

U.S. EPA (5102G)
1200 Pennsylvania Ave., NW
Washington, DC 20460

or call them at
(703) 603-9910.

Further information also can be obtained at **www.cluin.org** or **www.epa.gov/superfund/sites**.

United States
Environmental Protection
Agency

Office of Solid Waste and
Emergency Response
(5102G)

EPA 542-F-01-023
December 2001
www.epa.gov/superfund/sites
www.cluin.org

A Citizen's Guide to Soil Excavation

The Citizen's Guide Series

EPA uses many methods to clean up pollution at Superfund and other sites. If you live, work, or go to school near a Superfund site, you may want to learn more about cleanup methods. Perhaps they are being used or are proposed for use at your site. How do they work? Are they safe? This Citizen's Guide is one in a series to help answer your questions.

What is excavation?

Excavation is digging up polluted soil so it can be cleaned or disposed of properly in a landfill. The soil is excavated using construction equipment, like backhoes or bulldozers.

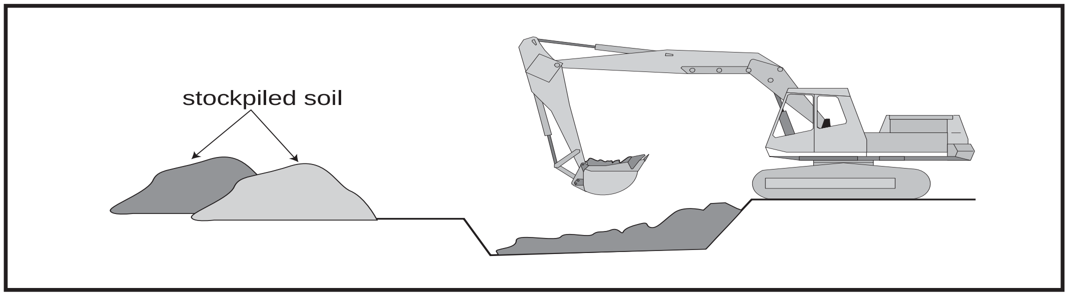
How does it work?

Before soil can be excavated, EPA must figure out how much of it there is. EPA also determines the types of harmful chemicals in the soil. This requires research on past activities at the site as well as testing of the soil.

Once the polluted areas are found, digging can begin. Backhoes, bulldozers and front-end loaders remove the soil and put it on tarps or in containers. The soil is covered to prevent wind and rain from blowing or washing it away. The covers also keep workers and other people near the site from coming into contact with polluted soil. The digging is complete when test results show that the remaining soil does not pose a risk to people or the environment.

The polluted soil may be cleaned up onsite or taken elsewhere for this purpose (See *A Citizen's Guide to Thermal Desorption* [EPA 542-F-01-003], and *A Citizen's Guide to Soil Washing* [EPA 542-F-01-008]). The soil may also may be disposed of in a regulated landfill. If the soil is cleaned, it may be returned to the holes it came from. This is called *backfilling.* The area may also be backfilled with clean soil from another location.

After an excavation is backfilled, it may be landscaped to prevent erosion or it may be paved or prepared for some other use.



Is excavation safe?

Excavation can safely remove most types of polluted soil from a site. However, certain types of harmful chemicals require special safety precautions. For example, some chemicals may *evaporate*, or change into gases. To prevent the release of gases to the air, site workers may coat the ground with foam or draw the vapor into gas wells. Other chemicals, like acids and explosives, also require special handling and protective clothing to reduce the danger to site workers.

How long will it take?

Excavating polluted soil may take as little as one day or as long as several months. Cleaning the soil may take much longer. The total time it takes to excavate and clean up soil depends on several factors:

- types and amounts of harmful chemicals present
- size and depth of the polluted area
- type of soil
- amount of moisture in the polluted soil (wet soil slows the process)

Why use excavation?

EPA has had lots of experience using excavation to clean up sites. Excavation is used most often where other underground cleanup technologies will not work or will be too expensive. Excavation of soil for disposal or treatment above ground is often the fastest way to deal with chemicals that pose an immediate risk. Polluted soils deeper than 10 feet generally cannot be excavated. This method is most cost-effective for small amounts of soil.

For more information
write the Technology Innovation Office at:

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1200 Pennsylvania Ave., NW
Washington, DC 20460

or call them at
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About AECOM

AECOM (NYSE: ACM) is a global provider of professional technical and management support services to a broad range of markets, including transportation, facilities, environmental, energy, water and government. With approximately 45,000 employees around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation, and collaborative technical excellence in delivering solutions that enhance and sustain the world's built, natural, and social environments. A *Fortune 500* company, AECOM serves clients in more than 130 countries and has annual revenue in excess of $8.0 billion.

More information on AECOM and its services can be found at www.aecom.com.

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