AECOM Environment

Prepared for:
City of Oshkosh
Oshkosh, WI

Prepared by:
AECOM
Green Bay, WI
60149415
April 2010

Analysis of Brownfield Cleanup Alternatives City of Oshkosh Riverwalk Marion/Pearl Segment

DRAFT

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April 2, 2010

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Ms. Melissa Enoch, Brownfields Specialist
Wisconsin Department of Natural Resources
101 South Webster Street RR/5
Madison, Wisconsin 53703

Subject: Analysis of Brownfield Cleanup Alternatives, City of Oshkosh Riverwalk, Marion/Pearl Segment, City of Oshkosh, Wisconsin -- AECOM Project No. 60149415

Dear Ms. Enoch,

On behalf of the City of Oshkosh (City), AECOM, Inc. has prepared the attached Analysis of Brownfield Cleanup Alternatives (ABCA) consistent with requirements of the Wisconsin Department of Natural Resources, Ready for Reuse Grant and the US EPA Brownfields Cleanup Grant. This ABCA has been prepared for the riverfront portion of Redevelopment Parcel J and the former Mercury Marine Plant 24 property. The subject property is a 30-foot wide parcel of property parallel and adjacent to the Fox River near the northwest corner of the intersection of Marion Road and Pearl Avenue, Oshkosh, Wisconsin. This ABCA provides an overview of site conditions, site cleanup objectives, and provides a review of remedial options. In addition, this ABCA includes an analysis of green cleanup criteria.

If you have any questions regarding the ABCA, please contact Mr. Paul Killian (920.406.3165) or Mr. Andrew Mott (920.235.0270). We appreciate your review of this document and support of the redevelopment efforts of the City.

Respectfully,

Andrew G. Mott, P.G., C.P.G.
Project Hydrogeologist

Paul J. Killian, P.E.
Principal Engineer

Cc: Ms. Darlene Brandt, Assistant Director of Planning Services
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77 West Jackson Boulevard, SE-4J
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Contents

List of Appendices

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DRAFT

Contents

List of Appendices

DRAFT

List of Tables

List of Figures

DRAFT

1.0 Introduction

On behalf of the City of Oshkosh (City), AECOM has prepared this Analysis of Brownfield Cleanup Alternatives (ABCA) for the Marion Road/Pearl Avenue segment of the Oshkosh riverwalk. This segment consists of a 30-foot wide parcel of property, approximately 1,400 feet long, that extends parallel and adjacent to the Fox River, northwest of the intersection of Marion Road and Jackson Street in Oshkosh, Wisconsin. The Marion Road/Pearl Avenue redevelopment area is a former industrial riverfront corridor that essentially links the University of Wisconsin-Oshkosh Campus to downtown Oshkosh. Redevelopment of this former industrial area has been promoted by the City and the City Redevelopment Authority. Several private development projects have occurred in this area and several more are in the planning stages. While the upland areas have been designated for private redevelopment, the City intends to maintain ownership of the 30-foot wide parcel adjacent to the Fox River. This riverfront portion will be developed by the City as a public riverwalk extending access to downtown Oshkosh from the WIOUWASH Recreational Trail. This segment of the riverwalk will become part of the City-wide pedestrian and bicycle route system. The subject of this ABCA is the 1,400-foot long segment of the riverwalk which includes portions of the properties formerly owned by Murphy Concrete Company (MCC), referred to as Parcel J and Mercury Marine Plant 24.

To attract redevelopment opportunities consistent with the prime location of this site, while maintaining public access to the Fox River, the City intends to construct the public riverwalk. Construction costs for this segment of the riverwalk are elevated due to the characteristics of the subsurface material which will be encountered during construction. The subsurface material consists of anthropogenic fill deposits, including wood waste and foundry sand. This fill material has been characterized as a solid waste and must be managed as such during construction. To assist in financing the additional expense related to environmental management of subsurface soils and waste fill material, the City submitted an application for Brownfield Redevelopment Funding through the Wisconsin Department of Natural Resources (WDNR) Ready for Reuse Program.

The City previously received a Brownfield Cleanup Grant through the U.S. Environmental Protection Agency (EPA) for Parcel J. This EPA Brownfield Cleanup Grant will be used to offset expenses related to environmental management of that portion of the riverwalk constructed on the Parcel J property. The Ready for Reuse Grant will specifically be applied to the west portion of the riverwalk, or that segment which was previously part of the Mercury Marine Plant 24 property.

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2.0 Site Description and History

2.1 Site Location and Description

The subject of this ABCA is the riverfront portion of property located southeast of the intersection of Marion Road and Jackson Street in Oshkosh, Wisconsin. The site encompasses approximately 1 acre (part of the former Mercury Marine Plant 24 property and part of the Parcel J property) and is located in the Northeast 1/4 of the Southeast 1/4 of Section 23, Township 18 North, Range 23 East, in the city of Oshkosh, Winnebago County, Wisconsin. The site is generally level to gently sloping and currently vacant. Buildings at the site have been razed; however, some concrete slob-on-grade foundations remain. The location of the subject property is depicted on Figure 1.

2.2 Site History

A Phase I Environmental Site Assessment (Phase I ESA) was performed by AECOM on both Parcel J and Mercury Marine property. According to the Phase I ESA, the Mercury Marine parcel has been developed with industrial and manufacturing facilities since the mid-1800s. Specifically, the area of the proposed development was developed in the 1890s with the Radford Brothers Saw, Shingle, and Lathe Company. The property was used for the storage of lumber. In the early 1900s, the Radford Brothers Company was replaced by the Oshkosh Candle Company, the manufacturer of candles, and the Cook & Brown Company bulk fuel tank farm. The bulk fuel storage was comprised of nine aboveground storage tanks (ASTs) ranging in size from approximately 1,000 to 5,000 gallons, including one approximately 10,000-gallon AST, and a pump house. The property along the river front of the Oshkosh Candle Company was used for storage of coal during this timeframe. In the early 1970s, the site was developed with a parking lot and boat docks along the Fox River. The site was owned by Kiekhaefer Aeromarine Company during this time period when it was purchased by the Mercury Marine Company (Mercury Marine) in the mid-1970s. Historically, the surrounding properties were used for both commercial and industrial purposes.

The Parcel J property has been developed with industrial and commercial facilities since the 1800s. Former facilities include sawmills, lumberyards, manufacturers of wood products, a machine shop, Wisconsin Automated Machine (WAM), a coal yard, a concrete batch plant, a tavern (Triangle Tavern), and a service station (Anhaltzer Trust parcel). The City has performed a Phase I ESA, Phase II ESA, and additional ESA work on the Parcel J parcel. Results of the Phase II ESA and the additional environmental subsurface assessments revealed elevated levels of polyaromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), and metals in both the soil and groundwater. The City performed remedial action (excavation of fill soil above clay) along the north and east boundaries of Parcel J for the new Marion Road alignment and future expansion of the Jackson Street right-of-way (ROW). The concrete batch plant on Parcel J has been razed. Currently, no buildings exist on site.

2.3 Results of Subsurface Assessment

Results of the soil borings indicate that fill soils apparently extend beneath the entire site and range from about 5 to over 14 feet thick. The fill soils are comprised of a silt, sand, gravel, brick fragments, cinders, wood chips, wood timber, and coal. Beneath the fill are natural deposits including silty clay, sandy clay, sandy silt, and silty clay with seams of coarse sand, coarse gravel, and peat. Depth to bedrock (dolomite) is estimated within 35 to 45 feet of the ground surface.

Groundwater was observed at a depth of approximately 1.5 feet below ground surface (bgs). Groundwater generally flows to the north-northwest in the spring, summer, and fall. In the winter months, up-river dam levels are decreased causing lower water elevations in the Fox River system. As a result of the lower water elevation, groundwater flow can change to the south-southeast toward the Fox River.

Based on results of the subsurface assessments, the concentration of lead, arsenic, and several PAH compounds represent a potential direct contact risk to human health. Additionally, VOCs (benzene, bromomethane, and/or naphthalene) were detected in several soil samples at concentrations that represent a potential risk to groundwater quality. Because of the elevated lead and PAHs, fill soils at the site should be managed as impacted material during site redevelopment and excess fill soils generated during redevelopment should be managed as solid waste. While not anticipated, fill materials may be considered a hazardous waste depending on specific chemical characteristics.

Groundwater quality is not expected to be impacted significantly and active groundwater remediation is not anticipated. If construction dewatering is necessary during redevelopment, discharge will be monitored and directed to the sanitary sewer.

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3.0 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 exceed a groundwater quality standards;
2. An impact on soil quality or groundwater quality that would exceed a surface water quality standard contained on Chapters NR 102 to 106,
3. Soil quality that would exceed 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 toxilogical 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.

3.2 Groundwater

Potential exposure pathways were evaluated by comparing analytical data collected at the site with Chapters NR 140 and 160 of the Wisconsin Administrative Code, which 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 represent groundwater cleanup criteria for this site.

Based on results of groundwater samples collected from monitoring wells installed on the former Mercury Marine property, benzene concentrations and arsenic concentrations exceed groundwater cleanup objectives near the south-central portion of the Mercury Marine property. Results of groundwater monitoring suggest elevated concentrations of benzene and arsenic are isolated and do not appear to be migrating off site or impacting surface water quality of the neighboring Fox River. Benzene concentrations appear to be stable or declining, and active groundwater remediation is not anticipated.

VOCs and PAHs were detected in groundwater samples collected from groundwater monitoring wells on Parcel J. Naphthalene concentrations exceeded the groundwater quality ES in the southeast corner of the site. Also, benzene and fluorine concentrations exceeded their respective NR 140 PALs in the southeast corner of the site. Results of groundwater monitoring suggest the elevated concentrations are isolated and do not appear to be migrating off site or impacting surface water quality of the neighboring Fox River. Concentrations appear to be stable or declining, and active groundwater remediation is not anticipated. Accordingly, this ABCA is limited to soil cleanup alternatives for Parcel J and the former Mercury Marine parcel, with the understanding that by addressing impacted soil, the source of groundwater quality degradation will be mitigated and environmental closure can be granted.

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4.0 Analysis of Soil Cleanup Alternatives

4.1 Site Redevelopment Plan

The City is finalizing plans and specifications for construction of the segment of the riverwalk extending west from Jackson Street to the west boundary of the former Mercury Marine property. In general, construction of the riverwalk will include the following elements:

- Removal of existing timber and concrete dockwall sections along the shoreline,
- Construction of riprap shoreline improvement,
- Subgrade preparation for walkway and riprap shoreline,
- Surface pavement of walkway, and
- Topsoil and vegetative cover for adjacent green space.

The City proposes to implement environmental corrective action concurrent with construction of the public riverwalk. In this manner constructed features of the walkway such as surface pavement and riprap can be integral components of the remedy.

Four potential soil cleanup alternatives were selected for evaluation;

1. No action,
2. Off-site landfilling,
3. On-site reuse with performance barriers and limited off-site landfilling,
4. Ex-situ thermal treatment and solidification/stabilization.

Details of these alternatives are outlined in the EPA Citizens Guides 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.

4.2.2 Off-Site Landfilling

The off-site landfilling alternative would involve the transfer of all impacted soil to an off-site 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 off-site sources would be brought into the site to raise the grade following removal of impacted soils.

Under this alternative, 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 Winnebago County Landfill or the Waste Management Valley Trail Landfill located in Berlin, Wisconsin.

4.2.3 On-Site Reuse with Performance Barriers and Limited Off-Site 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 area below the proposed riverwalk and riprap. Performance barriers would include the proposed paving and shoreline protection along with imported soil fill in landscaped areas. Performance barriers will consist of hardscape and greenspace areas will be covered with an engineered barrier consisting of a geotextile warning layer, 6 to 8 inches of clean soil, and at least 6 inches of topsoil. The barriers would substantially reduce the potential for the public 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.

4.2.4 Ex-Situ Thermal Treatment and Solidification/Stabilization

The ex-situ thermal treatment and solidification/stabilization alternative would involve combining two remediation technologies to address the different types of contaminants identified at the site. Ex-situ thermal treatment technology consists of incinerating impacted soil that has been excavated from the site to treat organic contaminants. An air pollution control typically treats the incinerator off-gases.

Because thermal treatment does not treat inorganic compounds (metals), the incinerated soil would also be required to undergo solidification/stabilization to address lead and arsenic impacts detected at the site. Stabilization involves altering contaminants to a less harmful or less mobile state. Solidification binds the impacted soil to prevent future migration of contaminants. Treatability studies are generally required to determine if soils are compatible with these technologies.

Under this alternative, soil would be excavated from the site and transported to and stockpiled at on-site or nearby location for incineration. Impacted soil would be loaded into high temperature incinerator(s) for treatment. Incinerated soil would then be stockpiled for solidification/stabilization. The solidification/stabilization process would include conveying the incinerated soil into a weight feeder, followed by a homogenizer where the soil would be mixed with water, followed by a pug mill where the soil would be mixed with a reagent. Treated soil would be would be reused on site as fill material.

4.3 Evaluation of Cleanup Alternatives

4.3.1 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 1. On the basis of technical simplicity, all alternatives rated equal with the exception of the ex-situ thermal treatment and solidification/stabilization alternative. In terms of effectiveness and protecting human health and the environment, the No Action Alternative rated lowest while the other three alternatives were equally effective. Arguably, ex-situ thermal treatment/stabilization and the use of performance barriers may not be as effective as off-site landfilling. Under the landfilling alternatives, impacted fill material would be excavated and removed from site; while with the other two alternatives, engineering controls or chemical treatment are being used to reduce direct contact and environmental risk while leaving material in place.

A summary of probable costs related to each of the other three cleanup alternatives is summarized on Table 2. Cost information presented on Table 2 is intended to be used for comparative purposes only and does not represent a formal budget to implement a specific alternative. Actual costs will depend on details of site development plans including grading plans, pavement plans, and landscaping. Economically, the No Action Alternative could be implemented for the least cost; however, from a broader perspective, without implementing corrective action, the former industrial property could not be redeveloped and the economic benefit related to improved neighboring property values and public access to the waterfront would not be realized. Costs are largely controlled by the volume of fill material that must be treated or landfilled at an off-site location. Based on the anticipated volume of soil generated under each cleanup alternative, on-site reuse of soil with performance barriers and limited off-site landfilling appears to be the least expensive alternative. That alternative includes implementing a cap maintenance plan to maintain the condition of the hardscape and other performance barriers. Cap maintenance plans for the purposes of environmental remediation should be consistent with building and grounds maintenance commonly practiced for a development such as this.

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 off site or treated prior to reuse. We anticipate that off-site landfilling, which largely consists of mass excavation and backfilling, could be accomplished in less time than constructing performance barriers and limiting off-site landfilling. Excavation and landfilling would largely occur prior to any significant construction effort while performance barriers would be constructed concurrent with other site improvements. Ex-situ thermal treatment and solidification/stabilization is expected to take longer than excavation and landfilling due to the time required to mobilize specialty thermal and mixing equipment.

4.3.2 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 five 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

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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 summarized on Table 3 along with the relative implementation difficulty and the corresponding relationship to each green remediation core element. As indicated on Table 3, there are several practices that could be employed or modified to enhance green remediation 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.

Green remediation criteria were also evaluated utilizing a sustainability metric evaluation tools. The US Air Force's Sustainable Remediation Tool (SRT) was used to compare remediation approaches on the basis of sustainability metrics. The tool allows users to estimate sustainability metrics for specific remedial action technologies. The SRT quantifies carbon dioxide emissions to the atmosphere, energy consumption, and safety/accident risk. An AECOM developed sustainability tool (LDW) was used to evaluate the thermal treatment technology. The LDW tool similarly quantifies air emissions, safety/accident risk, and energy consumption. Results of the sustainability metric evaluation are summarized in Table 4 and details are provided in Appendix B of this report.

Results of the sustainability metric evaluation (Table 4) along with the qualitative evaluation summarized in Table 3 were used to score each of the green remediation core elements relative to proposed corrective action alternatives. These comparative scores are provided in Table 1. As indicated in Table 1, the green remediation criteria are weighted such that collectively, the green remediation criteria have the same influence as each of the other feasibility criteria.

4.3.3 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 off-site landfilling alternative would remove the bulk of the impacted soil from the site, thereby reducing risk to the public and environment. A licensed landfill (Winnebago County Landfill) is located approximately 5 miles north of the site. The proximity of the landfill to the site reduces trucking costs and associated air emissions from the trucks. Disadvantages of off-site landfilling the entire mass of impacted soils at the site include high costs, fugitive air emissions during operations, excavation dewatering, and potential community concerns regarding trucking large quantities of impacted soil through downtown Oshkosh.

The on-site reuse with performance barriers and limited off-site landfilling alternative would address hazards to the public and environment at the site. This alternative would reduce soil excavation and off-site 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 ex-situ thermal treatment and Solidification/Stabilization alternative would address hazards to the public and environment at the site. The disadvantages of this alternative include high costs and relatively long implementation time. Thermal treatment is generally more cost-effective when treating hazardous waste, which has not been identified at the site.

4.4 Recommended Cleanup Alternative

The on-site reuse with performance barriers and limited off-site landfilling alternative is the preferred remedy for achieving environmental closure at the riverwalk parcel property due to the effectiveness, implementation feasibility, green remediation rating, 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. Additionally, 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 greenspace 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.

The use of performance barriers and limited landfilling support the core elements of green remediation largely because components of the environmental remedy leverage site improvements and infrastructure needs of the new development. Additionally, there are several management practices that could be employed under the selected remedy, which support the green remediation core elements with little impact on cost and effectiveness. Management practices which will be considered when implementing corrective action include imposing idle restrictions on construction equipment, planning trucking routes to limit noise disturbance in residential neighborhoods, sequencing work to reduce material handling, covering stockpiles for dust control, and limiting construction dewatering.

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Appendix A

EPA Citizen's 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

EPA

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.

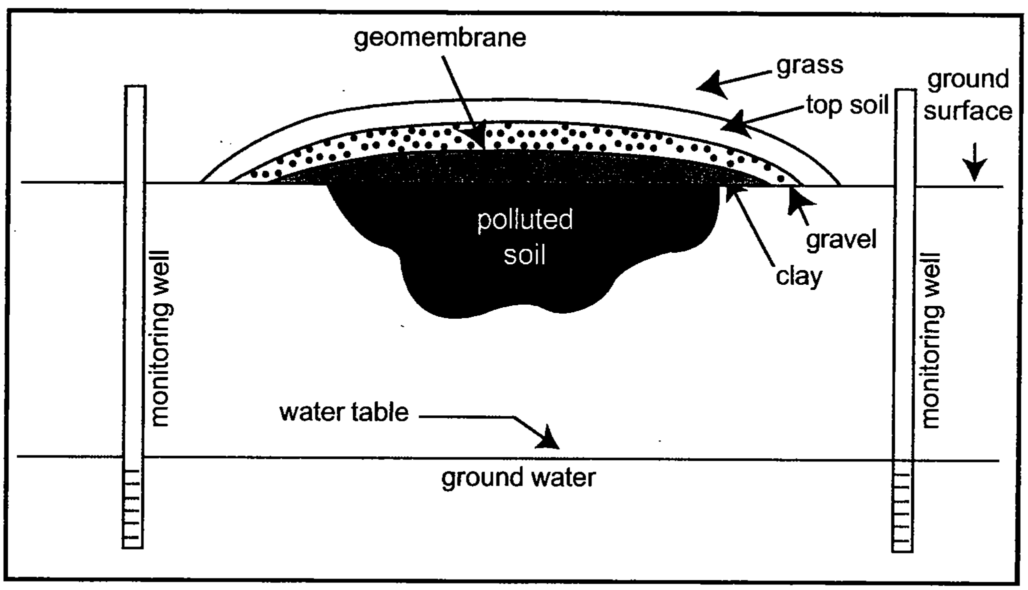
How does it work?

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.



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
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EPA

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.

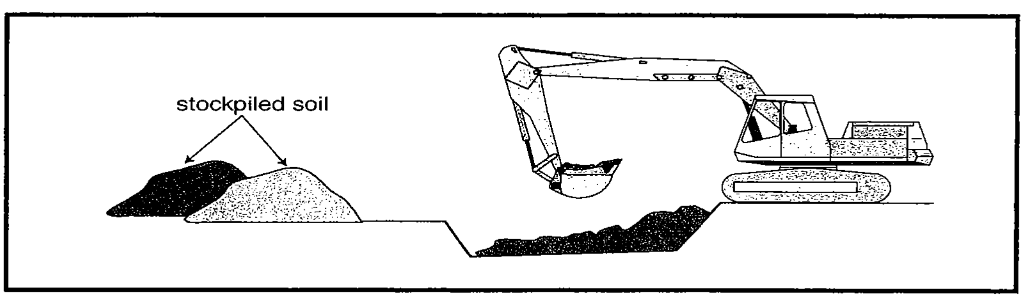
How does it work?

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.

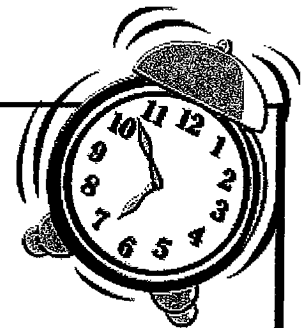
The polluted soil may be cleaned up onsite or taken elsewhere for this purpose (See *A Citizen's Guide to Thermal Desorption* [EPA 542-F-01-003], and *A Citizen's Guide to Soil Washing* [EPA 542-F-01-008]). The soil may also may be disposed of in a regulated landfill. If the soil is cleaned, it may be 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:

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.**

NOTE: This fact sheet is intended solely as general guidance and information to the public. It is not intended, nor can it be relied upon, to create any rights enforceable by any party in litigation with the United States, or to endorse the use of products or services provided by specific vendors. The Agency also reserves the right to change this fact sheet at any time without public notice.

United States
Environmental Protection
Agency

Office of Solid Waste and
Emergency Response
(5102G)

EPA 542-F-01-024
December 2001
www.epa.gov/superfund/sites
www.cluin.org

EPA

A Citizen's Guide to Solidification/Stabilization

The Citizen's Guide Series

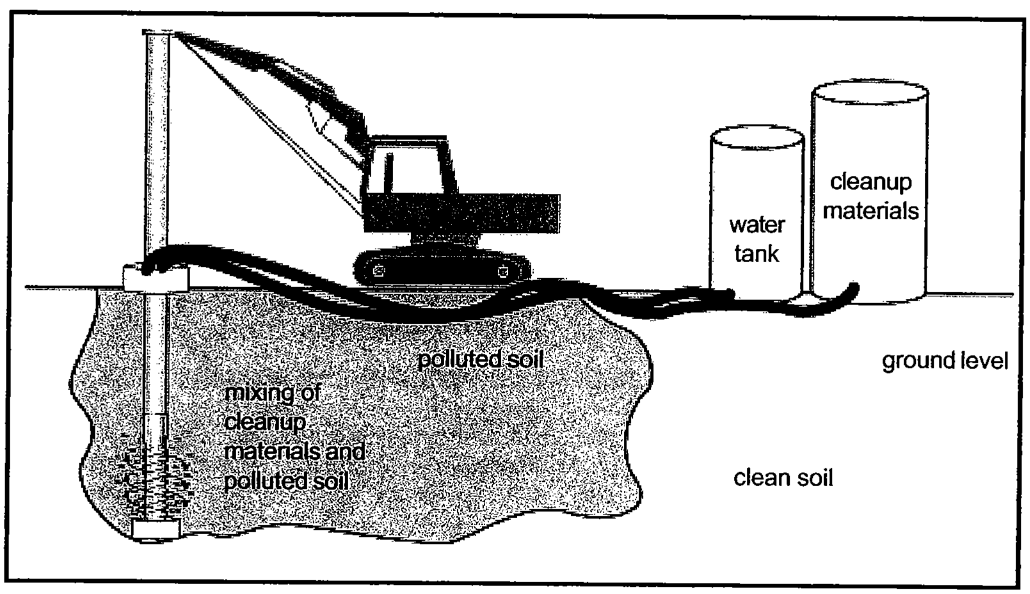
EPA uses many methods to clean up pollution at Superfund sites. If you live, work, or go to school near a Superfund site, you may want to learn more about these methods. Perhaps they are being used or are proposed for use at your site. How do they work? Are they safe? This Citizen's Guide is one in a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

What is solidification/stabilization?

Solidification/stabilization refers to a group of cleanup methods that prevent or slow the release of harmful chemicals from polluted soil or sludge. These methods usually do not destroy the chemicals—they just keep them from moving into the surrounding environment. Solidification refers to a process that binds the polluted soil or sludge and cements it into a solid block. Stabilization refers to changing the chemicals so they become less harmful or less mobile. These two methods are often used together to prevent exposure to harmful chemicals.

How do they work?

Solidification involves mixing polluted soil with a substance, like cement, that causes the soil to harden. The mixture dries to form a solid block that can be left in place or removed to another location. The solidification process prevents chemicals from spreading into the surrounding environment. Rain or other water cannot pickup or dissolve the chemicals as it



moves through the ground. Solidification does not get rid of the harmful chemicals, it simply traps them in place.

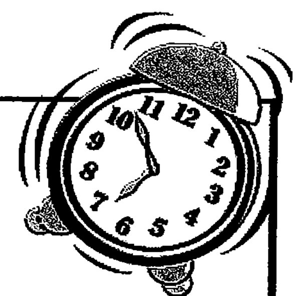
Stabilization changes harmful chemicals into substances that are less harmful or less mobile. For example, soil polluted with metals can be mixed with lime. The lime reacts with metals to form metal hydroxides. The metal hydroxides do not move through and out of the soil as easily.

Solidification/stabilization methods may or may not require the soil to be removed. Sometimes it is better to dig up the soil and place it in large mixers above ground to be sure that all of the polluted soil mixes with the cleanup materials, such as cement and lime. The mixture may then be returned to the ground at the site or placed in a landfill. At other sites, instead of digging up the soil, it is mixed in place with the cleanup materials. Then it is covered with clean soil or pavement. After solidification/stabilization is completed, EPA tests the surrounding soil to make sure no pollution was missed.

Is solidification/stabilization safe?

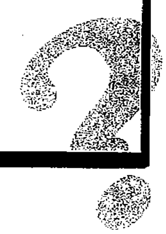
In order to make sure of the safety of the remedy, EPA tests the final mixture to confirm proper sealing of the harmful chemicals and for strength and durability of the solidified or stabilized materials. Sometimes EPA will place use restrictions on areas that have received solidification or stabilization. These land use restrictions can prevent future damage to the treated area.

How long will it take?



Solidification/stabilization may take weeks or months to complete, depending on several factors that vary from site to site:

- types and amounts of chemicals present
- size and depth of the polluted area
- types of soil and geologic conditions
- whether the mixing occurs in place or in mixing tanks



Why use solidification/stabilization?

Solidification/stabilization provides a relatively quick and low cost way to protect from the threat posed by harmful chemicals, especially metals. Solidification/stabilization has been chosen as part of the remedy at 183 Superfund sites across the country.

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.**

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Appendix B

Sustainability Evaluation Calculations

EXCAVATION - TIER 1
Oshkosh Riverwalk - Marion/Pearl Segment
OSHKOSH, WISCONSIN
CAPITAL and O&M

Instructions:
- (blank) =Enter your data here. Click button to the right of the cell for help.
- (shaded) =Use this default value or override with your own.
- (black) =Calculated value. You cannot change this.

Restore Defaults

Recommended flow:
Main → Input → Technology Design (☑ Excavation, ☑ Soil Vapor Extraction) → Results
You are here
Next>>

Design for Managing Soil

Airline miles flown by project team (total miles for all travelers)	0	*miles over proj lifetime*
Average Distance Traveled by Site Workers per one-way trip	10	*miles one-way*
Trips by Site Workers during construction	100	*# over project lifetime*
Trips by Site Workers after construction	10	*# over project lifetime*
Distance to Disposal (one-way)	5	*miles*
Type of Disposal	Non-hazardous	
Volume of affected soil	117,000.	*cu ft*
Volume of affected soil	4,334.	*cu yd*
Total hours to excavate	120.	*person-hours*
Number of loads for disposal	620.	*#*
Total miles driven for disposal	9,200.	*miles*
Total hours for fill dirt placement	150.	*hours*
Number of loads of fill dirt	500.	*#*
Total miles driven for fill	10,000.	*miles*

Materials and Consumable Amounts used for Metrics

Diesel	3,200.	*gal*
Gasoline	150.	*gal*

Technology Cost

Capital	440,000.	*$*
O&M	n/a	*$*

Project-specific Metrics (Add & Subtract/Offsets)

☑ Yes ☐ No

Additional Technology Cost		*$*
Total Energy Consumed		*Megajoules*
CO_2 Emissions to Atmosphere		*tons CO_2*
Safety / Accident Risk		*lost hours*

SUSTAINABLE REMEDIATION TOOL CALCULATION

ON-SITE REUSE WITH PERFORMANCE BARRIERS AND LIMITED OFF-SITE LANDFILLING REMEDIAL OPTION
FORMER WISCONSIN AUTOMATED MACHINERY
OSHKOSH, WISCONSIN

SOIL/SOURCE RESULTS

Instructions:
- (white) =Enter your data here.
- (shaded) =Use this default value or override with your own.
- (black) =Calculated value. You cannot change this.

Recommended flow:

Main → Input → Technology Design → Results (You are here*)

* Normalize metrics to see more, go back to Inputs to adjust & compare, go back to Main (Tier 1/2 or GW), or Exit.

Non-normalized
Calculations in natural units

	Excavation	SVE	
Carbon Dioxide Emissions to Atmosphere	43.	-	*tons CO_2*
CO_2 per pound of contaminant	#N/A	-	*lbs CO_2 per lb contam*
Total Energy Consumed	570,000.	-	*Megajoules*
	160,000.	-	*kWh*
Technology Cost	940,000.	-	*dollars*
Cost per pound of contaminant	#N/A	-	*dollars per lb contam*
Safety/Accident Risk	0.93	-	*lost hours*
	1.9E-02	-	*injury risk*
Change in Resource Service for Land - Economic	-	-	
Change in Resource Service for Land - Ecologic	-	-	

Normalize? ☐ Yes ☒ No

LANDFILLING REMEDIAL OPTION
FORMER WISCONSIN AUTOMATED MACHINERY
OSHKOSH, WISCONSIN

EXCAVATION - TIER 1
Oshkosh Riverwalk - Marion/Pearl Segment
OSHKOSH, WISCONSIN
CAPITAL and O&M

Instructions:
- (blank cell) =Enter your data here. Click button to the right of the cell for help.
- (shaded cell) =Use this default value or override with your own.
- (black cell) =Calculated value. You cannot change this.

Restore Defaults

Recommended flow:
Main → Input → Technology Design (☑ Excavation; ☐ Soil Vapor Extraction; Next>>) → Results
You are here

Design for Managing Soil

Airline miles flown by project team (total miles for all travelers)	0	*miles over proj lifetime*
Average Distance Traveled by Site Workers per one-way trip	10	*miles one-way*
Trips by Site Workers during construction	100	*# over project lifetime*
Trips by Site Workers after construction	10	*# over project lifetime*
Distance to Disposal (one-way)	5	*miles*
Type of Disposal	Non-hazardous	
Volume of affected soil	378,000.	*cu ft*
Volume of affected soil	14,000.	*cu yd*
Total hours to excavate	360.	*person-hours*
Number of loads for disposal	1,300.	*#*
Total miles driven for disposal	13,000.	*miles*
Total hours for fill dirt placement	140.	*hours*
Number of loads of fill dirt	1,500.	*#*
Total miles driven for fill	30,000.	*miles*

Materials and Consumable Amounts used for Metrics

Diesel	6,900.	*gal*
Gasoline	150.	*gal*

Technology Cost

Capital	1,400,000.	*$*
O&M	n/a	*$*

Project-specific Metrics (Add & Subtract/Offsets)

☒ Yes ☐ No

Additional Technology Cost		*$*
Total Energy Consumed		*Megajoules*
CO_2 Emissions to Atmosphere		*tons* *CO_2*
Safety / Accident Risk		*lost hours*

SUSTAINABLE REMEDIATION TOOL CALCULATION

LANDFILLING REMEDIAL OPTION
FORMER WISCONSIN AUTOMATED MACHINERY
OSHKOSH, WISCONSIN

SOIL/SOURCE RESULTS

Instructions:
- [white box] =Enter your data here.
- [shaded box] =Use this default value or override with your own.
- [black box] =Calculated value. You cannot change this.

Recommended flow:

Main → Input → Technology Design → Results (You are here*)

* Normalize metrics to see more, go back to Inputs to adjust & compare, go back to Main (Tier 1/2 or GW), or Exit.

Non-normalized

Calculations in natural units

	Excavation	SVE	
Carbon Dioxide Emissions to Atmosphere	91.	-	*tons CO_2*
CO_2 per pound of contaminant	#N/A	-	*lbs CO_2 per lb contam*
Total Energy Consumed	1,200,000.	-	*Megajoules*
	330,000.	-	*kWh*
Technology Cost	1,400,000.	-	*dollars*
Cost per pound of contaminant	#N/A	-	*dollars per lb contam*
Safety/Accident Risk	2.	-	*lost hours*
	4.2E-02	-	*injury risk*
Change in Resource Service for Land - Economic	-	-	
Change in Resource Service for Land - Ecologic	-	-	

Normalize? Yes No

SRT

8 THERMAL TREATMENT			Alt_1		Alt_2	
GAS EMISSION	CO_2 emissions	lb	E_{CO2}	575,170	E_{CO2}	875,259
	CO emissions	lb	E_{CO}	108	E_{CO}	164
	NOx emissions	lb	E_{NOx}	691	E_{NOx}	1,052
	SOx emissions	lb	E_{SOx}	3,390	E_{SOx}	5,159
WORK ACCIDENTS	expected number of accidents during miscellaneus activities	-	N_I	0.005	N_I	8.29E-03
	expected number of deadly accidents during miscellaneus activities	-	N_F	0.000	N_F	1.74E-05
ENERGY	energy consumption	MJ	E	3.45E+04	E	5.25E+04

Description	Units	Value	References
emission factor for CO_2	lb/gal	26.635	***AP 42, EPA, Fifth Edition, Volume I*** - Stationary External Combustion Sources - Gasoline and Diesel Industrial Engines (fuel imput emission factor_uncontrolled sources; assumes 99% conversion of carbon in fuel to CO2 with 87 weight % carbon in diesel, diesel heating value of 19,300 Btu/lb). Fuel density: 0,85 kg/l; sulfur fuel content: 1%
emission factor for CO	lb/gal	0.005	
emission factor for NO_x	lb/gal	0.032	
emission factor for SO_x	lb/gal	0.157	
combustion efficency	-	0.700000	
work accidents rate for heavy and civil engineering construction	accidents/worker/year	0.05100	***U.S. Department of labor (Industry Injury and illness Data, 2007 - Supplemental News Release Tables SNR05)***
deadly work accidents rate for opereting engeeners and other construction equipment operators	accidents/worker/year	0.00011	***U.S. Department of Labor,*** Bureau of Labor Statistics, Census of Fatal Occupational Injuries, 2008
work accidents rate for OTHER CATEGORIES	accidents/worker/year	0.00	OPTIONAL
deadly work accidents rate for OTHER CATEGORIES	accidents/worker/year	0.00	OPTIONAL
energy content of diesel fuel	MJ/gal	189.9625	Commonly accepted heating values for diesel fuel (EPA)
filterable PM (< 3μ)	lb/gal	0.008408	

Description	Equipment	Units	Alt 1	Alt 2	Alt 3a	Alt 3b	Alt 3c	Alt 3d	Alt 4a
volume	desorber	cubic yard	9,200	14,000	0	0	0	0	0
construction area	-	acres	1	1	0	0	0	0	0
soil density	-	pounds/cubic yard	2,601	2,601					
soil temperature increase	-	°C	300	300	0	0	0	0	0
specific heat of soil	-	megajules/pund °C	0.0004	0.0004	0	0	0	0	0
plant troughtput	desorber	long tons/day	336	336					
number of construction equipment operators	-	worker	3	3	0	3	3	3	3
OTHER CATEGORIES	-	worker	0	0	0	0	0	0	0

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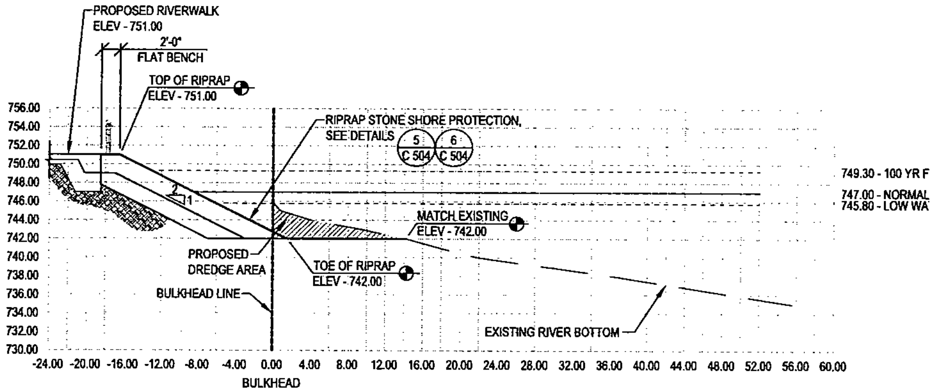
Appendix C

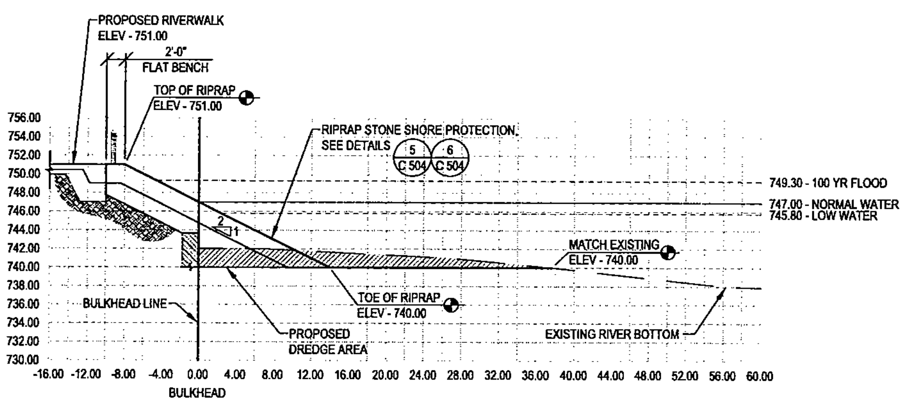
Drawings

FILE: P:\24920\000\CAD\sheet\4920-SH-SECT.dwg USER: hclifford DATE: Dec. 08 2009 TIME: 04:02 pm



1 SECTION THROUGH RIVEREDGE & DREDGING - RIVERWALK STA 11+75

SCALE: 1"=10'-0"



2 SECTION THROUGH RIVEREDGE & DREDGING - RIVERWALK STA 13+50

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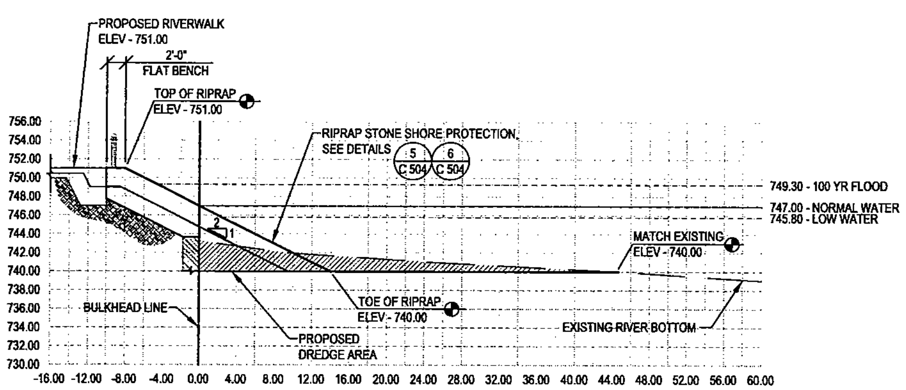

3 SECTION THROUGH RIVEREDGE & DREDGING - RIVERWALK STA 18+60

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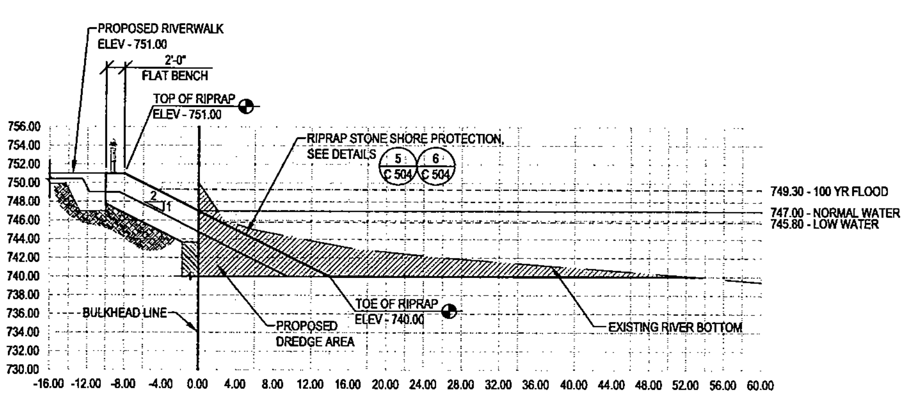


4 SECTION THROUGH RIVEREDGE & DREDGING - RIVERWALK STA 23+80

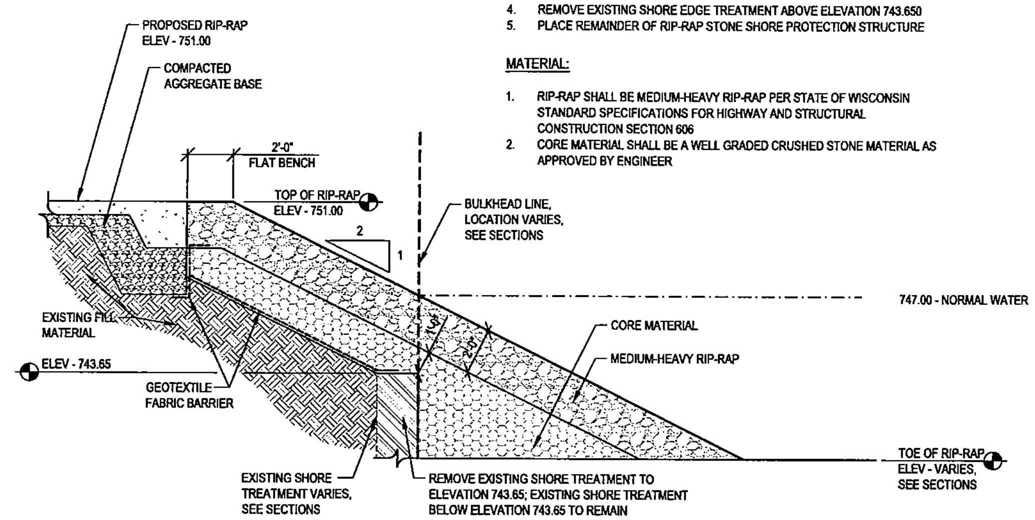
SCALE: 1"=10'-0"

EXPECTED CONSTRUCTION SEQUENCE:

1. INSTALLATION OF TURBIDITY BARRIER
2. REMOVE MISCELLANEOUS DEBRIS FROM SHORE PROTECTION FOOTPRINT
3. PLACE CORE MATERIAL TO ELEVATION 743.65
4. REMOVE EXISTING SHORE EDGE TREATMENT ABOVE ELEVATION 743.650
5. PLACE REMAINDER OF RIP-RAP STONE SHORE PROTECTION STRUCTURE

MATERIAL:

1. RIP-RAP SHALL BE MEDIUM-HEAVY RIP-RAP PER STATE OF WISCONSIN STANDARD SPECIFICATIONS FOR HIGHWAY AND STRUCTURAL CONSTRUCTION SECTION 606
2. CORE MATERIAL SHALL BE A WELL GRADED CRUSHED STONE MATERIAL AS APPROVED BY ENGINEER



5 RIPRAP STONE SHORE PROTECTION DETAIL

SCALE: ½"=1'-0"

EXPECTED CONSTRUCTION SEQUENCE:

1. INSTALLATION OF TURBIDITY BARRIER
2. REMOVE MISCELLANEOUS DEBRIS FROM SHORE PROTECTION FOOTPRINT
3. PLACE CORE MATERIAL TO ELEVATION 743.65
4. REMOVE EXISTING SHORE EDGE TREATMENT ABOVE ELEVATION 743.65
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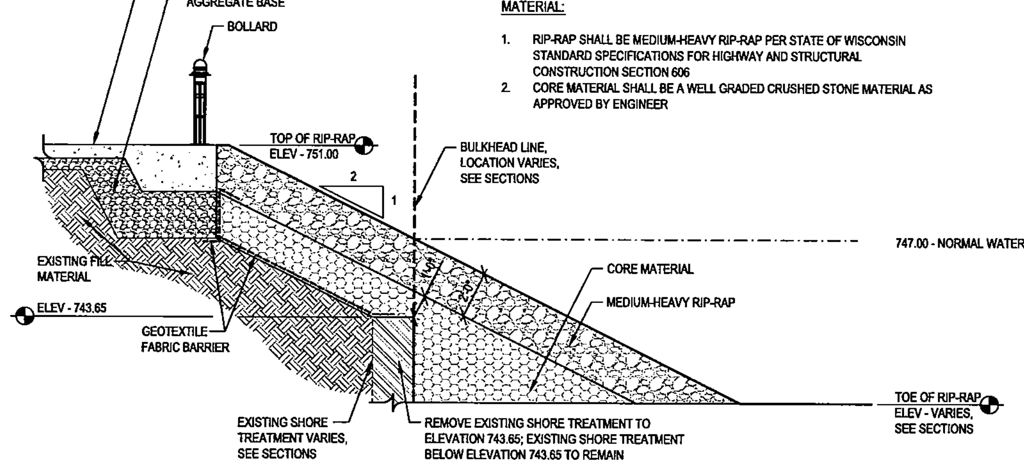
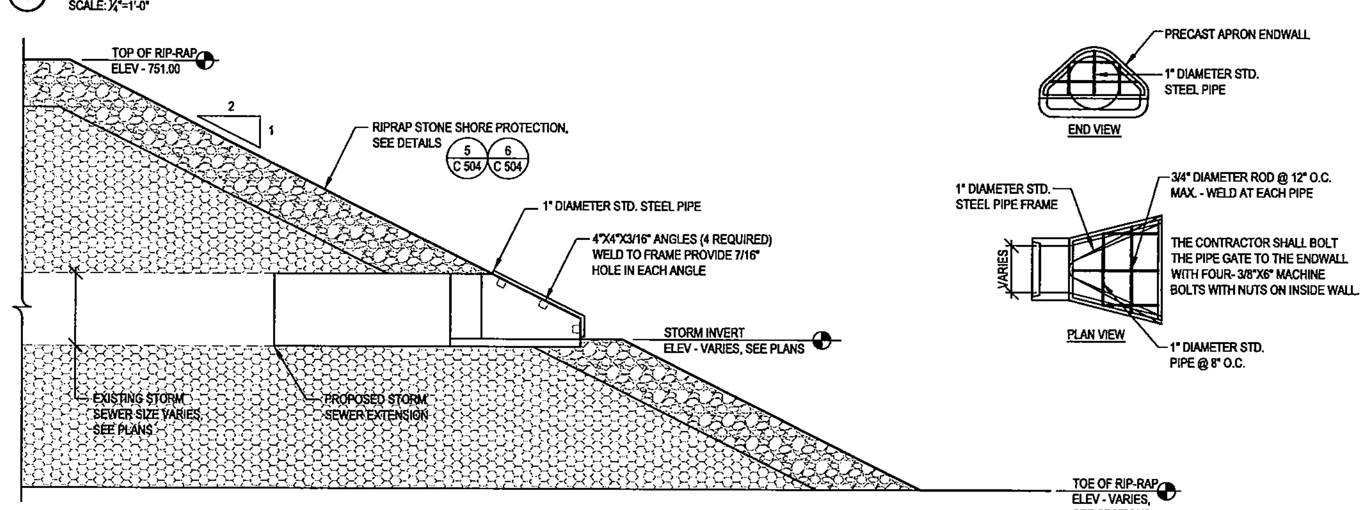
1. RIP-RAP SHALL BE MEDIUM-HEAVY RIP-RAP PER STATE OF WISCONSIN STANDARD SPECIFICATIONS FOR HIGHWAY AND STRUCTURAL CONSTRUCTION SECTION 606
2. CORE MATERIAL SHALL BE A WELL GRADED CRUSHED STONE MATERIAL AS APPROVED BY ENGINEER



6 RIPRAP STONE SHORE PROTECTION DETAIL WITH BOLLARD

SCALE: ½"=1'-0"



6 STORM SEWER EXTENSION TYP.

SCALE: ½"=1'-0"

OSHKOSH RIVERWALK

PHASE 1:
MARION ROAD ZONE

Owner:

CITY OF OSHKOSH, WISCONSIN

JJR landscape architecture, planning, urban design, civil engineering, environmental science
JJR, LLC
625 WILLIAMSON STREET,
MADISON, WISCONSIN 53703
608.251.1177 T
608.251.6147 F
www.jjr-us.com

ISSUED FOR	REV	DATE
PERMIT SUBMITTAL		05/19/2008
PERMIT APPLICATION		05/19/2008
PERMIT RESUBMITTAL		03/26/2009
PERMIT RESUBMITTAL		04/28/2009
SHEET RESUBMITTAL		06/30/2009

SEALS AND SIGNATURES

NOT FOR CONSTRUCTION

KEY PLAN

PROJECT NORTH

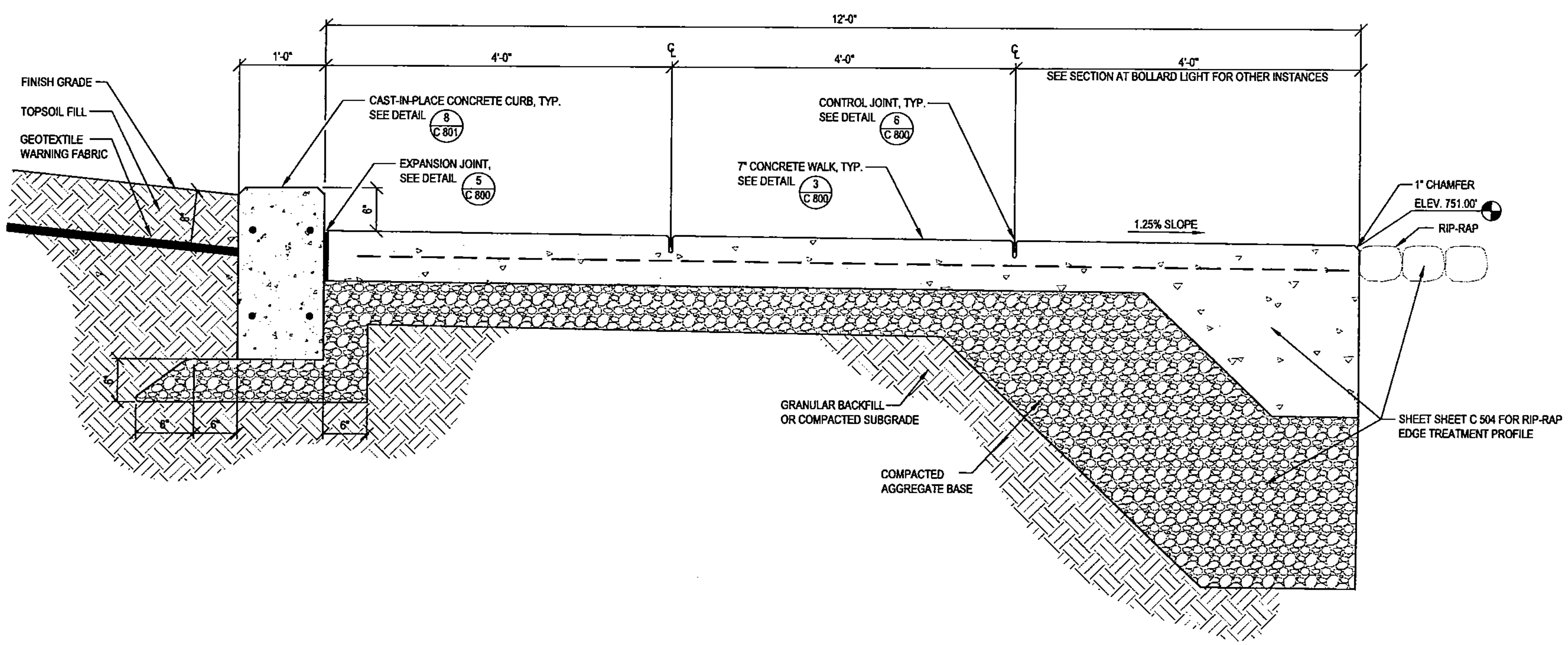
DRAWING TITLE

River Edge & Dredge Sections

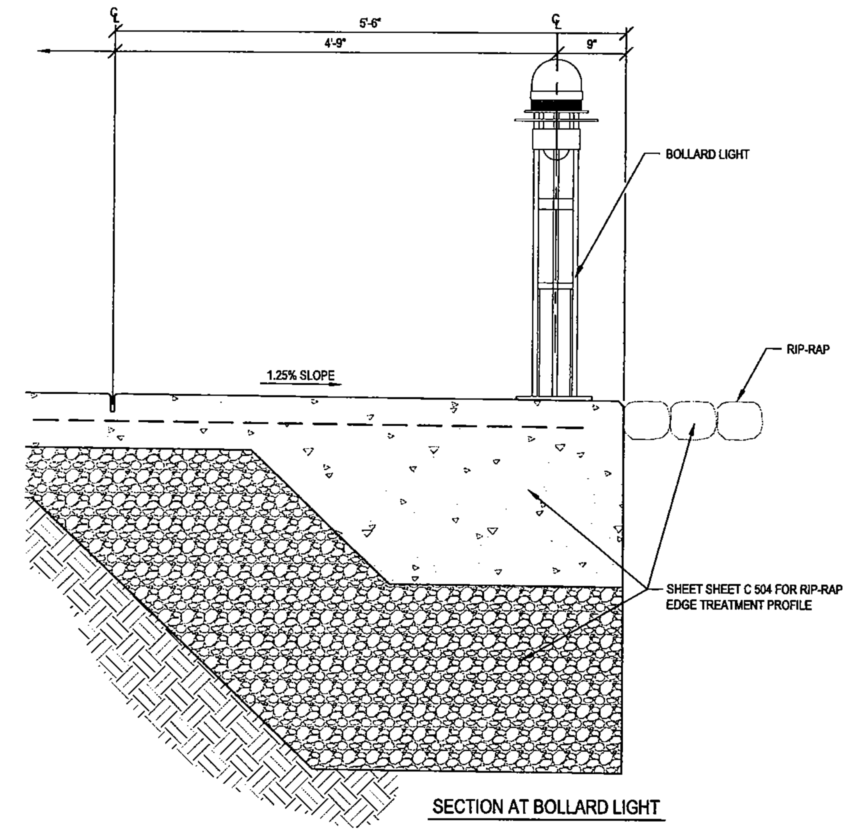
SCALE: AS SHOWN

PROJECT NUMBER: 24920.000

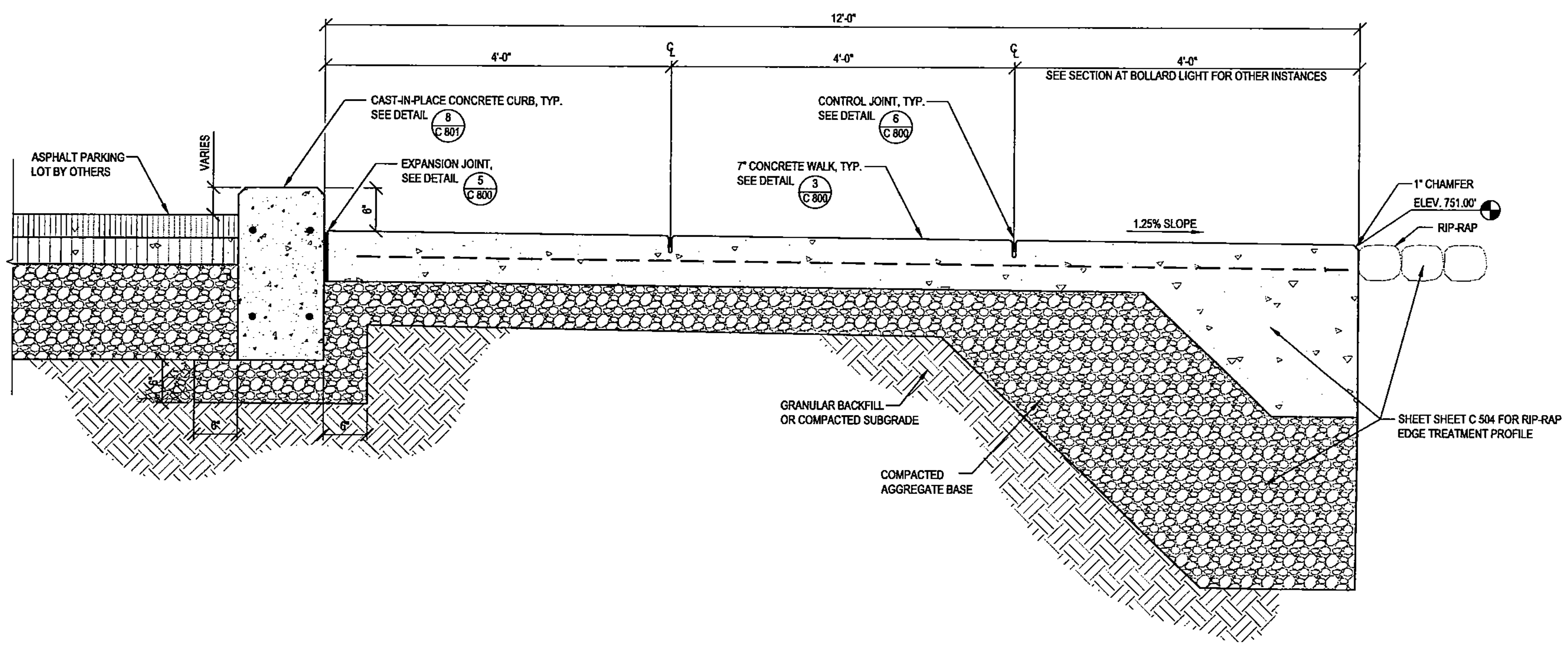
DRAWING NUMBER: C 504



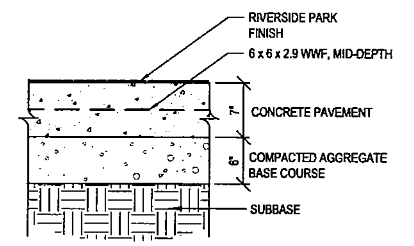
1 TYPICAL CONCRETE RIVERWALK
SCALE: 1"=1'-0"



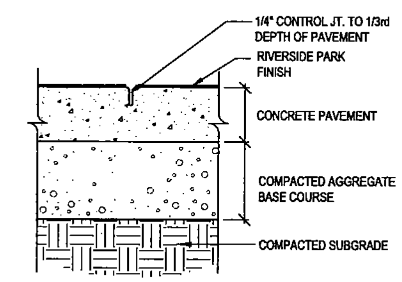
SECTION AT BOLLARD LIGHT



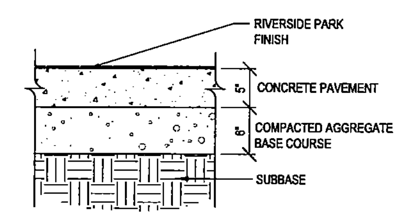
2 TYPICAL CONCRETE RIVERWALK - ADJACENT TO FUTURE ASPHALT PARKING LOT
SCALE: 1"=1'-0"



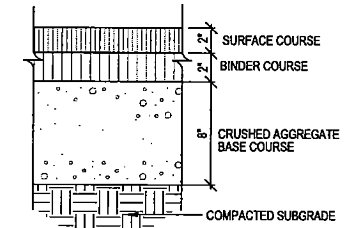
3 CONCRETE PAVEMENT, RIVERWALK
SCALE: 1"=1'-0"



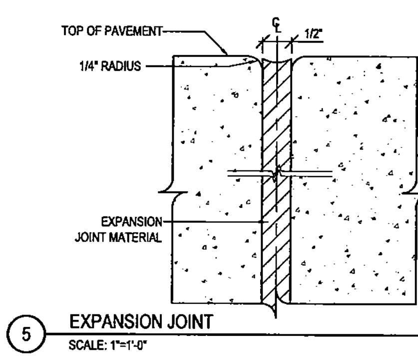
6 CONTROL JOINT
SCALE: 1"=1'-0"



4 CONCRETE PAVEMENT, STANDARD SIDEWALK
SCALE: 1"=1'-0"



7 ASPHALT PAVEMENT
SCALE: 1"=1'-0"



5 EXPANSION JOINT
SCALE: 1"=1'-0"

OSHKOSH RIVERWALK

PHASE 1:
MARION ROAD ZONE

Owner:

CITY OF OSHKOSH, WISCONSIN

JJR
landscape architecture
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PERMIT RESUBMITTAL		04/28/2009

SEALS AND SIGNATURES

NOT FOR CONSTRUCTION

KEY PLAN

PROJECT NORTH

DRAWING TITLE
Pavement Details

SCALE
SCALE: AS SHOWN

PROJECT NUMBER
24920.000

DRAWING NUMBER
C 800

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Tables

TABLE 1

EVALUATION OF POTENTIAL SOIL REMEDIAL ALTERNATIVES
OSHKOSH RIVERWALK - MARION/PEARL SEGMENT
OSHKOSH, WISCONSIN

	Feasibility Criteria	Weight	No Action	Off-Site Landfilling	On-Site Reuse with Performance Barriers and Limited Off-Site Landfilling	Ex-Situ Thermal Treatment and Stabilization
	Technical simplicity	5	3	3	3	2
	Effectiveness in protecting human health and the environment	6	1	3	3	2
	Affordability	6	3	1	2	1
	Implementation time frame savings	7	3	3	2	1
Green Cleanup Evaluation	Minimizes Total Energy Use and Maximizes Use of Renewable Energy	1	3	1	2	1
	Minimizes Air Pollutants and Greenhouse Gas Emissions	1	3	1	3	2
	Minimizes Water Use and Impacts to Water Resources	1	3	1	2	1
	Reduces, Reuses and Recycles Material and Waste	1	0	1	3	1
	Optimizes Future Land Use and Enhances Ecosystems	1	0	0	2	1
	TOTAL UNWEIGHTED SCORE		19	14	22	12
	TOTAL WEIGHTED SCORE		**69**	**64**	**71**	**41**

Scoring
1 = Low
2 = Medium
3 = High

TABLE 2

OPINION OF PROBABLE COSTS OF POTENTIAL REMEDIAL ALTERNATIVES
OSHKOSH RIVERWALK, MARION/PEARL SEGMENT
OSHKOSH, WISCONSIN

	Estimated Costs			
	No Action	Off-Site Landfilling	On-Site Reuse with Performance Barriers and Limited Off-Site Landfilling	Ex-Situ Thermal Treatment and Solidification/Stabilzation
Community Involvement	$0	$10,000	$10,000	$10,000
Treatability Study	$0	$0	$0	$30,000
Preparation of Work Plan	$0	$10,000	$10,000	$20,000
Site Remedial Activities	$0	$850,000	$550,000	$8,000,000
Confirmatory Sampling	$0	$20,000	$10,000	$30,000
Preparation of Corrective Action Completion Report	$0	$20,000	$20,000	$20,000
Contigency (5%)	$0	$45,000	$30,000	$400,000
Total Estimated Cost	**$0**	**$955,000**	**$630,000**	**$8,510,000**

Table 3

Environmental Benefits of Green Remediation Best Management Practices

Best Management Practice	Applicability			Green Remediation Core Element					Impact on other feasibility criteria			
	Landfill	Performance Barriers	Soil Treatment	Minimize total energy use	Minimize air pollutants and greenhouse gas emissions	Minimize water use and impact to water resources	Optimize future land use and enhance ecosystems	Reduce, reuse, recylce waste material	Technical practicability	Effectiveness in protecting human health and environment	Cost of implementation	Implementation schedule
Impose idle restrictions on construction equipment	↑	↑	↑	+	+	o	o	o	o	+	o	-
Impose restrictions to minimize noise disturbance	↑	↑	↑	o	+	o	o	o	o	+	o	-
Use low-sulfur diesel fuel	↔	↔	↔	-	+	o	o	o	o	+	-	o
Use alternative fuels, E85, Biodiesel	↔	↔	↔	-	+	o	o	+	o	o	-	o
Use enhanced emissions controls on construction equipment	↑	↑	↑	-	+	o	o	o	o	+	-	o
Sequence work to minimize material handling	↑	↑	↑	+	+	o	o	o	o	o	+	-
Cover stockpiles to control dust and sediment in runoff	↑	↑	↑	o	+	+	+	o	o	+	o	o
Collect rainwater for use as dust control	↔	↔	↔	o	o	+	o	+	o	o	-	o
Crush existing floor slab and asphalt pavement for use as construction material	↓	↑	↓	-	-	o	o	+	o	o	-	-
Minimize contruction dewatering	↓	↑	↓	+	o	+	+	o	o	o	+	-
Segregate wood waste from fill material, use as fuel source	↓	↓	↓	-	o	o	o	+	o	o	-	-
Use energy efficient equipment in job trailer	↑	↑	↑	+	+	o	o	o	o	o	o	o
Integrate anticipated future site use into cleanup strategy	↓	↑	↓	+	+	o	+	o	o	o	-	+

↑ Easy to apply to remediation alternative

↓ Difficult to apply to remediation alternative

↔ Medium difficulty in applying to remediation alternative

\+ Advances core element of green remediation

\- Negative impact on core element of green

o Little or no impact on core element of green

\+ Positive impact on feasibility criterion

\- Negative impact on feasibility criterion

o Little or no impact on feasibility criterion

TABLE 4

SUMMARY OF SUSTAINABILITY METRICS
OSHKOSH RIVERWALK, MARION/PEARL SEGMENT
OSHKOSH, WISCONSIN

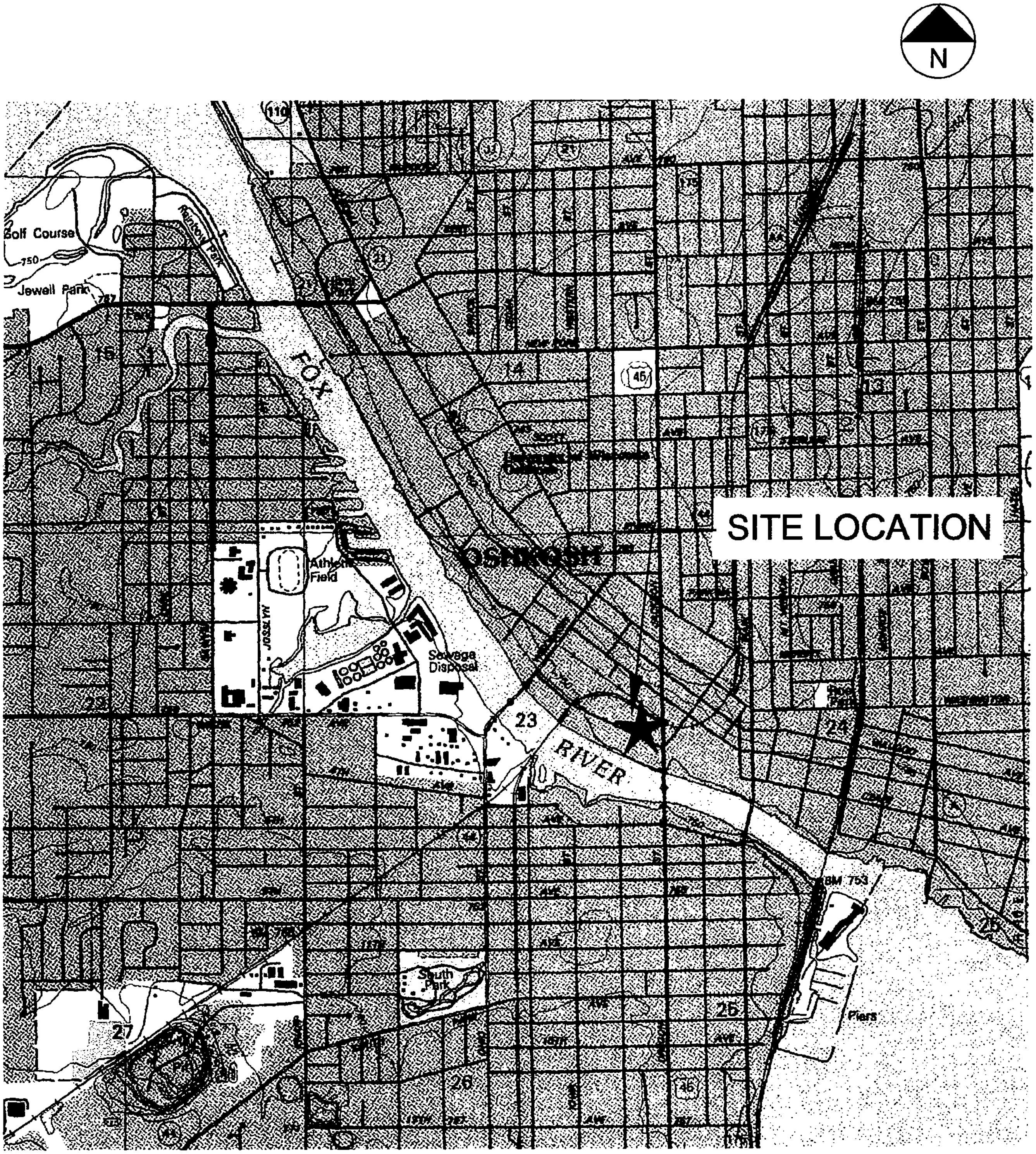
Remedial Alternative	**Atmospheric Carbon Dioxide Emissions (Tons)**	**Total Energy Consumption (Megajoules)**
No Action	0	0
*Off-Site Landfilling	91	2,100,000
*On-Site Reuse with Performance Barriers and Limited Off-Site Landfilling	43	1,200,000
**Ex-Situ Thermal Treatment and Stabilization	450	52,500

Notes: * Calculations per SRT
**Calculations per LDW

DRAFT

Figures

Figure 1 Site Location Map



NOTE: PREPARED FROM 7.5 MINUTE U.S.G.S. QUADRANGLE MAP OF OSHKOSH, WI. DATED 1992.

AECOM

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Site Location Map
Oshkosh Riverwalk
Marion/Pearl Segment
Oshkosh, Wisconsin

Drawn:	ALB	09/28/2009
Checked:	AGM	09/28/2009
Approved:		
PROJECT NUMBER	60149415	
FIGURE NUMBER	1	

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