



STATEMENT OF QUALIFICATIONS

DREDGING/SEDIMENT RESTORATION QUALIFICATIONS

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Engineering, Construction and Management Solutions

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INTRODUCTION

Sediment is defined as “material that settles to the bottom of a liquid”. Sediment is a mixture of inorganic soil particles, pore water, and organic debris with its gaseous products of decomposition. Sediment types may range from fluid mud to cemented sand and gravel.

Sediment restoration refers to the investigation, assessment, and actions taken to address sediments containing the products of industrial, urban, mining, or agricultural activities.

Hard Hat Services (HHS) is an organization with a strong experience base in sediment restoration. The experience base covers not only the investigation and assessment of sediments, but includes designing and managing sediment restoration actions. HHS offers services in:

- *Sediment Sampling*
- *Sediment Testing (physical tests)*
- *Preparation of Dredging Permits*
- *Assessment of Sediment Fate and Transport*
- *Setting Reasonable, Mass-Based Remedial Action Objectives*
- *Assessing Remedial Options*
- *Engineered Enhancements for Natural Recovery*
- *Siting and Designing Confined Disposal Facilities*
- *Designing Dredge Water Treatment Facilities*
- *Designing Armoring and In-Situ Caps*
- *Selecting Specialized Dredge Equipment*
- *Evaluating Sediment Treatment Technologies*
- *Managing Remedial Dredging Projects*
- *Implementing Turn-key Sediment Remediation*

In the early days of environmental recognition, sediment restoration meant dredging. Today sediment restoration is more likely to mean a combination of removal and other in-situ technologies, including engineered improvement of natural processes. HHS is on the leading edge of sediment restoration technology and brings a knowledge base to sediment issues that are unparalleled in the environmental services industry.

Further details on the services of HHS in sediment restoration are presented on the following pages.

Designing and Building Sustainable Clean, Green Solutions For Industry

Services Offered

1.0 Sediment Sampling

Sediment sampling is complicated by the soft or loose nature of the typical sediment requiring restoration. Sampling procedures must account for disturbance effects in sampling, separation of the sample constituents, and loss of the fluid mud section above the solid sediment surface. Often, the methods of recovering a sample must be modified in the field to obtain a representative sample of the sediment.

Most sampling today occurs with a vibrating head sampler that disturbs the very loose sediment sample. Because of the vibration disturbance, the conclusions drawn from the sampling are sometimes in error where the location of stratigraphic layers in the sediment is important.

HHS personnel have designed and/or implement the following types of sediment sampling to obtain representative sediment samples:

- *Piston tube sampling in thin walled tubes*
- *Air driven linear hammer sampling with thin wall tubes*
- *Use of foam sealant to retain tube samples*
- *Use of sphincter technology for sample retention*
- *Vibrating core sampling (where disturbance is not a problem)*
- *Vacuum suction sampling of zone settling area*
- *Grab sampling with clamshell type sampler*
- *Sediment probing using settling plate and probe*
- *Sediment probing using cone penetrometer*
- *Sediment probing using jetted probe*
- *In-situ vane shear testing*
- *Turbidity monitoring*
- *Bathymetric surveys*
- *Water column sampling*

2.0 Sediment Testing - Physical Tests

Sediment testing refers to the physical sediment tests needed to assess sediment handling and/or dewatering characteristics. Testing is required to determine the in-situ density and loosened density of the sediment after excavation. The ratio of loosened to in-situ density (bulking ratio) is used to determine the volume required to hold the excavated sediment. This is probably one of the simplest concepts, but is misunderstood by a large number of service providers in the sediment restoration business. Sediment physical testing also includes properties such as water content, specific gravity, and organic content.

When sediment is suspended in water during excavation by hydraulic dredging methods (the most common way to remove fluid mud), the sediment settles and deposits through three distinct stages. The first stage is the suspension of the sediment particles in the water with the particles settling in accordance with the principals of Stoke's Law. The second stage is zone settling, where the particles get close enough together to slow the movement of water out from between the soil particles (this is the fluid mud stage often found on the top of natural occurring sediment deposits). The third stage is compression settling, where the soil particles in the sediment are in contact with each other and are transmitting load from particle to particle. Testing to measure the rate at which these phases occur is important in the design of facilities to remove water from sediment. The testing must be conducted in large diameter settling columns to prevent the edge of the settling vessel from influencing the test.

Dewatered sediment must often be capped or excavated and moved to another location. The time rate of drainage of the sediment is an important factor in determining when further activities may occur with the sediment. Testing of the rate of drainage may be done using large volume settling columns, but the time to obtain test results is often prohibitive. Other state-of-the-art technologies, such as seepage consolidation are used by HHS to reduce the time required to obtain the time rate of drainage.

Physical testing also involves the determination of chemical additives or reagents to improve the removal of fine sediments from water. The tests are performed in jars with the additives mixed under similar conditions. It is important that someone who understands the actual field practices introduce the additives to the water-sediment mixture so that the laboratory tests reflect the actual practice in the field. Testing for solidifying agents is done in a similar manner, with paper cups substituted for the jars.

For all sediment testing programs, it is important that the testing personnel have experience with full-scale sediment handling and restoration. Experienced personnel will recognize the problems that occur during testing and will be able to adjust the testing program to obtain useful results. Tests performed by personnel that have no sediment restoration or commercial dredging experience often result in unusable information. HHS personnel are experienced in the application of dredging to sediment restoration and have performed or managed the following testing:

- *Water content*
- *Grain size and hydrometer*
- *Loss on ignition*
- *Specific gravity*
- *Settling tests (USACOE EM 1110-2-5027)*
- *Self-weight consolidation testing (Seepage Consolidation)*
- *Coagulation/flocculation*
- *Leaching*
- *Dissolved organic content*
- *Hydraulic parameter testing*

3.0 Preparation of Dredging Permits

Filling or excavating activities in a navigable water body require a permit under Section 404(b)(1) of the Federal Clean Water Act. The 404 permit is granted by the Army Corps of Engineers with the exception of a few states where the State has the 404 permit authority. A permit is also required under Section 401 of the Clean Water Act for any activities that may impact water quality. The 401 permit is usually granted by the State. The supporting documentation for these permits is usually a composite of the information collected during sampling, testing, and other design activities. HHS can:

- *Prepare support for Section 404(b)(1) compliance determinations*
- *Prepare support documents for Certification for Dredging, Dredge Material Disposal and Filling in Waters under Section 401 of the Clean Water Act*
- *Prepare specific support documents for state requirements under Section 401*

4.0 Assessment of Sediment Fate and Transport

Sediment fate and transport assessments using mathematical models is becoming a more common way to assess the impact of sediment restoration. The modeling of harbors and bays and the tidal effects on sediment transport is possible with today's computer systems. However, the ability to determine if the computer model is correct depends on the experience of the person evaluating the results of the model. Even under the best of conditions the model will depend on some assumed parameters. The choice of these parameters may have a significant impact on the answer obtained. A sound understanding of the assumptions and that the answers are not absolute is critical in interpreting the results of mathematical projections.

HHS is familiar with the actual restoration processes and the factors that effect the movement of sediment. HHS is able to look at analytical projections and separate reality from mathematical magic. HHS's expertise includes:

- *Sediment transport analysis*
- *Experience with screening level analysis*
- *Models of stream flow*
- *Contaminant mass transfer between sediment-water-air*
- *Understanding of the variability in modeling parameters*

5.0 Setting Reasonable, Mass-Based Remedial Action Objectives

The real goal for sediment restoration should always be mass removal from contact with the environment. The most difficult problem with any sediment restoration commitment is agreement on the proper action level for restoration. The problem is that determinations are usually based on an established maximum value and the assumption that the entire restored area is at that value following restoration. The regulatory enforced clean-up levels for this approach are usually unattainable.

The deposition of a chemical of concern in sediment occurs by several processes. The processes are the same ones that deposit minerals of commercial value within a geologic formation. The feasibility of mining mineral deposits is often measured by projecting the mass of mineral present based on limited sampling of the geologic media containing the mineral. The techniques used in mineral exploration are directly applicable to calculating the mass of a chemical of concern in a given sediment volume. The number of sediment samples required may be determined using mining exploration principals to avoid over sampling.

HHS has significant experience in setting practical clean-up levels and approaches to projects that produce an end point for sediment restoration. Some of those approaches are:

- *Mass versus absolute limit concept*
- *Statistical versus absolute minimum concept*
- *Consideration of natural recovery effect*
- *Combined removal and containment*
- *Use of Kriging to establish fixed quantities (USEPA's Geo-EAS & SURFER)*
- *Use of Monte Carlo method for parametric variations*

6.0 Assessing Remedial Options

HHS personnel have experience with sediment restoration at numerous sites, as described in Appendix A. The sediment restoration has included everything from natural recovery to removal of sediment. Successful projects usually include some aspects of several technologies for sediment restoration. HHS is familiar with the following broad classes of technologies for sediment restoration:

- *Natural Recovery - The natural covering of old sediments by new sediments results in lowered exposure to the contaminants in the old sediments. This occurs in sediment depositional areas where erosive forces are small.*
- *In-Situ Capping/Armoring - Where erosive forces predominate the isolating effect of natural recovery may be obtained by placing clean sediment and armoring the sediment to keep it in place.*
- *Consumptive Remedies - Many contaminants dissipate due to biological or chemical reactions. Sometimes these reactions may be accelerated by engineered intervention.*
- *Removal - Removal includes dredging using hydraulic, mechanical or pneumatic means or some combination of these methods. Removal may also mean the excavation of sediments from a dewatered portion of a water body*
- *Stream Bypasses - Stream bypasses may be used for either a temporary or permanent relocation of a stream. For temporary use the bypass usually in-*

volves pumping the stream while work is ongoing in the dewatered stream. Permanent bypasses are used where sediment is contained in-place.

7.0 Engineered Enhancements for Natural Recovery

In many water bodies like ponds, lakes, harbors and backwater areas, natural recovery will result in the restoration of contaminated sediment through capping with clean sediment through natural deposition processes. These processes may be accelerated or improved by engineered additions to the water body. HHS personnel are experienced in the design of engineered sediment control systems including:

- *Baffles for flow control*
- *Headwater structures*
- *Silt curtains*
- *Steel sheet pile dividers*
- *Earth berms*
- *Rip-rap mounds*

8.0 Siting and Designing Confined Disposal Facilities

Dredge materials are usually placed in an earthen berm containment referred to as a confined disposal facility (CDF) located near the dredging area. The earth berm area may be located in the water or on an upland area above the normal high water level. The CDF is often designed as the permanent location for the sediments and is closed out and capped after filling. The CDF may also be a temporary location for settling and dewatering the sediments prior to treating the sediment or prior to moving the sediment to another final disposal location.

HHS is experienced in the geotechnical and environmental factors for selecting a CDF location. HHS also has extensive experience in the public policy participation process for finding acceptable locations:

- *Assessing site suitability parameters*
- *Rating sites*
- *Design of site liners*
- *Design of dewatering systems*
- *Design of horizontal barriers*
- Design of protection for in-water site

9.0 Designing Dredge Water Treatment Facilities

The most critical part of the environmental dredging process may be the treatment of the return water. Large volumes of fluid mud sediment are usually moved by hydraulic methods. The sediment normally makes up 10 to 15% by weight of the pumped slurry. The remainder of the slurry is carriage water used to transport the sediment to the CDF (settling basin). The carriage water must be removed and treated to some specific level before return to the body of water.

Carriage water treatment is predominantly a solids removal process. The bulk of the sediment in the carriage water is removed in the primary settling basin. The residual is usually removed by secondary polishing in a second settling basin and by final polishing with pressure sand filters. At sites where physical settling basins are not possible, mechanical dewatering methods may be used to remove solids. Mechanical methods are more expensive and inherently riskier to operate than the settling basin approach.

Dredge water treatment facility discharge standards must be realistic to make sediment removal possible. No impact carriage water treatment standards are often requested, but unrealistic goals. A sound understanding of mass removal goals in concert with reasonable carriage water treatment standards is necessary for the removal of sediment by hydraulic dredging methods.

HHS is experienced with the following carriage water treatment technologies:

- *Coagulant and flocculent additives*
- *Filtration methods*
- *Sedimentation techniques*
- *Adsorption*
- *Aeration*
- *Recessed chamber presses*
- *Belt filter presses*
- *Vibrating screen decks*
- *Mineral jigs*
- *Hydrocyclones*
- *Sand screws and spiral classifiers*
- *Fenton's reaction*
- *Ultraviolet oxidation*
- *Oil-water separation*

10.0 Designing Armoring and In-Situ Caps

For sediments located in areas of active erosion, capping with armor protection is a good way to reduce exposure and to prevent transport and redeposit of contaminated sediment. HHS is experienced with not only the methods for designing capping and armoring systems, but also the analysis of hydraulic changes that will result from the capping. HHS provides:

- *Selection of isolation cap material*
- *Selection of proper thickness of isolation cap*

- *Selection of armoring material and thickness*
- *Analysis of hydraulic impact from armoring*

11.0 Selecting Specialized Dredge Equipment

HHS personnel have worked in the production and the environmental dredging businesses. HHS is able to help in selecting or designing specialized equipment and in the application of the equipment to environmental projects.

12.0 Evaluating Sediment Treatment Technologies

HHS is experienced in application of treatment technologies for contaminated sediments. The simplest technologies often offer the most restoration for the dollar expended. Dewatering of the sediment reduces the weight for landfilling and for further treatment. Other technologies to reduce the concentration of chemicals of concern may be appropriate where the concentrations of the chemicals are high. However, most sediment restoration involves large volumes of sediment with low concentrations of the chemical of concern.

HHS is experienced with:

- *Thermal desorption*
- *Incineration*
- *Stabilization*
- *Solidification*
- *Sediment washing*
- *Sediment separation*
- *Consolidation*
- *Jigging*

13.0 Managing Remedial Dredging Projects

Environmental dredging requires constant attention to sediment control, water treatment, and removal objectives. All of these issues must be constantly monitored and controlled as conditions change in the operation. These management demands differ from production dredging where yards moved per hour is the predominant objective.

HHS knows the types of equipment available for sediment restoration projects. HHS understands the difference between sediment restoration work in small industrial lagoons and work in open bodies of water. HHS prepares cost estimates for sediment restoration based on estimates of the cost of input factors (labor, equipment, and expenses) to complete the work. Unit prices are not reliable in the estimating of environmental dredging as in more conventional earthwork or buildings.

Appendix A - Project Experience

Coal Pile Runoff Pond Expansion Project

In December of 2008 Hard Hat Services (HHS) was awarded a Coal Pile Runoff Pond expansion project for a utility company located in Central Iowa. The project scope included removal of runoff sediments from the pond bottom and side slopes (stockpiled on-site), flow diversion and control features installation, access road construction, and pond side slope restoration.

HHS's scope included:

- Installation, maintenance, and removal of all erosion and sediment migration control features.
- Removal of approximately 5,000 cubic yards of sediment and soils from the pond bottom and side slopes. The last 2-foot of cut was completed at, or below, ground water level. All removed material was staged and managed on-site.
- Two concrete flow diversion structures, and one discharge weir structure, were installed once removal activities were completed.
- Installed approximately 500-lf of pond berm access road (liner and rock).
- Pond side slope stabilization and restoration. This task included the installation of approximately 3,000 tons of 3-inch stone, 3,000 tons of Class A stone, and 300 tons of Rip Rap rock.
- Upon completion of the above activities, all stockpiled material was secured, disturbed areas were fine graded for drainage, and final mulching and seeding will be completed in the Spring of 2009.

Completing this work during the winter months presented some unique challenges. Even given those factors, this project was completed for the contracted amount, with only approximately 2 weeks of schedule lost to the extreme conditions.

Wisconsin River Sediment Removal Project

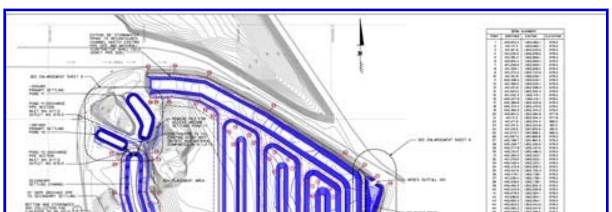
In July of 2008 Hard Hat Services (HHS) was awarded a contaminated sediment removal project on the Wisconsin River in Central Wisconsin. The project scope included removal of PAH contaminated sediment from the river, source removal activities on the river bank, sediment dewatering, water treatment, and river bottom and bank restoration.
HHS's scope included:

- Installation, maintenance, and removal of all turbidity and sediment migration control features.
- Construction and removal/restoration of a 50-ft. x 120-ft. sediment dewatering basin.
- Setup and operation of a water treatment facility, with final discharge back to the river. During completion of the work approximately 600,000 gals. of water was treated and discharged.
- Subaqueous sediment removal of approximately 3,500 ton of contaminated river sediment.
- Removal of approximately 800 tons of source material (from the river bank and adjacent shoreline).
- Dewatering (as necessary) of the removed sediments.
- Subaqueous sand capping in the removal areas – 6-inch sand layer of approximately 1,000 tons.
- Final river bank stabilization and restoration – approximately 320-lf.

This project was completed for the contracted amount, and was completed approximately 4 weeks ahead of schedule.

Ottumwa Generating Station Settling Pond Reconfiguration

The Alliant Energy generating station uses steam from coal fired boilers for power production, and pulls in water from the adjacent Des Moines River. HHS completed a Pond Maintenance Plan and investigation, which included a bathymetry survey, studying the various flows that were emptying into the settling pond, and sampling the pond sediment to determine how and where the solids were settling out. HHS was able to predict a lifespan for the existing pond based on the solids input, and design a solution to optimize the use of the settling pond to ensure present and future compliance with the NPDES permit.



The settling pond was redesigned to include three separate basins. There is a primary pond, where approximately 95% of the solids are removed. A secondary s-shaped settling basin was designed. By using an s-shape design in the space available, the water is flowing through a much longer path, allowing additional fine solids to drop out of suspension. The s-shape of the basin also allows for easy maintenance, making all the areas accessible for routine dredging. HHS also developed an innovative concrete ash collection basin to improve bottom ash handling, in order to reduce the amount of bottom ash filling the secondary basin. Water that flushes out ash from the boiler passes through the collection basin, where the ash drops out and can be easily removed before the water enters the settling basin.

Cassville Generating Station Coal Dredging

A generating station near Cassville, Wisconsin receives shipments of coal via Mississippi River hopper barges. During the movement from the barge to the hopper incidental amounts of coal may miss landing back in the hopper barge or in the conveyor hopper, falling in the water. This coal accumulated under the dock area so that full barges were unable to be staged against the dock mooring cell at the unloader.

HHS dreded the area immediately under the clamshell to an elevation similar to the surrounding riverbed. The dredge area was about 150ft long along the bank by 100ft wide (from the loader to the channel).

The project area was located near a known historical mussel bed that supports a diverse community of species, including a federally endangered mussel and species listed as rare in Wisconsin. HHS communicated with the U.S. Fish and Wildlife Service and the Wisconsin Department of Natural Resources to determine that a mussel survey of the site should be performed to determine potential impacts to the freshwater mussel resources.

After the mussel study was completed, HHS coordinated the fieldwork activities in order to minimize the delays to the client's coal unloading process. A barge was spudded adjacent to the area to facilitate dredging. A silt curtain was draped around the project area to keep suspended sediment from affecting habitat conditions downstream. HHS also engineered a solution to control incidental coal fallback into the River during future unloading of coal barges, a flexible chute that deflects the fallback into the hopper barge.

St. Louis River/Interlake/Duluth Tar Site

HHS was retained to provide project management services for this Response Action (RA) site is on the St. Louis River, approximately four river miles upstream of Lake Superior. The site includes approximately 255 acres of land and river embayments, wetlands, and shipping slips. The aquatic portion of the site is approximately 90 acres. Onsite sediments are contaminated with Polycyclic Aromatic Hydrocarbons (PAHs). The ROD requires a combination of dredging and in situ capping along with the construction of an underwater contained disposal facility. HHS is serving as the PRP representative on site during the RA, reporting directly to the Project Director, and coordinates efforts with other client project team members. HHS is also responsible for all project construction management services, which includes constructability reviews, prequalification and bid-phase services for RA Contractors, and on-site construction administration and man-

agement during the Response Actions. As project Construction Manager, HHS prepares overall project cost budgets, schedules, and scope documents to ensure proper coordination with Regulatory Agencies and. During RA activities, HHS is responsible for the daily oversight of the RA Contractors and reports on daily work progress. HHS also participates in construction management services as necessary during the Response Actions. The almost $60 million project is currently in the second year of a projected 4 year construction schedule (including restoration). As Project Managers, our objective is to control and mitigate our client's project-related risks and preserve their rights for cost recovery.

Lordship Gun Club

The Remington Arms Company operated a rod and gun club on the shore of Long Island near their Bridgeport, Connecticut manufacturing facility. During the operation of the Rod and Gun Club from 1926 to 1986, approximately 1500 tons of lead shot was discharged to the shore and water at the club. The State of Connecticut required the owner to develop a sediment restoration program to protect the waterfowl that feed in the waters off the Gun Club.

HHS personnel prepared a work plans and designs for the dredging of sediment containing lead shot, the processing of the sediment to remove the shot, and the backfilling of the sediment to restore the near-shore beach area. The design includes a procedure for determining the mass removal of lead shot to a statistically acceptable goal. The dredging, sediment processing, and backfilling will be a continuous process. HHS has also supported the owner in obtaining permits and was on-site during the spring and fall of 2000 to oversee the dredging and sediment restoration.

Mangere Waste Water Treatment Plant Expansion

The wastewater treatment plant for the city of Auckland, New Zealand was constructed in 1960 and uses a combination of primary settlement with secondary treatment in oxidation ponds constructed in former inter-tidal areas on the coast of Manukau Bay. Since 1960, the city of Auckland has grown out to the edge of the wastewater treatment plant. Because of the population pressures and the capacity limits of the treatment plant, the oxidation pond system is being removed in favor of an anaerobic sludge secondary treatment system.

HHS provided services to establish a performance specification for the removal of 2,000,000 cubic meters of oxidation pond sludge. The sludge is to be removed during the decommissioning of the 1,200 acres of ponds and prior to the ponds being reopened to the ocean. The project is being completed on a design/build basis with the work beginning in 1998.

In the summer of 1998, HHS provided testing of the oxidation pond sludge to determine the consolidation and dewatering characteristics of the sludge. The testing results were used to modify the operations to direct landfilling of the sludge after mechanically removing approximately 50% of the free water. The sludge will consolidate in the landfill as it is placed due to the weight of the overlying sludge.

Fox River Sediment Removal Project

The Fox River between Lake Oshkosh and Green Bay Wisconsin contains several paper mills. The mills recycled carbonless copy paper in the 1950's and 1960's. Recycling of the paper resulted in the release of some Polychlorinated Biphenyl (PCB) into the river. As part of the continuing efforts between the State of Wisconsin and the Paper Mills, a demonstration of sediment removal by hydraulic dredging was undertaken in 1999 to measure the environmental impact versus benefit of sediment removal.

HHS was part of a team for the remedial design and remedial action bid package preparation for the Demonstration Project. The demonstration, performed by others, remove approximately 20,000 cubic yards of PCB-containing sediment from the Lower Fox River in Green Bay, Wisconsin. HHS's responsibilities included developing and implementing a sediment sampling and bench-scale testing program to obtain data for the remedial design, designing a sediment removal, dewatering, and disposal demonstration program, and preparing contractor bid packages.

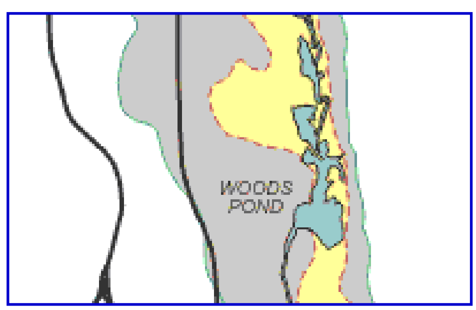
Sediment Removal from Creek

Surface water runoff from a manufacturing operation resulted in the transport of sediments into a stream. The State of Illinois is requiring the manufacturer to remove the impacted sediments at both his former operation and eventually from the stream.

HHS provided guidance on the methods for removing sediment from a 2-mile long section of the stream. The stream flows at an average rate of 16 cubic feet per second. The guidance on methods for removing the sediment was used by the client in developing a sampling and testing plan for the sediment.

Housatonic River

Polychlorinated Biphenyl (PCB) were used from the 1920's to 1970's in the manufacturer of transformers in Pittsfield, Massachusetts. Some of the PCBs ended up in sediments of a 26-acre lake adjacent to the manufacturing facility and the Housatonic River flowing south from Pittsfield. The river includes extensive backwaters and wetland areas and old mill pond dams which acted as sediment traps on the river. The State of Massachusetts required the



manufacturer to perform a RCRA facility investigation and corrective action assessment for the manufacturing site, adjacent lake, and downstream river.

HHS provided services for the preliminary assessment of corrective action measures for sediments in the 26-acre lake and the Housatonic River. The preliminary assessment included evaluation of sediment removal technologies, evaluation of in-situ sediment restoration technologies, siting issues for confined disposal facilities, evaluation of sediment treatment technologies, and the preliminary design of sediment capping.

102nd Street Landfill

The owners asked a contractor to remove the upper sediments in the Niagara River and place the sediments in an adjacent landfill. The sediments were in a cove area with shallow water. However, the sediment below the shallow sediment was very soft and similar to the sediment requiring removal.

HHS personnel designed a soil cofferdam to separate the shallow water cove from the main channel of the Niagara River. The cofferdam was designed to allow for settlement of the underlying soft sediment without risking overtopping of the cofferdam. The area inside the cofferdam was dewatered and the sediment was excavated using conventional construction equipment. The earth cofferdam design was more cost effective than steel sheet piling. Because of HHSs expertise in soil mechanics, the owners saved considerable expense on the project.

Waukegan Harbor

The Outboard Marine Company (OMC) operated an aluminum casting operation at Waukegan Harbor starting in the 1920's. During the 1950's and continuing up until 1976, OMC used Polychlorinated Biphenyl (PCB) as a coolant in the casting process. Some of the PCB was released through floor drains into Waukegan Harbor and an adjacent stream known as the crescent ditch. Most of the PCB mass remained in uniform fine sand at the point of discharge and above an impermeable clay layer approximately 25 feet below the water level of Lake Michigan.

HHS personnel were involved in this project starting in 1981 with the development of alternatives for removing and containing sediments with PCB concentrations greater than 50 ppm. The services on this project included technical support for litigation and latter negotiation support for a settlement with the regulatory agencies. The settlement included the negotiation of a reasonable mass based cleanup standard. After settlement with the agencies, HHS personnel were responsible for the design of confined disposal facilities, water treatment works, caps, and dredging equipment. The same HHS personnel managed the implementation of the sediment removal project including monitoring of sediment resuspension and dewatering of the dredged sediment.

Cannelton Industries
Heavy metals and aesthetically undesirable materials from a former tannery operation were found in the near shore sediments on Whitefish Bay just upstream of the Sault Ste. Marie ship locks. The initial planning by others was focused on sediment removal with landfilling on the former tannery site immediately adjacent to the town elementary school.

HHS personnel lead a successful effort to change the decision by the regulatory agencies from removal by dredging and placement in a confined disposal facility to an in-situ stabilization and capping remedy. The remedy included the partial removal of sediment, the placement of a clean capping layer, and stabilization of the area from the erosive forces of the St. Mary's river and ice flows. The remedy was implemented in the summer of 1999.

South Street
Portions of this 21-acre site were used from 1915 to the mid-1930's for the manufacture of woven asbestos products. Some materials from the operation were deposited on the site and on the banks of the Neponset River in Walpole, Massachusetts.

HHS personnel supported the negotiation of a remedy to enclose a section of the Neponset River in a large diameter oval culvert to prevent the further erosion of the river bank soil containing asbestos. HHS personnel designed a pumping system to temporarily bypass the river during sediment removal and installation of the culvert. The remainder of the site was capped and wetland areas along the bank were restored to their pre-industrial condition.

Grand Calumet River
The Grand Calumet River flows through a heavy industrial area in Northwest Indiana, and high concentrations of a large number of contaminants, including PCBS, volatile and semi-volatile organics, and metals, have been detected in the river sediment. HHS personnel have completed a number of the sediment investigation, technology assessment, and sediment removal study activities required for the 5-mile stretch of contaminated river. Work included:

- Performed sediment sampling, bench-scale sediment settleability and dewatering tests
- Provided sediment removal services
- Designed and constructed a unique test chamber to evaluate dredging air emissions
- Evaluated foundation conditions, earthwork requirements, and structural needs for river access ramps.

Torx

The owner wished to remove sediment from a small lagoon at a fastener manufacturing operation. The lagoon was in a sandy soil and located above the normal ground water level. The owner was certain that the removal should occur using a hydraulic dredge based on the recommendation of his consultant.

HHS developed a remediation approach for the removal of sediments using a cost effective dewater and excavate approach. The owner requested dredging of the pond and would have resulted in the total dewatering of the pond leaving the dredge sitting on solid ground. HHS designed a full-scale test to show that the pond would be totally dewatered by the dredge. After the test, the sediments were stabilized with lime and disposed of as special waste.

Ft. Edward

In 1973, the Fort Edward Dam on the Hudson River was removed by the dam's owner. The dam was installed in the 1820's to divert water into the Lake Champaign Canal. During the life of the dam, slab wood, sawdust, and sediment accumulated behind the dam. In the 1900's Polychlorinated Biphenyl (PCB) and heavy metals from upstream industries and sewer discharges accumulated in the sediment and sawdust behind the dam. On removal of the dam a part of the sediments were transported downstream and a large part of the sediment remained behind as remnant bank deposits. The site consisted of four separate remnant sediment deposits totaling approximately 50 acres.

HHS personnel supported the negotiations with the regulatory agencies to develop a remedial solution for the remnant deposits. The work included sampling and testing of the sediments to determine the storm flow suspension potential without remedial action. The testing also included the determination of the upper elevation limit for remedial action. Alternatives from no action to complete removal were examined and the risk of each assessed. The final remedy approved by the USEPA was capping with an armor protective layer to reduce the possibility of future suspension of the sediments during storm flow. HHS personnel were also involved in the management of the construction to install the cap and armor.

Bryant Mill Pond

The mill pond on Portage Creek in Kalamazoo, Michigan was filled with paper mill sludge in the 1950's and 1960's. The sludge contained Polychlorinated Biphenyl (PCB) from the recycling of carbonless copy paper at the adjacent Paper Mill. The site owner was proceeding towards a stream diversion with closure of the sediments in place under the authority of the Michigan Department of Natural Resources.

HHS personnel completed on-site field trials on the load support characteristics of the sediment for use in designing a cap. HHS personnel also provided an assessment of options for the diversion of the creek around the pond to allow for capping and closure of the sediments in-place. The creek diversion was complicated by the requirement to have the creek reenter its original channel at the mill pond dam.

Auto-Ion

A former City of Kalamazoo power plant was converted to a metal plating waste treatment facility about 1960. Cyanide metal plating wastes were pumped into the basement of the building and were neutralized by the addition of lime. The effluent was discharged to the Kalamazoo River through two subsurface intake and outlet tunnels that were originally the water intake and outlets for the power plant. The site's buildings, tanks, and the underground tunnels were contaminated with metal plating sludges.

HHS personnel designed and built a cofferdam to dewater the cooling water intake from the Kalamazoo River. After installing the cofferdam, sediments were removed from 200 feet of the intake pipe by vacuum suction. HHS also designed and installed reinforcing in the partially collapsed power plant to allow other contractors to safely enter and remove the aboveground contents of the building and tanks.