Remediation of Contaminated Sediment at the Unnamed Tributary to the Ottawa River

Summary Report
January 2000

Prepared for:

United States Environmental Protection Agency - Great Lakes National Program Office
Ohio Environmental Protection Agency
City of Toledo

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Executive Summary

This document summarizes the successful sediment investigation and remediation recently completed at the Unnamed Tributary to the Ottawa River located in Toledo, Ohio. As a result of several factors, including a cooperative partnership between government representatives and private industry, this site was successfully remediated in record time, culminating in the removal of more than 56,000 pounds of PCBs.

Investigating the Site

In December 1988, the Ohio Environmental Protection Agency (OEPA) initiated sediment sampling in the Ottawa River and an Unnamed Tributary in Toledo, Ohio. This initial round was followed up by two additional OEPA-led sampling events. During the investigations, polychlorinated biphenyls (PCBs) were reported in a number of sediment samples, ranging in concentration from 56 to 2,500 parts per million (ppm). The highest PCB concentration was reported in a sample collected from the Unnamed Tributary nearest a 96-inch storm sewer outfall that served as drainage for a number of nearby industrial facilities.

Although several potential sources were identified, the OEPA approached GenCorp, a former owner of one of the local industrial facilities — about remediation of the Unnamed Tributary. At the same time, a grant to remediate the site became available from the United States Environmental Protection Agency's Great Lakes National Program Office (USEPA's GLNPO). GenCorp subsequently entered into a partnership with the OEPA, USEPA's GLNPO, City of Toledo, and during the selection of a remedial alternative, the United States Fish and Wildlife Service.

Selecting the Site Remedy

After conducting two additional site assessments to further delineate the vertical and horizontal extent of PCBs, a Remedial Options Evaluation (ROE) Report (BBL, June 1997) was prepared, which identified the following potential technology types to address PCBs at the site: *No Action*, *Institutional Controls*, *In-Situ Technologies*, and *Ex-Situ Technologies*. Specific remedial options were assembled from each of these technology types and evaluated on the basis of the screening criteria presented by the USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, October 1988).

Based on a detailed and comparative analysis of the various alternatives, the ROE Report recommended implementation of the PCB mass removal option, which included:

- **Removal of ~97% of the PCB mass in the Unnamed Tributary sediments;**
- **Removal of the highest concentration of PCBs detected within soils of the low-lying area;**
- **Extension and rerouting of the existing storm sewer pipes into a newly-constructed storm water drainage channel;**
- **Hydraulic isolation of the Unnamed Tributary; and**
- **Placement of 5 to 15 feet of clean fill over residual sediments.**

Implementing the Site Remedy

Mobilization to the site began in January 1998 with remediation activities continuing though the end of June 1998. Sheetpiling and earthen berms were used to hydraulically isolate removal areas allowing excavations to proceed "in-the-dry." A total of 8,039 cubic yards of sediment and 1,653 cubic yards of soil were excavated and disposed off-site according to all applicable regulations. At the conclusion of site remediation, the area was backfilled, graded, and seeded with a variety of wetland species; sheetpiling was left in place at the former mouth of the Unnamed Tributary serving as a permanent hydraulic barrier. In all, it has been estimated that more than 56,000 pounds of PCBs were removed.

Seven key elements led to the successful and expeditious cleanup of this site, namely:

- **Well-defined scope;**
- **Award of the U.S. Environmental Protection Agency GLNPO grant;**
- **Formation of a partnership between government and private industry;**
- **Thorough site characterization;**
- **Flexibility and support afforded by the City of Toledo;**
- **Extensive site preparation; and**
- **Ideal site conditions.**

Introduction

This project summary serves as a source of general information regarding the investigation and successful remediation of contaminated sediment at the Unnamed Tributary to the Ottawa River in Toledo, Ohio. At the project onset, a partnership was formed between several government Agencies, City representatives and private industry to determine how to investigate and remediate sediment containing polychlorinated biphenyls (PCBs). By establishing an atmosphere of cooperation among the partners, with common goals and shared objectives, the site was remediated in less than two years.

This report outlines the process used at the Unnamed Tributary to successfully investigate and remediate contaminated sediment. Upon completion of the site remediation, approximately 16,000 tons of soil/sediment and 1 million gallons of water were treated and disposed. The following summary includes:

- **Brief synopsis of the site description and history;**
- **Characterization of site contaminants;**
- **Description of remediation alternatives considered (including the selected remedy), together with a discussion of the remedial action and current status of the site; and**
- **Review of the factors that contributed to the success of the project.**

Site Description & History

The site of the former Unnamed Tributary is located within the City of Toledo, Ohio, and is situated north of Interstate Highway 75, between LaGrange Street and Stickney Avenue (refer to Figure 1), approximately 6 miles upstream of Maumee Bay. Prior to remediation, this tributary was hydraulically connected to the Ottawa River. The Ottawa River flows into Maumee Bay in Lake Erie's Western Basin and is part of the Maumee River Area of Concern (AOC). Agricultural runoff, combined sewer overflows (CSOs), and contaminated sediments lead the list of pollution problems that have led to the lower Maumee River's designation as an AOC.

View of Unnamed Tributary looking north, before remediation.

Historically, the Unnamed Tributary was part of the Ottawa River's main channel. Sometime prior to 1940, however, the Ottawa River was straightened and rechannelized in this area and a portion of the abandoned river channel was filled. The remaining unfilled portion of the channel, left to convey storm water to the Ottawa River, was referred to as the Unnamed Tributary.

The Unnamed Tributary was bordered by a marshy, low-lying area to the west and high soil banks on the south and east. The mouth of the Unnamed Tributary (where it joins the Ottawa River) is approximately 90-feet wide. Proceeding upstream from the river confluence, the former Unnamed Tributary tapered towards the south for approximately 650 feet, and eventually turned towards the west for approximately 325 feet before ending as a narrow (approximately 10-foot wide) channel. Prior to remediation, three storm sewers (including 96-inch, 54-inch and 30-inch pipes) and a concrete drainage culvert discharged into the Unnamed Tributary in an area where the tributary turned from the south to the west. Two additional sewers (24-inch and 12-inch pipes) were also identified at the western end of the Unnamed Tributary.

In general, the former Unnamed Tributary flowed towards, and into, the Ottawa River. However, during periods of low flow when a strong wind was blowing from the east or the north, a reversal of flow, or a seiche, was noted. Under these conditions, water flowed upstream from Lake Erie, into the Ottawa River and the river's tributaries (including the former Unnamed Tributary).

GenCorp's involvement with this site stems from its former ownership of a 40-acre industrial site located approximately 1,000 feet east of the Unnamed Tributary. The industrial site included a 400,000-square-foot manufacturing plant and a three-story office building. GenCorp manufactured plastic coated fabrics such as vinyl upholstery used for car interiors and furniture covers. The industrial site is now operated by another company.

From 1967 to 1972, GenCorp reportedly utilized a PCB-containing oil as an internal heat exchange fluid in their manufacturing machinery. GenCorp's use of this oil reportedly ceased in 1972, when it was removed and replaced with non-PCB containing fluids.

Investigating the Site

In December 1988, the OEPA initiated sediment sampling within the Unnamed Tributary to determine whether PCBs were present in sediment near the outfall of a 96-inch storm sewer pipe. This initial round of sampling was followed by two additional OEPA-led sampling events conducted in August and September 1994.

In general, PCB concentrations in the sediments ranged from 56 to 2,500 parts per million (ppm), with the highest concentration reported in a sample collected near to the 96-inch storm sewer discharge. According to OEPA "no actionable levels" of other constituents, except PCBs, were identified.

Developing a Mechanism to Move Forward

Based on the results of these initial sampling activities, the OEPA approached GenCorp about remediation of the "very discretely bounded area.....confined to sediments in a 700 by 50-foot area" (OEPA, 1996). Although other potential PCB sources have been identified in the area, GenCorp agreed to initiate studies for remediation of the site.

GenCorp subsequently entered into a partnership with the City of Toledo, OEPA, USEPA/GLNPO, and during the selection of a remedial alternative, the Department of the Interior Fish and Wildlife Service. This partnership worked cooperatively throughout the entire investigation and remediation process, with periodic meetings held to promote that work activities conducted and reports prepared met the interests and approval of all parties involved. Funding sources for the Unnamed Tributary activities included:

- **$500,000 grant from the GLNPO for remedial activities at the site, following a joint request submittal by the GenCorp, OEPA, and the City of Toledo;**
- **$140,000 contributed for remedial activities through the State of Ohio; and**
- **Remainder of the funds to complete the investigation and remediation supplied by GenCorp.**

Additional Site Investigations

Assessing the Need . . .

At GenCorp's request, the parties agreed to let GenCorp conduct a thorough, but expedited investigation program to delineate the extent of PCBs and evaluate remedial alternatives in the Unnamed Tributary, provided that investigation activities did not prolong implementation of remedial measures at the site. As described later, timely and successful implementation of remedial measures occurred, consistent with the remedial design, due to the time/effort spent thoroughly characterizing the site at the beginning of the project.

Conducting the Site Investigation (SI) . . .

In December 1996, Blasland, Bouck and Lee, Inc.(BBL), on behalf of GenCorp, conducted an SI of the Unnamed Tributary. During the SI, sediment probing was conducted at 101 locations along 17 transects to determine the sediment depths and to calculate associated in-situ sediment volumes. Two different types of sediments were measured and recorded: soft sediments (i.e., sediments that were penetrated with a metal rod using little or no human force) and stiff sediments (i.e., sediments penetrated with a metal rod using reasonable human force). Approximately 10,500 cubic yards (cy) of sediments were present in the Unnamed Tributary, of which approximately 8,800 cy were considered soft sediments.

Based on visual observations and the sediment probing results, 28 sediment cores were collected from select locations within the Unnamed Tributary. The sediment cores generally were segmented into 2-foot depth intervals (where possible). A total of 104 sediment samples were collected from the 28 sediment cores and analyzed for PCBs, total organic carbon (TOC) and percent solids. PCB concentrations in these samples ranged from non-detect to 74,000 parts per million (ppm) with an average of 3,500 ppm. Approximately one-half of the sediment samples analyzed contained total PCBs at a concentration of 50 ppm or less, and less than 10% of the sediment samples analyzed contained PCBs greater than 10,000 ppm. In general, PCB concentrations in the sediments generally decreased to less than 5 ppm as the sediment core depths progressed downwards towards stiffer/underlying sediments. PCB analytical results for the sediments sampled and analyzed during the SI are presented on Figure 2.

Conducting the Supplemental Site Investigation (SSI) . . .

Based on the results of the SI, GenCorp requested that additional investigative activities be conducted in the low-lying area adjacent to the Unnamed Tributary to assess the potential presence and extent of PCBs in this area. The SSI was conducted by BBL during the week of February 22, 1997.

A total of 53 soil samples were collected from 19 locations within the low-lying area. The samples were collected along four transect lines previously established during the SI. It should be noted that not all of the samples collected were analyzed at the laboratory. Rather the analysis of specific sample increments was performed using a phased approach. Initially, 16 soil samples obtained from the sampling locations closest to the Unnamed Tributary were analyzed for PCBs, TOC and percent solids; all other samples were held at the laboratory. Based on the results of the initial round of analyses, three additional samples were selected and analyzed for PCBs, TOC and percent solids. These samples were selected based on relative PCB concentrations and trends noted during the first phase of analyses.

In summary, PCB concentrations in the low-lying area soil ranged from 0.30 ppm to 440 ppm, with a median concentration of 13 ppm. In general, PCB concentrations in the low-lying area soils decreased substantially as the soil samples progressed downwards (in depth) and away (west) from the Unnamed Tributary. The PCB analytical results for the low-lying soils sampled and analyzed are presented on Figure 2.

In addition to soil sampling and analyses, additional probing was conducted to the north of transect T-17 in the Unnamed Tributary to determine the extent/volume of sediment present between T-17 and the confluence of the Unnamed Tributary with the Ottawa River. Based on this probing, approximately 900 cy of soft sediments (in addition to the 8,800 cy found during the SI between transects T-1 and T-17) were identified.

Selecting the Site Remedy

Following completion of the investigative activities, a Remedial Options Evaluation (ROE) was performed to develop and evaluate potential remedial alternatives for the site. The 'remedial action objectives' agreed to by the partnership to address PCB-containing sediments at the site were:

- Reduce the potential for PCB movement from the Unnamed Tributary; and
- Minimize the potential for human and wildlife exposure to PCB-containing sediments in the Unnamed Tributary.

The potential technology types identified in the ROE Report, as well as the selected alternative, are discussed below.

Evaluating Potential Technology Types

Potential technology types were reviewed to evaluate the full range of potential remedial options. This review included an extensive literature search, a review of precedents set at similar remediated sites, and when appropriate, the incorporation of bench-scale studies. The following technology types were retained from this initial screening to undergo further analysis:

- **No Action;**
- ***U*** **Institutional Controls;**
- ***U*** **In-Situ Technologies; and**
- ***U*** **Ex-Situ Technologies.**

These technology types were evaluated on the basis of screening criteria required by both the USEPA and OEPA. These criteria include effectiveness, implementability, and relative cost.

No Action . . .

Consistent with the requirements of the National Contingency Plan (NCP), this technology type was retained as a baseline against which other remedial options may be compared. It assumes that no activities would be implemented to address the PCB-containing sediments in the Unnamed Tributary. In general, since no remedial activities would be conducted at the site, sediment transport from the Unnamed Tributary would still exist and the potential for human or wildlife exposure to the PCB-containing sediment would not be minimized. As a result, this option was not expected to meet the remedial action objectives for the site.

Institutional Controls . . .

Institutional controls generally consist of non-intrusive efforts focused on minimizing potential contact with PCB-containing sediment in the Unnamed Tributary. These controls could include site access restrictions (e.g., security fencing) and deed restrictions. However, because institutional controls would not treat, contain or remove any PCB-containing sediments, they alone would not achieve the remedial action objective of reducing the potential for PCB movement from the Unnamed Tributary.

In-Situ Technologies. . .

In-situ technology types identified during the initial evaluation as being potentially applicable for the Unnamed Tributary included capping and in-situ treatment. Although capping was retained for further analysis, in-situ treatment options such as solidification/stabilization (S/S), biodegradation and vitrification were screened out. Bench-scale studies indicated that, following several rounds of testing, a suitable in-situ S/S agent could not be identified for the site which would significantly reduce the leachability of PCBs in the Unnamed Tributary sediment. Furthermore, other in-situ treatment options such as biodegradation and vitrification also were not retained due to a lack of use and/or proven effectiveness for treating PCB-containing sediments in-place.

Ex-Situ Treatment . . .

Ex-situ treatment technology types considered during the initial screening process were separated into three general categories: sediment removal, sediment treatment, and sediment disposal. Sediment removal options included hydraulic, pneumatic and mechanical removal. Based on the limited water depth and presence of debris, it was determined that mechanical removal struck the best balance of the three initial evaluation criteria. With regards to sediment treatment, several treatment technologies were initially considered including biodegradation, chemical destruction, chemical extraction, thermal extraction, thermal destruction and soil washing. Based on the large space requirements to set up an ex-situ treatment operation, the prolonged time required for treatability testing and permitting, and the high cost to treat such a relatively small volume of material on-site, the ex-situ treatment technologies were screened from further consideration. In addition, due to cost and implementability issues, the only disposal option considered was placement of sediments in a chemical waste landfill permitted to accept PCB-containing materials greater than 50 ppm under the Toxic Substances Control Act (TSCA).

Based on the results of the initial technology screening, several remedial options were developed and retained for a more detailed evaluation. To implement any sediment remedial option in the Unnamed Tributary, it was determined by the partners that permanent rerouting of the storm sewers and hydraulic isolation of Unnamed Tributary would be necessary to eliminate concerns regarding transport of PCBs. The options developed for further evaluation were therefore considered in two phases:

1. Phase I, Activity #1- Storm Sewer Reroute

2. Phase I, Activity #2- Hydraulic Isolation of the Unnamed Tributary

With the exception of No Action, several Phase II remedial options were proposed, which, if implemented in conjunction with Phase I activities, would accomplish the remedial action objectives for the site. These options included:

3. Phase II, Option 1- No Action

4. Phase II, Option 2a- Dredging with Off-Site Landfill Disposal (PCB Mass Removal)

5. Phase II, Option 2b- Dredging with Off-Site Landfill Disposal (Complete Sediment Removal)

6. Phase II, Option 3- Dredging with Off-Site Disposal (Complete Removal) at a Permitted, Secure Landfill Specifically Constructed for the Unnamed Tributary Sediments

7. Phase II, Option 4- In-Place Capping

Each of these options was further evaluated in detail against an additional set of criteria, including:

- **Short-Term Effectiveness;**
- **Long-Term Effectiveness and Permanence;**
- **Reduction of Toxicity, Mobility, or Volume Through Treatment;**
- **Implementability;**
- **Compliance with state and federal regulations;**
- **Overall Protection of Human Health and the Environment; and**
- **Cost.**

Based upon a detailed and comparative analysis of the various alternatives, the ROE recommended that, along with both Phase I activities (i.e., Storm Sewer Reroute and Hydraulic Isolation), Option 2a (PCB Mass Removal) presented the best balance of the seven aforementioned evaluation criteria. This option is briefly described below.

PCB Mass Removal Alternative (Option 2a)

Remediation of the Unnamed Tributary Site would be implemented in two phases. As part of Phase I, existing storm sewer pipelines that drain into the Tributary would be extended and rerouted into a newly-constructed channel. This channel would flow away from the Unnamed Tributary (i.e., into the low-lying area), and ultimately drain directly into the Ottawa River. To facilitate this pipeline extension/reroute, approximately 2,000 in-situ cy of sediment (adjacent to the 96-inch, 54-inch and 30-inch storm sewer outfalls) containing the highest reported PCB concentrations would be removed, dewatered and disposed in an off-site permitted, secure landfill. The area from which sediment is removed would be backfilled with up to approximately 10 to 12 feet of material suitable

to support the new storm sewer pipes. In addition, Phase I activities also would consist of constructing a sheetpile dam at the mouth of the Unnamed Tributary, physically isolating it from the Ottawa River. Taken together, all Phase I activities would effectively eliminate the Unnamed Tributary from acting as any sort of surface water flow channel.

Phase II remedial activities would include the additional removal of PCB-containing materials from the remainder of the Unnamed Tributary and the adjacent low-lying area, with subsequent restoration/covering through the placement of clean fill. More specifically, this option would target to additionally remove approximately 4,500 in-situ cy of soft sediment.

Overall, this operation would target the reduction of the PCB mass present in the sediments by approximately 97%, and theoretically would leave behind (beneath 5 to 15 feet of clean fill) residual PCB levels in sediments of approximately 25 ppm.

In addition to sediment removal, approximately 1,800 cy of soil (up to a depth of approximately 1 foot) would be removed from the low-lying area and managed consistent with the excavated sediments. This activity would remove the highest concentration of PCBs detected within the low-lying area.

Following completion of the removal activities, confirmatory composite samples of both the soil and sediment would be collected to determine whether the sediment PCB cleanup goal of 50 ppm had been achieved, or if additional sediment removal was warranted. Following verification sampling, the Unnamed Tributary would be backfilled with clean fill to a final design grade, covering any residual materials with at least 5 feet of backfill. That portion of the low-lying area disturbed as part of the construction activities would be returned to original grade through placement of clean fill. The regrading of the site would be carried out such that all water is directed away from the location of the former Unnamed Tributary and towards the low-lying area. As a result, the Unnamed Tributary would essentially be removed as an aquatic habitat.

The implementation of Option 2a not only hydraulically isolates the Unnamed Tributary from the Ottawa River, but it also targets the removal of approximately 97% of the PCB mass (more than 56,000 lbs.) from the Tributary. This mass removal percentage is extremely significant. In addition to targeting the removal of this PCB mass, this option would also provide adequate protection against human/wildlife contact with any residual PCBs through the placement of 5 to 15 feet of clean fill over the excavated areas.

Following review and input, the Agencies (City of Toledo, USEPA, OEPA, and the Department of Interior Fish and Wildlife Service) concurred with the ROE, and asked that GenCorp move forward with implementation of the PCB Mass Removal Alternative (Option 2a).

Implementing the Site Remedy

After selecting and designing plans for the PCB Mass Removal Alternative (Option 2a) and receiving the proper approvals, GenCorp moved forward with implementing the selected remedy. Cooperatively working together, the team of agency personnel, GenCorp representatives, and technical specialists successfully completed the remedial activities. According to William J. Burkett, the Project Manager for the City of Toledo, "the team effort put forth during this project has been nothing short of inspiring." The following text provides a brief summary of the work tasks involved to implement the site remedy.

Contracting Mechanism and Selection

GenCorp was tasked with selecting a contracting mechanism and contractor(s) to perform the sediment remedial activities at the Unnamed Tributary. To successfully execute a remedial project of this magnitude, GenCorp recognized that ultimate control of the day-to-day operations must be handled by an on-site representative (i.e., owner or agent). GenCorp decided to contract the entire remediation (i.e., oversight, engineering and construction) through one firm. This contracting mechanism eliminated the more traditional owner-engineer-subcontractor "triangle" relationship (which exists when the on-site representative does not hold the contract with the subcontractor), which requires significantly more time/input from the owner, weakens the relationship between the on-site representative and the subcontractor, and eliminates the ability of the on-site representative to provide direction to the contractor. GenCorp attributes the success of the project, in part, to the contracting mechanism selected.

The Remediation Contract for the site was awarded to BBL Environmental Services (BBLES), while Sevenson Environmental Services, Inc (Sevenson) was selected as the prime subcontractor for all construction related activities.

Storm Water Drainage Channel Construction . . .

Mobilization to the site commenced in January 1998. In order to effectively navigate equipment into and out of the site, certain portions of the site were cleared/grubbed, temporary access roads were built, and an equipment/material staging area was constructed.

View looking west of the permanent storm water drainage channel.

Initiation of the drainage channel construction activities began in January 1998. To mobilize excavation equipment to the area along the proposed drainage channel, a temporary bridge was constructed across the Unnamed Tributary just north of transect T-8.

Once the temporary bridge was completed, the contractor prepared the site for excavation activities. As discussed previously, the potential for flooding at the site was particularly high due to the seiche events often experienced in the Ottawa River. Therefore, to minimize the potential for flooding to impact excavation activities, contingency measures, including the construction of temporary earthen berms, were taken at the site to hydraulically isolate the excavation areas.

The new storm water drainage channel was cut using conventional earth-moving equipment such as a bulldozer, modified backhoe, and off-road all-wheel drive hauling vehicles. Based on previous soil sampling conducted in 1997, soils excavated along the proposed drainage channel were either designated as "clean" and staged on site with other backfill materials, or disposed off-site as regulated materials.

Storm Sewer Reroute/Sediment Removal Activities . . .

Prior to extending the storm sewer pipes to the newly constructed drainage channel, storm water was temporarily diverted and sediment was removed from portions of the Unnamed Tributary where the piping was to be placed. Sediment removal was accomplished in a step-wise approach by first hydraulically isolating and dewatering specific sediment areas between transects T-1 and T-8, and then excavating sediment using modified backhoes capable of maneuvering within the sediment bed of the Unnamed Tributary. Once the pre-defined removal depths were achieved, post-confirmation PCB sampling and (where determined necessary) additional excavation were performed prior to backfilling.

Typical sediment removal operations from the Unnamed Tributary. Swamphoe (seen in sediment bed) excavates sediment and transfers it to the edge of the bank. Trackhoe removes the transferred sediment and loads it directly into off-road hauler to be transported to the stabilization pond.

Water infiltration to the excavation areas was easily controlled and the sediment effectively dewatered in place, allowing sediment removal to occur essentially "in-the-dry." Due to the absence of standing water, and the dense cohesive nature of the sediment and underlying clay, distinct layers of sediment were effectively removed with little/no recontamination of cleaner underlying material during removal.

Following implementation, the estimated sediment removal volume totaled 642 cy between transects T-1 and T-5, and 3,295 cy between transects T-5 and T-8. Upon completion, the final post-removal PCB sediment concentrations in the excavation and between transects T-1 and T-8 were reduced from concentrations ranging up to 74,000 ppm (pre-removal) to 4.6 ppm.

Sediment removal activities between transect T-8 and the permanent steel sheetpile dam installed at the mouth of the Unnamed Tributary were conducted in a step-wise approach, similar to removal of sediments between transects T-1 and T-8. Overall, approximately 4,102 cy were removed from transect T-8 to the permanent steel sheeting dam installed at the mouth of the Unnamed Tributary. Final post-removal PCB sediment concentrations in these excavation areas ranged from non-detect to 38 ppm, with an overall post-removal arithmetic average (entire Unnamed Tributary) reduced from approximately 3,500 ppm (pre-removal) to approximately 8 ppm.

Soil Removal Activities . . .

Soil was removed from the low-lying area using conventional earth moving equipment such as bulldozers and loaders. The low-lying area was dry and no water collection/control measures were necessary. Based on sampling conducted during site characterization, an estimated 1,800 cy of soil was proposed for removal.

Following implementation, the actual soil removal volume estimate totaled 1,653 cy for the low-lying area. Final post-removal PCB soil concentrations ranged from non-detect to 0.37 ppm.

Material Disposition . . .

In total, nearly 16,000 tons of material were properly characterized and disposed of off site in either a TSCA or Non-TSCA landfill. All soil and sediment removed from the Unnamed Tributary and the low-lying area was taken to the staging area for treatment prior to disposal. Initially, these materials were placed in a covered pile and allowed to gravity drain into a sump that was subsequently pumped through the on-site waste water treatment plant. Drained material was fed into a hopper and then directly into a pugmill. In the pugmill, the soil/sediment was mixed with sufficient pozzament to stabilize the material prior to off-site transport/disposal.

On-Site Wastewater Treatment . . .

Wastewater generated during the sediment remediation process was collected, treated on site, and discharged to the city's sanitary sewer system. A permit establishing discharge limitations and monitoring requirements was obtained from the City of Toledo. The temporary wastewater treatment plant accepted wastewaters from three major sources throughout the duration of this project:

- **Water generated during excavation/remediation activities in the Unnamed Tributary and drainage swale;**
- **Water captured in a sump at the staging area where materials were stockpiled prior to stabilization; and**
- **Decontamination water used for cleaning personnel and equipment prior to leaving the site.**

As wastewater was generated, it was initially pumped to an oil/water separator. A coagulant was added to the wastewater to promote oil separation and encourage settling of the suspended solids. Oil was skimmed off the top of the separator and the effluent overflowed into a pair of 50,000 gallon Influent Modutanks. Water was conveyed from the Modutanks, to a set of static mixers where a coagulant and polymer were added. These chemical additions facilitated further separation and removal of suspended solids. The solids were removed from the system via an Inclined Plate Clarifier (IPC). Water exiting the clarifier was passed through a series of bag, sand and activated media filters, to remove remaining particulates, oils and dissolved phase organic constituents, respectively. Finally, treated water was routed to an effluent tank, sampled, and discharged to the city sanitary sewer system.

In all, approximately one million gallons of water were treated, and nearly 20 tons of sludge were generated by the temporary wastewater treatment plant. At the conclusion of water treatment activities, the sludge, bag filters, and other filter media (e.g., sand, activated media) were disposed of as TSCA-regulated wastes.

Site Restoration . . .

The low-lying area and the east bank adjacent to the Unnamed Tributary are both owned by the City of Toledo. With the City's permission, soil (borrow material) from the east bank and portions of storm water drainage channel were sampled for use as backfill during site restoration. Results indicated that these materials contained less than 1 ppm PCBs, with the majority of samples reported as "non-detect."

Regrading of the disturbed portion of the low-lying area following remediation. View is looking north towards the permanent sheetpile dam and the Ottawa River.

Backfill materials were placed and compacted to regrade the site so rain water would drain away from the area of the former Unnamed Tributary, and (in conjunction with the permanent steel sheeting) hydraulically isolate the site from the Ottawa River. Finally topsoil was placed over the subbase, and the area was hydro-seeded with a variety of grasses and wetland species to encourage revegetation of the area. The final conditions of the site following restoration are shown on Figure 3.

Remedy Summary

The site investigation assessment and remedial activities have been successfully completed at the Unnamed Tributary Site. In fact, according to the Project Manager for the City of Toledo William J. Burkett, "The team effort put forth during this project has been nothing short of inspiring." The following is a summary of the mass/volume of material removed from the site.

Estimated Volume of Sediment Removed:		**8,038 cy**
Estimated Volume of Soil Removed:		**1,653 cy**
Total Material Removed:		**9,691 cy**
Mass of Sediment/Soil Disposed:		**15,856 tons**
Estimated Mass of PCBs Removed:		**56,782 lbs**
Arithmetic Average PCB Concentration	**Pre-Removal**	**3,500 ppm**
	Post-Removal	**8 ppm**

Keys to Success

As discussed in more detail below, seven key elements led to the successful and expeditious cleanup of this site, namely:

- Well-defined scope;
- Award of the USEPA GLNPO grant;
- Formation of a partnership between government and private industry;
- Thorough site characterization;
- Flexibility and support afforded by the City of Toledo;
- Extensive site preparation; and
- Ideal site conditions.

Well-Defined Scope

One incentive for GenCorp to participate was the clearly defined scope of their involvement, which was limited to remediation of the "very discretely bounded area...confined to sediments in a 700 by 50-foot area". In the course of delineating the extent of PCBs in the Unnamed Tributary sediments, GenCorp identified and voluntarily addressed both sediment and soil within the bounds of the "site", as originally defined. Due primarily to the relatively small volume and the high PCB concentrations of materials, agreements were reached early on that this would be a removal project.

Award of the GLNPO Grant

The award of a GLNPO grant to cover the "orphan's share" to partially fund the cleanup work was instrumental in creating an atmosphere of cooperation and common, shared objectives which lasted throughout the duration of the project. Although it represented a relatively small fraction of the total project cost, the grant award served as a catalyst to bring all of the affected parties together in a non-confrontational environment, and encouraged an open discussion of all available alternatives. This approach resulted in the site being characterized and remediated in less than 2 years.

Formation of the Partnership

At project onset, a partnership was established between the Agencies, the City of Toledo, and GenCorp**.** Meetings were held every few months to identify the interests of each party, discuss technical issues related to sediment investigation/remediation, and develop a strategic plan for moving forward. At the meetings, each organization was represented by senior staff members with a vast array of relevant knowledge and experience. With senior staff present, decisions that were fundamental to progress of the project could be made at the meetings, rather than deferred (e.g., recognition of the factors inherent with dredging and achieving aggressive cleanup criteria, when selecting a PCB cleanup goal, such as sediment mixing, resuspension, and redeposition). This was a key component to the project's success.

The sharing of information and timely review of submittals kept the project on track with an aggressive schedule, and resulted in a remedy that was acceptable to all parties. According to David A. Ulrich, acting USEPA Region V Administrator, "This was a remarkably quick cleanup that shows what can be accomplished when there is a spirit of cooperation."

Thorough Site Characterization

Upon review of available site data, the parties agreed to let GenCorp conduct an expedited investigation program to further characterize site conditions. The focused site characterization program was developed and implemented to:

- **Characterize the distribution of PCBs in the Unnamed Tributary sediment;**
- **Evaluate the potential for PCB movement from the Unnamed Tributary; and**
- **Assist in development and evaluation of remedial measures to address PCBs in the Unnamed Tributary sediment.**

The site characterization was effective in achieving these objectives. The distribution of PCBs in the Unnamed Tributary sediments and soil were thoroughly delineated through an iterative process of sediment probing and sampling. The sediment and soil remedial boundaries were established, based on the results of the site characterization data. Timely and successful implementation of remedial measures occurred (with no surprises during construction), consistent with the remedial design, due to the time/effort spent thoroughly characterizing the site at the beginning of the project. Full funding of the comprehensive site assessment by GenCorp, on a voluntary basis, was essential to timely development and implementation of the remedy and the necessary initial team-building effort.

Flexibility & Support Afforded by the City of Toledo

Flexibility and support provided by the City of Toledo was a key factor in the success of the project. The City of Toledo helped to facilitate the remediation process by granting property access to remediation areas, allowing the use of on-site borrow materials, and allowing reconfiguration of the property and the institution of deed restrictions.

Extensive Site Preparation

Before conducting sediment removal activities in the Unnamed Tributary, the following site preparation activities were implemented to minimize the potential for disturbance/release of sediment containing PCBs during removal:

- **Construction of large earthen berms, placed around sediment excavation areas to allow site dewatering and prevent flooding due to high river/seiche events;**
- **Construction of a pile-driven temporary bridge across the Unnamed Tributary;**
- **Construction of a new storm water drainage swale to re-direct flow from the storm sewer pipes to the Ottawa River;**
- **Temporary rerouting of the 94-inch, 54-inch, 30-inch and 12-inch storm sewer pipes (these activities were staged in phases, with sediment excavation activities); and**
- **Construction of a sediment/equipment staging area and set up of a pugmill and waste water treatment plant.**

In total, eight weeks were spent preparing the site for sediment excavation. The time and effort spent preparing the site was key to the smooth and uneventful removal of sediments from the Unnamed Tributary.

Ideal Site Conditions

Site conditions encountered during the sediment removal activities allowed the contractor to achieve low residual PCB concentrations without the need to significantly over excavate (in an attempt to achieve low residual PCB concentrations). Due to the absence of standing water and the dense cohesive nature of the sediments, a distinct layer of sediment was easily removed, with little/no recontamination of cleaner underlying material during removal. In addition, water infiltration to the excavation areas was easily controlled and the sediment effectively dewatered in place, allowing sediment removal to occur essentially "in-the-dry."

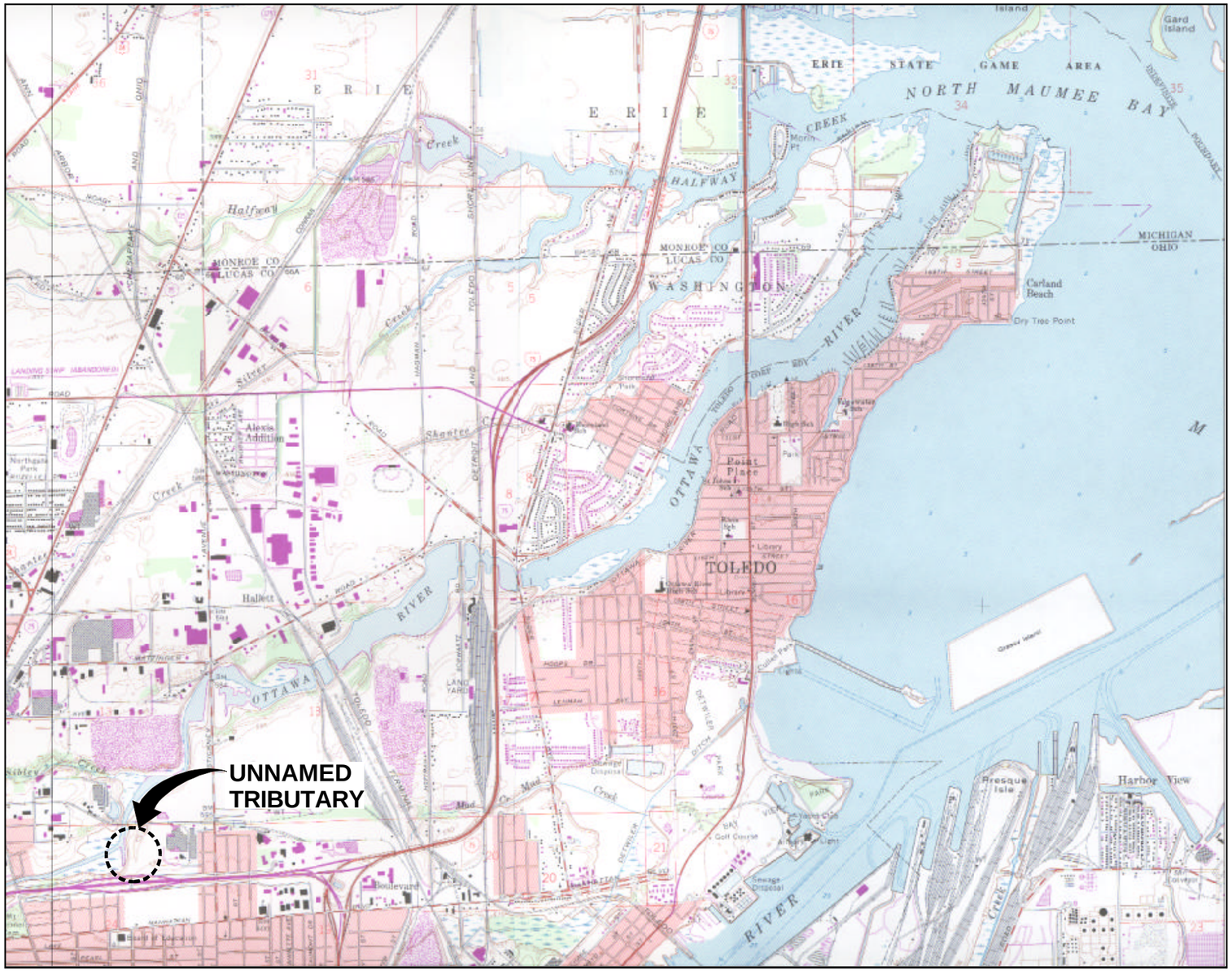
Conclusion

Overall, it was the site-specific culmination of these seven factors which resulted in a rapid and well-strategized clean up. Due to the dedication and commitment by GenCorp, OEPA, USEPA, the City of Toledo and the United States Fish and Wildlife Service personnel to expedite this project, all activities (investigation through remediation) were completed at the site in less than two years. The total cost for the project was approximately $5 million. This cost included conductance of the site investigation and remedial option evaluation activities, site remediation and restoration, and treatment/disposal of approximately 16,000 tons of soil/sediment and 1 million gallons of water.

For More Information . . .

Low-lying area looking north toward the Ottawa River several weeks after completing remedial activities.

Additional information on this project is available from Marc Tuchman, Sediment Team Leader, Great Lakes National Program Office, at (312) 353-1369 (e-mail: tuchman.marc@epamail.epa.gov).



REFERENCE: BASE MAP SOURCE USGS 7.5 MINUTE QUADS. SERIES TOLEDO, OHIO-MICHIGAN, OREGON, OHIO-MICHIGAN, 1965, PHOTOREVISED 1980.

3000' 0 3000'

Approximate Scale: 1" = 3000'

AREA LOCATION

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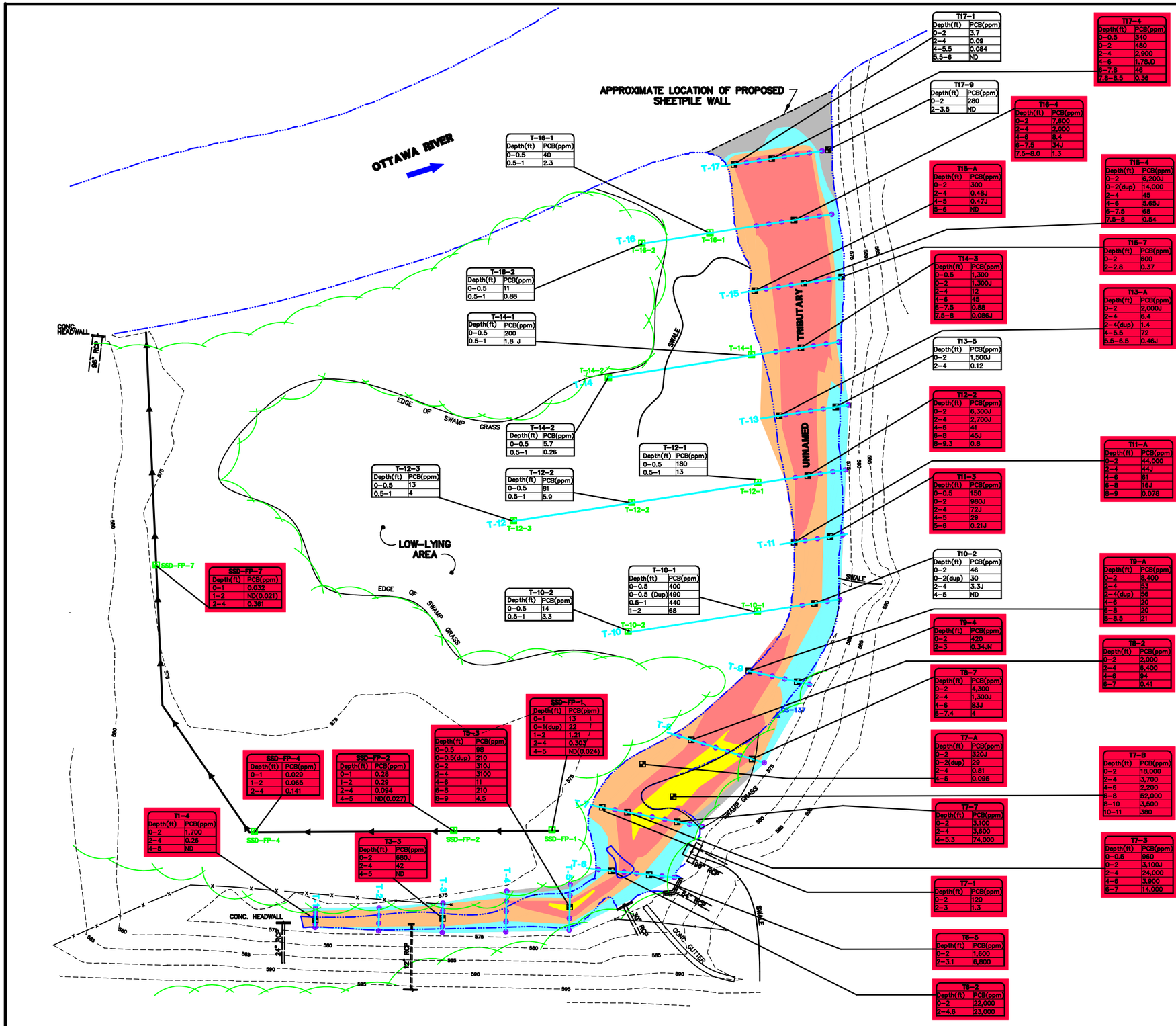
SITE LOCATION

FIGURE
1



LEGEND:

- EDGE OF WOODS
- EDGE OF WATER
- T-11 TRANSECT
- SEDIMENT SAMPLE/PROBE LOCATION (DEC. 1996)
- CS-137 GEOCHRONOLOGIC SEDIMENT CORE LOCATION (APPROXIMATE)
- SEDIMENT PROBE LOCATION (DEC. 1996)
- T-12-3 SOIL SAMPLE LOCATION (1997)
- CHAIN LINK FENCE
- PROPOSED DRAINAGE CHANNEL
- T15-7 Depth(ft) PCB(ppm) 0–2 600 2–2.8 0.37 SEDIMENT/SOIL CORE ID

ND	NON–DETECT
N	TENTATIVELY IDENTIFIED COMPOUND
J	ESTIMATED VALUE
D	DILUTED SAMPLE
PCB	POLYCHLORINATED BIPHENYLS (TOTAL)
ppm	PARTS PER MILLION
dup	DUPLICATE SAMPLE RESULT

- 0–2' SOFT SEDIMENT DEPTH
- 2'–4' SOFT SEDIMENT DEPTH
- 4'–6' SOFT SEDIMENT DEPTH
- 6'–8' SOFT SEDIMENT DEPTH
- 8'–9' SOFT SEDIMENT DEPTH

NOTES:

1. ELEVATIONS BASED ON NAVD 1988.
2. FIELD SURVEY COMPLETED BY BBL ON NOV. 11, 1996.
3. SEDIMENT SAMPLE LOCATIONS T7–A, T7–B, T11–A, T13–A, T15–A, AND T17–9 WERE NOT PROBED PRIOR TO SAMPLING.
4. DATA PRESENTED ON THIS FIGURE HAVE BEEN VALIDATED.
5. ALTHOUGH NOT PRESENTED, SEDIMENT DEPTHS BETWEEN TRANSECT T17 AND THE PROPOSED EARTHEN BERM DAM ARE ASSUMED TO AVERAGE 3.5 FEET.

0 40' 80'
APPROXIMATE SCALE

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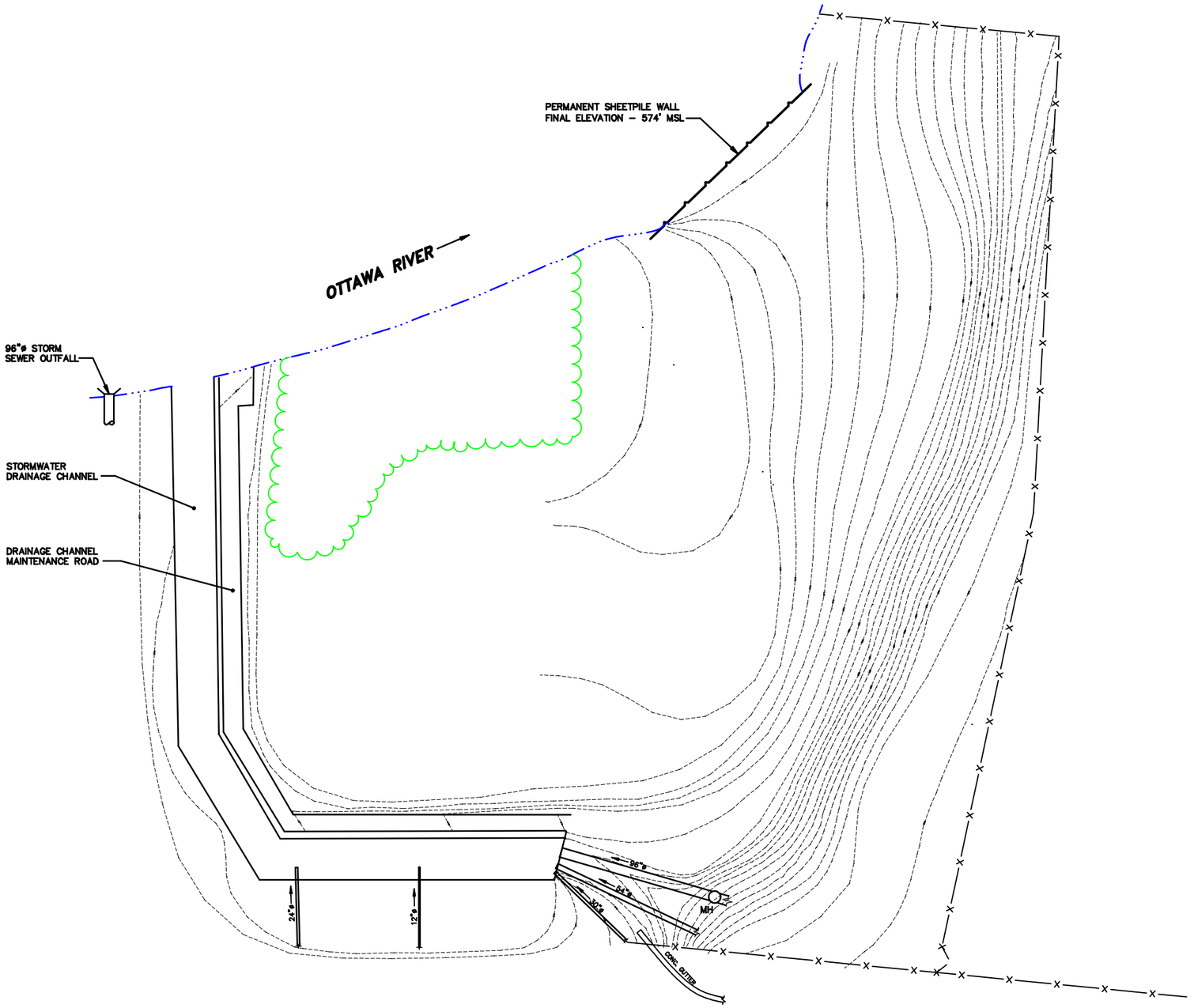
PRE-REMEDIATION SOIL/SEDIMENT PCB DATA

FIGURE 2



LEGEND

- EXISTING EDGE OF WOODS
- EDGE OF WATER
- PERMANENT SHEETPILE WALL
- 30"ø NEW EXTENDED STORMWATER DRAINAGE PIPE
- CHAIN LINK FENCE

NOTE:

1. THE TOPOGRAPHICAL CONTOURS AND LOCATION OF THE NEWLY INSTALLED FENCING HAVE BEEN PROVIDED BY SEVENSON ENVIRONMENTAL SERVICES, INC. IN FIGURE DATED 7/16/98. (SEE APPENDIX D).
2. THE LOCATION OF THE "EDGE OF WOODS" HAS BEEN APPROXIMATED FROM AERIAL PHOTOGRAPHS OF THE SITE TAKEN 8/26/98.

0 50' 100'
GRAPHIC SCALE

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FINAL SITE GRADING PLAN

3