Project Work Plan

Mahoning River, OH

Sediment and Bank Sampling, Characterization and Distribution Study

Prepared for:

U.S. Army Corps of Engineers
Pittsburgh District
DACW59-02-D-0005
Delivery Order No. 0002

Prepared by:

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June 2003

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Table of Contents

Tables

Figures

List of Appendices

1.0 Project Introduction

This Project Work Plan (PWP) was prepared by Altech Environmental Services, Inc. (Altech) for the US Army Corps of Engineers (USACE) Pittsburgh District (CELRP) to support a feasibility study for aquatic ecosystem restoration of the Mahoning River in Ohio.

1.1 Project Size and Location

The project encompasses nearly 35-miles of the Mahoning River in Ohio, with the town of Leavittsburg near the upstream end of the project. From there, the river flows east through Warren, Youngstown and Lowellville to the Pennsylvania state line. Figure 1, the Project Vicinity Map, depicts the general location of the project relative to Pittsburgh, PA and Cleveland, OH. Figure 2 is a closer view depicting the cities, towns and major roadways in the vicinity of the subject reach.

1.2 Ownership History

Property ownership history is described in a document by Leanne Turner, 2002, published through a grant from the US EPA to the Mahoning River Education Project, a partnership between Youngstown State University and the Mahoning River Consortium. The following is an excerpt from the document, which explicitly addresses Mahoning River property ownership.

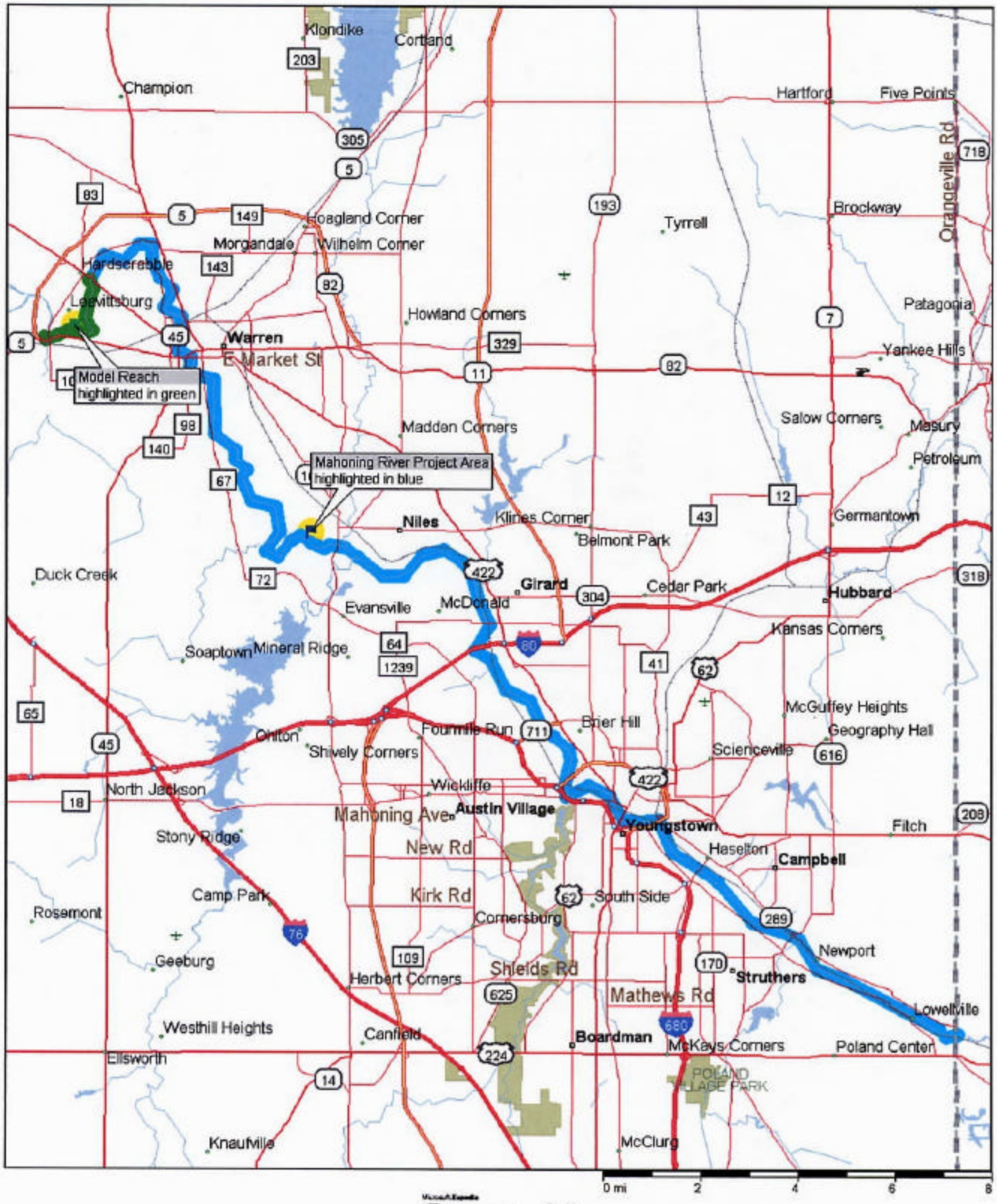
Figure 1 - Project Vicinity Map

Mahoning River, Ohio

Streets98

Figure 2- Project Location Map

Mahoning River, Ohio



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"The state of Ohio holds in trust the water that flows in the Mahoning River and its streams. This is referred to as the "public trust doctrine." The land beneath the flowing water and out to middle of the river belongs to the riparian property owner—the person, company or municipality that owns the land along the river. The quality of the water is regulated by the Ohio & US Environmental Protection Agencies, and the level of the Mahoning River is regulated by the US Army Corps of Engineers who decide how much water is let out of the reservoirs and into the river."

1.3 Project Authority

The authority for the Feasibility Study was detailed in the Project Study Plan as follows:

"This study was initiated pursuant to the provision of funds under the 1998 Energy and Water Development Appropriations Act. The Feasibility Study is being conducted under the authority of Section 312(b) of the Water Resources Development Act (WRDA) of 1990 as amended by Section 205 of the Water Resources Development Act of 1996 and Section 224 of WRDA 1999. This authority reads as follows:

> *IN GENERAL - The Secretary may remove and remediate contaminated sediment from the navigable waters of the United States for the purpose of environmental enhancement and water quality improvement if such removal and remediation is requested by a non-Federal sponsor and the sponsor agrees to pay 35 percent of the cost of such removal and remediation."*
>
> *"DISPOSAL COSTS - Costs of disposal of contaminated sediments removed under this section shall be shared as a cost of construction."*

1.4 Purpose and Scope of the Work Plan

The Altech component of the project includes planning, implementation and reporting the results of an investigation that includes sampling of sediment and soils, chemical and geotechnical testing. This PWP is intended to guide accomplishment of the nine tasks specified in the Altech statement of work. The nine tasks are listed below. A detailed description of each is provided in the statement of work under contract DACW59-02-D-0007, Delivery Order No. 2 between CELRP and Altech (Appendix E).

- Task 1 - Project Plans
- Task 2 - Field Sampling
- Task 3 - Investigation Derived Waste
- Task 4 - Geotechnical and Chemical Laboratory Analyses
- Task 5 - Organization of Data
- Task 6 - Depict Subsurface Conditions
- Task 7 - Develop X-Sections and Profiles of Subsurface Conditions
- Task 8 - Summary Report
- Task 9 - Meetings

The PWP is supplemented by five project specific Appendices:

- A project specific Quality Control Plan (QCP);
- A Sampling and Analysis Plan (SAP), which includes a Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP);
- A Site Safety and Health Plan (SSHP); and
- Altech's internal QC (Independent Technical Review - ITR) and CELRP Quality Assurance (QA) review comments, responses and resolutions.
- Project Statement of Work

1.5 Project Organization and Responsibilities

The project organization, responsibilities and schedule of tasks and deliverable products are described in the Appendix A, the QCP. Altech has the responsibility for:

- Preparing the Project Work Plan;
- Collection, custody and delivery of properly packaged and transported samples to the laboratory;
- Performing laboratory analyses by way of a USACE validated laboratory;
- Reviewing and presenting all raw data,
- Validating data, compiling and formatting complete summary data tables of all analyses results;
- Proper disposition of Investigation Derived Waste;
- Evaluating and interpreting subsurface conditions and chemical and geotechnical data and depicting in subsurface logs and transect cross-sections; and
- Producing a comprehensive Summary Report.

As further detailed in Appendix A, three subcontract firms are contributing to the Altech component of the project. Coleman Engineering Company (CEC) is providing field sampling support, and General Physics Laboratories (GPL) and DLZ National Laboratories (DLZ) are providing chemical and geotechnical laboratory services, respectively.

2.0 Site Description and History

2.1 Geology

USGS mapping and published geologic data indicates that the Mahoning River is located in the glaciated Allegheny Plateau Physiographic Region. The Mahoning River in the subject reach is entrenched in Lower Mississippian Age shales and sandstones of the Cuyahoga, Berea and Bedford Formations. Younger Pennsylvanian Age rock of the Pottsville and Allegheny Groups overly these formations.

USGS Quadrangle maps indicate that the Cuyahoga formation underlies most of the subject reach of the Mahoning River. The Cuyahoga formation is comprised of the Orangeville Shale Member, Sharpsville Sandstone Member and, in part, the Meadville Shale Member. The contact between the Cuyhoga and the underlying Berea Sandstone and Bedford Shale Formations is mapped nearly coincident with the Mahoning River from Perkins Park in Warren, Ohio to a point nearly four miles downstream, approximately 1.5 miles to the west of Niles, OH. The Berea Sandstone and Bedford Shale Formations are undifferentiated on the USGS mapping.

Beginning in the vicinity of Girard, OH, Pennsylvainian Age rock of the Allegheny and Pottsville Groups overlies the Cuyahoga Formation along the walls of the Mahoning River Valley. Below Girard, the aerial extent of the Cuyahoga Formation necks down to a progressively narrow strip that barely extends beyond the banks of the river.

2.2 Topography

The Mahoning River begins in Ohio near Winona in Columbiana County and flows through five counties of eastern Ohio. It joins the Shenango River in western Pennsylvania to form the Beaver River, which flows into the Ohio River. The upper portion of the Mahoning River, between Alliance and Leavittsburg, Ohio is typically rural. However, the Mahoning River from northwest of Warren, Ohio to Lowellville, Ohio (almost to the State Line with Pennsylvania) is heavily urbanized and industrialized.

Figures B-2 through B-13 depict the site topography in the vicinity of the Mahoning River through the entire length of the area to be investigated from upstream to downstream end at a scale of one inch equal 800 feet. The normal low flow elevation of the Mahoning River at the downstream end of the project is approximately 790 feet above Mean Sea Level (MSL). The top of dam elevation near the upstream end of the area of investigation at the Leavittsburg Leavitt Road Dam is 881 feet MSL.

In the upstream areas of the project, the Mahoning River Valley is relatively broad. As the river travels eastward, the valley narrows. Very steep valley walls rising more than 400 feet above the river elevation constrain the river as it flows into Pennsylvania.

2.3 Site Conditions and History

The Mahoning River Valley from Warren, Ohio downstream to near the Pennsylvania state line became intensely industrialized from the late 1800s through the 1970s and remains mostly urbanized. During this time, a series of dams were built along the river

and along tributaries upstream in the watershed, which altered the natural river hydraulics. Generally, the dams on the river in the subject reach were low head dams associated with support of production operations at adjacent steel mill or other industrial facilities. Larger dams upstream in the watershed control most flow into the Mahoning River. These include the Berlin Reservoir on the Mahoning River and the Michael J. Kirwin Reservoir and Mosquito Creek Lake on tributaries to the Mahoning River.

According to information attributed to Carol Trube at the Mahoning River Watershed Project website:

"The Mahoning River was polluted during the nineteenth and twentieth centuries by two major sources: the steel industries and the human population (the lack of waste water treatment plants alongside the Mahoning River until the 1960s also contributed to the river's pollution; until 1965, raw sewage from homes and businesses went directly into the river).

The industrialized Mahoning River is the section of the waterway that was used by steel mills and factories. It includes approximately 30 miles of the river—starting just west of Warren in Leavittsburg and continuing southeast to Lowellville, Ohio at the border of Pennsylvania. There are 10 low-head dams in this area of the river. These dams were built by the steel industries to increase the amount of water in front of each mill complex in order use it to cool the hot steel and machinery (that water, which after being used was often 100 degrees and filled with chemicals, was poured directly back into the river). Over decades of this practice, most of the toxins from the steel mills were washed downstream to the Beaver and Ohio Rivers, while some of the toxic sediments settled on the bottom of the Mahoning River and accumulated in large amounts behind these low-head dams."

3.0 Previous Investigations

There have been numerous previous investigations and studies related to the impaired environmental condition of the Mahoning River. Two of the most recent and relevant investigations are briefly summarized below. Each of these documents provided

references to numerous other relevant investigations and data regarding the environmental conditions in and along the Mahoning River.

The Ohio EPA published a report in May 1996 titled, "Biological and Water Quality Study of the Mahoning River Basin." This comprehensive investigation included collection of samples and analyses for water chemistry and bacteria, sediment chemistry and biota, and fish, including tissue analysis. The study included a review and comparison of recent data to the results of several previous investigations as far back as 1976. It also included a thorough account of relevant point source discharges regulated under National Pollution Discharge Elimination System (NPDES) permit and the associated data. The report concluded that detectable improvements in water chemistry and the overall performance of biological communities have occurred. However, it also concluded that there is no indication that the river sediment is any less contaminated than in previous investigations.

The most recent relevant study was the, "Mahoning River Environmental Dredging Reconnaissance Study, Trumbull and Mahoning Counties" prepared by CELRP in 1998. A supplement was also prepared by CELRP to this report, titled, "Results of Supplemental River Bank Sediment Sampling Conducted on 14, 17 and 18 September 1998 along the Mahoning River, Ohio."

The data and observations from the Reconnaissance Study and supplement indicated that soft, oily, black soil (sediment and depositional material) with a pudding like consistency appears to be located beneath the river and in bank soils throughout much of the subject

reach, especially behind each dam. The occurrence of this soft, oily, black soil material was associated with very fine grained sands, silt and clay deposits and very high levels of Total Recoverable Petroleum Hydrocarbon (TRPH) compounds. There was a strong correlation between the presence of high concentrations of TRPH and the presence of a variety of other potentially toxic chemical contaminants, including a variety of PAHs, PCBs and heavy metals. Another significant finding from the previous investigations was that most areas where contaminated river bank sediments were observed, they are overlain by a veneer of cleaner, denser bank sediments, sometimes up to a couple of feet thick. However, little to no veneer or "cap" of cleaner sediment was observed overlying in river sediments in the precious investigations. Reportedly, stiff clay was typically found below the soft, oily black muck.

Table 1 below is an excerpt from the CELRP Supplemental Investigation Report that provides a summary of the chemical analysis results of these two previous investigations. The table clearly indicates the correlation of the visual observations that significantly higher concentrations of target analytes were found in the soft, oily black muck materials than in the soils found above or below them along the banks of the Mahoning River.

The results of the Reconnaissance Study and the Ohio EPA study were used to establish remedial action objectives for the aquatic restoration project. The process of establishing the restoration objective included consultation and coordination with a steering committee, which included the U.S. Fish and Wildlife Service (USFWS), the OEPA, Ohio Department of Natural Resources - Division of Fish and Wildlife (ODNR-FWS), and ERCOG. Specifically, these objectives are:

Table 1 - Summary of Previous Investigation Results

Mean Distribution of Primary Contaminants Within Various Strata of the Lower Mahoning River Bank Samples Collected in July and September of 1998 Compared to an Upstream Control Station (From USACE 1998 - "Results of Supplemental River Bank Sediment Sampling Conucted on 14, 17, and 18 September 1998 along the Mahoning River, Ohio"

Parameter	Upstream Control Station in Leavittsburg	Mean Values for Specific Types of Sampels at All Stations in the Degraded Reach of the Lower Mahoning River			
		Core Samples Taken @ Ordinary High Water Elevation	Core Samples of "Clean" Cap Over Sediments	Core Samples of Black Pudding Consistency & Muck Covered Sands	Deep Layers Beneath the Puddings & Black Sand
TRPH/Oil &Grease (mg/kg)	244 SF <137 OHW	245 n=2	738 n=10	16,937 n=17	789 n=7
Total PCBs (ug/g)	<0.069 SF <0.069 OHW	0.139 n=2	0.396 n=3	8.24 n=9 (without 1 high sample (45.7), 3.56, n=8)	<0.069 n=1
Chromium (mg/kg)	68 SF 25 OHW	148 n=2	128 n=3	495 n=10	21 n=1
Lead (mg/kg)	46 SF 117 OHW	92 n=2	119 n=4	438 n=10	15 n=1
Zinc (mg/kg)	131 SF 227 OHW	371 n=2	538 n=2	1,710 n=10	87 n=1

1. SF - Core Samples collected at the river's edge.
2. OHW - Core sampes collected at the Ordinary High Water elevation
3. N - Number of samples in set.

> *"Restore the aquatic ecosystem and biotic integrity of the Mahoning River within the project area to a level existing on a model reach on the Mahoning River just upstream of the project area and to eliminate the Ohio Department of Health Human Health Advisory currently in effect."*

The "model reach" is defined as a baseline condition where the Mahoning River meets the OEPA warm water habitat (WWH) conditions. The model reach is just upstream of where the degradation begins and is specifically defined as the reach of the Mahoning River between Warren, Ohio at r.m. 44.0 and r.m. 46.2, just upstream of the Leavittsburg Leavitt Street Dam. The objective is to achieve an equal or better state throughout the degraded reach in the lower portion of the river.

4.0 Project Objectives

The purpose of the study is to investigate the feasibility and the extent of Federal interest in restoring the aquatic ecosystem and biotic integrity of the Mahoning River and removal of the Human Health Advisories in Trumbull and Mahoning Counties, Ohio. The primary objectives of the Mahoning River Sediment Characterization component of the Feasibility Study are to determine the horizontal and vertical distribution and degree of contaminated in-river and bank sediments. This requires representative chemical and geotechnical data to accurately characterize conditions in the model reach, which includes both pooled and free flowing areas and representative chemical and geotechnical data to accurately characterize conditions in both pooled and free flowing areas of the subject reach, which extends downstream of the model reach at r.m. 44.0 to the Pennsylvania state line.

The combined chemical and geotechnical data are intended to support screening of remedial action alternatives, which could include one or more of the following components:

- Dredging from the river,
- Excavation from the banks,
- In-situ bioremediation of river sediment and bank soils,
- Capping, encapsulating or stabilizing contaminated material,
- Dredge sediment staging and dewatering, and
- Transport, storage and/or and placement of contaminated material in upland repositories and/or regulated waste treatment and disposal facilities.

Geotechnical data is needed as a basis for evaluating viable remedial action alternatives, particularly for evaluation of dredged material disposal options and potential environmental impacts related to dredging of contaminated sediment. In addition geotechnical data will be used to separate the data into subsets to evaluate potential correlations with chemical data.

5.0 Data Gaps

The previous Ohio EPA and CELRP studies identified a variety of chemical contaminants throughout the study area. The primary data gap was the sparseness of sampling relative to the total length of the project.

Data collected from more locations is needed to characterize the vertical and horizontal distribution of contaminated materials to provide an appropriate basis for estimating potential dredging quantities and chemical concentrations. Analyses have been performed for the Toxic Characteristic Leaching Procedure (TCLP), but only from discrete core samples. Composite samples representative of the materials across the entire transect are scheduled for TCLP analyses to represent the entire transect. The previous data did not include testing of sediments for potential radioactive contaminants or hexavalent chromium. Although there is no previous data indicating a concern for these two specific types of contaminants, the parameters were suggested by proponents of the project, and they were selected to improve the comprehensiveness of the investigation.

6.0 Data Quality Objectives

CELRP developed a sample design for the sediment characterization based on a variety of qualitative and quantitative technical considerations, and it included direct input from USEPA, Ohio EPA, ERCOG and others. Final transect locations were based on site reconnaissance by Altech and CELRP personnel, and the final number of scheduled samples and chemical analyses were selected to maximize the utility of the chemical data within the pre-established budget. Table B-1 is a comprehensive summary of the selected sampling and analyses. Table B-2 provides a detailed, line-by-line, account of every boring, sample and chemical and geotechnical analysis scheduled for the project. Tables B-5 and B-6 summarize the project specific Data Quality Objective criteria.

The primary data quality objective is to produce the quantity and quality of chemical and geotechnical data specified in the Sampling and Analysis Plan. Because the project area is so large, (inclusive of 31 miles of river with 10 low head dams), subsets of the data by dam pool are needed. Each subset of data must accurately characterize in-river and bank material located below the Ordinary High Water Line for free flowing and pooled reaches, throughout both the "model reach" and the subject reach. Table B-1 includes a column with a "P" or "F" designation at each of the 87 scheduled sampling transects to delineate flow conditions.

The object of the sampling and analyses downstream of the "model reach" is to determine the location of sediments where chemical contaminants exist at concentrations higher than those found in the "model reach." The data must be sufficient to develop cross sectional depictions of subsurface conditions and provide a basis for quantity estimates of the volume of sediment downstream of the "model reach" requiring remediation to achieve conditions comparable to upstream.

7.0 References

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