April 23, 2003

Mr. Terry E. Goodwald
Project Officer
Pennsylvania Department of Environmental Protection
Field Operations-Environmental Cleanup Program
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222-4745

Subject: **Preliminary Systematic Plan**

Dear Terry:

Enclosed please find the supporting documents comprising a Statement of Work for the Marino Brothers Scrap Yard site (the Site), Rochester, Pennsylvania. They were developed through the U.S. Environmental Protection Agency=s (EPA) Technology Innovation Office (TIO) Brownfields Technology Support Center (BTSC). The Statement of Work is designed to support Pennsylvania Department of Environmental Protection Agency=s (PADEP=s) efforts to develop a cost effective remedial cleanup strategy for the site. Through our BTSC, we agreed to conduct a systematic planning process at the Marino site to help you understand <u>and</u> to help us showcase our ATriad@ approach (elements described below) to streamline site cleanups through better characterization and monitoring approaches.

Please note that these materials are not marked as Apreliminary.@ The documents that make up the Statement of Work have been reviewed and revised to the degree possible by the BTSC and they are now ready for your review and modification. The documents are intended to guide you as you work with experts within your agency and with your consultants to tailor an appropriate and protective approach for your site. The materials are still preliminary only in that additional details will need to be inserted by PADEP to tailor the approach to meet specific project procurement requirements. As more is learned about the site section of the Statement of Work, such as the specifications will need to be modified on part by the Contractor(s) performing the work. In addition, you may find it necessary to refine some of the documents according to your more detailed understanding of PADEP regulatory requirements and needs.

The work products are intended to help you and your Contractor(s) develop a strategy for applying the Triad approach to guide a focused removal at the Marino site. We initially presented this information to PADEP in our meeting on November 21, 2002. We forwarded a draft to you a few months ago as we were making a few additional revisions before sending you this final product. The primary differences in this document and the draft relates to the method for establishing decision criteria as it pertains to sampling and analysis during the methods applicability study and the monitoring and measurement activities (Task 1) supporting a removal. Placement of any waste onsite is not covered by the materials provided.

The BTSC appreciates this opportunity to collaborate with PADEP in employing a model approach to site characterization and remediation using a formalized process of systematic planning, a dynamic work plan strategy, and real-time measurement technologies (the Triad). We want to continue to work with you to track progress at the site and to create training materials to encourage the broader application of these approaches at other sites managed by PADEP as well as other organizations involved in site reuse and land recycling. As I stated in our May 2002 transmittal, our intent is to demonstrate how the Triad could support a cleanup process at your site that meets the reuse goals of the locality as well as your regulatory, budgetary, and time requirements. The materials are presented in a manner consistent with the US Army Corp of Engineers (USACE) design build format used for a similar site, the Wanachee Tree Fruit soil removal action provided to the BTSC by the Seattle District (for more information of the Tree Fruit Site, including example quality assurance plans and sampling and analysis plans etc., Go to cluin.org).The Seattle District has provided comments on the contents of the Statement of Work as it was being prepared. This was done such that the document would be of sufficient quality for use in preparing potential training materials. We are giving you two hard copies of the entire package with the exception of the unrevised USACE guide specifications. In addition, a third hardcopy of the Statement of Work accompanied by electronic versions of the attachment is enclosed along with a complete set of electronic PDF and working files for use when revising the materials for use.

At the end of this letter, you will find brief descriptions of each portion of the Statement of Work (Part I) and Cost Estimate (Part II) to provide insight into the implications of the products provided. We would like to begin planning for a one-day workshop for regulators and consultants to help promote the understanding of the concepts of our ATriad@ and to hold up the Marino site as an example of this approach in a reuse/recycling scenario. We plan to develop and distribute a case study on the site once work is completed and to use these products as illustrations to help support our development of a Ahandbook@ on the application of the Triad approach.

As with the initial materials sent in May, EPA is committed to assisting PADEP in finding the most cost effective strategy for remediation at the Marino site while showcasing the effectiveness of the Triad in a reuse setting. We hope both the materials sent you in May, 2002 and this package to begin to help meet this mark and aid you as you continue your discussions within PADEP on the reuse of the Marino site. Our efforts have been extremely beneficial to us in developing supporting materials for and sharpening our understanding of the actual application of the approach. If you have any questions please contact me at (703) 603-7196 or powell.dan@epa.gov.

Sincerely,

Daniel M. Powell, Project Manager
EPA Technology Innovation Office
Brownfields Technology Support Center

Enclosures

cc: Walter Kovalick (w/o enclosures)
Steve Luftig (w/o enclosures)
Linda Garczyinski (w/o enclosures)
Tom Stolle (w/o enclosures)
Jeff Heimerman (w/o enclosures)
Deana Crumbling (w/o enclosures)

Statement of Work:
Applying the Triad Approach to Advance Land Reuse
Marino Brothers Scrap Yard Site

Description of Contents

Part I –Statement of Work

Basic Ordering Agreement

The Basic Ordering Agreement (BOA) is designed as the document that binds together the components of the Statement of Work such as the Systematic Plan and Project Specifications provided in Parts A and B respectively of the Statement of Work. The BOA is intended to provide the general scope of services be expected to be performed and introduces for the first time the general nature of the Tasks anticipated and identifies those Contractor(s) currently anticipated to perform what Tasks. PADEP contact information and contract details will need to be added before the BOA can be used during procurement by PADEP.

Part A - The Preliminary Systematic Plan

The Preliminary Systematic Plan is actual Part 2 of the BTSC support effort. Part 1 was provided as an attachment to the Systematic Plan involved the development of a preliminary conceptual site model (CSM) based on existing results provided by PADEP for the Site (Baker, 2002). Based on the results of the Part 1 effort the BTSC in cooperation with PADEP developed the Part 2 or Part A of this Statement of Work the Preliminary Systematic Plan. The Preliminary Systematic Plan describes in more detail the history of the site and describes how data from Part 1 was used to develop the Systematic Plan. The reader should be careful not to confuse part 1 and 2 of the overall BTSC effort with Part I (Statement of Work) and Part II (Cost Estimate) portions of this deliverable.

The Preliminary Systematic Plan also provides some preliminary details concerning how an Additional Studies and Implementation program might be executed. Many of the details concerning the information required during implementation of any selected remedy could not be refined at this time. The final approach to cleanup and reuse the Site will depend on the information collected as part of the Additional Studies program and PADEP specific requirements. The information provided is meant as a starting point in refining an approach and developing detailed planning documents that could be required during Implementation. The nature of the cleanup activities was assumed to be solely excavation and off-site disposal. The actual solution selected may include many other elements not specifically addressed in the current Statement of Work. Identification and refinement of these and any other details required during Implementation are the sole responsibility of PADEP and its Contractor(s).

Part B – Specifications

Two sets of specifications are provided as part of this Statement of Work. One is a set of more exhaustive specifications which have been made project specific and must be edited and revised using the USACE Specs Intact editing program which is available on-line at (…………). These specifications provide the most complete set of instructions available for some activities, but they are incomplete and will need to be finalized as more is learned about the site. These specifications are also provided along with a copied version of the Specs Intact editor. Use of the editor can require some diligence in learning to use Specs Intact.

In addition, to these specifications some other unmodified guide specifications prepared by the USACE and used at other similar sites are provided electronically in a Microsoft Word format for ease in reuse and modification. These specifications provide some alternatives to the more detailed specifications that might be considered should it be deemed desirable by PADEP to further streamline the specification preparation process.

PART II – Cost Estimate

The cost estimate provided in Part II of this deliverable is intended to stand alone as a first cut cost estimate to be used by PADEP for cost comparison and planning purposes. Most of the cost information provided is based on a sensitivity analysis, which assumes two different potential levels and associated volumes of wastes containing mercury and or lead might be classified as hazardous or non-hazardous under the Resource Conservation and Recovery Act (RCRA). The cost of disposal is the primary cost of implementation at the Site using the surgical removal approach described in the Preliminary Systematic Plan. No Toxicity Characteristic Leaching Procedure (TCLP) data was available at the time when the Cost Estimate was prepared. Therefore, the cost estimate will need to be revised once TCLP for mercury and lead is collected during project startup and during the Additional Studies program. Hardcopy only cost backup information is provided for most other aspects of the project, but have not been confirmed with hard quotes because the exact volume of differing waste streams is needed before concrete estimates can be provided by specific disposal facilities.

STATEMENT OF WORK:
APPLYING THE TRIAD
APPROACH TO ADVANCE LAND REUSE

MARINO BROTHERS SCRAP YARD SITE

Prepared By:

Pennsylvania Department of Environmental Protection
In Cooperation with
the U.S. Environmental Protection Agency
Brownfields Technology Support Center

April 2003

CONTENTS

CONTENTS (Continued)

FIGURES

Figure

CONTENTS (Continued

TABLES

Table

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ATTACHMENTS

Attachment

PART B SPECIFICATIONS (see USACE Specs Intact to modify)

Preliminary Project Specifications

I. BASIC ORDERING AGREEMENT - TEMPLATE

I. BASIC ORDERING AGREEMENT

Agreement Number/Contract Number

Task Order

April 2003

1.0	**TITLE**	**Statement of Work: Applying the Triad Approach to Advance Land Reuse at Marino Scrap Yard Site**
2.0	**PROJECT LOCATION**	**Rochester Borough, Beaver County, Pe nnsylvania**
3.0	**TYPE OF TASK ORDER**	**Characterization and Implementation**

4.0 BACKGROUND

The Site is located in Rochester Borough, along the Ohio River, in Beaver County, Pennsylvania. The former scrap yard facility is situated in an industrial area and is bordered on the north by Railroad Street, on the south by the Ohio River (Part A, Figure 1), on the east by a concrete supplier (Beaver Concrete and Gravel Co. [Beaver Concrete]) and on the west by commercial properties. The Site occupies approximately three acres and was operated as a scrap yard from the 1920s until October 1998. Before the 1920s, a number of businesses occupied the property including the Olive Stove Works foundry, Rochester Flour mill, Rochester Clay Pot Company, AID Soap Manufacturing Company, and a lumberyard, which included a saw and planing mill. The Borough of Rochester now owns the Site property.

The facility is currently abandoned and the majority of scrap and equipment associated with the scrap yard operations have been removed from the Site. Several buildings (e.g., office building/scale house and associated truck scale, a three-story garage building, and remnants of a storage building) and process equipment (e.g., two hydraulic shears and a hydraulic metal crusher) remain onsite (Part A, Figure 2). A chain-link fence with locked entry gates secures the property on all sides except the south. The southern side of the property is bounded by the Ohio River. A storm sewer runs from south to north across the eastern portion of the Site. A sanitary sewer runs through the Site generally from east to west in the middle of the Site.

Portions of the Site are covered with vegetation (trees and shrubs), remnant scrap metal, and miscellaneous debris. However, the eastern portion of the property has generally been cleared of scrap metal. Most of the south-central and western portions of the property are covered with concrete, which was generated by Beaver Concrete and dumped at the Site. The remaining parts of the property are unpaved.

The Pennsylvania Department of Environmental Protection (PADEP) assumed responsibility for any environmental liability associated with the Site. PADEP has developed the following documents to assist in developing an expedited cleanup strategy for the Site. This basic ordering agreement (BOA) is the document under which all of the other documents and enclosures included in this statement of work are interrelated.

5.0 TASKS

As part of the development of an expedited approach for cleanup at the Marino Scrap Yard a Preliminary Conceptual Model (CSM) was developed (Part A, Enclosure 1). This CSM and associated work products were used to form the basis for development of a draft expedited site assessment strategy for the site. As part of the development of this strategy two primary types of work were identified. Those activities recommended by PADEP to complete a final cost estimate to support development of a contracting strategy for implementation of a remedy (Additional Studies) and those activities to be performed in direct support of the cleanup at the site (Implementation). Because of the interrelated nature of these two activities this Statement of Work has been written to include elements of both types of work should PADEP decide to perform the work on a continuous basis.

The work required to complete the cleanup may actually be performed by two separate contractors or sets of contractors here to referred to as the Additional Studies Contractor(s) or the Implementation Contractor(s) respectively. Some types of work can apply collectively to both types of contractor(s), in this case it is usually clear by the nature of the activity which contractor would be responsible for the particular task or they are collectively called out as the Contractor(s). For further clarification the Contractor(s) should contact PADEP directly. One set being responsible for activities primarily targeting the collection of additional site characterization data prior to development of a final cost estimate and the other who will design and then implement the final remedy selected by PADEP. Both may need to provide some or all personnel, labor, services, equipment and supplies necessary to complete any group of tasks described in this Statement of Work in accordance with guidance from PADEP.

The technical approach for the tasks identified are provided in Part A, The Preliminary Systematic Plan (Part A) is designed to be used as a starting point for the development of site specific work plans used during any portion of the project to be specified by PADEP. Specifications have been partially modified to meet the intent of currently envisioned project needs and are provided (Part B) as guidelines for establishing final project specifications for use during implementation. It will be the responsibility of the Implementation Contractor(s) to work with PADEP to finalize any or all of these specifications or other reorganization and modification to tasks in accordance with PADEP requirements.

Part A: Draft Systematic Plan

Task 1 – Monitoring and Measurement Activities

Task 1 and several of the other tasks, described in more detail in the Draft Systematic Plan (Part A), are broken into two separate sets of sub-tasks. Sub-tasks to be conducted prior to performance of a final cost estimate for the cleanup (Additional Studies) and activities in direct support of the cleanup (Implementation). Contractor(s) will implement a near real time sampling and analysis program to complete monitoring and measurement activities during all portions of the project when appropriate or as directed by PADEP. The sub-tasks related to Task 1 Monitoring and Measurement Activities are listed below for both the Additional Studies and Implementation potions of the project.

Additional Studies Sub-Tasks or Work Elements Include:

Task 1.1 – Plan Development and Preparation for Characterization and Implementation (PADEP recommends some plans to be developed during Implementation only see Section 3.1)
Task 1.2 – Refinement of Decision Criteria
Task 1.3 – Site Preparation (PADEP recommends some areas be identified and prepared after completion of the Additional Studies program).
Task 1.4 – Sample Collection
Task 1.5 – Chemical Analysis during Additional Site Characterization and Initial Waste Volume and Type Estimation

Implementation Sub-Tasks or Work Elements Include:

Task 1.6 – Waste Characterization for Disposal
Task 1.7 – Post-Excavation Confirmation

Task 2 – Detailed Design

The Additional Studies contractor(s) shall prepare a site topographic map. Based on the data collected during the additional studies program the Implementation Contractor(s) will develop a streamlined design adequate for the removal, segregation, and disposal of contaminated soil present at the site in accordance with any and all potentially applicable state, local, or federal requirements. The sub-tasks are described below:

Additional Studies Sub-Tasks Include:

Task 2.1 – Site Topographic Mapping

Implementation Sub-Tasks Include:

Task 2.2 – Design Development Phase (50 percent complete, after characterization)
Task 2.3 – Construction Document Phase (100 percent complete, after characterization)
Task 2.4 – Detailed Construction Cost Estimate (pre-excavation)

Task 3 – Soil Excavation and Disposal

The Implementation Contractor(s) shall implement the final design as described by the above mentioned design documents. The sub-tasks associated with the removal action are described below:

Task 3.1 – Contaminated Soil Excavation
Task 3.2 – Waste Stream Segregation and Stockpiling
Task 3.3 – Transport, Treatment, and Disposal of Excavated Soil
Task 3.5 – Sampling, Analysis, and Disposal of Investigation Derived Waste (Additional Studies and during Implementation)
Task 3.6 – Backfilling, Grading, and Revegetation

Task 4 – Construction Completion Report

The Implementation Contractor(s) shall prepare a Construction Completion Report that will serve as the executive record summarizing the cleanup activities implemented at the Site. The completion report, at a minimum, shall include a detailed records of the work activities implemented during the cleanup, present as-built drawings of soil excavation areas, and provide details regarding soil treatment and or disposal.

Task 5 – Project Management

Contractor(s) shall be responsible for managing the overall implementation of the program and subtasks assigned to them by PADEP. At a minimum, the project management activities will include:

Task 5.1 – Project Scheduling and Coordination

6.0 PART B: SPECIFICATIONS

PADEP recommends that work be performed using the information provided in Part A of this Statement of Work (Draft Systematic Plan) and some combination of the specifications partially developed and provided in Part B of this Statement of Work as referenced in this BOA. The specifications provided are preliminary. Final specifications will need to be revised and submitted to PADEP for approval. Unrevised draft specifications received from the U.S. Army Corps of Engineers are also provided in Part B for the contractor's use as appropriate and as directed by PADEP.

7.0 COMPLETION AND SUBMITTAL SCHEDULE

An estimated schedule broken down by tasks is provided in the Draft Systematic Plan (Part A), but a final schedule should be developed for each of the two types of work envisioned at the site as directed by PADEP.

8.0 SITE SECURITY REQUIREMENTS

Site security requirements are to be identified by PADEP and specified in this section.

9.0 PADEP POINT OF CONTACT TO BE SPECIFIED HERE

CONTENTS

CONTENTS (Continued)

FIGURES

CONTENTS (Continued

TABLES

Table

ATTACHMENTS

Attachment

PART B SPECIFICATIONS (see USACE Specs Intact to modify)

Preliminary Project Specifications

CONTENTS (Continued)

<u>USACE Example Guide Specifications for a Dig and Haul using a Dynamic Work Plan</u> (see attached CD for all versions of this SOW)

FIGURES

<u>Figure</u>

TABLES

<u>Table</u>

ATTACHMENTS

<u>Attachment</u>

1.0 INTRODUCTION

The following systematic plan was prepared by PADEP to support the planning and application of innovative cleanup approaches for the Marino Brothers Scrap Yard, located in Rochester Borough, Pennsylvania (the Site). This document was prepared to provide ideas on expedited approaches to conduct analytical sampling activities supporting the cleanup of the site. The systematic plan has been prepared to assist prospective Contractor(s) identified to assist on the project to make maximum use of existing data in order to streamline characterization and cleanup activities to be conducted at the Site. A dynamic work plan strategy was developed to make maximum use of field-based measurement technologies by the Pennsylvania Department of Environmental Protection (PADEP). The material presented is strictly the opinion of PADEP regarding the most logical course of actions for characterization and cleanup of the Site utilizing the expedited approach described as the Triad. PADEP developed this Statement of Work and systematic plan as a technical basis for refinement of a final plan for cleanup at the Site. Many of the concepts described herein are difficult to communicate solely on paper, contractors are urged to seek further guidance as necessary through interaction with PADEP.

1.1 PURPOSE

The purpose of this systematic plan is to provide a summary of findings, conducted by PADEP concerning methods for management of the cleanup activities being considered for the Site. Information included in this document is intended to assist during implementation of activities associated with (a) additional studies, (b) design and cleanup or implementation of a cleanup action. The suggestions made in this systematic plan are intended to provide a basis for decision-making concerning the selection of the most viable options for restoration at the Site. Final design and implementation requirements are the sole responsibility of PADEP and their contractor(s).

1.2 SITE HISTORY AND DESCRIPTION

The Site is located in Rochester Borough, along the banks of the Ohio River, in Beaver County, Pennsylvania (Figure 1). The former scrap yard facility is situated in an industrial area and is bordered on the north by Railroad Street, on the south by the Ohio River, on the east by a concrete supplier (Beaver Concrete and Gravel Co. [Beaver Concrete]) and on the west by commercial properties. The Site occupies approximately three acres and was operated as a scrap yard from the 1920s until October 1998. Before the 1920s, a number of businesses occupied the property including the Olive Stove Works foundry, Rochester Flour mill, Rochester Clay Pot Company, AID Soap Manufacturing Company, and a lumberyard, which included a saw and planning mill. The Borough of Rochester now owns the Site property.

The Site is abandoned and the majority of scrap and equipment associated with the scrap yard operations have been removed from the property. Several buildings (e.g., office building/scale house and associated truck scale, a three-story garage building, and remnants of a storage building) and process equipment (e.g., two hydraulic shears, hydraulic metal crusher, etc.) remain on the property (Figure 2). A chain-link fence with locked entry gates secures the Site on all sides except the south. The southern side of the property is bounded by the Ohio River. A storm sewer runs from south to north across the eastern portion of the Site. A sanitary sewer runs through the Site generally from east to west in the middle of the Site.

Portions of the Site are covered with vegetation (trees and shrubs), remnant scrap metal, and miscellaneous debris. However, the eastern portion of the property has generally been cleared of scrap metal. Most of the south-central and western portions of the property are covered with concrete, which was generated by Beaver Concrete and dumped at the Site. The remaining parts of the property are unpaved.

1.3 MEDIA AND CONSTITUENTS OF CONCERN

PADEP has established that surface soil located within the Site boundary and soil from the top of the current topographic surface to the groundwater table (approximately 12 feet below ground surface) is the principal media of concern. Initial site-specific standards were developed by PADEP for the targeted constituents of concern in soil, which include seven metals and two Aroclors [commercial formulations of polychlorinated biphenyls (PCBs)], as shown in Table 1 (see Attachment 1, Developing a Preliminary Conceptual Site Model to Guide Clean-up, Enclosure #2 Screening Level Risk Analysis). PADEP has indicated that soil at or below the groundwater table will not be addressed because there is no identified use of groundwater in the area and because groundwater does not impact the Ohio River above identified action levels (see Attachment 1, Part 1, Enclosure #4, Groundwater to Surface Water Modeling Results). Rochester Borough will likely implement a deed restriction prohibiting use of groundwater because some residual contamination of limited mobility may remain at the Site after cleanup is complete.

PADEP has indicated that contaminated materials associated with existing buildings are not included as part of this systematic plan and are to remain on Site. These buildings and any associated residual contamination located within the buildings will be dealt with as part of Site redevelopment activities, which will be conducted separately. Most other residual debris are to be identified, appropriately decontaminated or treated, and properly disposed of off site by the Contractor. This will include, but is not limited to, impermeable or porous materials such as contaminated soil, old equipment, concrete, and shrubs known to be present at the Site.

TABLE 1
SITE-SPECIFIC ACTION LEVELS AND PADEP RECOMMENDED FIELD-BASED METHOD REPORTING LIMITS FOR THE ADDITIONAL STUDIES PROGRAM
MARINO BROTHERS SCRAP YARD
ROCHESTER BOROUGH, PENNSYLVANIA

Constituent Name	Site-Specific Action Risk Based Action Levels (mg/kg)	PADEP Recommended Field-Based Method Reporting Limits (mg/kg)
Inorganics		
Antimony	520	52
Arsenic	196	20
Cadmium	2,059	260
Iron	389,944	40,000
Lead	1,300	130
Mercury	390	39
Thallium	86	8.6
Organics		
Aroclor-1248	59	5.9
Aroclor-1254	59	5.9

Source: Tetra Tech 2002 (See Attachment 1, Enclosure 2)

Note:

mg/kg Milligrams per kilogram

1.4 TECHNICAL APPROACH

The final plan concerning cleanup actions required before land reuse can be completed at the Site will depend on many factors. The cost of disposal, intended reuse scenarios, and the practicality of any clean-up approach are a few of the main factors that will ultimately control the implementability of a final remedy. A cleanup approach may involve excavation of contaminated soil and disposal in an appropriate landfill, off-site treatment, or capping and exposure pathway elimination on certain portions of the Site. These final design considerations will need to be evaluated by PADEP and their contractor(s) as more information becomes available for the Site (e.g. after the Additional Studies program has been completed). For the purpose of this preliminary systematic plan, it has been assumed that materials present above site-specific action levels will be removed and segregated for off-site disposal. The viability of 100 percent off-site disposal will be evaluated by PADEP once the Additional Studies program has been completed. The approach developed was designed to support various other combinations of reuse alternatives identified by PADEP while limiting costs and assuring the protectiveness of the remedy.

The additional studies contractor(s) will prepare the site for cleanup, develop needed base maps and staging areas, and collect sufficient additional analytical data to support the development of a final design. Soil data collected by the contractor(s) will be of sufficient quantity and quality to evaluate the presence or absence of contaminants of concern (COCs) shown in Table 1. The data collected as part of the Additional Studies program will also include the collection of toxicity characteristic leaching procedure (TCLP) data that will be needed to refine estimated project costs such that a final design can be developed.

Once this additional data has been collected design and implementation of the remedy can commence. The Implementation Contractor shall perform waste segregation and final characterization prior to disposal or placement. The contractor will confirm soil has been adequately removed or placed in accordance with PADEP and approved project plan requirements. If any of the nine COCs are found above the site-specific risk based action levels during or after excavation then additional soil may need to be excavated, provided the groundwater table has not been intercepted. Contaminated soil will be segregated in accordance with expected disposal requirements and then sampled to assure compliance with any and all potentially applicable State, Federal, local, or other disposal requirements. The Site will be backfilled to original grade once excavation is complete.

Surface water controls and handling and disposal of contaminated groundwater encountered during the implementation of the remedy shall be the responsibility of the Contractor(s). The Contractor(s) shall be responsible for controlling health and safety considerations at the Site during all Site activities. Air monitoring or dust suppression during construction shall be addressed to ensure that off-site receptors are not impacted during remediation. Dust control is of principal concern during remediation as most of the constituents of concern have low volatility, but could be present on dust carried away from the Site. It is the responsibility of the Contractor to identify and comply with any and all PADEP or other state or federal air monitoring requirements before implementation of a remedy.

1.5 PROPERTY REUSE SCENARIOS

Reuse scenarios are not yet well established for the Site. However, based on the remediation scenario described in this systematic plan, potential reuse scenarios are expected to be less limiting than with other potential alternatives. The goal of the preliminary planning provided in this Statement of Work is to facilitate the implementation of a cost-effective remedy, which will allow the broadest potential reuse of the Site. Future restrictions regarding soil must address the duration of direct contact exposure relative to the recreational reuse scenario described in the preliminary conceptual site model for the Site (Attachment 1, Part 1 – Preliminary Conceptual Site Model to Guide Clean Up [Tetra Tech 2002]). Buildings, which may be contaminated and are slated for reuse, may need to be remediated or pathways for direct exposure eliminated to assure the protectiveness of the proposed remedy. Under no circumstances shall groundwater be used or contacted as any portion of the proposed remedy or reuse scenario without careful consideration and application of a water management program that is consistent with Site conditions and PADEP requirements.

The remedy identified in this Statement of Work and associated systematic plan does not account for direct contact with either river water or contaminated sediments, which may be present along the Ohio River adjacent to the Site. The embankment, between the Site surface and the boundary of the Ohio River shall be considered only in terms of the removal of soil to levels beneath the site-specific action levels. Stabilization or intrusive activities conducted down to or below the level of groundwater at the Site are not addressed. It is assumed that embankment stabilization, direct contact with river bottom sediments adjacent to the Site, or other physical hazards associated with the embankment and river access will be addressed as part of the final redevelopment plan. Any such redevelopment plans should also be consistent with the identified recreational reuse scenario and exposure assumptions identified for the Site (see Attachment 1, Enclosure 2).

1.6 PROPOSED STRATEGY FOR IMPLEMENTATION

The proposed remedy for the Site could involve the excavation and removal of soil with contaminant concentrations above site-specific risk-based concentrations (RBCs). The objective of any cleanup action is to eliminate human exposure to unacceptable levels of Site contaminants. This is proposed to be accomplished by initially further refining the nature and extent of contamination at the Site (Additional Studies program) and then removing or containing contaminated surface and subsurface soil (e.g., surgical dig and haul or dig and place during the implementation program) and disposing of the contaminated soil at an appropriate disposal facility or as appropriate on site. A field-based measurement strategy is suggested to improve Site coverage and improve the certainty of project decision-making. Field-based sampling and analyses in combination with fixed lab analyses is proposed to limit costs and assure completeness of the cleanup. Cleanup activities are expected to include removing and sorting gross debris (during Additional Studies program), followed by excavating surface and subsurface soil, sorting and stockpiling excavated soil, and backfilling or reclaiming the property prior to redevelopment (during implementation program). The major components of the proposed cleanup are described below.

1.7 WORK BREAKDOWN STRUCTURE

The Contractor(s) shall provide all personnel, labor, services, equipment, and supplies necessary to complete the following work elements. Sub-tasks are presented for both the additional studies contractor(s) and the Implementation Contractor(s) for tasks 1 and 2. Task 5 applies equally to both the additional studies contractor(s) and the Implementation Contractor(s). Tasks 3 and 4 apply only to the Implementation Contractor(s) once the Additional Studies program has been completed.

1.7.1 Task 1 – Monitoring and Measurement Activities

The contractor(s) shall implement a near real time sampling and analysis programs. The data to be collected during the Additional Studies program will be sufficient to support selection of treatment and disposal options. Subsequent to the Additional Studies program waste segregation will be performed by the Implementation Contractor(s). In addition, the Implementation Contractor(s) will perform final waste characterization prior to disposal or placement and post-excavation confirmation sampling to verify removal action objectives have been meet. The sub-tasks under the monitoring and measurement task are listed below:

Additional Studies

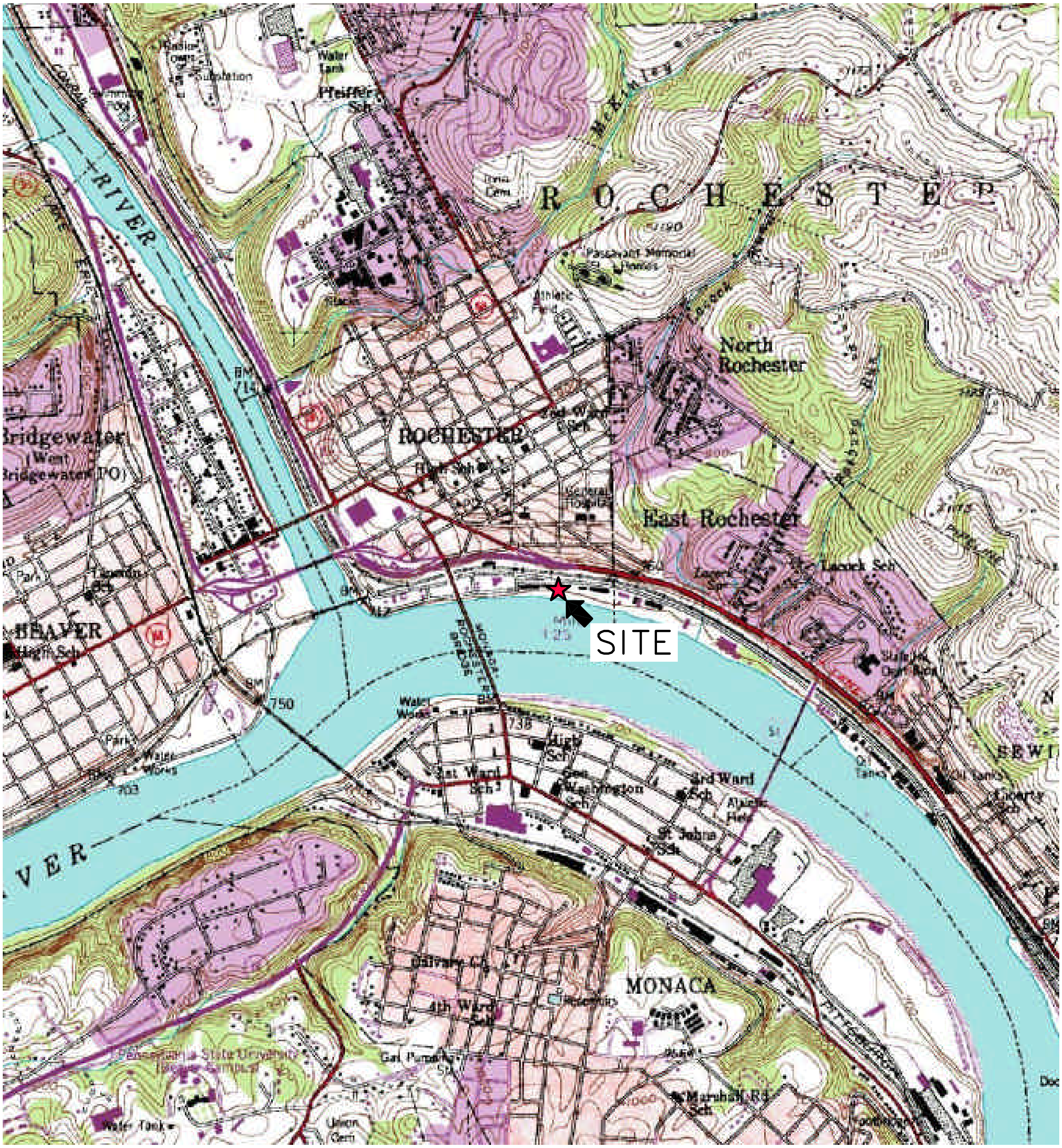
Task 1.1 – Plan Development
Task 1.2 – Refinement of Decision Criteria
Task 1.3 – Site Preparation
Task 1.4 – Sample Collection for Additional Characterization
Task 1.5 – Chemical Analyses During Additional Site Characterization and Initial Waste Volume and Type Estimation

Implementation

Task 1.6 – Post-Excavation Waste Characterization Sampling/Analyses
Task 1.7 – Post-Excavation Confirmation Sampling/Analyses

1.7.2 Task 2 – Detailed Design

The additional studies Contractor(s) shall prepare a site topographic map. Following collection of the additional studies information the Implementation Contractor(s) shall prepare the detailed design



LEGEND

★ SITE LOCATION

SOURCE:
USGS 7.5 MINUTE QUADRANGLE
ROCHESTER, PENNSYLVANIA
LAST REVISED 1993

N

2000 0 2000

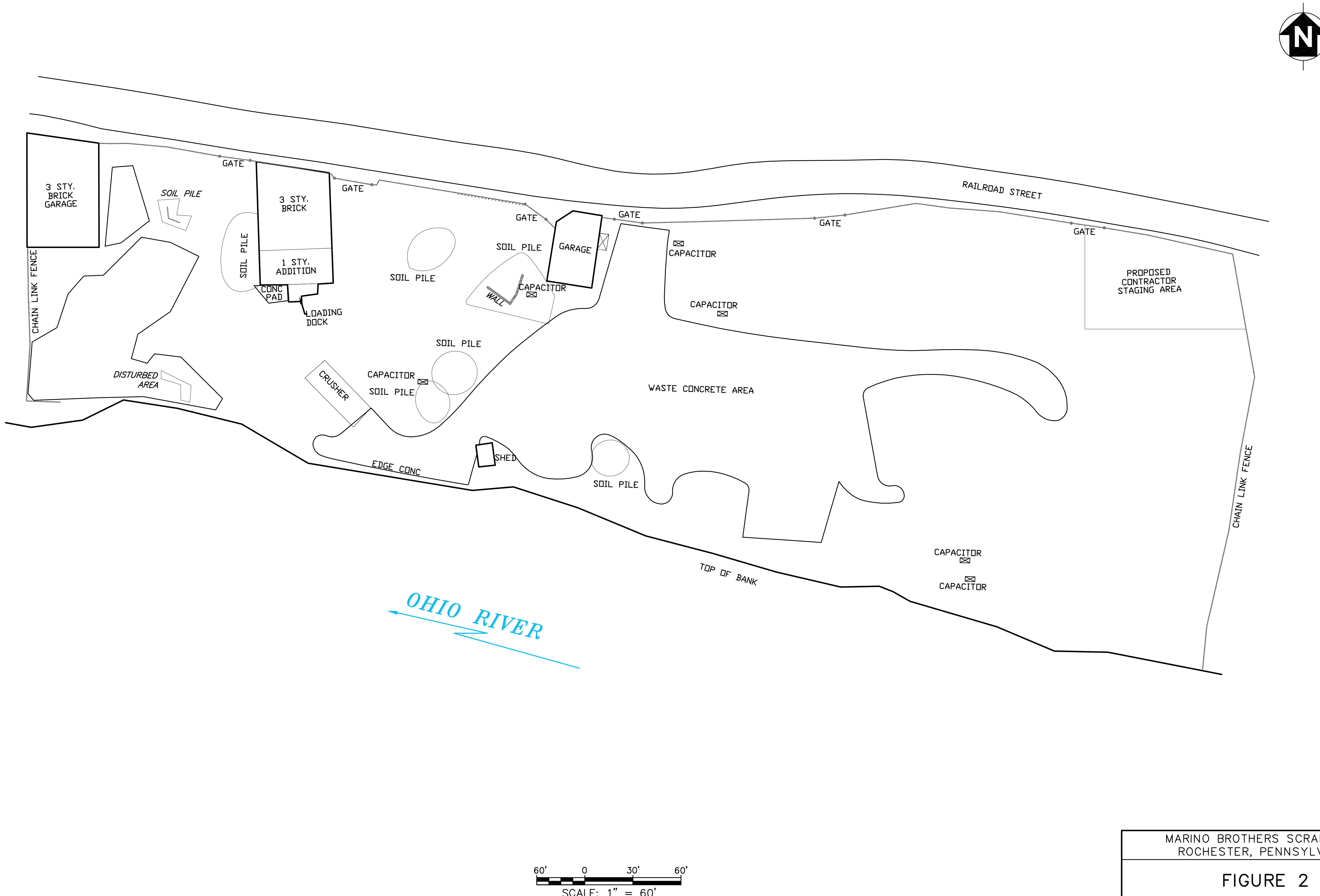
SCALE: 1" = 2000'

MARINO BROTHERS SCRAP YARD
ROCHESTER, PENNSYLVANIA

FIGURE 1

SITE LOCATION MAP

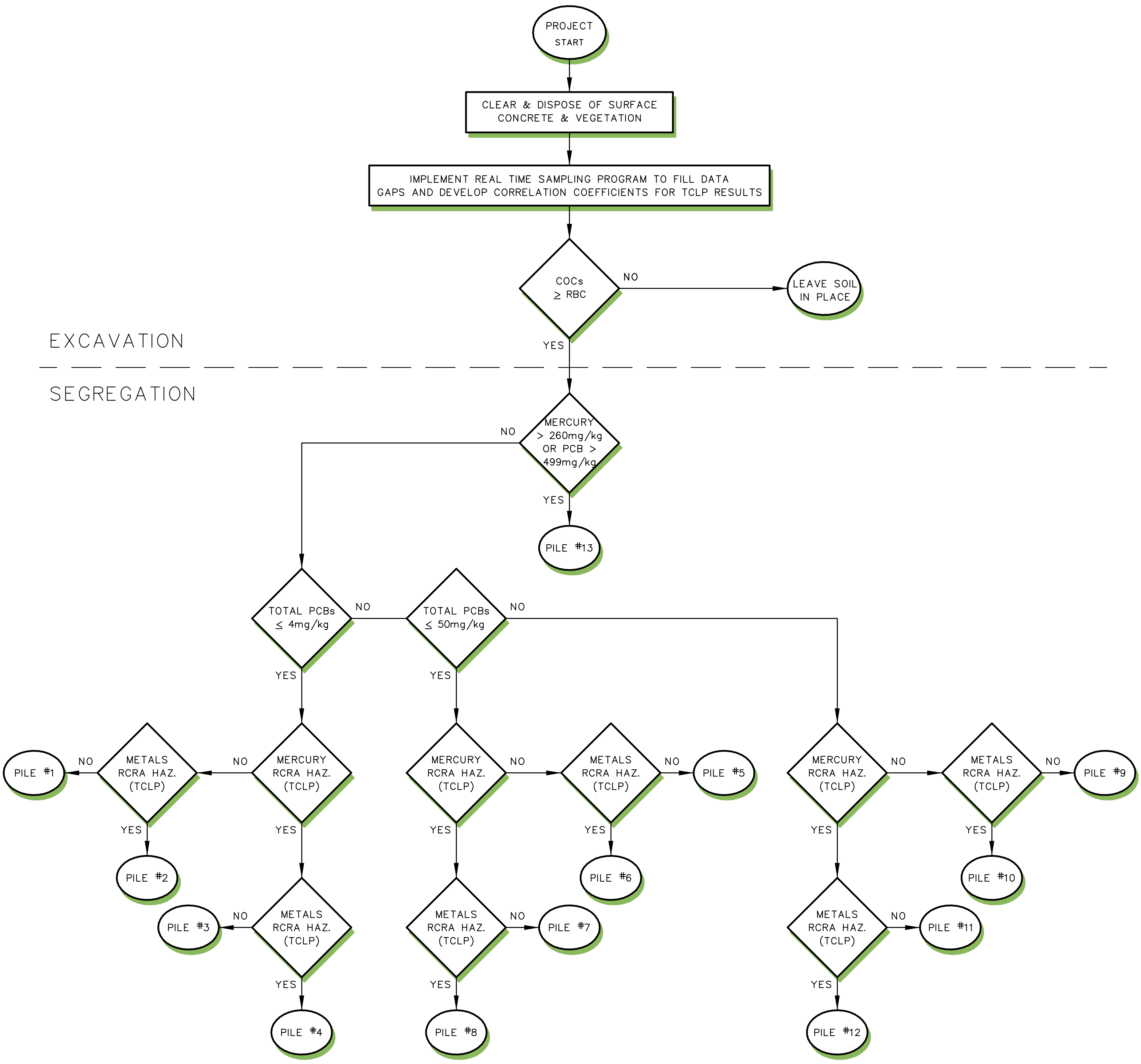
R:\Clients\Marino Brothers\Temp-figures\ Figure 1 sitelocmap.dwg 04/27/2003 Vincent.Cavanaugh DN



MARINO BROTHERS SCRAP YARD
ROCHESTER, PENNSYLVANIA

FIGURE 2

GENERAL SITE MAP

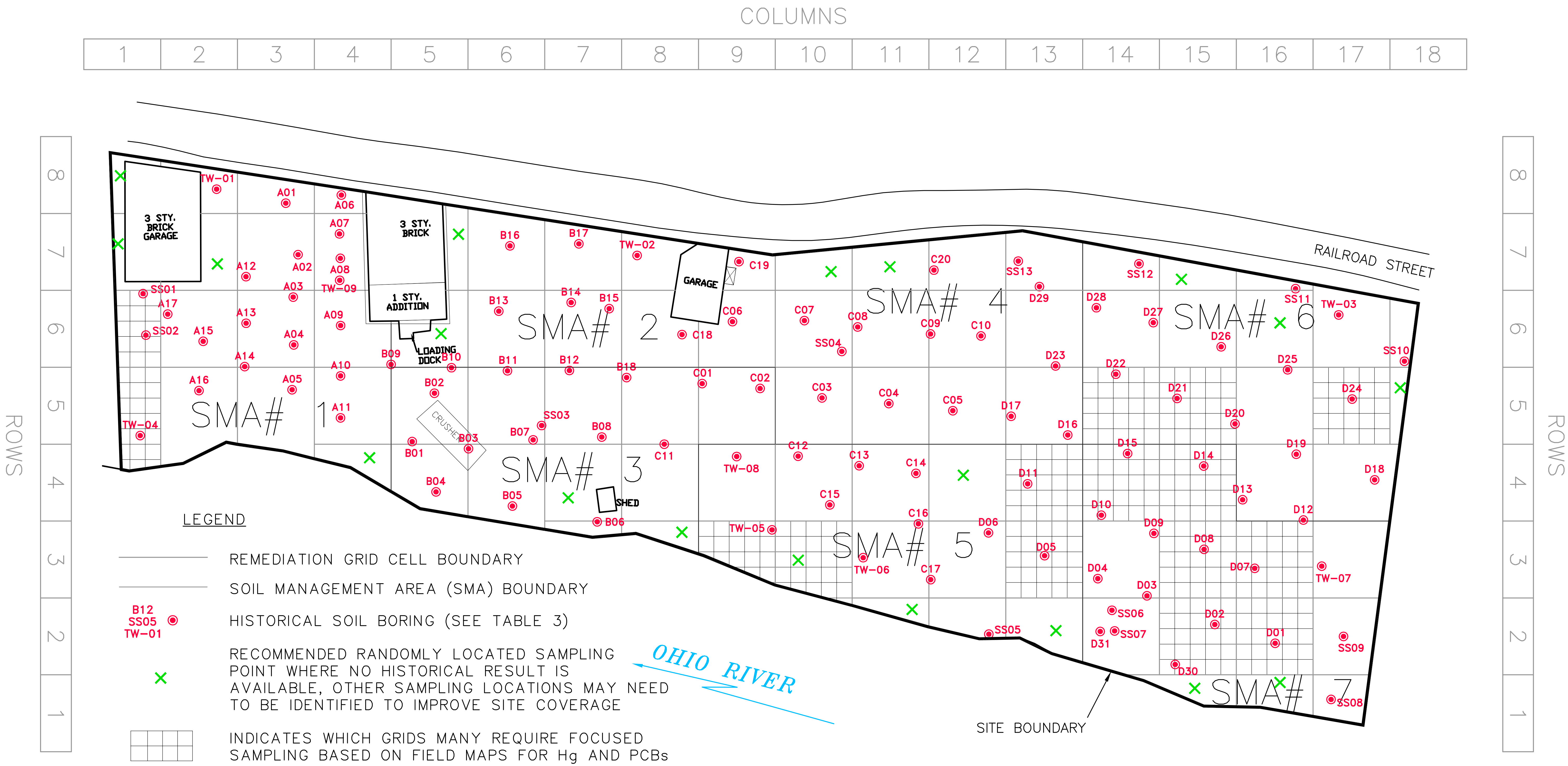


COC = CONSTITUENTS OF CONCERN (TABLE 1)
HAZ = HAZARDOUS
PCB = POLYCHLORINATED BIPHENYL
RBC = SITE-SPECIFIC RISK-BASED CONCENTRATION
RCRA = RESOURCE CONSERVATION AND RECOVERY ACT
TCLP = TOXICITY CHARACTERIZATION LEACHING PROCEDURE

MARINO BROTHERS SCRAP YARD
ROCHESTER, PENNSYLVANIA

FIGURE 3

WASTE EXCAVATION AND SEGREGATION SCHEME



NOTES: FOR THE PURPOSE OF THE DRAFT SYSTEMATIC PLAN, GRIDS WHERE ADDITIONAL DETAILED SAMPLING MAY BE WARRANTED BECAUSE HG OR PCB CONCENTRATIONS ARE EXPECTED TO BE GREATER THAN 20X THE TCLP THRESHOLD (4 PPM) OR PCB'S EXCEEDED 50 PPM.

ppm = PARTS PER MILLION OR MICROGRAMS PER LITER

TCLP = TOXICITY CHARACTERISTIC LEACHING PROCEDURE. BASED ON THE DEMONSTRATION OF METHODS APPLICABILITY AND RESULTS OBTAINED IN THE FIELD, THEN NEED FOR MORE DETAILED SAMPLING SHOULD BE REEVALUATED (SEE TASK 1.5 OF DRAFT SYSTEMATIC PLAN).

60' 0 30' 60'
APPROXIMATE SCALE: 1" = 60'

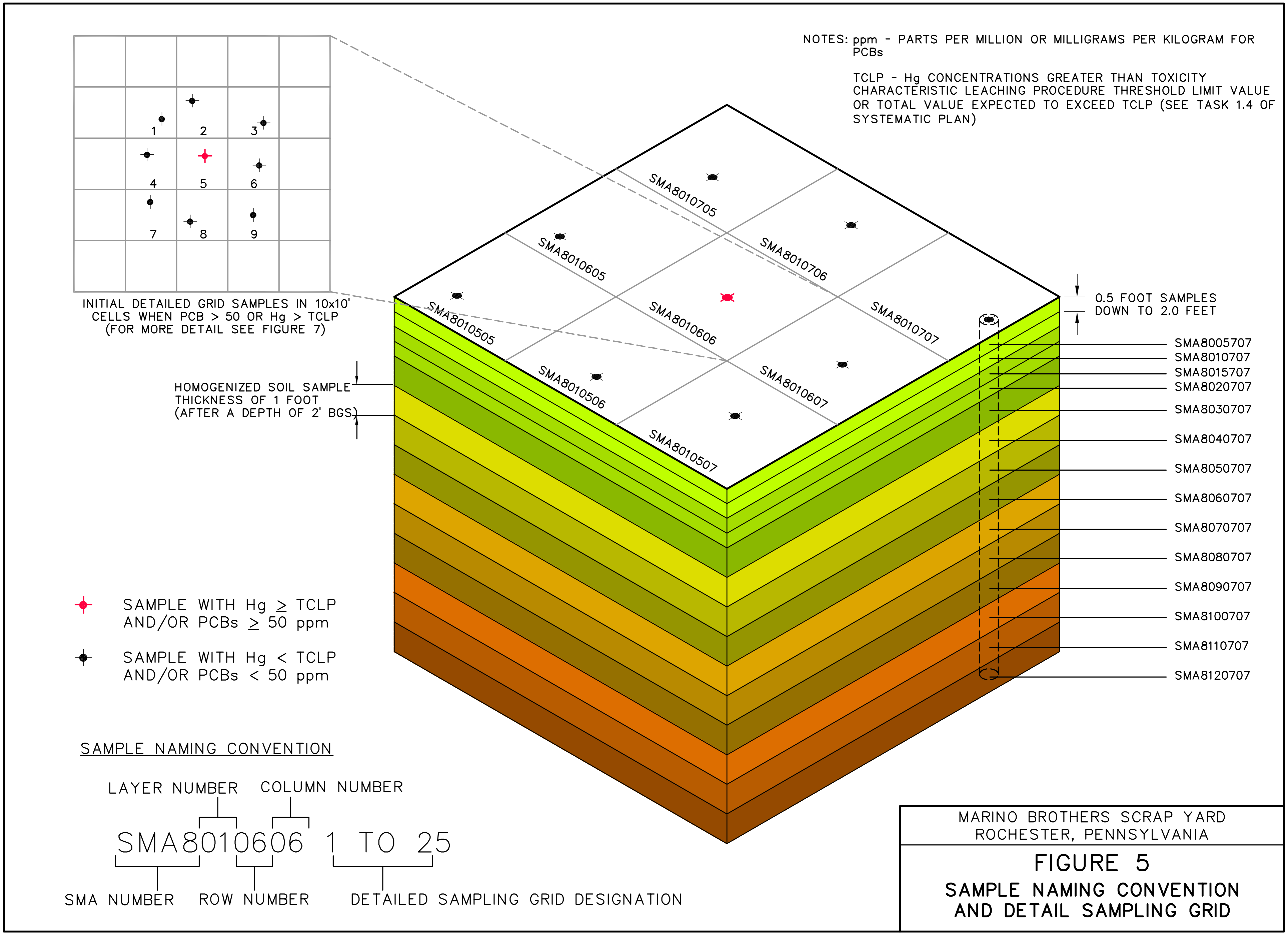
MARINO BROTHERS SCRAP YARD
ROCHESTER, PENNSYLVANIA

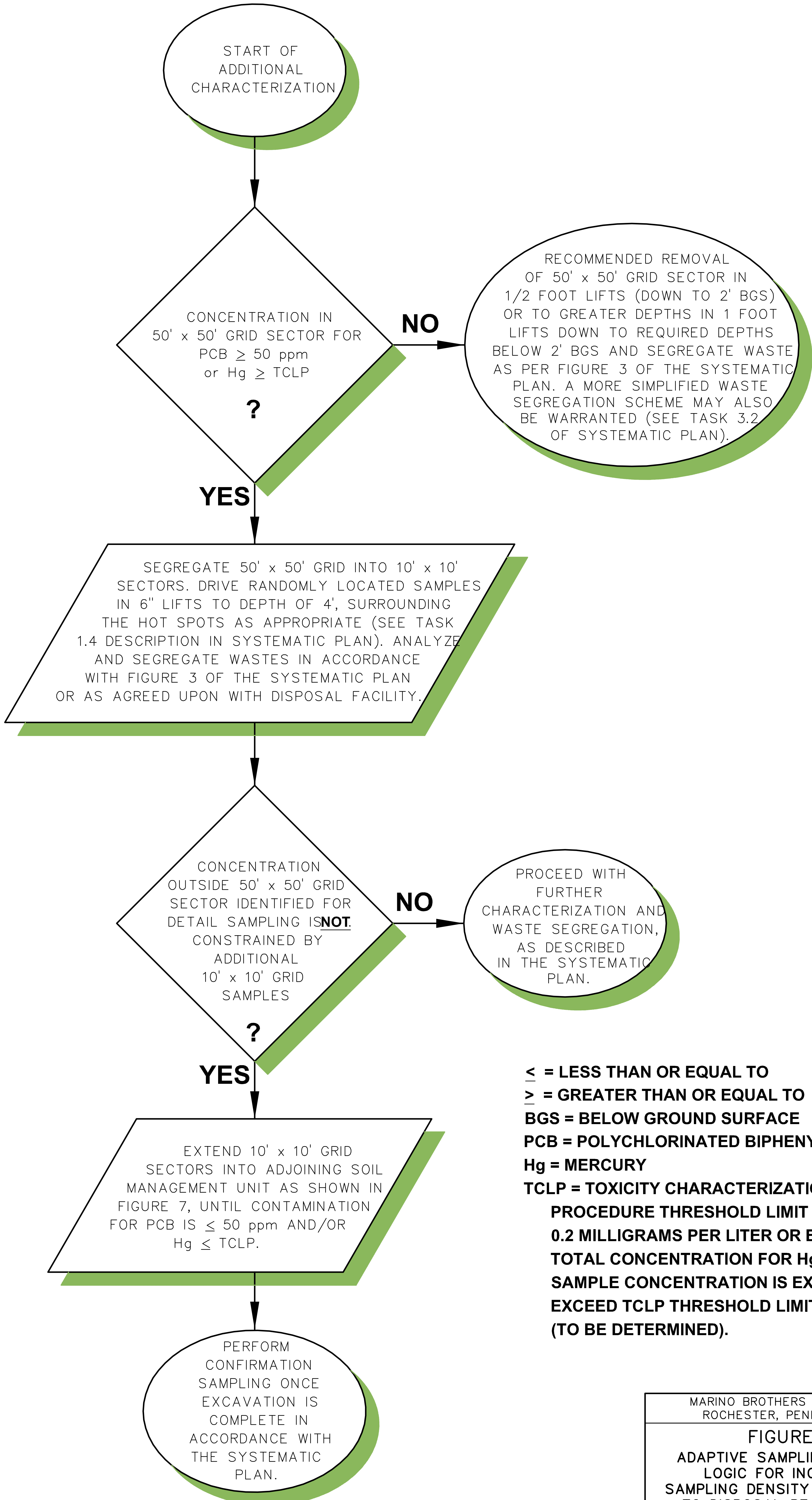
FIGURE 4

PRELIMINARY SYSTEMATIC PLAN REMEDIATION SAMPLING GRID AND SOIL MANAGEMENT AREAS (SMAs)

R:\Clients\Marino Brothers\Temp-figures\ remediation sma area.dwg 04/27/2003 Vincent.Cavanaugh DN

R:\Clients\Marino Brothers\Temp–figures\ sample naming conv.dwg 04/27/2003 Vincent.Cavanaugh DN





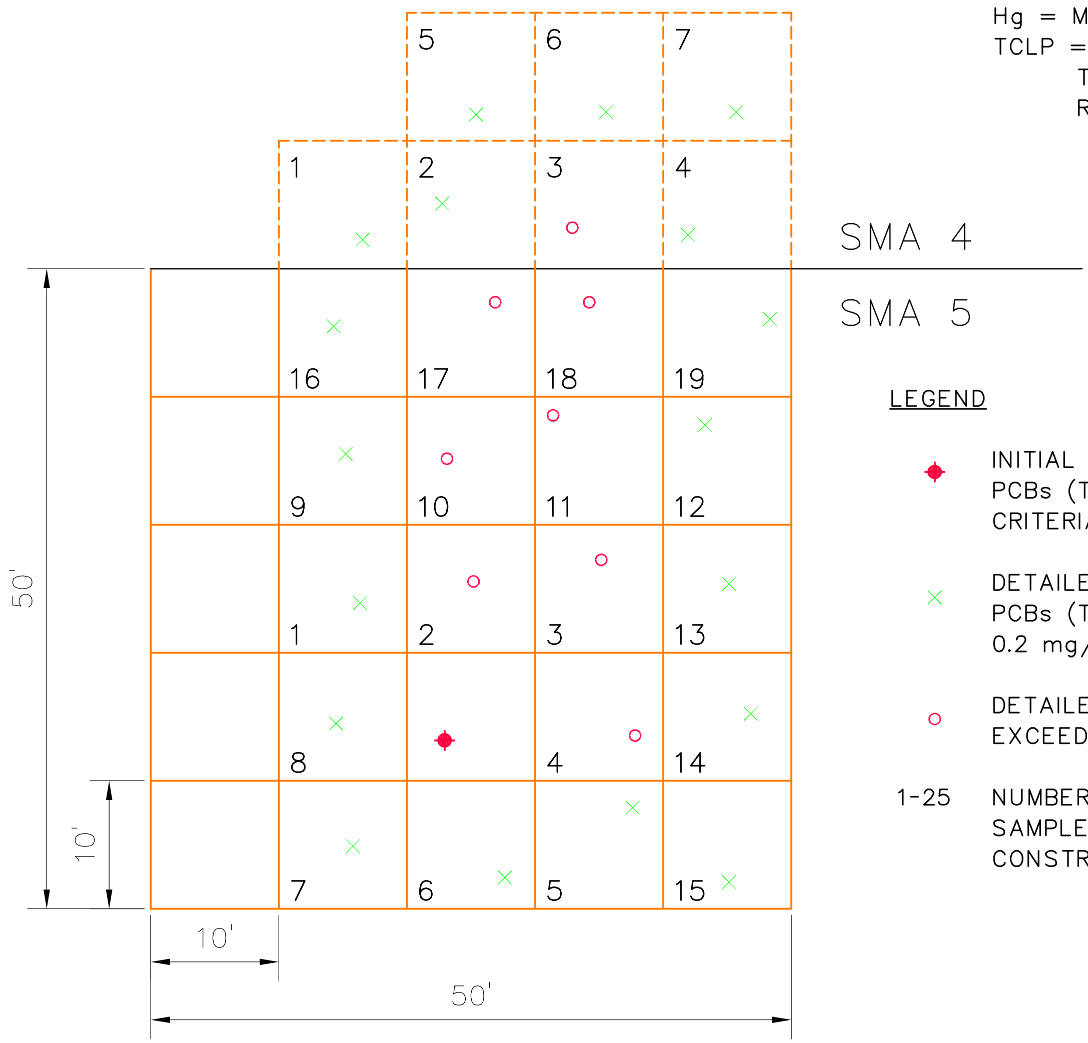
≤ = LESS THAN OR EQUAL TO
≥ = GREATER THAN OR EQUAL TO
BGS = BELOW GROUND SURFACE
PCB = POLYCHLORINATED BIPHENYL
Hg = MERCURY
TCLP = TOXICITY CHARACTERIZATION LEACHING PROCEDURE THRESHOLD LIMIT FOR Hg OF 0.2 MILLIGRAMS PER LITER OR ESTIMATED TOTAL CONCENTRATION FOR Hg WHERE SAMPLE CONCENTRATION IS EXPECTED TO EXCEED TCLP THRESHOLD LIMIT VALUE (TO BE DETERMINED).

MARINO BROTHERS SCRAP YARD
ROCHESTER, PENNSYLVANIA

FIGURE 6
ADAPTIVE SAMPLING PROGRAM LOGIC FOR INCREASING SAMPLING DENSITY IN RESPONSE TO DISPOSAL REQUIREMENTS

R:\Clients\Marino Brothers\Temp-figures\ Figure 7 detail grid expansion.dwg 04/27/2003 Vincent.Cavanaugh DN

EXTENDED DETAIL GRIDS USED TO CHASE SOIL WITH ELEVATED DISPOSAL COST.



NOTES:

PCB = POLYCHLORINATED BIPHENYL
Hg = MERCURY
TCLP = TOTAL Hg CONCENTRATION EXPECTED TO EXCEED TCLP THRESHOLD LIMIT OF 0.2 mg/L OR ACTUAL TCLP RESULT EXCEEDS 0.2 mg/L

LEGEND

INITIAL RANDOM SAMPLE LOCATION WITH CONCENTRATION FOR PCBs (TOTAL) AND/OR Hg VALUES THAT EXCEED DISPOSAL CRITERIA OF 50 ppm OR 0.2 mg/L RESPECTIVELY

DETAILED SAMPLING LOCATION WHERE CONCENTRATION FOR PCBs (TOTAL) AND Hg DO NOT EXCEED 50 ppm OR 0.2 mg/L RESPECTIVELY

DETAILED SAMPLING LOCATION WHERE CONCENTRATIONS EXCEED 50 ppm PCBs AND 0.2 mg/L Hg

1-25 NUMBER INDICATES THE APPROXIMATE ORDER IN WHICH SAMPLES WOULD BE COLLECTED AND ANALYZED TO CONSTRAIN A "HOT SPOT"

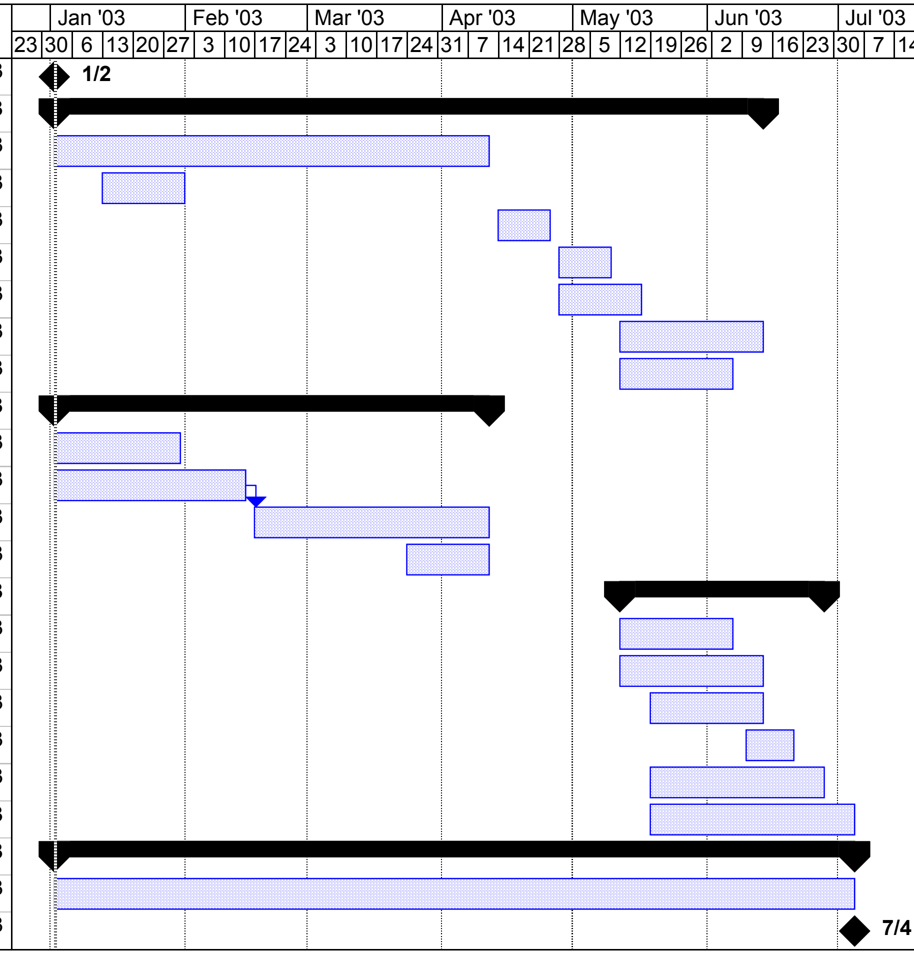
MARINO BROTHERS SCRAP YARD
ROCHESTER, PENNSYLVANIA

FIGURE 7

EXAMPLE SHOWING DETAILED GRID EXPANSION AS NECESSARY TO CHASE SOIL WITH HIGHER DISPOSAL COST

FIGURE 8 - WORK BREAKDOWN SCHEDULE
MARINO BROTHERS SCRAP YARD SITE
SOIL REMOVAL ACTION
PRELIMINARY DESIGN/BUILD SCHEDULE

ID	Task No.	Task Name	Start	Finish
1		**Notice to Proceed**	Thu 1/2/03	Thu 1/2/03
2	**1.0**	**TASK 1 -- Additional Site Characterization**	**Thu 1/2/03**	**Fri 6/13/03**
3	1.1	Plan Development	Thu 1/2/03	Fri 4/11/03
4	1.2	Refinement of Decision Criteria	Mon 1/13/03	Fri 1/31/03
5	1.3	Site Preparation	Mon 4/14/03	Fri 4/25/03
6	1.4	Sample Collection for Add'l Characterizatior	Mon 4/28/03	Fri 5/9/03
7	1.5	Add'l Site Charact. and Prelim. Waste Segr.	Mon 4/28/03	Fri 5/16/03
8	1.6	Waste Characterization Sampling/Analysis	Mon 5/12/03	Fri 6/13/03
9	1.7	Post Exc. Confirmation Sampling/Analysis	Mon 5/12/03	Fri 6/6/03
10	**2.0**	**TASK 2 -- Detailed Design**	**Thu 1/2/03**	**Fri 4/11/03**
11	2.1	Site Topographic Mapping	Thu 1/2/03	Thu 1/30/03
12	2.2	Design Development (50%)	Thu 1/2/03	Fri 2/14/03
13	2.3	Construction Document Dev. (100%)	Mon 2/17/03	Fri 4/11/03
14	2.4	Detailed Construction Cost Estimate	Mon 3/24/03	Fri 4/11/03
15	**3.0**	**TASK 3 -- Soil Excavation and Disposal**	**Mon 5/12/03**	**Fri 6/27/03**
16	3.1	Contaminated Soil Excavation	Mon 5/12/03	Fri 6/6/03
17	3.2	Waste Stream Segregation and Stockpiling	Mon 5/12/03	Fri 6/13/03
18	3.3	Transport, Treatment, and Disp. of Exc. Soi	Mon 5/19/03	Fri 6/13/03
19	3.4	Sampling, Analysis, and Disposal of IDW	Tue 6/10/03	Fri 6/20/03
20	3.5	Backfilling, Grading, and Revegetation	Mon 5/19/03	Fri 6/27/03
21	**4.0**	**TASK 4 -- Construction Completion Report**	**Mon 5/19/03**	**Fri 7/4/03**
22	**5.0**	**TASK 5 -- Project Management**	**Thu 1/2/03**	**Fri 7/4/03**
23	5.1	Project Scheduling and Coordination	Thu 1/2/03	Fri 7/4/03
24	--	**Project Completion**	Fri 7/4/03	Fri 7/4/03



Project: workbreakdown
Date: Thu 1/2/03

Task | Split | Milestone | Summary | Deadline

TABLES

TABLE 3
MARINO BROTHERS SCRAP YARD
RECOMMENDED SAMPLING AND ANALYSIS PROGRAM FOR SOIL MANAGEMENT AREA NO. 1

Available Sampling Results for Lead in Soil Management Area No. 1[1]

Row	8	8	8	8	7	7	7	7	6	6	6	6	5	5	5	5	4
Column	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	4
Layer 1	NA	114	2980	NA	NA	NA	4740	293	2480	2090	1880	3210	3470	NA	2830	6540	NA
Layer 2	NA	NA	2680	NA	NA	NA	NA	3620	NA	NA	1920	NA	NA	NA	NA	3200	NA
Layer 3	NA	NA	NA	NA	NA	NA	7630	NA	NA	NA	3260	59.6	NA	NA	NA	NA	NA
Layer 4	NA	NA	NA	NA	NA	NA	NA	NA	NA	6110	1810	197	NA	165	4790	994	NA
Layer 5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	NA	NA	NA	NA	NA	NA	NA	94.3	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	NA	486	314	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 8	NA	NA	NA	NA	NA	NA	NA	605	NA	50.1	422	118	868	20.6	20.4	226	NA
Layer 9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 10	NA	NA	NA	NA	NA	NA	NA	NA	NA	15.9	NA	NA	NA	NA	NA	NA	NA
Layer 11	NA	218	NA	NA	NA	NA	NA	NA	NA	NA	1320	30.4	NA	NA	NA	NA	NA
Layer 12	NA	NA	NA	179	NA	NA	167	43.7	NA	13.2	1300	19.8	NA	NA	NA	15.8	NA

Recommended Sampling Locations Based on Results for Lead in Soil Management Area No. 1

Row	8	8	8	8	7	7	7	7	6	6	6	6	5	5	5	5	4
Column	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	4
Layer 1	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Layer 2	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Layer 3	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
Layer 4	0	0	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0
Layer 5	0	0	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0
Layer 6	0	0	1	1	1	1	1	0	1	1	1	0	1	0	1	0	0
Layer 7	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	0	0
Layer 8	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Layer 9	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Layer 10	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Layer 11	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Layer 12	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Total Samples: 120	4	0	8	8	8	8	8	7	9	9	14	4	9	5	9	5	5
Total Intervals: 88	2	0	6	6	6	6	6	5	7	7	12	2	7	3	7	3	3

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TABLE 3 (Continued)
MARINO BROTHERS SCRAP YARD
RECOMMENDED SAMPLING AND ANALYSIS PROGRAM FOR SOIL MANAGEMENT AREA NO. 2

Available Sampling Results for Lead in Soil Management Area No. 2[1]

Row	7	7	7	7	7	6	6	6	6	6
Column	5	6	7	8	9	5	6	7	8	9
Layer 1	NA	8710	2300	2900	9510	NA	3570	12800	3340	NA
Layer 2	NA	NA	3580	NA	NA	NA	NA	10900	NA	NA
Layer 3	NA	NA	462	468	NA	NA	NA	2230	NA	NA
Layer 4	NA	297	NA	NA	61.8	NA	113	NA	22.5	23.4
Layer 5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	NA	NA	NA	NA	NA	NA	NA	77.4	NA	13.4
Layer 7	NA	NA	NA	21.7	NA	NA	NA	NA	NA	NA
Layer 8	NA	NA	156	NA	NA	NA	51.4	NA	NA	NA
Layer 9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 10	NA	NA	NA	NA	NA	NA	NA	3660	NA	NA
Layer 11	NA	107	NA	NA	12.6	NA	NA	NA	16.5	NA
Layer 12	NA	NA	NA	NA		NA	19.9	21.8	NA	13.5

Recommended Sampling Locations Based on Results for Lead in Soil Management Area No. 2

Row	7	7	7	7	7	6	6	6	6	6
Column	5	6	7	8	9	5	6	7	8	9
Layer 1	2	2	2	2	2	2	2	2	2	2
Layer 2	2	2	2	2	2	2	2	2	2	2
Layer 3	1	1	0	0	1	1	1	1	1	1
Layer 4	0	0	0	0	0	0	0	1	0	0
Layer 5	0	0	0	0	0	0	0	1	0	0
Layer 6	0	0	0	0	0	0	0	1	0	0
Layer 7	0	0	0	0	0	0	0	1	0	0
Layer 8	0	0	0	0	0	0	0	1	0	0
Layer 9	0	0	0	0	0	0	0	1	0	0
Layer 10	0	0	0	0	0	0	0	1	0	0
Layer 11	0	0	0	0	0	0	0	1	0	0
Layer 12	0	0	0	0	0	0	0		0	0
Total Samples: 56	5	5	4	4	5	5	5	13	5	5
Total 1' Intervals: 36	3	3	2	2	3	3	3	11	3	3

TABLE 3 (Continued)
MARINO BROTHERS SCRAP YARD
RECOMMENDED SAMPLING AND ANALYSIS PROGRAM FOR SOIL MANAGEMENT AREA NO. 3

Available Sampling Results for Lead in Soil Management Area No. 3[1]

Row	5	5	5	5	5	4	4	4	4	3	3
Column	5	6	7	8	9	5	6	7	8	7	8
Layer 1	2750	3280	4660	NA	NA	6350	1470	NA	NA	2470	NA
Layer 2	NA	NA	5980	NA	NA	NA	NA	NA	NA	NA	NA
Layer 3	889	3750	4960	NA	NA	NA	NA	NA	988	NA	NA
Layer 4	804	132	NA	93.2	9620	NA	2990	NA	NA	7970	NA
Layer 5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	148	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	112	NA	NA	NA	NA	316	NA	NA	NA	NA	NA
Layer 8	44.6	23.3	157	NA	NA	NA	NA	NA	NA	NA	NA
Layer 9	13.1	4940	2030	NA	NA	NA	15	NA	292	NA	NA
Layer 10	NA	NA	NA	NA	NA	NA	15	NA	NA	NA	NA
Layer 11	17	NA	NA	NA	21.6	NA	54.1	NA	NA	130	NA
Layer 12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Recommended Sampling Locations Based on Results for Lead in Soil Management Area No. 3

Row	5	5	5	5	5	4	4	4	4	3	3
Column	5	6	7	8	9	5	6	7	8	7	8
Layer 1	2	2	2	2	2	2	2	2	2	2	2
Layer 2	2	2	2	2	2	2	2	2	2	2	2
Layer 3	0	1	1	1	1	1	1	1	0	1	1
Layer 4	0	1	1	0	1	1	1	1	0	1	1
Layer 5	0	1	1	0	1	1	1	1	0	1	1
Layer 6	0	1	1	0	1	1	1	1	0	1	1
Layer 7	0	1	1	0	1	0	1	1	0	1	1
Layer 8	0	1	1	0	1	0	1	1	0	1	1
Layer 9	0	1	1	0	1	0	0	0	0	0	0
Layer 10	0	1	1	0	1	0	0	0	0	0	0
Layer 11	0	1	1	0	0	0	0	0	0	0	0
Layer 12	0	1	1	0	0	0	0	0	0	0	0
Total Samples: 101	4	14	14	5	12	8	10	10	4	10	10
Total 1' Intervals: 79	2	12	12	3	10	6	8	8	2	8	8

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TABLE 3 (Continued)
MARINO BROTHERS SCRAP YARD
RECOMMENDED SAMPLING AND ANALYSIS PROGRAM FOR SOIL MANAGEMENT AREA NO. 4

Available Sampling Results for Lead in Soil Management Area No. 4[1]

Row	7	7	7	7	6	6	6	6	5	5	5	5
Column	10	11	12	13	10	11	12	13	10	11	12	13
Layer 1	NA	NA	1960	1830	7850	1500	1170	4790	NA	102	NA	31600
Layer 2	NA	NA	NA	NA	NA	NA	2030	3070	NA	NA	NA	
Layer 3	NA	NA	NA	NA	0.43	5.6	NA	82.5	NA	NA	1650	119
Layer 4	NA	NA	45.4	27.7	NA	NA	181	NA	12.5	NA	920	51.5
Layer 5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	NA	NA	NA	NA	NA	NA	10.5	NA	NA	NA	58	15.9
Layer 8	NA	NA	NA	26.6	NA	NA	23.4	16.5	NA	11.6	30.9	NA
Layer 9	NA	NA	NA	NA	NA	NA	NA	19.2	NA	NA	NA	NA
Layer 10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 11	NA	NA	NA	NA	NA	NA	NA	NA	NA	23.4	NA	13.8
Layer 12	NA	NA	13.2	NA	12.9	NA	NA	NA	NA	44.6	NA	NA

Recommended Sampling Locations Based on Results for Lead in Soil Management Area No. 4

Row	7	7	7	7	6	6	6	6	5	5	5	5
Column	10	11	12	13	10	11	12	13	10	11	12	13
Layer 1	2	2	2	2	2	2	2	2	2	0	2	2
Layer 2	2	2	2	2	2	2	2	2	2	0	2	2
Layer 3	1	1	1	1	0	0	1	0	1	0	1	0
Layer 4	0	0	0	0	0	0	0	0	0	0	0	0
Layer 5	0	0	0	0	0	0	0	0	0	0	0	0
Layer 6	0	0	0	0	0	0	0	0	0	0	0	0
Layer 7	0	0	0	0	0	0	0	0	0	0	0	0
Layer 8	0	0	0	0	0	0	0	0	0	0	0	0
Layer 9	0	0	0	0	0	0	0	0	0	0	0	0
Layer 10	0	0	0	0	0	0	0	0	0	0	0	0
Layer 11	0	0	0	0	0	0	0	0	0	0	0	0
Layer 12	0	0	0	0	0	0	0	0	0	0	0	0

Total Samples: 51	5	5	5	5	4	4	5	4	5	0	5	4
Total 1' Intervals: 29	3	3	3	3	2	2	3	2	3	0	3	2

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TABLE 3 (Continued)
MARINO BROTHERS SCRAP YARD
RECOMMENDED SAMPLING AND ANALYSIS PROGRAM FOR SOIL MANAGEMENT AREA NO. 5

Available Sampling Results for Lead in Soil Management Area No. 5[1]

Row	4	4	4	4	4	3	3	3	3	3	2	2	2
Column	9	10	11	12	13	9	10	11	12	13	11	12	13
Layer 1	404	NA	658	NA	7090	14000	NA	5410	NA	2760	NA	2020	NA
Layer 2	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 3	NA	NA	621	NA	NA	NA	NA	3530	NA	35	NA	NA	NA
Layer 4	NA	41.7		NA	58.2	NA	NA	NA	91.8	NA	NA	NA	NA
Layer 5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	NA	NA	NA	NA	NA	18.5	NA	36.2	24.3	NA	NA	NA	NA
Layer 8	142	NA	NA	NA	NA	NA	NA	NA	19	NA	NA	NA	NA
Layer 9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 10	NA	18	15.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 11	NA	18	15.9	NA	61.5	NA	NA	111	18.8	NA	NA	NA	NA
Layer 12	16.2	NA	NA	NA	NA	NA	NA	NA	NA	21.3	NA	NA	NA

Recommended Sampling Locations Based on Results for Lead in Soil Management Area No. 5

Row	4	4	4	4	4	3	3	3	3	3	2	2	2
Column	9	10	11	12	13	9	10	11	12	13	11	12	13
Layer 1	0	2	0	2	2	2	2	2	2	2	2	2	2
Layer 2	0	2	0	2	2	2	2	2	2	2	2	2	2
Layer 3	0	1	0	1	1	1	1	1	1	0	1	1	1
Layer 4	0	0	0	0	0	0	0	1	0	0	0	0	0
Layer 5	0	0	0	0	0	0	0	0	0	0	0	0	0
Layer 6	0	0	0	0	0	0	0	0	0	0	0	0	0
Layer 7	0	0	0	0	0	0	0	0	0	0	0	0	0
Layer 8	0	0	0	0	0	0	0	0	0	0	0	0	0
Layer 9	0	0	0	0	0	0	0	0	0	0	0	0	0
Layer 10	0	0	0	0	0	0	0	0	0	0	0	0	0
Layer 11	0	0	0	0	0	0	0	0	0	0	0	0	0
Layer 12	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Samples: 55	0	5	0	5	5	5	5	6	5	4	5	5	5
Total 1' Intervals: 33	0	3	0	3	3	3	3	4	3	2	3	3	3

TABLE 3 (Continued)
MARINO BROTHERS SCRAP YARD
RECOMMENDED SAMPLING AND ANALYSIS PROGRAM FOR SOIL MANAGEMENT AREA NO. 6

Available Sampling Results for Lead in Soil Management Area No. 6[1]

Row	7	7	7	6	6	6	6	6	5	5	5	5	5	4	4
Column	14	15	16	14	15	16	17	18	14	15	16	17	18	16	17
Layer 1	1040	NA	780	2710	2270	NA	727	461	7580	15200	563	2820	NA	13000	12000
Layer 2	NA	NA	NA	NA	2070	NA	NA	NA	NA	10700	NA	NA	NA	NA	NA
Layer 3	NA	NA	NA	300	NA	NA	NA	NA	NA	NA	80.6	52.6	NA	25.3	NA
Layer 4	NA	NA	NA	NA	NA	NA	NA	NA	15.6	583	37.6	NA	NA	232	9.2
Layer 5	NA	NA	NA	NA	96.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	NA	NA	NA	3060	NA	NA	NA	NA	NA	NA	22.8	NA	NA	NA	NA
Layer 7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	27.3	11.6	NA	9.7	17.5
Layer 8	NA	NA	NA	14.1	NA	NA	4.5	NA	NA	NA	NA	NA	NA	9.6	NA
Layer 9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	46.9	19.2	NA	NA	NA
Layer 11	NA	NA	NA	NA	19.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 12	NA	NA	NA	NA	NA	NA	NA	NA	34.4	NA	NA	NA	NA	39.8	NA

Recommended Sampling Locations Based on Results for Lead in Soil Management Area No. 6

Row	7	7	7	6	6	6	6	6	5	5	5	5	5	4	4
Column	14	15	16	14	15	16	17	18	14	15	16	17	18	16	17
Layer 1	0	2	0	2	2	2	0	0	2	2	0	2	2	2	2
Layer 2	0	2	0	2	2	2	0	0	2	2	0	2	2	2	2
Layer 3	0	1	0	1	1	1	0	0	1	1	0	0	0	0	1
Layer 4	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0
Layer 5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Layer 6	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Layer 7	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Layer 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Layer 9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Layer 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Layer 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Layer 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Samples: 54	0	6	0	9	6	6	0	0	5	5	0	4	4	4	5
Total 1' Intervals: 34	0	4	0	7	4	4	0	0	3	3	0	2	2	2	3

TABLE 3 (Continued)
MARINO BROTHERS SCRAP YARD
RECOMMENDED SAMPLING AND ANALYSIS PROGRAM FOR SOIL MANAGEMENT AREA NO. 7

Available Sampling Results for Lead in Soil Management Area No. 7[1]

Row	4	4	3	3	3	3	2	2	2	2	1	1	1
Column	14	15	14	15	16	17	14	15	16	17	15	16	17
Layer 1	10600	9640	3900	2830	1320	6060	2710	3200	1950	1050	NA	NA	310
Layer 2	1430	NA	8270	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 3	NA	NA	16.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 4	26.1	83.3	42.3	17.5	11	NA	12.1	2	26.1	NA	NA	NA	NA
Layer 5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 6	NA	NA	54.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Layer 7	16.5	11.3	16.2	NA	NA	NA	20.9	NA	NA	NA	NA	NA	NA
Layer 8	25.1	NA	NA	NA	NA	1720	NA	18	8.7	NA	NA	NA	NA
Layer 9	NA	NA	NA	NA	NA	NA	16.6	NA	NA	NA	NA	NA	NA
Layer 10	NA	NA	NA	NA	NA	NA	13.7	NA	NA	NA	NA	NA	NA
Layer 11	NA	20.2	NA	NA	NA	854	NA	NA	NA	NA	NA	NA	NA
Layer 12	NA	NA	NA	NA	10.5	NA	NA	13.2	15.2	NA	NA	NA	NA

Recommended Sampling Locations Based on Results for Lead in Soil Management Area No. 7

Row	4	4	3	3	3	3	2	2	2	2	1	1	1
Column	14	15	14	15	16	17	14	15	16	17	15	16	17
Layer 1	2	2	2	2	2	2	2	2	2	2	2	2	0
Layer 2	2	2	2	2	2	2	2	2	2	2	2	2	0
Layer 3	1	1	0	1	1	1	1	1	1	1	1	1	0
Layer 4	0	0	0	0	0	1	0	0	0	0	0	0	0
Layer 5	0	0	0	0	0	1	0	0	0	0	0	0	0
Layer 6	0	0	0	0	0	1	0	0	0	0	0	0	0
Layer 7	0	0	0	0	0	1	0	0	0	0	0	0	0
Layer 8	0	0	0	0	0	1	0	0	0	0	0	0	0
Layer 9	0	0	0	0	0	1	0	0	0	0	0	0	0
Layer 10	0	0	0	0	0	1	0	0	0	0	0	0	0
Layer 11	0	0	0	0	0	0	0	0	0	0	0	0	0
Layer 12	0	0	0	0	0	0	0	0	0	0	0	0	0

Total Samples: 66	5	5	4	5	5	12	5	5	5	5	5	5	0
Total 1' Intervals: 42	3	3	2	3	3	10	3	3	3	3	3	3	0

Notes:

All layers are 1 foot thick; the number "1" indicates recommended location for collecting a 1 foot-thick composite sample.
Color-coding indicates sample results as follows - brown: lead > 1,300 mg/kg; aqua: lead <= 1,300 mg/kg.

[1]Sample results used during the development of recommended sampling depths can be found in Draft Remedial Investigation Report (Baker 2001) and other supplemental investigation results reports.

NA Not analyzed
L Less than or equal to

b:\project\tio\brownfield support center\marino scrap yard\final sow\deliverable 04_29_03\pdf files\marino table 3.doc

TABLE 4
MARINO BROTHERS SCRAP YARD
ESTIMATED NUMBER OF SAMPLES REQUIRED
TO COMPLETE CLEANUP DESIGN

Soil Management Area (SMA)	Recommended Number of Samples
1	120
2	56
3	101
4	51
5	55
6	54
7	66
Total	503

ATTACHMENT 1

PRELIMINARY CONCEPTUAL SITE MODEL
(SEE ATTACHED COMPACT DISC FOR MOST VERSIONS OF THIS SYSTEMATIC PLAN)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

May 24, 2002

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

Mr. Terry E. Goodwald
Project Officer
Pennsylvania Department of Environmental Protection
Field Operations-Environmental Cleanup Program
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222-4745

Subject: **Draft Preliminary Conceptual Site Model, Marino Scrap Yard Site**

Dear Terry:

Enclosed are the draft work products comprising a preliminary Conceptual Site Model as developed through the U.S. Environmental Protection Agency's (EPA) Technology Innovation Office (TIO) for the Marino Brothers Scrap Yard site, Rochester, Pennsylvania. They support Pennsylvania Department of Environmental Protection Agency's (PADEP's) efforts to systematically plan a cost effective remedial cleanup strategy for the site. Through our Brownfields Technology Support Center, we agreed to conduct a systematic planning process at the Marino site to help you understand and to help us showcase our "Triad" approach (elements described below) to streamline site cleanups through better characterization and monitoring approaches. Please note that these materials are marked as "preliminary draft" as they are intended to guide you as you work with experts within your agency and with your consultants to develop an appropriate and protective approach for your site. The materials will require review and, if necessary, revision based on your more detailed understanding of PADEP regulatory requirements and needs. If you would like further EPA review or input, please let me know.

The work products help develop a preliminary conceptual site model (CSM) and cost scenarios for restoration at Marino. We initially presented much of this information to PADEP in February 2002. TIO appreciates this opportunity to collaborate with PADEP in employing a model approach to site characterization and remediation using a formalized process of systematic planning, a dynamic work plan strategy, and real-time measurement technologies (the Triad approach). We want to continue to work with you to track progress at the site and to create training materials to encourage the broader application of these approaches at other sites managed by PADEP as well as other organizations involved in site reuse and land recycling. The intent of our effort was to demonstrate how the Triad could support a cleanup process at your site that meets the reuse goals of the locality as well as your regulatory, budgetary and time requirements. TIO's support contractor, Tetra Tech EM, Inc., prepared these products.

The materials are organized in a chronological order conducive to presentation in an educational setting. This was done to provide PADEP with the opportunity to comment on potential training materials that EPA is developing based on the team's collaborative efforts. We are giving you the data in both hard copy and electronic formats to facilitate PADEP's distribution and reuse of the materials. The package contains:

- Enclosure 1 (Part A) – The Relational Database
- Enclosure 1 (Part B) – Statistical Analysis for Soil and Groundwater
- Enclosure 2 – Screening Level Risk Analysis used in the Development of Site-Specific Soil Remediation Standards
- Enclosure 3 – Isoconcentration Maps and Cross-Sections used in Development of the CSM
- Enclosure 4 – Groundwater to Surface Water Modeling Results
- Enclosure 5 – Preliminary Analysis of Remedial Alternatives and Cost Estimates

At the end of this letter, you will find brief descriptions of each enclosure to provide insight into the implications of the products provided. We request PADEP's input and suggest as a next step in this project that we develop a draft, model statement of work (SOW) for the actual cleanup activities. The SOW will help you understand (and help us illustrate) the application of the other two elements of the Triad, a dynamic work plan strategy and the optimum use of on-site analytical technologies. In addition, we would like to begin planning for a one-day workshop for regulators and consultants to help promote the understanding of the concepts of our "Triad" and to hold up the Marino site as an example of this approach in a reuse/recycling scenario. We plan to develop and distribute a case study on the site once work is completed and to use these products as illustrations to help support our development of a "handbook" on the application of the Triad approach.

EPA intends, by offering this support, to assist PADEP in finding the most cost effective strategy for remediation at the Marino site while showcasing the effectiveness of the Triad in a reuse setting. We hope the draft products begin to help meet this mark and aid you as you continue your discussions within PADEP on the reuse of the Marino site. Our efforts have been extremely helpful to us in developing supporting materials for and sharpening our understanding of the actual application of the approach. If you have any questions please contact me at (703) 603-7196 or powell.dan@epamail.epa.gov.

Sincerely,

Daniel M. Powell, Project Manager
EPA Technology Innovation Office
Brownfields Technology Support Center

Enclosures

cc: Walter Kovalick (w/o enclosures)
Steve Luftig (w/o enclosures)
Linda Garczyinski (w/o enclosures)
Tom Stolle (w/o enclosures)
Jeff Heimerman (w/o enclosures)
Deana Crumbling (w/o enclosures)

DESCRIPTION OF ENCLOSED MATERIALS
ELEMENTS OF THE DRAFT CONCEPTUAL SITE MODEL

Enclosure 1 (Part A) -The Relational Database

A compact disc (CD) is provided that contains the relational database developed by Tetra Tech EM Inc. (Tetra Tech). The files contained in the attached CD are organized according to the subtitles provided below. The database was created using the results provided by PADEP for the remedial investigation (RI) conducted by Baker Environmental (Baker). The data compiled from Baker by Tetra Tech also includes results from several subsequent follow on sampling events. The structure of the database as created by Tetra Tech is discussed further in Enclosure 1.

Enclosure 1 (Part B) - Statistical Analysis for Soil and Groundwater

As part of the strategic meeting between PADEP and EPA it was determined that soil, groundwater, sediment, surface water, buildings, and debris remaining on the site were of potential concern to human health and the environment. Of these media, sediment and building/former activity debris were either already being addressed or would be addressed later in the remedial process. No groundwater use on or downgradient of the site was identified by the planning team because of the planned recreational use and the proximity of the site to the Ohio River. Groundwater statistics were developed to assist PADEP in assessing the level of personal protective equipment (PPE) needed for worker safety during periods of construction and to estimate the potential impact from groundwater to the Ohio River. Tetra Tech was tasked with evaluating principally the risk associated with soil and groundwater discharge to surface water.

Results from the statistical analysis of soil indicated a need for the development of more appropriate site-specific risk based standards. Based on the standards developed for soil, a final draft list of contaminants of potential concern was developed and is presented in the summary statistics table provided in Enclosure 1. Chemical constituents in groundwater whose maximum values exceed the residential media-specific concentration (MSC) (PADEP, Act 2, 2002, Technical Guidance) were retained for modeling the potential impact from groundwater to surface water and to provide some general information concerning the severity of groundwater contamination at the site. These results are presented in Enclosure 1.

For soil a truncated data set representing the distribution of results below the site-specific standards was also developed. This data set will be used for refining the sampling approach should PADEP decide to proceed with a surgical removal approach at the site. The truncated data is representative of conditions that could exist at the site once remediation is complete (i.e. results obtained are all below the site-specific action levels) and verification of attainment is to commence. The data has not been used thus far and is provided for completeness.

Enclosure 2 -Screening Level Risk Analysis used in the Development of Site-Specific Soil Remediation Standards

Enclosure 2 provides the results of a screening level risk assessment performed to identify contaminants of potential concern (COPCs) based on residential MSCs selected using PADEP's Act 2, Technical Guidance (PADEP, 2002). Results are presented in the form of a Microsoft EXCEL spreadsheet provided in Enclosure 2. Based on discussions with PADEP Tetra Tech also prepared site-specific standards for the site and a write-up explaining the approach used during development of these standards is also provided in Enclosure 2. Equations used and exposure assumptions are presented in separate files provided in Enclosure 2. More formal documentation of the risk-based approach used will be prepared later as EPA finalizes a case study for the site.

Enclosure 3 - Isoconcentration Maps and Cross-Sections used in Development of the CSM

Maps and cross-sections showing lines of equal concentration were prepared for the site. Cross-sections were principally prepared to identify where significant data gaps may bias the results of volume estimates and to identify how contaminants appear to propagate through the soil column. Cross-sections were prepared primarily along north south transects and east west transects because of the distribution of data points. The lines of equal concentration were estimated on the cross-sections by selecting a half-way point between the sample results that were reported as above the site-specific action level or the MSC, which ever was appropriate. This is a serious limitation relative to the volume of contamination that would be estimated based on the cross-sections alone. However, the software program used to prepare the plan view maps and volume calculations was EPA's Fully Integrated Environmental Location Decision Support or FIELDs, which utilizes a weighted average. This helped the project team avoid the inherent limitations of the cross-sections. The cross-sections do show where data gaps are present and they also confirm that contamination does not appear to be spreading out with depth. This is important if a top down sampling scheme is employed in support of remedial action at the site. Enclosure 3 contains a reference map showing both where the cross-sections were constructed and identifying individual well names to assist PADEP during future site evaluations.

Isoconcentration maps were prepared using FIELDs based on residential MSCs and logical contour intervals selected by Tetra Tech to enhance the detail provided concerning changes in concentration across the site. The same exercise was performed using only those analytes retained that exceeded the site-specific standards. The overlap between risk driving COPCs was reviewed in order to select lead as the most widely distributed COPC upon which volume estimates could be based. Additional information concerning the methods for isoconcentration map development are also provided in Enclosure 3.

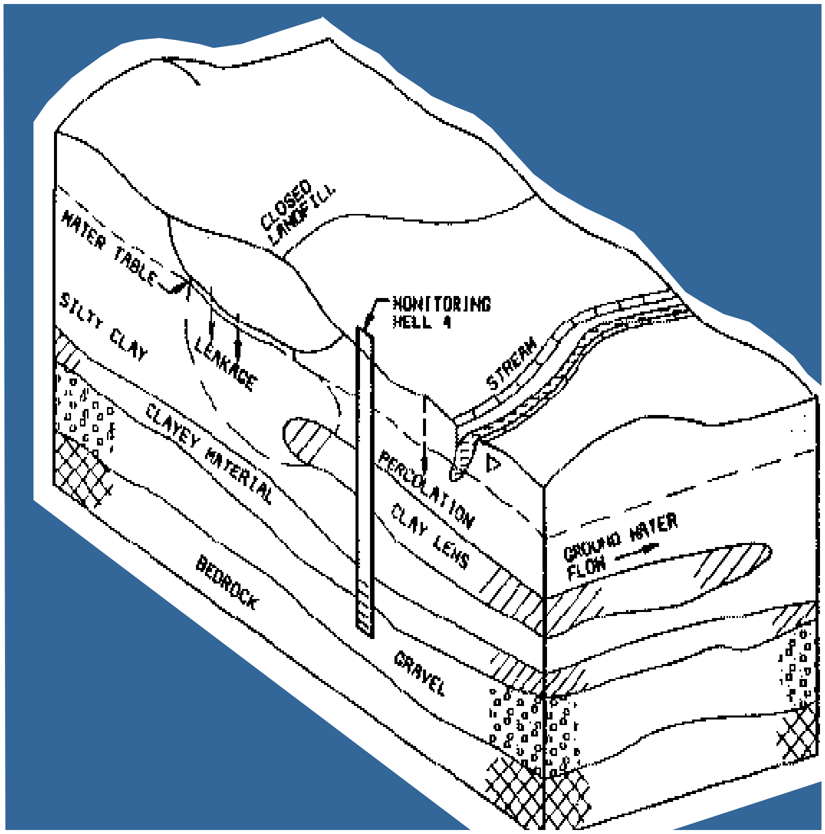
Enclosure 4 - Groundwater to Surface Water Modeling Results

Tetra Tech used the Pennsylvania Single Discharge Wasteload Allocation Computer Program for Toxic Substances (PENTOX) model to evaluate the potential for contaminants found in groundwater to impact the Ohio River. Geometric mean concentrations were applied as though they existed across the entire site. Hydrogeologic flow conditions from the remedial investigation were used to estimate discharge rates from the site to the river for all COPCs in groundwater found to have a maximum value that exceeded the residential MSC for groundwater based on the ACT 2, Technical Guidance (PADEP, 2002) requirements. These assumptions and others used during the modeling effort are discussed in greater detail in Enclosure 4. Results of the modeling effort indicate that the impacts from the site to the Ohio River are negligible. The impact of groundwater to sediments was not evaluated.

Enclosure 5 – Preliminary Analysis of Remedial Alternatives and Cost Estimate

Enclosure 5 provides a summary of proposed approaches to the site restoration developed by the project planning team. Alternatives include capping, treatment, and excavation. Preliminary estimated costs for each alternative are also provided. The preferred alternative is yet to be determined. A final decision will be based on discussion to be held between PADEP and the Rochester Borough. Based on the results of these discussions the need for further support from EPA will be determined by PADEP. Preliminary indications are that at least some treatibility study data should be collected before final cost estimates can be prepared and a refined plan for restoration at the site developed. By all indications it appears that an approach based on the principles of the Triad Approach could be extremely beneficial to PADEP and its contractor in conducting remedial action at the site.

WORK PRODUCTS SUPPORTING A SYSTEMATIC PLANNING PROCESS AT THE MARINO SCRAP YARD SITE



Part 1 – Developing a Preliminary Conceptual Site Model to Guide Clean-Up

Developed By

Pennsylvania Department of Environmental Protection
In Cooperation with
Brownfields Technology Support Center

documents needed to implement the Site cleanup. The Sub-tasks of the streamlined design component of the work are listed below:

Additional Studies

Task 2.1 – Site Topographic Mapping

Implementation

Task 2.2 – Design Development (50 percent complete)
Task 2.3 – Construction Documents (100 percent complete)
Task 2.4 – Detailed Construction Cost Estimate

1.7.3 Task 3 – Soil Excavation and Disposal

The Implementation Contractor(s) shall implement the cleanup action as described by the streamlined design documents. The major sub-tasks associated with the cleanup action are listed below:

Task 3.1 – Contaminated Soil Excavation
Task 3.2 – Waste Stream Segregation and Stockpiling
Task 3.4 – Transport, Treatment, and Disposal of Excavated Soil
Task 3.5 – Sampling, Analyses, and Disposal of Investigation Derived Waste
Task 3.6 – Backfilling, Grading, and Revegetation

1.7.4 Task 4 – Construction Completion Report

The Implementation Contractor(s) shall prepare a Completion Report that will serve as the executive record summarizing the cleanup activities implemented at the Site. The completion report, at a minimum, shall include a detailed record of the work activities implemented during the cleanup, present as-built drawings of soil excavation areas, and provides details regarding soil treatment and disposal.

1.7.5 Task 5 – Project Management

The Contractor(s) shall be responsible for managing all aspects of the additional studies or implementation programs. At a minimum, the sub-task associated with project management will include:

Task 5.1 – Project Scheduling and Coordination

2.0 PRELIMINARY CONCEPTUAL SITE MODEL AND DESIGN BASIS

The US Environmental Protection Agency (EPA) Brownfields Technology Support Center (BTSC) developed a preliminary conceptual site model to help guide the selection of an approach to Site cleanup. Initially, the BTSC (Attachment 1) constructed a preliminary conceptual site model (CSM) using data collected by Baker Environmental (Baker) and presented in the Remedial Investigation (RI) Report (Baker, 2001). The preliminary CSM was used to develop estimates concerning soil removal volumes expected during cleanup and to identify additional data needs that should be addressed prior to completing design and implementing the cleanup. This document serves as a template to allow PADEP to further refine and issue a plan to the contractor(s) selected to perform any portion of the cleanup at the Site.

2.1 INITIAL SITE INVESTIGATIONS

A Site investigation was conducted by PADEP's contractors in two phases. During the first phase of the RI, Civil and Environmental Consultants, Inc. (CEC) investigated the property for the Borough of Rochester, collecting data from June 1998 through June 1999 (CEC, 1999). Nine groundwater-monitoring wells were installed and surface and subsurface soil samples were collected. Polychlorinated biphenyls (PCBs), benzo(a)pyrene, antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, thallium, and zinc were found above PADEP medium-specific concentrations (MSCs). Groundwater samples were collected during three quarterly events. PCBs, bis(2-ethylhexyl)phthalate, cadmium, chromium, and lead in groundwater samples were found to be above drinking water MSCs.

Baker Environmental conducted the second phase of the investigation from November 2000 to April 2001. The second phase of the investigation consisted of collecting surface soil samples, collecting subsurface soil samples using direct-push sampling methods, collecting sediment from the Ohio River, installing nine temporary and five permanent groundwater monitoring wells, and measuring water levels in monitoring wells and the Ohio River. Surface soil samples were collected from 80 locations, and subsurface soil samples were collected from 94 soil borings at depths ranging from 2 to 19 feet below ground surface (bgs). Samples were analyzed for U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Target Analyte List (TAL) for metals, Target Compound List (TCL) for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), and PCBs. The nature and extent of these contaminants in soil and groundwater is discussed in the RI report (Baker, 2001). The sediment-sampling program, however, was not successful because debris on the river bottom prevented successful sample collection.

2.2 PRELIMINARY CONCEPTUAL SITE MODEL (CSM)

The preliminary CSM reflects the RI data and presented it in a letter report to PADEP (Attachment 1). The BTSC developed summary statistics and plots for each soil and groundwater analyte evaluated during the RI. Summary statistics included the detection frequency, mean, median, geometric mean, minimum and maximum detected concentrations and reporting limits, standard deviation, variance, and 95% upper confidence level (95 UCL) of the maximum concentration. Probability plots, maps, and cross-sections were also developed to assist in the identification of preferred alternatives for reuse and cleanup of the Site.

2.2.1 Unsaturated Soil Statistics and Identification of Chemicals of Concern

As part of the systematic planning process to identify reasonable alternatives for reuse of the Site, unsaturated soil data sets were compared to the appropriate residential and commercial reuse reference values chosen following PADEP Act 2 guidance (Part 2, Technical Guidance, PADEP 2002). Appropriate medium-specific concentration (MSC) reference values were selected by taking the lower value of the soil direct-contact value (Act 2, Technical Guidance, PADEP 2002) and the soil-to-groundwater value, then comparing that value to the historical results to identify potential risk drivers. The MSC values used for preliminary identification of contaminants of potential concern (COCs) are provided in bold text in the attached soil summary statistics table (see Attachment 1, Enclosure #1).

The groundwater table at the Site is located approximately 12 feet below ground surface (bgs). Discussions with PADEP and an analysis of the Site data indicated that saturated soil (soil generally below 12 feet bgs) would not be addressed as part of the soil cleanup. Furthermore, conversations with PADEP determined that site-specific, risk-based standards (RBCs) would be developed for contaminants of potential concern (COCs). It was determined that remediation based on default residential or industrial MSCs would be cost prohibitive, because of the ubiquitous presence of low levels of arsenic above the residential MSCs. The distribution of low levels of arsenic across the Site was attributed to the presence of slag used to backfill the Site.

As part of the effort to plan an investigation and cleanup strategy reflective of Site goals identified by PADEP, the BTSC performed a preliminary screening level risk assessment to calculate site-specific RBCs for each COC, based on a recreational exposure scenario for a six-year-old child. The exposure scenario incorporated exposure occurring through incidental soil ingestion, dermal contact with soil and inhalation of soil particles (Attachment 1, Enclosure #2). Based on this screening level risk assessment the COCs shown in Table 1 were identified along with appropriate levels to be used in guiding the removal or cleanup of soil. Rough cost estimates were then prepared for several potential alternatives including cap and close, solidification/stabilization and monitoring, and surgical removal of the contaminants followed by disposal as necessary at an offsite location. Off-site disposal was identified as the preferred alternative based on the protectiveness of the remedy and retention of maximum reuse options. This option may or may not be viable. PADEP will evaluate the need for an alternative approach once the Additional Studies program is completed.

2.2.2 Estimated Volume of Soil Requiring Removal

The BTSC used the Fully Integrated Environmental Location Decision Support (FIELDS) system to develop contour maps of contaminant concentrations above residential and site-specific RBCs. This software program was developed by the U.S. Environmental Protection Agency (EPA) Region V and provides the user with the ability to query a database, develop ArcView shape files based on the query, contour the data and perform mass and volume calculations. The maps were contoured using the natural neighbor interpolation algorithm and plotted on ArcView maps. The data set was parsed into two-foot thick depth intervals to facilitate the analysis with FIELDS, which is a two-dimensional analytical tool. The subsurface data were concentrated within particular depth intervals; only those depth intervals that had sufficient coverage to support the generation of contours were analyzed, these intervals included: 0.0 to 2.0 feet bgs, 2.0 to 4.0 feet bgs, 6.0 to 8.0 feet bgs, and 10.0 to 12.0 feet bgs (Attachment 1, Enclosure #3).

The BTSC generated maps to indicate the areal extent of soil contaminants with concentrations above one of the screening levels (PADEP residential MSCs or site-specific RBCs). Maps were not generated if the natural neighbor algorithm did not calculate a value greater than the screening level (i.e., residential MSC or site-specific RBC). As a result, at least one map was generated showing soil concentrations above residential MSCs for ten contaminants including: antimony, arsenic, cadmium, iron, lead, mercury, zinc, and three PCB Aroclors, 1248, 1254, and 1260). Seven of the ten contaminants above the residential MSCs also had a contoured interval that exceeded site-specific RBCs including: antimony, iron, lead, mercury, and the three Aroclors. Visual analysis of the maps indicated that the areal extent of lead contamination above site-specific RBCs encompassed that of all other contaminants found at or above their respective site-specific RBCs. Therefore, it was decided that lead above site-specific RBCs would initially be used to define the extent of excavation required.

The BTSC also used FIELDS to generate an estimate of the contaminated soil volume requiring removal. This volume estimate included all of the contoured areas in the three depth intervals where lead concentrations were estimated to be above the site-specific RBC of 1,300 milligram per kilogram (mg/kg): 0.0 to 2.0 feet bgs, 2.0 to 4.0 feet bgs, and 6.0 to 8.0 feet bgs. Averaging the volumes calculated for the surrounding intervals filled the 4.0 to 6.0-foot data gap. The preliminary estimate of unsaturated soil requiring excavation using FIELDS during the cleanup was approximately 18,000 cubic yards (yd^3) (see Attachment 1, Enclosure #3 of Preliminary CSM [Tetra Tech 2002]). A revised volume estimate using a three-dimensional inverse distance algorithm via the University of Tennessee's software package Spatial Analysis and Decision Assistance (SADA) was similar at 16,853 yd^3. This value was deemed most appropriate for use in preparing this systematic plan because of the more advanced three-dimensional capabilities of the SADA software. The bid schedule provided in the Statement of Work (SOW) includes estimated volumes of soil to be removed by disposal category identified by the BTSC. The volumes provided are for bidding purposes only, final volumes shall be determined after the Additional Studies program has been completed and a revised cost estimate prep ared (Task 2.4).

2.2.3 Groundwater Evaluation

PADEP decided that no future use of groundwater beneath the Site should be allowed. To assess the impact of Site groundwater on the Ohio River, modeling to calculate mass loading to the Ohio River was performed using the Pennsylvania Single Discharge Wasteload Allocation Computer Program for Toxic Substances (PENTOX-SD). PENTOX-SD uses a mass-balance water quality analysis model that incorporates first-order decay and mixing, to calculate the water quality-based effluent limits (WQBEL) and maximum daily limits (MDL) for 22 COCs. The list of COCs included aluminum, barium, copper, manganese, nickel, thallium, vanadium, dibenzo[a,h]anthracene, ideno[1,2,3-cd]pyrene, benzo[k]anthracene, benzo[a]anthracene, and benzo[a]pyrene which had maximum values that exceeded the drinking water MSCs and or had a potentially applicable ambient water quality criteria (Title 25 of the Pennsylvania Code). The WQBELs and MDLs calculated with PENTOX-SD are greater than the contaminant concentrations present below the footprint of the Site, which indicates that groundwater discharge from the Site is not significantly impacting the water quality of the Ohio River.

2.3 CONCEPTUAL SITE MODEL FOR CLEANUP

Through the compilation and analysis of existing results, a systematic plan and conceptual site model for cleanup at the Site was developed. Based on information provided in Part 1 - Developing a Preliminary Conceptual Site Model to Guide Clean-up (Attachment 1) it was established that the mechanism for release of the contaminants generally follows a top down pattern (See Attachment 1, Enclosure #3, Cross-Sections [Tetra Tech 2002]). Contamination is generally higher at the surface and decreases rapidly with depth. Several exceptions to this rule were noted and PADEP recommends in these areas that sampling proceed to the depth necessary to confirm the reliability of the historical results and assure the protectiveness of the remedy.

Project decisions will require that the Contractor analyze samples for the presence of the COCs identified in Table 1. Initially it was hoped that lead could be used as an indicator for directing the need for excavation. While this appears, based on visual inspection to generally be the case, a closer examination of the correlation coefficients between COCs suggests that this approach might not be applicable across the site (Attachment 2). Linear correlation coefficients are generally less than 50 percent or r^2 less than 0.50 for all but one of the pairs of COCs evaluated. PADEP recommends analyses to support waste segregation, because many of the COCs are regulated under either the Resource Conservation and Recovery Act (RCRA) or the Toxic Substance Control Act (TSCA). PADEP also recommends additional limited characterization prior to excavation using the Toxicity Characteristic Leaching Procedure (TCLP) for where new samples will be collected. These metals and their associated regulatory threshold limit values are provided in Table 2.

TABLE 2
T0XICITY CHARACTERISTIC LEACHING PROCEDURE REGULATORY THRESHOLD LIMIT VALUES AND PADEP RECOMMENDED METHOD REPORTING LIMITS FOR FINAL WASTE DISPOSAL MONITORING AND MEASUREMENT ACTIVITIES
MARINO BROTHERS SCRAP YARD
ROCHESTER BOROUGH, PENNSYLVANIA

List of 8 RCRA Metals for TCLP Testing	TCLP Characteristic RCRA Waste Designation Regulatory Threshold Limit Values (mg/L)	PADEP Recommended Method Reporting Limits/Quantitation Limits (mg/L)
Arsenic	5.0	1.0
Barium	100	10
Cadmium	1.0	0.5
Chromium	5.0	1.0
Lead	5.0	1.0
Mercury	0.2	0.025
Selenium	1.0	0.1
Silver	5.0	1.0

Note:

mg/L Milligrams per liter

In order to refine the CSM at the Site, upfront analyses for these constituents during the Additional Studies program is recommended by PADEP so that preliminary waste segregation action levels based on total metals concentration available from the RI can be developed and included in the final design (See Section 3.1). These results shall be used to begin segregating wastes into discrete waste piles prior to final waste characterization sampling, disposal, or placement. A preliminary correlation should be made between total metals concentrations and those TCLP concentrations that exceed the regulatory threshold limit values shown in Table 2. As the additional studies sampling program proceeds split samples for TCLP and total metals analysis on top of those performed as part of the demonstration of methods applicability (Task 1.2) should be collected and analyzed to continue to refine the segregation screening levels for use in the final design (Task 1.5). These analyses will further facilitate the Implementation Contractor(s) ability to design a waste segregation scheme and refine disposal costs and other treatment requirements. No new sampling should be necessary where historical data from the RI is available unless the results are so close to a screening value as to warrant additional sampling and or analyses. A historical result may also be deemed unrepresentative for other reasons, such as location relative to other historical sampling locations or position within a particular grid. The need for additional analyses for waste segregation or excavation can be made in the field based on agreed upon data review and decision making protocols. More details concerning this program are provided in Section 3.1 of this systematic plan under Work Elements (WE) 1.4 through 1.6.

Analyses for total polychlorinated biphenyls (PCBs) in the field are also recommended by PADEP during the Additional Studies program to assure that the cost of disposal of PCB containing waste can be accurately predicted. Figure 3 provides a schematic of the decision logic that should be considered in designing a waste segregation scheme for the Site. Metals concentrations are expected to drive waste disposal options when concentrations of metals are sufficient to classify the waste as characteristically hazardous under RCRA. TSCA requirements, landfill permit requirements, and Land Disposal Restrictions (LDRs) may also control the method of disposal or treatment required. As shown on Figure 3 concentrations for PCBs and mercury that exceed 499 and 260 milligrams per kilogram (mg/kg) respectively are required to be aggressively treated prior to disposal using a treatment technology such as incineration or retorting. When samples appear to exceed these concentrations or other threshold limit or screening values, this will result in much higher costs for disposal, PADEP recommends that the field-based analyses for total PCBs be confirmed in a fixed lab using gas chromatography/mass spectrometry particularly when concentrations are slightly above 499 mg/kg and other disposal limit thresholds (i.e. 50 mg/kg). Levels at which these types of analyses might be advantageous should be included in the decision criteria determined during systematic planning and provided with the Implementation Contractor(s) Sampling and Analysis Plan.

The Site was previously sampled using 50-foot grid spacing (Figure 4). Similar grid spacing should be useful during the Additional Studies program because of the importance of maximizing the use of existing data. A cost benefit analysis based on the estimated average disposal versus sampling cost was used in arriving at this recommendation. PADEP recommends a random systematic sampling pattern or unaligned grid where additional sampling is required (See US EPA QA/G-5S, Chapter 7, December 2002). More details concerning the basis for the sampling design and suggested methods for collection of the samples are provided in Section 3.1 under WE 1.4.

PADEP recommends a sampling and analysis program using a combination of hand auger and direct-push sampling methods and field-based analyses based on the availability of existing information. PADEP recommends analytical methods such as X-ray fluorescence (XRF) and PCB analyses using a single column gas chromatograph in the field to collect near real-time results based on the site-specific action levels shown in Table 1. PADEP recommends limited TCLP analyses as mentioned above at a fixed laboratory initially during a methods applicability study and during the additional studies effort to maximize the reliability of action levels to be used during design and implementation of the cleanup. PADEP recommends sequencing of the sampling, analysis, planning, and excavation work to save time and money by limiting mobilizations of subcontractor equipment and personnel. For this purpose the Site has been segregated into seven soil management areas (SMAs) shown in Figure 4.

By griding the Site, under one convention and numbering samples in accordance with the scheme shown in Figure 5, it should be possible to conduct activities in a sequential, orderly fashion that will limit crew size and the need for multiple mobilizations.

PADEP recommends clearing and grubbing of the Site prior to the commencement of the Additional Studies program. Concrete placed on the Site by the former owner should be removed and characterized prior to commencing with the additional studies activities. Initially it is envisioned that the far northeast portion of the Site will be cleared and backfilled to accommodate placement of a decontamination pad, on-site laboratory, and field office prior to large-scale mobilization to the Site (Figure 2). Detailed guidance concerning proposed analytical methods and sampling schemes and anticipated modifications can be found in Sections 3.1.4, 3.1.5, 3.1.6, and 3.1.7.

2.3.1 Soil Segregation and Disposal

Remediation costs for the Site will depend not only on the total volume of soil excavated but also on the treatment and disposal restrictions and related costs that will apply to excavated soil. The main considerations that will control the cost of disposal and need for additional sampling and analysis will include:

(1) Are the wastes characteristic under RCRA (Toxicity)
(2) The LDR requirements;
(3) The specific permit requirements of the receiving facility
(4) Other potentially applicable State, Federal, or local requirements.

It is essential that soil be segregated in accordance with its ultimate disposal or placement alternative segregation by waste type to minimize costs associated with treatment and off-site disposal. Requirements will obviously play a large part in any waste stream segregation plan. At a minimum, regarding the segregation, disposal, or placement of contaminated soil excavated from the Site, the Implementation Contractor(s) should consider requirements for disposal or placement related to at least total PCBs, metals, or other potentially regulated substances or characteristics. The Implementation Contractor(s) should evaluate and coordinate with the disposal facilities and transport companies expected to be involved with any off-site waste disposal activities. It shall be the Implementation Contractor's responsibility to develop a plan for excavated soil disposal that complies with State, Federal, and local restrictions on land disposal. The information presented below is intended only to outline anticipated soil segregation possibilities that may apply to soil excavated from the Site. The actual segregation scheme and recommended disposal options selected shall be the responsibility of the Implementation Contractor with PADEP oversight.

2.3.2 Segregation of Excavated Site Soil

Figure 3, presents an example of an excavation and disposal decision flow chart, developed to present the waste segregation requirements for the contaminants found at the Site. The figure shows the excavated soil could be segregated into thirteen or even fifteen separate piles that correspond to identified treatment and disposal options. It is likely that piles may need to be combined when similar treatment and disposal costs apply. It is the Contractor's responsibility to design and optimize a waste segregation scheme that will be implementable and comply with all applicable soil transportation, treatment, and disposal requirements. PADEP recommends that segregation be conducted in such a fashion as to maximize the volume of soil that can be managed at one time while still allowing for the collection of representative samples for waste characterization purposes. A more detailed description of the recommended approach to waste segregation on the Site is provided in Section 3.1.8 and 3.3.2 under WE 3.2.

2.3.3 General Requirements for Disposal of Metals Contaminated Soil

It is possible that soil excavated from the Site will contain sufficiently high metals concentrations such that it will be regulated as a characteristic waste under RCRA for disposal purposes. Therefore, excavated soil piles will need to be tested using the TCLP to determine whether it is a characteristic waste. Generally, if the waste is hazardous under RCRA it must be treated prior to disposal. For the metal contaminants found at the Site, it is expected that local treatment facilities will be capable of treating excavated soil if the soil is not regulated by TSCA for PCBs. It is also possible that out-of-state treatment and disposal facilities may be more capable of economically treating a specific waste characteristic found in contaminated soil. With the exception of mercury contaminated soil, it is anticipated that soil excavated from the Site that is found to be characteristically hazardous for metals will be treated similarly by a disposal facility and may not need to be segregated from other metals contaminated soil. Additionally, if mercury concentrations are above 260 mg/kg then other treatment requirements may be applicable and the soil may need to be segregated based on this criterion, which will likely require other treatment prior to disposal.

2.3.4 General Requirements for Disposal of PCB Contaminated Soil

The State of Pennsylvania (the State) allows contaminated soil with concentrations of total PCBs below 4 mg/kg to be disposed at a permitted Subtitle D landfill. If contaminated soil contains concentrations of total PCBs that are equal to or greater than 4 mg/kg but less than 50 mg/kg then the State of Pennsylvania considers the soil to be a PCB contaminated waste but still allows it to be disposed at a permitted Subtitle D landfill. If contaminated soil contains total PCB concentrations equal to or greater than 50 mg/kg, then the contaminated soil falls under the federal restrictions imposed by TSCA. If the soil contains total PCB concentrations that are equal to or greater than 50 mg/kg and less than 499 mg/kg then they may be disposed at a TSCA permitted disposal facility. If the soil contains total PCB concentrations that are equal to or greater than 499 mg/kg then additional treatment steps may be applicable (Figure 3).

It is possible for some local Subtitle D landfills to have more restrictive permit requirements than those of the State. For contaminated soil with total PCB concentrations equal to or greater than 50 mg/kg, it is likely that out of state disposal facilities will be the only available disposal alternative. It shall be the Contractor's responsibility to develop a plan that addresses the proposed treatment and disposal requirements for Site generated wastes. The excavation and handling plan or waste management plan, should include an economic justification for the waste segregation scheme based on identified treatment and disposal alternatives.

2.3.5 Scheduling and Sequencing During Remediation

Scheduling and sequencing of activities during the cleanup action at the Site will be critical to project success. Figure 8 shows the preliminary schedule developed by PADEP as an approximate guide to how the Contractor(s) might consider scheduling and sequencing activities during the Additional Studies program and during implementation of the cleanup action. After contract award, the additional studies Contractor(s) shall proceed with planning and decision criteria development (WE 1.1 and 1.2). The development of preliminary decision criteria shall involve collecting select samples by hand and analyzing these samples at several offsite locations for TCLP and total metals. Preparation of a detailed topographic surface and general survey of the Site could also commence at this same time (WE 2.1).

Once planning documents for the Additional Studies program are approved, initial Site activities will likely focus on clearing the Site of vegetation and residual concrete in preparation for collection of soil samples as part of an additional characterization program. An on-site staging area shall be established by clearing surface soil from a small portion of the Site and backfilling (See WE 1.3). A suggested location for the staging area is shown on Figure 2. Once the staging area has been established along with a decontamination pad it is recommended that the mobile laboratory and sampling equipment be mobilized to the Site.

PADEP recommends that sampling and analyses proceed in each individual SMA sequentially. It is usually preferred that cleaner less contaminated SMAs be addressed first followed by more complex areas with increasing levels of decision complexity and potential contamination. This approach will limit the possibility for sample cross-contamination and help expedite when confirmation and backfilling activities can commence. Since it is unlikely that PADEP will mobilize the additional studies and Implementation Contractor(s) into the field simultaneously, sequencing activities such that each SMA can be managed as an individual decision unit will be most critical after the final design has been completed and additional studies results evaluated. This will help maintain the Site in discrete subsets and simplify compilation of the construction completion report (Task 4) and minimize mobile laboratory time on the Site (WE 1.7). Excavation maps for each individual SMA should be prepared as soon as desktop reviews and data assessments for each SMA are complete. After excavation of each SMA, confirmation sampling shall commence to confirm that COCs have been removed to below action levels (Table 1) while additional excavation and sampling is underway at other SMAs. Staging activities in this way is expected to help limit crew size and reduce the need for multiple mobilizations to the Site.

Verification of cleanup attainment shall be performed by collecting grab samples from the base of each excavated individual grid cell within a SMA. The analytical results for each SMA shall be compiled and attainment verified in accordance with PADEP Act 2, Technical Guidance (PADEP, January 2002) requirements.

A 95% upper confidence limit (UCL) shall be calculated based on the results obtained from each grid within a particular SMA and compared to the action levels provided in Table 1. If attainment is not reached then additional soil shall be removed from those cells that exceed action levels until the statistical analyses can be performed again and attainment is reached. Each area shall then be backfilled until the Site is restored to its original grade. For more details concerning these steps see Section 3.3 (WE 3.1, 3.2, and 3.5).

Once contaminated soil has been removed from the Site and the original grade (unless otherwise stipulated by PADEP) restored, revegetation and completion of the construction completion report shall be performed (WE 3.5 and Task 4). The Contractor shall also conduct a final walk through of the Site to demonstrate that the required project goals have been accomplished.

3.0 SYSTEMATIC PLAN

The Contractor(s) shall be responsible for performing activities associated with (a) monitoring and measurement activities, (b) cleanup design, (c) cleanup action, and (d) documentation of attainment. The anticipated work activities for the project are summarized below, with more detailed explanation of specific project activities provided in subsequent sections.

Task 1 – Monitoring and Measurement Activities

Additional Studies program

- **Plan Preparation** – The Contractor(s) shall develop project-planning documents that will be submitted for review and approval before the implementation of activities in the field. The project-planning documents are anticipated to include but are not limited to a Work Plan, Community Relations Plan, Sampling and Analysis Plan, Health and Safety Plan, Chemical Data Acquisition Plan, Environmental Protection Plan, Quality Control Plan, Waste Management Plan, and Excavation and Handling Plan **(WE 1.1)**. The specific plans for each element of the proposed remedy will be determined by PADEP. Because of the need for field-based decision making it is recommended that plans be combined where possible.

- **Refinement of Decision Criteria** – The additional studies Contractor(s) shall conduct analyses to support development of preliminary decision criteria to be used during implementation **(WE 1.2).**

- **Site Preparation** – The additional studies Contractor(s) shall implement site preparation activities, which shall include the clearing of surface concrete, abandoned machinery, miscellaneous debris and scrap metal, and vegetation. Site preparation shall also include establishing the appropriate site infrastructure needed to carry out real-time sampling and soil waste pile management (**WE 1.3)**

- **Chemical Analyses During Additional Site Characterization and Initial Waste Volume and Type Estimation** – The additional studies Contractor(s) shall implement a real-time sampling and analysis program to complete the characterization of the Site and provide an indication as to how much waste and of what type will be encountered during implementation of a remedy. This information will be used by the Implementation Contractor(s) to develop a final design and cost estimate for the cleanup action **(WE 1.4 and 1.5)**.

Implementation

- **Waste Characterization for Disposal –** After soil has been excavated, the Implementation Contractor will conduct final waste segregation and analysis to determine placement or disposal options **(WE 1.6)**.

- **Post-Excavation Confirmation** – The Implementation Contractor will conduct real-time analyses and data assessment prior to backfilling of open excavations to confirm attainment of RBCs in accordance with PADEP Act II requirements **(WE 1.7)**.

Task 2 – Detailed Design

Additional Studies program

- **Site Topographic Map** – The Contractor will prepare an updated site topographic map to be used during additional characterization and design **(WE 2.1)**

Implementation

- **Cleanup Design** – The Contractor shall prepare the design documents needed for managing excavation, segregation, and disposal of contaminated soil. Also, the Contractor shall prepare construction drawings and specifications needed to implement the cleanup action and ready the site for future redevelopment activities **(WE 2.2 and 2.3)**. Logically, this element and the preparation of a detailed construction cost estimate are essential to the plan preparation process. These work elements are provided separately to facilitate PADEP using potentially two different contract vehicles to complete the proposed scope of work.

- **Prepare a Detailed Construction Cost Estimate** – The Contractor shall update soil disposal volumes estimates, waste types, treatment requirements, and disposal destinations in order to develop a construction cost estimate for Site cleanup **(WE 2.4)**

Task 3 – Soil Excavation and Disposal (Implementation only)

- **Soil Excavation and Disposal** – The Contractor shall implement the cleanup action for the Site, which shall generally include excavating contaminated soil, segregating it by disposal destination, performing final confirmation sampling to verify the completeness of the soil removal, and disposing of excavated contaminated soil **(WE 3.1, 3.2, and 3.3)**.

- **Backfilling, Grading, Re-vegetation, Investigative Waste Sampling/Analyses/Disposal, and Site Walk –** The Contractor shall backfill the excavated areas of the Site using clean imported material, re-grade the Site and re-vegetate the property. In addition, the Contractor shall analyze and dispose of investigation derived waste and conduct a final Site walk through to demonstrate that project objectives have been met and the documentation is sufficient **(WE 3.4 and 3.5)**.

Task 4 – Construction Completion Report (Implementation only)

- **Construction Completion Report** – The Contractor shall prepare a construction completion report that will serve as the executive record summarizing the cleanup activities implemented at the Site. The construction completion report, at a minimum, shall include a detailed record of the work activities implemented during the cleanup action, present as-built drawings of soil excavation areas, and details of soil treatment and disposal **(WE 4.0)**. The Contractor shall obtain and retain a Site closure letter.

Task 5 – Project Management (Additional Studies and Implementation)

- **Project Management** – The Contractor(s) will implement a project management program that assures stakeholder involvement and approvals as necessary. The program will also allow PADEP to track project costs on a real-time basis **(WE 5.0 and 5.1)**.

3.1 TASK 1 – MONITORING AND MEASUREMENT ACTIVITIES

Task 1 involves the development of planning documents **(WE 1.1)** to support additional studies and implementation of the remedy for the Site. Additional studies documents may need to be revised by the Implementation Contractor prior to commencement of field activities. Some plans may not be possible to develop until the data from the Additional Studies program become available. It also includes conducting sampling and analyses activities to support refinement of decision criteria **(WE 1.2)** that shall be used in the field for on-site decision making concerning the need for the collection of additional data to fully delineate the nature and extent of contamination at the Site. Site preparation **(WE 1.3)** is also included in this task and includes preparation of decontamination facility and clearing of the site to make it suitable for conducting the Additional Studies program. Sample collection **(WE 1.4)** and the analytical program during the Additional Studies program to support development of a final design and cost estimate **(WE 1.5)** is included in this task. This task includes final waste characterization prior to disposal **(WE 1.6)**. The last component of this task includes post excavation sampling to confirm attainment of the project cleanup goals **(WE 1.7)**. All but the last two work elements in this task are intended to be conducted prior excavation and development of a final cost estimate for implementing the remedy for the site. Planning documents may also need to be revised once the additional characterization program has been completed.

3.1.1 Plan Development

As part of this task the project Contractor(s) shall be responsible for preparing a series of plans that will be used during additional studies and modified as necessary for use during implementation by field and laboratory personnel, project managers, and stakeholders. PADEP recommends that the plans include the following types of information: PADEP recommends that plans be generic to the activities anticipated to be required at the site during both additional studies and implementation to the degree practicable.

- **Work Plan** – This plan will describe the essential elements of the work such that it can be reviewed by stakeholders and other interested parties who may or may not be intimately familiar with the project. Critical project elements such as the overall project schedule, critical decision points, and lines of communication and authority shall be clearly described. PADEP recommends the development of separate work plans to support the additional studies as well as the implementation portions of the work.

- **Community Relations Plan** – A community relations plan shall be prepared to ensure that public outreach requirements are met prior to implementation of the remedy and to provide the necessary contacts for obtaining public comments throughout the project. PADEP recommends that one such plan should suffice for both the additional studies and implementation portions of the work.

- **Sampling and Analysis Plan** – A Sampling and Analysis Plan (SAP) shall be prepared to provide the necessary decision logic required to implement the dynamic work plan strategy discussed in this systematic plan. The SAP shall provide specific guidance concerning the methods to be used for sample collection and performance of analyses in the field-based and off-site laboratories. Decision diagrams for each of the characterization and soil management activities shall be provided along with QA/QC requirements to identify the need for any corrective actions. The SAP shall provide detailed standard operating procedures (SOPs) for field sampling and analysis activities. Special attention shall be paid to how data will be processed and communicated to stakeholders to support real time decision-making. Special attention shall be paid to how the principle sources of decision uncertainty will be identified and managed as more data is obtained. Requirements relative to documentation preparation and storage will also be provided (additional guidance for preparation of sampling and analyses plans can be found in the attached Specification Section 01450 – Chemical Data Quality Control). All identified sampling and analysis activities shall be specifically addressed in the SAP. PADEP recommends that one such plan should suffice for both the additional studies and implementation portions of the work with only minor modifications as necessary.

- **Health and Safety Plan** – A Health and Safety Plan shall be prepared to describe methods and procedures that will be implemented by the Contractor to protect workers, visitors, and off-site receptors from hazards associated with Site cleanup. The plan will document the location of and travel routes to the nearest medical facilities should they be needed to address problems that arise during execution of the work. In addition, the plan will discuss work zones including how they are established and maintained during construction as well as personal protection and air monitoring requirements (detailed requirements are addressed in Specification Section 01351 – Safety, Health, and Emergency Response). The health and safety plan will also address the on-site laboratory operational requirements for protecting the workers and assuring the proper disposal of any laboratory derived wastes. PADEP recommends that one such plan should suffice for both the additional studies and implementation portions of the work with only minor modifications as necessary.

- **Chemical Data Acquisition Plan** – The Contractor shall prepare a Chemical Data and Acquisition Plan that will provide the information needed to assure that data collected during project execution meets the quality requirements necessary to assure the defensibility of Site decisions. The plan shall include quality assurance review procedures and triggers for corrective action implementation, detailed on-site and off-site laboratory requirements for method performance, and standard operating procedures (SOPs). The Contractor shall pay particular attention to the identification of site-specific QC requirements and the methods for identifying and correcting problems as they are identified in the field. The plan shall define lines of communication, chain of command for on-site decision-making and acceptable levels of decision error. Data review, management, and assessment requirements will be stressed to assure that the required information is readily available to support real-time decision-making. The project database structure shall be detailed in this plan; at a minimum it should resemble the database structure currently developed for the Site and provided in Attachment 1, Enclosure 1, Part A 1-3.

PADEP recommends that one such plan should suffice for both the additional studies and implementation portions of the work with only minor modifications as necessary.

- **Environmental Protection Plan –** The Contractor shall prepare an Environmental Protection Plan to describe the procedures that will be implemented to minimize impacts to the environment during implementation of the remedy. The plan will detail storm-water drainage control procedures, handling requirements for contaminated groundwater, air monitoring requirements, and other potential environmental impacts that may arise due to Site remediation (detailed requirements are described in Specification Section 01355 – Environmental Protection). PADEP recommends that one such plan should suffice for both the additional studies and implementation portions of the work with only minor modifications as necessary.

- **Quality Control Plan –** The Contractor shall prepare a Quality Control Plan that will describe the procedures and organization necessary to produce an end product that complies with contract requirements (detailed requirements are described in Specification Section 01451–Contractor Quality Control). PADEP recommends this plan be developed during implementation.

- **Excavation and Handling Plan –** The Contractor shall prepare an Excavation and Handling Plan that details soil excavation management to assure worker safety, limit cross-contamination, SMA staging, and confirmation sampling (detailed requirements are described in Specification Section 02111–Excavation and Handling of Contaminated Material). PADEP recommends this plan be developed during implementation.

- **Waste Management Plan –** This plan shall detail waste handling procedures during Site cleanup including waste manifests preparation, coordination with waste treatment and disposal facilities, waste transport operations, and lines of communication and vital contacts. In addition, the plan shall specify analytical requirements and decision criteria associated with waste disposal (detailed requirements are described in Specification Sections 01572–Construction and Demolition Waste Management and 02120–Transport and Disposal of Hazardous Waste). PADEP recommends this plan be developed during implementation.

Any of these plans may be combined or otherwise packaged by the Contractor at its discretion provided all of the requirements described in the Statement of Work and this systematic plan are adequately addressed. Prior to combining any of these planning documents, the Contractor(s) shall receive approval by PADEP and the other project stakeholders. PADEP reserves the right to add or delete plans or requirements stipulated in the attached specification at their own discretion. All employees of the Contractor(s) or their Subcontractor(s) who perform work covered by any of these plans are required to read all applicable approved plans and sign appropriate documentation agreeing to strictly adhere to all applicable procedures and protocols.

3.1.2 Development of Preliminary Decision Criteria using a Demonstration of Methods Applicability Study (WE 1.2)

When developing decision logic for sites where actions will be based primarily on the use of field-based measurement technologies it is often necessary to consider many factors. For example:

- Field observations or other data may suggest that there is the potential for similar, yet different analytes to give similar responses when a test kit or other screening analytical method is used. This issue can be effectively accommodated using a variety of strategies, the selection of which will depend on project-specific considerations.

- If a significant bias is expected in the field analytical results, one strategy to deal with this bias is to collect sufficient comparison data (i.e., splitting well-homogenized samples for analysis by both the field and traditional methods) during a demonstration of method applicability or early sampling events (or both). If a predictive relationship can be demonstrated between the field measurements and analyte-specific, this predictive relationship can be used to guide decision-making using the field methods.

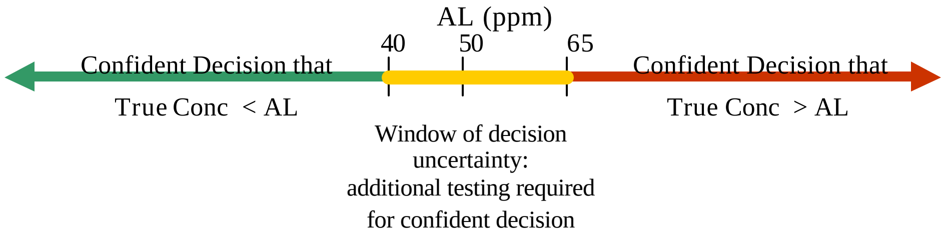
A predictive relationship can be established qualitative or quantitatively. Qualitative relationships are based on professional judgment and negotiation between involved parties to set the limits that will be used to make decisions based on field data. Setting these limits using qualitative professional judgment is necessary when the comparison data set is too small or too poorly behaved for meaningful mathematical (i.e., statistical) treatment. The limits are selected based on an estimate of where decisions can be made with adequate confidence that intolerable decision uncertainty is avoided. The words "adequate" and "intolerable" correctly imply that values and personal style and interests are involved in making these judgments. That is why setting these limits should involve participation and negotiation among all concerned parties.

If the budget or work plan allows for the generation of a sufficiently large comparison data set of the correct type, a quantitative statistical relationship may be calculated. Value judgments will still be involved in selecting the level of statistical confidence to be used.

A quantitative option for expressing this predictive relationship is to develop "response factors" or multipliers that mathematically adjust the field-based measurement results to "correct" the bias so that the field data are more directly comparable to traditional laboratory results for comparison with regulatory threshold limit values. The validity/regulatory acceptance of such "corrections" will be dependent on documentation that the causes of the bias are understood, as well as on transparent documentation of how the mathematical relationship between the field and traditional data sets are derived.

Another option for expressing this predictive relationship between the two data sets is to set "decision intervals." Depending on the nature of the project and the decision, 2 or 3 decision internals are common. The most common breakdown is into 3 intervals: 1) an interval where it is judged that the field data results can be confidently trusted to declare areas as "clean" (i.e., no further action needed); and 2) an interval where field results can be trusted to confidently declare an area "dirty" (i.e., remedial action needed); and 3) an interval where the field results are considered ambiguous, and a confident decision of "clean" or "dirty" would require more data to manage the decision uncertainty (see figure below).

Reasons for this uncertainty may stem from sampling variability or from analytical uncertainty (i.e., imprecision or bias in the field method). When only 2 intervals are used, a single limit is proposed: data results below this value allow the area to be declared “clean,” and data above the limit are accepted as indicating that the area is “dirty.”



Especially when qualitative judgment is used to set the decision interval limits, setting the limits of these intervals becomes a judgment call that must balance several considerations: 1) the “goodness” of the predictive relationship (i.e., how many comparison points are available to build confidence that decisions can be made correctly, and how much scatter is present around the predictive line); 2) how well the range of variables affecting the performance of the two analytical systems was captured in the comparison data set (i.e., potential analytical interferences, different matrix characteristics, low vs. high levels of contaminants, etc.); and 3) the cost of making a decision error (i.e., declaring an area “clean” when it actually is not, or declaring an area “dirty” when it actually is not) versus the cost of getting the additional data needed to avoid excessive decision error.

- Estimating the “cost” of collecting additional data should consider not only the financial cost of collecting and analyzing additional samples, but also the repercussions of any delays to the project schedule that may be incurred. (If the project work plan is based on a dynamic approach, the cost to budget and schedule may be minimal.)

- Estimating the “cost” of a “false action” decision error (i.e., incorrectly declaring an area “dirty” so that follow-up action is required) requires considering whether the cost of the “false action” would be minor or major. For example, the cost may be minor if it is known that a soil treatment system or institutional control will be built anyway, and the ramification of this particular “false action” decision will only add an incremental amount of soil to the volume already slated for treatment, or will add additional yards of fencing to isolate 11 acres instead of 10 acres. On the other hand, a “false action” decision could be very costly if the entire decision of whether a treatment system or institutional control is needed or not hinges on a faulty conclusion. The “costs” of “false action” decision errors also should factor in any social, redevelopment, or political ramifications of declaring an area “dirty.”

- Estimating the cost of a “false inaction” decision error (i.e., incorrectly declaring an area “clean” so that no further action is needed) must consider the human and ecological

> health ramifications of potential exposure to excessive contamination, as well as the social and political costs that will be incurred when the error is discovered or suspected. From a regulatory point of view, it is more important to protect public and environmental health from potentially harmful health effects, therefore from a regulatory standpoint it is better to "err on the side of caution." On the other hand, this can be very costly and wasteful of scarce resources. So naturally, correct decisions are desired by everyone. However, since it can be prohibitively expensive in some scenarios to gather all the information needed to ensure that decisions are entirely correct, is possible to structure the decision-making process so that substantial costs can be saved by judiciously deciding when relatively small "errors on the side of caution" can be accommodated. These can be thought of as a kind of "safety factor" that supports using field measurements and other types of non-traditional tools to achieve significant project cost savings while decisions remain protective of human health and the environment.

Managing decision uncertainty that stems from sampling variability can require the collection of grab or composite samples to get 1) a more confident estimate of the concentration mean for the decision unit or 2) a more confident estimate of the boundaries of contamination. Managing decision uncertainty that stems from analytical uncertainty requires first that sampling uncertainty has been managed (so the representativeness of samples is known). Then samples that represent critical decision points are selected for processing by more rigorous analytical methods to produce analyte-specific data or data free of excessive analytical bias or imprecision.

Usually a study (called a "demonstration of methods applicability" by the U.S. EPA Office of Solid Waste) is designed and implemented initially to begin the process of evaluating potential sampling and analytical method issues, as well as the comparability of the different sampling and analytical methods under consideration. The usefulness of statistical comparisons to compute appropriate **safety factors** and **uncertainty limits for decision-making** that should be applied at a site. Differing safety factors may need to be developed for a particular monitoring and measurement technology and type of decision being made. Uncertainty limits to support decision-making are used to establish at what concentration stakeholders feel comfortable that a correct decision is being made. Safety factors relate to how field-based and fixed lab methods correlate. While safety factors are an essential part of developing uncertainty limits for decision-making they are but one piece of the puzzle, as will be discussed later in this section.

A demonstration of methods applicability is usually designed to evaluate method reliability and comparability for certain types of contaminants, analytical methods, and source area types. The purpose is to evaluate the inherent bias of the field-based instrument technology such that an adequate safety factor can be built into the overall decision uncertainty limits. Internal laboratory QC results along with investigative, duplicate, and replicate sample results prepared in the laboratory are generally used to establish safety factors. When methods applicability studies are done, budget constraints tend to limit the number of data points, making rigorous statistical analysis non-productive. Judgment is therefore used to evaluate the comparison data set in order to construct a decision-making mechanism that allows use of the data, but with a sufficient safety buffer so that intolerable decision errors are avoided.

The Demonstration of Methods Applicability Study Design Proposed for Marino Scrap Yard

A demonstration of methods applicability study is to be performed to support refinement of on-site decision logic and costing efforts being conducted at the Marino Scrap Yard site. The goal of this limited preliminary sampling and analysis exercise is to identify threshold values where, based on total metal concentrations, it can be expected that TCLP results will exceed the regulatory threshold limit values provided in Table 2. Lead is the most widely distributed contaminant of concern at the site and will likely drive the need for removal and impact disposal costs most often. Mercury is also a major driver relative to the cost of disposal, but all RCRA metals that will result in a soil classification as hazardous under RCRA will likely have some impact on the economics that will drive reuse options at the Site. A secondary objective of the demonstration of methods applicability study is to determine the comparability of X-ray fluorescence (XRF) results (SW-846 method 6200) with the standard fixed lab methods (EPA SW-846 method 6010) prior to use of the XRF method in the field.

The contractor will collect samples and perform metals analyses to assess whether soil excavated from the Site could be potentially classified as a hazardous waste under RCRA based on total metals results. It is not feasible to perform TCLP analyses in the field because of detection limit and sample processing requirements. No TCLP data was collected during the RI performed at the site, therefore, to make maximum use of the existing data it is necessary to collect some limited TCLP and related total metals data such that the available data from the RI can be put to better use in estimating overall project costs.

Collection of a total of 16 homogenized soil samples from approximately 4 depth intervals from four different locations is recommended. Samples should be collected from the approximate location of RI borings B-10, B-14, D-24, and D-19 shown in Figure 2-1 of the draft RI (Baker, 2001). At these locations samples are expected to contain significant quantities of lead and mercury and other RCRA metals shown in Table 2. By collecting samples from the surface to a depth of 2 feet bgs it is anticipated that a broad cross section of analytical results will be obtained. Having a large range of values extending from low concentrations to well above Site action levels should allow for development preliminary decision criteria for when total metals concentrations measured could result in a waste being characterized as hazardous.

Four homogenized samples should be collected at each of the four boring locations for a total of 16 samples. Samples should be collected in 2 or 3-inch diameter sleeve and cut into 6-inch depth intervals down to a total depth of 2 feet. Each boring location should have a sample collected at 0-6 inches below ground surface (bgs), 6-12 inches bgs, 12-18 inches bgs, and 18-24 inches bgs. Each sample collected in a 6-inch interval should be crudely sieved (passed through a sieve, size 20-mesh or greater) to remove any gross fragments or other debris and then homogenized thoroughly and split into two aliquots using the cone and quarter method. One aliquot should then be sent to the contract lab for total metals analysis using SW-846 Method 6010. The analysis performed in the fixed lab should use the maximum allowable soil volume for the method (10 grams). Dilutions for metal concentrations exceeding the calibration range may be performed after sample digestion as necessary to reduce the variability in results in response to sample heterogeneity. Method reporting limits in soil should not exceed those recommended in SW-846 method 6010.

Fixed lab analyses for total metals, particularly those for lead and mercury, should be reviewed prior to performance of XRF and TCLP analyses, to evaluate whether concentrations for mercury and lead exceed 20 times the TCLP threshold values shown in Table 2. Any samples with total metal results for mercury of greater than 4 mg/kg or lead greater than 20 mg/kg should also be analyzed using the TCLP and field-based XRF methods. Based on simple dilution, these are the lowest concentrations that could result in an exceedence of the regulatory threshold limit values shown in Figure 2.

TCLP results from the 16 samples collected as part of the study will also be used to develop correlations between total metals and TCLP analyses. These correlations will provide data users a better estimate of the total metals result that can be expected to yield a TCLP result greater than the disposal thresholds listed in Table 2. A comparison between XRF and SW-846 method 6010 results should be made to evaluate the presence of any bias or to identify any sampling issues that might need to be addressed. A total metals concentration threshold value will then be developed for as many of the RCRA regulated metals shown in Table 2 as possible. These estimated upper limit values shall include a safety factor and will be used initially to segregate soil in a manner consistent with the Contractor's Waste Management Plan. Further refinement of these decision criteria shall proceed throughout the additional site characterization phase and be re-evaluated after the additional characterization portion of the program has been completed (See description of WE. 1.4 in Section 3.1.4).

In addition to continuing to refine waste segregation criteria, the project team should also continue to refine sample support, preparation, and analysis techniques to be used for the project. For example, the need for sample down-sizing or ball milling should be evaluated based on the correlation between fixed lab and XRF results. It may be necessary to select secondary peaks for quantitation of lead and the application of interelement corrections for arsenic because of the high concentrations of lead expected at the site. The Contractor should seek the assistance of potential XRF vendors when evaluating the need for modifications of equipment operating conditions to meet the performance-based project requirements.

3.1.3 Site Preparation (WE 1.3)

The additional studies Contractor(s) shall plan and implement appropriate Site preparation activities as part of the additional studies portion of the Monitoring and Measurement Activities Task. Site preparation activities are intended to prepare the Site in order to effectively implement the additional characterization activities planned at the Site. At a minimum, the Contractor shall address the following key elements associated with the site preparation phase of the project:

- **Site Clearing** – This component of the work includes clearing the Site in preparation of implementing the additional Site characterization activities. Existing vegetation, concrete surfaces, and gross surface debris shall be stripped and disposed offsite. It will be necessary to strip concrete surfaces and site vegetation (e.g., brush and trees) to gain full access to site soil, which will be necessary for the additional site characterization activities. Specification Sections 02231 – Clearing and Grubbing and 02220 – Demolition describe these project requirements in more detail.

- **Mobile Laboratory and Project Trailer** – This component of the work includes establishing an area within the Site for placement of the onsite mobile laboratory that will be used to perform the field based analytical work. It also includes connecting to available power and other utilities for establishing a project trailer for coordinating onsite operations. PADEP recommends that prior to establishing the Site staging area, as shown on Figure 2, that surface soil in the area be excavated and the area lined and filled with clean backfill. The excavated soil removed from the area shall be adequately characterized such that it can be stockpiled for later disposal. Specification Section 01500 – Temporary Construction Facilities describes these project requirements in more detail.

- **Decontamination Facilities** – Decontamination facilities shall be designed to control cross contamination during the additional site characterization activities. PADEP recommends that these facilities be established along the northeastern edge of the Site within the Contractor staging area. Decontamination facilities shall be consistent with Specification Section 01355 – Environmental Protection.

The Contractor shall prepare the Site to facilitate collection of additional samples and implement the cleanup action. At a minimum, the Contractor shall address the following key components:

- **Existing Buildings** – Existing Site buildings are not included in the cleanup action scope of work and shall remain undisturbed during the cleanup action activities. The Contractor shall evaluate the impact of soil excavation on planned future building use. Care should be taken to protect foundations and, if necessary, design and implement mitigative measures to protect building foundations during excavation.

- **Existing Underground Utilities** – The Contractor shall develop a plan for abandoning in place or removing inactive underground utilities prior to or during soil excavation activities. As part of the plan, the Contractor shall include methods for identifying and protecting active underground utilities that could be damaged by soil excavation activities.

- **Decontamination Pad**– It is anticipated that haul trucks will be used to transport contaminated soil to off-site treatment and disposal facilities. A decontamination pad will be required to control offsite contaminant movement during transport operations and to decontaminant excavation equipment.

- **Personnel Decontamination** – Facilities shall be designed and constructed that at a minimum include personnel decontamination, change areas, and break areas. Specification Section 01351 – Safety, Health, and Emergency Response describes these requirements in more detail.

- **Contaminated Soil Stockpile/Loading area** – A specific area of the Site shall be used for contaminated soil stockpiling and off-site transport truck loading. The Contractor shall design the stockpile area to accept and temporarily store excavated soil. The transport truck loading area shall be designed to efficiently load contaminated soil into transport trucks. Measures shall be taken to keep segregated soils separate during the waste disposal and confirmation-sampling period. Specification Section 02111 – Excavation and Handling of Contaminated Materials describes these requirements in more detail. PADEP recommends this area be identified after completion of the Additional Studies program.

- **Engineering Controls** – The Contractor shall design appropriate engineering controls and incorporate them during the cleanup action. At a minimum, the purpose of engineering controls is to limit Site access to authorized personnel, allow for the controlled movement of transport trucks into and out of the Site during contaminated soil removal, provide defined transportation routes within the Site, and allow for the organized stockpiling of excavated soil prior to final sampling and transport off-site. It is anticipated that features such as fencing around the Site perimeter, a loading area for haul trucks, defined transport routes in the Site area, defined transport routes into and out of excavation areas, and contaminated soil stockpile areas will need to be addressed during the cleanup design phase of the project. PADEP recommends these controls be identified after completion of the Additional Studies program.

3.1.4 Sample Collection for Additional Characterization (WE 1.4)

This additional studies sampling program shall use real-time sampling methods to augment the RI data set. Samples may be collected prior to excavation using a hand auger (for depths of 3 feet or less) or direct-push methods (for depths greater than 3 feet. The goal of pre-excavation sampling is to fill the data gaps in the RI data set such that a detailed excavation and disposal cost estimate can be prepared (WE 2.4). In addition, the pre-excavation results will also be used to estimate what disposal requirements might apply (WE 1.5) to the material in a given grid sector such that the material can be sorted into the appropriate piles prior to final waste segregation testing and disposal (WE 1.6). During pre-excavation and post excavation sampling the project team will need to identify when and if decision criteria need modification or additional QC samples are required. The quality assurance requirements for each sampling and chemical analysis work element are described in Section 3.1.8.

A grid system consisting of 50-foot by 50-foot grid cells shall be laid out at the Site as shown on Figure 4. Figure 4 also indicates cells where additional focused sampling may be beneficial in limiting the quantities of more highly contaminated wastes that would drive up disposal costs. For those 50-foot by 50-foot grid cells where the original sample indicates total PCB concentrations greater than 50 ppm or mercury concentrations greater than 4 ppm, the contractor should consider use of a focused, more tightly grid sampling approach using 10-foot by 10 foot cells to further define the extent of contamination. The criteria of 4 ppm for mercury is based on the TCLP 20 times rule, the contractor should evaluate the viability of this decision rule based on the results obtained from the demonstration of methods applicability and revise the criteria. The twenty times rule is a very conservative number that assumes that 100 percent of the mercury in a sample will leach into the TCLP extraction liquid. More realistic action levels that might be expected based of the demonstration of methods applicability could be several orders of magnitude higher. For historical results from the RI, Aroclors should be summed to arrive at the total PCB concentration expected in a particular grid. This value should than be compared to the disposal restriction of 50 ppm for total PCBs before a decision is made to collect additional samples on a tighter grid spacing. Interferences can also play a role in deciding based on field-based results for PCBs when additional sampling on a tighter grid should be considered. As described in Section 3.1.8, off-site confirmation analysis may be necessary when total PCB concentrations, estimated by field based method results are near, or only slightly above the action level and/or analysts observations indicate that interferences could be biasing the analytical results. Under these circumstances additional analysis using a dual column fixed lab method may be warranted when field results are within the limits of site-specific decision uncertainty established for total PCBs.

The cost of additional field sampling to more clearly delineate compliant vs. non-compliant material was evaluated to be less costly than the associated disposal costs for contaminated soil requiring special predisposal treatment or transport to a RCRA permitted facility. The pre-excavation sampling grid includes additional cells along the site boundaries that will assist to further identify the need for focused sampling efforts. Existing data in some of the areas suspected to contain higher concentrations of PCBs and mercury were limited during the RI and additional data is needed before more detailed recommendation can be made. At present 91 grid cells have been identified for sampling at the site excluding any samples required should focused sampling be deemed beneficial.

Figure 4 depicts the grid system used for estimation of the size of the sampling effort that will be required for designing and costing the remediation effort. The heavy black lines divide the Site into seven subsets, which are referred to as soil management areas (SMAs). A sample designation scheme for the purpose of labeling and supporting decision-making is provided in Figure 5. Division of the Site into the SMAs is intended to facilitate project planning, work sequencing, and confirmation sampling. In Table 3 historical results for lead from each one-foot-depth interval from within a given 50 x 50' grid sector were compared to the site-specific standard shown in Table 1 of 1,300 mg/kg.

Table 3 depicts the maximum lead concentrations in each grid cell (in the upper half of the table) and the depth intervals that PADEP recommends to be sampled by the contractor to fill data gaps (in the lower half of the table for each of the 7 SMAs). The site-sampling grid was arranged to correspond with individual SMAs, one table is provided for each SMA. Populated cells are color-coded: orange where the maximum value exceeds the site-specific RBC for lead and aqua where the maximum value is equal to or less than the site-specific RBC.

Table 3 shows the recommended sampling strategy. Sampling is recommended in 6-inch intervals for the top 2 feet of each SMA and 1 foot intervals for the remaining depths to groundwater (Figure 5). Increasing the sampling frequency in the top 2' bgs is recommended to limit the volume of the most contaminated material that could drive up disposal costs. Samples needed to fill data gaps correspond to depth intervals that generally fall between the lowest "dirty" result (greater than the site-specific RBC) highlighted in orange, and the highest "clean" result (less than or equal to the site-specific RBC) highlighted in aqua. In a few cases, where a "dirty" result is located at a depth below a "clean" result, the "dirty" result takes precedence and is considered to define the area that exceeds the threshold. Sampling cells located near the perimeter of the Site may have few, or no, previous sample results. The characteristics of other nearby cells, particularly those within the same SMA, are used to estimate the potential vertical extent that could require sampling.

The estimated number of samples that will be submitted for XRF analysis is 503 (Table 4). Fifteen of the 91 grid cells do not need to be sampled based on lead. Lead is generally the most widespread COC found above the site-specific action levels and was used as a preliminary indicator of where excavation would be required, however the Contractor shall confirm that excavation is not required based on an evaluation of all available results for each COC before designing a final excavation program and waste management plan and cost estimate.

PADEP recommends that the additional studies Contractor(s) use direct-push sampling methods to collect most soil samples. Specification Section 02210–Subsurface Drilling, Sampling, and Testing describes specific project requirements. Each direct-push borehole shall be randomly located within each applicable sampling grid that covers the Site, the size of the sampling grids are generally 50-feet by 50-feet. Grids that are 50-feet by 50-feet should be further segregated into 10-foot grids (see Figure 7) for any SMA grid where the results for the random sample exceeds threshold criteria for mercury (4 ppm) or PCBs (50 ppm). The cost benefit of additional sampling and contaminant delineation at these grid sites outweighs the increased disposal costs for PCBs and mercury if the entire 50-foot by 50-foot grid were to be remediated. The 10-foot by 10-foot grids are expected to potentially be required in areas where more dense grids are shown on Figure 4. The need for chasing hot spots was preliminarily identified through the examination of revised nature and extent maps created using FIELDS and provided in Attachment 1, Enclosure #3. The need for more detailed sampling to delineate hot spots should be confirmed once the Site 50 x 50' grid sampling locations have been surveyed. At this point a single drive point from each of the potentially impacted 50 x 50' grids should be driven and samples analyzed for the presence of total metals and total PCBs as described below. Detailed grid sampling to define the nature and extent of each hot spot should proceed as described and shown in Figures 5, 6, and 7.

An acetate or polypropylene liner shall be placed inside the direct-push sample core barrel. Generally, the sampling barrel shall be advanced in 4-foot increments from the surface to groundwater (approximately 12 feet bgs). However, depending on the depths at which the samples must be collected, the actual sampling intervals shall vary between boreholes. The top 2 feet across the site should be sampled in 6-inch intervals, resulting in samples collected from 0-6 inches bgs, 6-12 inches bgs, 12-18 inches bgs, and 18-24 inches bgs. Below 2 feet bgs, samples should be collected in 1-foot intervals (Figure 5). In the first 4-foot interval at any sampling location, after removing the core sampler from the ground, the top two feet of the liner shall be divided into four 6-inch intervals (0-6 inches bgs, 6-12 inches bgs, 12-18 inches bgs, and 18-24 inches bgs) and two 1-foot intervals (2-3 feet bgs and 3-4 feet bgs). For depths greater than 2 feet bgs, after removing the core sampler, the liner shall be divided into four 12-inch sections. Soil from each section corresponding to the required sampling interval shall be removed from the liner, homogenized in a stainless steel mixing bowl, split or sieved as necessary and placed into a series of labeled glass containers, and sealed with a Teflon-coated lid. If the sampling barrel is returned to the surface with insufficient soil volume for complete sample collection, the Contractor shall push another sample adjacent to the first location to collect additional soil. If co-located borings are required, soil from the same depth interval in each boring shall be homogenized prior to placement in the sample container.

When chasing hot spots for mercury and PCBs, the depth of sampling should be limited by examining initial results that indicated the potential for a problem. Samples should progressively be sampled out away from the hot spot and to depths necessary to delineate when PCBs are expected to be below 50 mg/kg and/or mercury less than the TCLP threshold limit value. Decisions concerning the need for more characterization in response to elevated mercury may need to be confirmed using TCLP fixed-lab analyses. This is particularly true when sample results are near the regulatory threshold limit values (Table 2). Delineation of hot spots may not be limited to being advantageous during the additional characterization portion of the program. A similar, but slightly modified approach should also be considered for use during excavation, final waste disposal classification, and during confirmation to support a demonstration of attainment. More details concerning when and how such modification might be identified and implemented is provided in Section 3.1.8.

Sample Identification

A unique sample identification number shall be assigned to each sample collected at the Site. The sample identification numbering system shall be designed to be compatible with a computerized data management system that includes results for previous samples collected at the Site. A well organized, logical sample numbering system will allow each sample to be uniquely identified and provide a means of tracking the sample from collection through analysis, reporting, and the real-time decision-making processes.

The site has been partitioned into 91 grids. Numbered rows and columns organize the grids. The entire grid system is divided among seven SMAs. Further, the grid and SMA system is vertically divided into 6-inch layers from 0-2 feet bgs and 1-foot-thick layers from 2 feet to 12 feet bgs. The sample numbering system proposed will indicate the horizontal location of each borehole within its respective SMA and grid row and column, and its vertical layer. For example, a sample collected within SMA 7, grid row 6 and column 5, from the 7-8 foot interval will be designated sample number SMA70700605 (Figure 5). For detailed sampling to chase hot spot a simple numerical prefix is recommended that would increase sequentially only as necessary to constrain the hot spot. Sequential numbering should follow 50 x 50' grid sector boundaries and never exceed 25' for any one layer or grid designation. Once detailed mapping is completed a single combined excavation profile map should be compiled for inclusion into the design to be used during implementation.

3.1.5 Chemical Analyses During Additional Site Characterization and Initial Waste Volume and Type Estimation (WE 1.5)

PADEP recommends that soil samples be analyzed in the field during this portion of the Additional Studies program for (a) total metals using a portable x-ray fluorescence (XRF) analyzer and (b) total PCBs using gas chromatography. The purpose of analyzing samples for these constituents is two fold: 1) results obtained can be compared to site specific action levels to determine the need for removal of the material and; 2) results can be used along with the appropriate correlation factors to identify how waste should be segregated into piles prior to final waste characterization (WE 1.6) to meet disposal facility requirements. In section 3.1.8 details concerning the quality control and development of the specific decision criteria for each of these two activities is discussed in more detail. Essentially, limits will be established for decision uncertainty that will guide when and if soil is identified for removal and to which stockpile the material should reside until final waste characterization can be performed. Method reporting limits and practical quantitation limits for the field-based methods shall be: five to ten times lower then the site-specific action levels shown in Table 1, or sufficiently low to assure an adequate comparison between the TCLP extract sample results and regulatory threshold limit values shown in Table 2, and sufficiently below the LDRs and other disposal criteria indicated on Figure 3. The analytical results will be maintained in a database and maps prepared on a daily basis to support decision making on a real time basis. All documentation generated in support of the analytical results developed during this and all other portions of the field program must be maintained in fire proof file cabinets and be of sufficient quantity and quality to allow for the independent verification and validation of the results on a real-time basis. When specific problems are identified in the field corrective actions, described in section 3.1.8 may need to be implemented to assure the defensibility of decisions made in the field.

3.1.6 Waste Characterization for Disposal (WE 1.6)

After the contaminated soil has been excavated, segregated, and placed into designated piles, the Implementation Contractor(s) shall collect samples to confirm final disposal requirements.
At a minimum PADEP recommends that five- to ten-point composite samples be collected from those piles where waste is expected to contain the following characteristics:

- A waste with mercury and PCB soil concentrations greater than 260 and 499 mg/kg, respectively
- TSCA-regulated PCB contaminated waste (e.g., equal to or greater than 50 mg/kg)
- PCB contaminated waste (e.g., PCB concentrations from 4 to 50 mg/kg)
- RCRA-hazardous waste for metals, particularly mercury

Other waste types than those shown above may need to be addressed. The Contractor will review all potentially applicable regulations before deciding how wastes will need to be handled. The total number of samples required to characterize a particular waste stream shall be determined in the field based on the volume of material and proximity of results to a threshold limit value. When reported concentrations on average are near a potentially applicable threshold limit value for disposal, such as an LDR, it may be advantageous to collect additional samples to assure the waste is segregated properly. It can even be desirable to further segregate a waste pile when it becomes evident that contaminants are not evenly distributed. The Contractor should be prepared to make maximum use of the on-site laboratory capabilities when identifying waste characteristics. By using on-site analyses, it may be possible to further segregate wastes prior to sending final off-site analyzes to the fixed laboratory for TCLP analysis.

Samples shall be analyzed on site for total metals and PCBs and at the off-site laboratory for TCLP metals. No more then 500 cubic yards shall be analyzed using a single composite sample (see specification section 02111). The contractor shall also coordinate with the expected receiver of waste to ensure that their specific requirements are met. Grab samples from random locations and depths within each waste pile shall be collected and prepared in a similar fashion as soil samples collected during the additional characterization program. A similar QC program to that described for the additional characterization program shall be employed. PADEP recommends samples with results that approach the critical limits of 260 and 499 mg/kg for mercury and PCBs respectively are to be confirmed at an off-site laboratory using a dual column method for PCBs (SW846 method 8082B) and cold vapor atomic absorption for mercury (SW-846 method 7470A). Before sending high concentration samples, the Contractor shall inform the laboratory that special precautions shall be used. For more details concerning when and if offsite confirmation should be considered see Section 3.1.8.

It may be necessary for the contractor to analyze discrete samples used to prepare a composite when composite results indicate that the waste will require a more expensive form of disposal. By analyzing the samples individually it may be possible to further segregate the waste prior to performance of the offsite TCLP analyses. This could be the preferred option if it is found that heterogeneity of the waste is significant. Once again PADEP recommends that the Contractor consider the use of Ingersoll's uncertainty calculator to help in this determination (Ingersoll, 2001). Placing field results from the initial characterization effort and preliminary pre-excavation analyses into the uncertainty calculator will provide some indication if the proposed scheme is adequate. When uncertainty related to sample heterogeneity is high method modifications may be necessary to assure the representativeness of the results as described in more detail in section 3.1.8.

3.1.7 Post-Excavation Confirmation (WE 1.7)

After excavation is completed in a particular SMA, and the waste stockpiled for later disposal, the Implementation Contractor(s) shall collect additional discrete or composite samples from each of the designated sectors within an SMA where excavation has been performed. Sidewalls and floors of the excavation from each grid sector shall be sampled as necessary or appropriate. The Contractor shall devise a confirmation-sampling scheme and have it approved by PADEP, which identifies when and if composite or discrete samples are to be collected. A minimum of 7 discrete or composite samples shall be analyzed using XRF for metals and gas chromatography for individual Aroclors (PCBs) from each SMA. The results from these analyses shall be used to confirm that soil exceeding site-specific RBCs has been removed. If the 95 % UCL of the results collected for individual Aroclors (PCBs) or other COCs exceeds the RBCs as per PADEP ACT 2 guidelines, than the Contractor shall remove an additional 0.5 feet of soil from the sectors with the highest reported values and then recalculate the 95% UCL until the SMA as a whole does not exceed the RBCs. For additional detail concerning the development of the 95 % UCL and establishing when and if off-site analyses might be required please see Section 3.1.8.

3.1.8 Limits of Uncertainty to Support Project Decisions

Establishing limits of uncertainty for the purpose of decision-making can include many types of evaluations and data. In the following section the major types of project decision envisioned will be discussed and potential methods for establishing acceptable limits of uncertainty proposed. The range of methods for establishing limits for uncertainty management range from the use of classical statistical methods through the use of analyst observations or other practical considerations that suggest additional QC sample analyses or other action is required before a decision can be made.

As the project proceeds, investigative data and QC data should be analyzed on an on-going basis such that decision criteria for the project can be adjusted as a more robust comparison data set is assembled. Duplicate (collocated), replicate (well-homogenized splits), matrix spikes, other field-laboratory QC, and analysts observations can play a role in setting up and adjusting uncertainty limits for decision making. Poor replicate agreement can be an indicator of inadequate sample homogenization prior to splitting the sample, or inadequate sample support (i.e. size, shape, and orientation) used during sample preparation procedures prior to instrumental analysis, or poor analytical precision. Matrix spike results and analysts observations can indicate that analytical interferences are present and alternative methods are required. Poor duplicate (collocated) agreement can indicate a high degree of matrix heterogeneity. The distance between the collocated samples provides an indication of the scale of the heterogeneity. For instance, extreme heterogeneity (concentrations ranging from 100 ppm to 50,000 ppm over a distance of 2 feet) has been observed at some sites where nuggets of pure product are common. Composite sampling can be used to limit the impact of these types of heterogeneities and could play a significant role in the sampling design selected during the confirmation and final waste classification prior to disposal portions of this project.

There is a wide range of information that may need to be considered when deciding on limits of uncertainty to guide decision-making and resolve apparent data problems. Decisions about what actions are scientifically appropriate are totally dependent on how the data will be used to make decisions and the "scale" of those decisions (i.e., the decision support). For example, decisions about a remedial design that will surgically remove individual hotspots will require a much finer scale of characterization than will decisions about a design that relies on institutional controls. Likewise, remedial design for a solvent flushing project to treat subsurface DNAPL contamination can require characterization on a finer scale than will the remedial design of a thermal treatment project to treat the same problem. The following table lists some of the potential uncertainty management issues and type of responses that could be appropriate.

UNCERTAINTY MANAGEMENT ISSUES AND POTENTIAL RESPONSES

Problem	How to Identify	Resolution
Matrix heterogeneity	Compare the results of samples collected at known distances from each other (collocated duplicates)	After determining the scale over which it is important to understand the impact of heterogeneity, increase the sampling density in those areas where incorrect decisions would be risky from a protectiveness or economic aspect
Inadequate sample preparation/ homogenization	Compare the precision of replicate sample prep + analysis on raw aliquots from a single sample jar to the precision of replicate analyses performed on a single prep'd sample aliquot (replicate analyses on a single extract or digest)	Improve the consistency of sample preparation procedures, or select a procedure more appropriate to the matrix. Increasing sample size or the use of compositing might also need to be considered.
High analytical variability	Analytical QC sample results are outside required performance criteria or interferences are suggested by analysts observations	Apply additional sample cleanup steps or use an alternative peak to perform the analyte quantitations. For example, use an alternative spectral line for quantitation of arsenic when lead concentrations are high. In the case of PCBs use a dual column method with reverse elution order to verify the quantitation
Detection limits are elevated due to the presence of interferences.	Non-detections are above the action level for the site resulting in the calculation of artificial risk	Same as above or selection of an alternative method that is more analyte specific. For example, use of a mass spectrometry for PCBs when present in the parts per million range
Detection frequencies are insufficient or the distribution of results so erratic that the population characteristics cannot be adequately defined for comparison purposes	If detection frequencies are less than 50 percent or data distributions can not be established as either normal or lognormal use of a UCL for determination of attainment may not be possible.	Block or stratify the data into different populations that could be more amenable to statistical analysis. Collect more data based on a geostatistical or tighter grid design to better characterize the population of interest. Composite sampling should also be considered to limit any nugget effects.
Results are very close to the action level making decision making difficult	Based on the project limits of uncertainty the results fall in the category of too close to call	Decide that the result should be considered dirty, take a conservative approach, or collect additional confirmation results using an alternative method. Alternatively collect sufficient data such that the true mean can be estimated more accurately and a decision made with the level of significance and confidence required by the project.

For these reasons the analysis of the 9 or more samples using both the field-based and fixed lab confirmation methods, as is often the case for most demonstrations of methods applicability is, rarely adequate. A focused quality control program, which evaluates decision uncertainties on a real-time basis, must also be used to refine decision criteria and the limits on uncertainty that can be tolerated as a project progresses.

When using a dynamic work plan and field-based measurement technologies it is imperative that the project team track and adjust decision uncertainty limits as more is learned about the site. It might also be necessary to establish a range in concentrations or decision uncertainty limits where the need for additional sampling and analyses is triggered. The need for additional data is also usually driven by the nature of the proposed remedy and cost of a particular cleanup action. If a remedy is very expensive, it may warrant the collection of more samples rather then just making a conservative decision to send soil for off-site treatment or decide that the location is dirty. For example, if results indicate that the concentration for a particular COC in a soil pile is right at the level of concentration mandated by a Land Disposal Restriction (LDR) it might benefit the project team to collect additional samples to confirm the decision before manifesting the waste. On the other hand, if the concentration reported is substantially below or above the LDR and duplicate variability is low, additional sampling may not be warranted. Establishing these types of uncertainty limits and related quality assurance requirements for decision-making purposes and providing clear guidance concerning the resulting actions is crucial to projects using the Triad.

The Contractor shall collect soil samples and perform chemical analysis in such a manner that the resulting data meet and support data use requirements. The Contractor shall develop and implement a Chemical Data Acquisition Plan to ensure that data are of sufficient quality to support project decisions. Measurement objectives shall be defined and presented for each chemical parameter and its accompanying measurement method used for the project.

Some of the potential decisions that will be required during implementation of the dynamic work plan for the site are listed below. Also provided are several recommendations concerning how limits of uncertainty might be established and the need for additional analyses (investigative and QC) identified on a real-time basis and decision criteria revised. Suggestions provided are meant as guidelines only and do not represent any type of formal guidance. The actual methods used in the field to develop limits of uncertainty to support decision-making will need to be developed by the contractor and approved by PADEP and other project stakeholders before use and on a real-time basis as more is learned about the site. Some of the decisions, methods for establishing limits of uncertainty, and other elements that can be used to support decision making are provided below in chronological order in which they are likely to occur for each SMA:

- **Development of Preliminary Decision Logic Based on the Results of a Demonstration of Methods Applicability (WE 1.1).** Once the data is available from the methods applicability Study described earlier in this SOW it will be possible to begin the process of refining decision criteria for many of the activities described in this section. Setting the appropriate initial field decision (i.e., action) levels should include comparison using regression analyses between the field-based and fixed lab analyses. Reasonable correlation must be observed otherwise alternative methods or serious method modifications should be identified and tested to determine an alternate method for evaluating contaminant distributions at the site. Regression analyses should also be used to compare fixed lab TCLP results and field-based total metals results. Correlation factors of this type will be important come time for excavation and stockpiling of soil prior to final characterization using TCLP before disposal. Results obtained from the methods applicability study for this purpose will likely be insufficient, so the project team should pay special attention to roll in the initial results from the additional characterization effort, in which twenty percent of the samples are slated for TCLP and field analyses. As mentioned previously care should be taken that sample sent for TCLP are sufficiently high (above the twenty times rule) before they are sent off for TCLP analysis. Similarly the project team should consistently roll results into a relational database such that the correlation between fixed lab and field-based lab results can be tracked and the need for revision of the field based decisions for all other activities get revised as more is learned on a real-time basis.
- **Assuring the sufficiency of soil data (WE 1.4)**. A significant source of uncertainty related to project decision-making can come from the spatial variability of soil sample results. Past analyses at the site indicate the presence of significant hot spots that can drastically impact disposal costs. Because of the availability of a mobile laboratory at the Site, the project team will have the flexibility to collect additional samples to characterize any given sector or SMA. PADEP recommends that if the concentration for total PCBs is above 50 mg/kg or the concentration of mercury exceeds the total metals concentration expected to result in an exceedence of the TCLP criteria for mercury (see WE 1.1) that the Contractor subdivide the grid sector into smaller sectors and collect additional samples to provide characterization at a finer spatial scale. Ten by ten foot grids, as discussed earlier in this document should then be used to chase the hot spots and minimize wastes requiring additional characterization. Initial site planning efforts indicate that the field-lab sample throughput capability will be greater than is necessary to support the 50 by 50 foot grid-sampling scheme, which will allow the Contractor greater flexibility in collecting additional samples when the data evaluation process indicates it is necessary to limit the need to dispose of wastes containing higher concentrations of PCBs and mercury. The cost of analysis will need to be weighed against disposal requirements once they are better defined to decide when and how to collect additional samples. It is recommended that a tool such as Ingersoll's uncertainty calculator be used to track when site heterogeneity is sufficiently high to warrant additional sampling (Ingersoll, 2001) and to identify primary sources of uncertainty (i.e. sampling versus analytical). Additional sampling protocols such as the use of composite samples instead of discrete samples may also need to be considered if site spatial variability is found to be too high to support the currently proposed sampling and analysis plan.
- **Estimating the volume and location of soil within the site boundary that contains COCs at or above the site-specific RBCs (WE 1.5), identifying the need for the removal of contaminated soil.** Defining the limits of uncertainty for supporting decision-making during this effort will be relatively straightforward. The contractor, in accordance with PADEP Act II guidelines will identify when and if either historical or field-based measurement results indicate a particular grid sector exceeds the RBCs provided in Table 1. If the available results for a grid sector are above the RBC then the material must be slated for removal. If the results are well below the RBC than the material can be left in place. If the contractor discovers that some analytical bias is evidenced from the results collected using the field-based methods then it may be necessary to identify a region where results are to close to the action level to make a clear call

and that either confirmation samples or additional data needs to be collected to better define the need for removal of the material. I most cases this will be an issue when reported concentration are near but below the action level, but It could also be the case sometimes when results are near the action level and the presence of an interference is indicated by the analyst. In real life these types of situations rarely occur, but when they do the results should be communicated and a decision made concerning the most appropriate action between PADEP and the Contractor. The collection of additional data, or the analysis of confirmation data using and alternative method, or both need to be considered.

- **Initial waste segregation prior to excavation to limit disposal costs**. Samples analyzed for the presence of PCBs and mercury may vary greatly at the Site based on a review of existing results. These two chemical constituents have the greatest impact on disposal costs. However, other metals that can result in a waste being classified as Hazardous under RCRA may also impact disposal costs. Values recorded near the upper threshold limit as stipulated in Federal LDRs are of particular concern for total PCBs and mercury. When concentrations for PCBs and mercury approach 499 mg/kg and 260 mg/kg respectively, additional sampling and analysis may be required. Additional sampling and analysis is also recommended by PADEP when results are near or above either of the above mentioned LDRs, or near or above 50 mg/kg total PCBs, or near and above the level for mercury estimated during the methods applicability study that would result in the waste being characterized as Hazardous under RCRA for mercury.

  Mercury or total PCB concentrations that exceed Federal LDRs and other respective criteria will require more costly incineration or other treatment prior to disposal. To assure that PCB or mercury contaminated soil expected to exceed these values is clearly defined it is recommended that the Contractor supplement data from the methods applicability study as more data is collected such that decision criteria can be refined and clear correlation factors developed to support segregat ion of soil into the appropriate staging areas prior to excavation. Not only should the field-based decision criteria be sound, additional sampling should be conducted as appropriate to limit soil volume for samples containing elevated levels of total PCBs, mercury, and even other metals that could potentially exceed TCLP threshold limit values (Table 2).

  As with the previous activity it is essential that the Contractor identify and develop a method for communicating with PADEP when results appear to be too close to call. Depending on the observed bias of the field-based method, the apparent heterogeneity of the site materials, and analysts observations it may be prudent to collect additional samples for analysis or to send select samples to an off-site laboratory for confirmation analysis using an alternative method. These types of decisions will need to be made based on observations and conclusions drawn in the field as the data from the demonstration of methods applicability study and other confirmation sample results are obtained and processed.

- **Pre-disposal TCLP analyses.** Prior to disposal, piles of soil will need to be characterized in accordance with disposal facility requirements. Required levels of sensitivity and logistical considerations mandate that TCLP analyses be conducted at an off-site laboratory. The limits of decision uncertainty will primarily be controlled by the heterogeneity of the soil piles. The TCLP threshold limits and QC requirements are established in EPA Method 1312 (Table 2). The use of field analysis can provide some added value during this portion of the program when composite results are reported and they exceed the TCLP threshold limit values. The Contractor should maintain sub-samples of those used to prepare the comp osites sent to the laboratory along with a map detailing their approximate location and depth within the pile. A minimum of ten samples should generally be used to prepare any one composite to limit impacts from isolated hot spots within any given pile slated for disposal. Upon receipt of the results the Contactor should consider the use of additional field based results to decide whether further segregation of the pile might provide added value by decreasing the amount of material requiring a more expensive disposal alternative. Field analyses of the discrete samples used to prepare the composite sent to the laboratory might then be used to identify portions of a particular pile that are most likely to have resulted in the observed exceedence of the TCLP criteria. To facilitate this type of segregation a griding system should be used to collect the initial composites. When possible and practical further segregation and limiting of the materials requiring more expensive disposal should be attempted. The practicality of such an exercise will obviously depend on the amount and location of more contaminated materials within a particular soil pile. When the size and nature of a soil pile appear to be less heterogeneous and segregation difficult, homogenization of the entire pile using a backhoe or other devise could also be warranted. For example if a single sample at the bottom of a pile is identified as having a much higher concentration then the surrounding soil, segregation may be impractical, but homogenization and resampling could resolve the apparent discrepancy in results.

- **Confirmation after excavation.** Confirmation sampling after excavation is another situation when the Contractor should maximize the use of the field based laboratory to add project value, save time and money. The post excavation process is inherently dynamic. According to PADEP Act II guidelines, the 95% UCL for COC results for a particular SMA must be below the RBCs for each COC before backfilling can commence. This can mean selectively removing contaminated grid sectors sequentially until the remediation goal is met. The Contractor should at the same time consider the observed variability in results generated in support of the confirmation effort to decide when and if more detailed griding is warranted or if compositing is justified to limit any nugget effects and improve coverage. Definitive decision logic and limits on the flexibility of the program should be carefully discussed with PADEP and subject to stakeholder review prior to implementation. Special attention should be paid to use visual observation to guide sampling activities. Special attention should also be paid to use of off-site confirmation testing when analysts observations indicate the potential for the presence of interferences. Real time decision making during this and most other elements of this project will be best facilitated through the use of a well design SMA data management and communication strategy. Web based applications can be a powerful tool for this purpose.
- **Protect worker and public health during the cleanup action**. This program will at least include some personal air monitoring and dust control measures to assure that releases of dust during excavation do not exceed potentially applicable guidelines. The contractor will also need to consider weather when conducting site activities. Rain or inclement winds need to be anticipated and the Site controlled adequately.

At a minimum, the measurement objectives stipulated for the project shall include a discussion of the following elements, which are necessary to meet project objectives. Each element described below shall be addressed as it relates to the use of field-based and fixed-laboratory analytical procedures:

- **Accuracy of Analytical Method** - Stipulate the accuracy (bias and precision) of each analytical method as applied to a given analytical instrument for a given analyte in a given matrix and the degree of accuracy required for this project. Analytical methods performance shall be documented for the same or similar matrix prior to method startup. This may require the use independent reference standards or spiked samples, method and other types of blanks, more frequent instrument calibrations than in a fixed lab environment.
- **Reporting Limits for Analytical Method** - Stipulate the detection limit for each proposed analytical method in each matrix involved at the Site and the reporting limit (practical quantitation limit) required for the project. Methods for determining analytical limits shall be addressed, and corrective action specified for situations where they cannot be achieved.

- **Precision of Analytical Method** - Stipulate the methodology used to determine the precision of each analytical method using QC samples and instrumentation checks, and the degree of precision necessary for the project. In determining the precision of the analytical method for any given analyte, the sample matrix shall be taken into account.
- **Data Comparability** - Stipulate the methodology for performing data comparisons considering specific units, equations, and data formats to be used.
- **Checks for transmittal, data reduction and reporting errors** - Any process used for data validation must be close to the origin of the data, while being independent of the data production process.
- **Qualification of primary sample results** - The basis for qualification shall be addressed, with consideration to the results of analysis of blank samples, duplicates, spiked samples and QC check samples before site decisions are made.
- **Representativeness of Data** - Include a discussion of sampling and analysis issues that may be encountered and when and what type of corrective action will be taken when uncertainty in results suggests data are not sufficient to support real-time decision-making.
- **Data Completeness** - Include a discussion of the assessment procedures and reviews to identify unusable data, usable data, and any data use restrictions. The usable data completeness objective for each individual analytical method should be agreed upon. Data sets with less than the agreed upon percent completeness shall be addressed and corrective action documented in daily quality control reports. The Contractor shall modify its procedures to achieve the percent data completeness objective and shall implement those modifications only after the Contracting Officer has approved them.

Calibration Procedures

The Contractor shall calibrate all analytical instrumentation, whether used in field-based or fixed-lab analysis, to ensure that the equipment is functioning optimally. EPA SW-846 methods 8080b (PCBs) and 6200 (XRF) methods shall be used to establish the underlying theoretical basis for refinement of field-based methods, refinement and modification of the protocols recommended in these methods will more than likely require revision to meet project requirements. Keen attention should be paid to revising sample preparation and calibration frequency requirements to adapt to the rigors of a field-based laboratory operation. Fixed laboratory analyses will also be based on EPA SW-846 basic method requirements for calibration, again with special attention being paid to the need to assure the comparability of XRF and inductively coupled argon plasma spectrometry analyses (ICAP) using EPA Method 6010. Waste analyses will be performed in accordance with EPA SW-846 method 1312. Care should be taken that calibration standards are prepared in a fashion similar to the samples when appropriate or necessary.

- The calibration procedures and instrumentation shall be consistent with the sample analysis requirements of this project and standard methods (such as SW-846).
- Preventive Maintenance - The Contractor, using qualified maintenance personnel, shall routinely perform preventive maintenance on all analytical equipment and instrumentation.

- Detailed calibration records and notes discussing problems encountered and their resolution shall be maintained and made available for inspection by the Contracting Officer on request.

Quality Control Samples

The Contractor shall conduct internal quality control checks designed to establish technically sound criteria for each measurement parameter, which shall serve to accept, qualify, or reject data in a uniform and systematic manner. Internal (laboratory) and external (field) QC check samples will be analyzed at a frequency sufficient to assure the reliability of project decisions. These checks are designed to ensure accuracy and precision in the sampling procedure and the analytical methods. They include blanks, duplicates (collocated), replicate (splits) matrix spikes, reference standards and performance evaluation samples. The numbers and types of QC samples analyzed should be commensurate with decision making requirements and data distributional characteristics. The program should be designed to identify when unacceptable bias or precision limit the project teams ability to make reliable decisions in the field. A flexible and adaptive QC program designed around known site conditions is preferred. For example, random collection of field duplicates can be used to evaluate the general heterogeneity of a particular COC. However, the project QC officer and field team members should also have established guidelines for identifying when additional QC should be collected. If duplicate results are variable for PCBs or metals results using the proposed methods and results non conclusive for decision making purposes, the Contractor should consider sending a split to the fixed lab for confirmation using an alternate method. Another way in which QC results might be used to trigger corrective action could include selection alternate spectral lines or differing interelement corrections when concentrations of lead interfere with the quantitation of arsenic.

Corrective Actions

The Contractor, after notifying the PADEP Project Technical lead of any and all deviations or non-compliance events relating to chemical data quality management requirements or receipt of such notice from the project technical lead or Contracting Officer, shall immediately take corrective action. If the Contractor fails to comply promptly, the Contracting Officer may issue an order to stop all or part of the work until satisfactory corrective action has been taken. Such an order shall encompass activities of both the Contractor and its Subcontractors. The Contractor shall make no part of such time lost due to such stop orders the subject of claim for extension of time or for excess costs or damages.

- If the measurement objectives are not met, or internal or external quality control checks show significant deficiencies in the sample analysis process, the Contractor or its Subcontractor shall prepare a letter discussing the corrective action to be taken and submit it to the Contracting Officer.

- Discussion of corrective actions shall include the limits of data acceptability for each analytical parameter and sample matrix along with the possible corrective actions to be taken when these limits are exceeded.
- The Contractor shall identify personnel who are responsible for initiating and performing the corrective actions. In addition, the Contractor shall document all pertinent information regarding the problem.

Analyst Proficiency Testing

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It is imperative that field-based sampling and analyses be carried out with a high level of proficiency. Analysts are expected to handle and track soil samples, manage data, and conduct soil sample analysis and quality control procedures. The Contractor shall demonstrate meeting these requirements by developing written plans that ensure reliable and consistent data of known and documented quality are generated and that equipment operator errors are minimized.

The Contractor shall develop and present for approval, a list of analytical equipment operator proficiency requirements and set of procedures by which the analyst will be tested to demonstrate proficiency. At a minimum, the primary chemist responsible for performing on-site analysis should have a minimum of 4 years of experience directly related to the regulated analytical equipment. The project quality control (QC) officer should have at least one year of experience in conducting laboratory audits and data validation. The QC officer will be responsible for evaluating and documenting method and analyst proficiency before, during, and after each portion of the field program. When, and if, equipment or personnel must be changed during the course of the project, method and or analyst proficiency must be re-evaluated and approved by the QC officer before more analyses can be performed.

3.2 TASK 2 – DETAILED DESIGN (WE 2.0)

The Implementation Contractor(s) shall prepare the detailed design documents needed to implement Site cleanup and ready the Site for future redevelopment. At a minimum, detailed design documents shall include calculations, drawings, specifications, and a construction cost estimate. The detailed design shall describe the existing features of the Site, temporary facilities needed during construction, excavation maps, engineering and environmental controls needed during construction, final grading of the Site surface following soil excavation and backfilling, revegetation, run-on/run-off controls for the finished Site surface, and permanent engineering controls. The detailed design has been divided into four subtasks as follows:

- Site topographic mapping (Additional Studies Task) ,
- Design document development,
- Construction document development, and
- Detailed construction cost estimate.

3.2.1 Site Topographic Map (WE 2.1)

The additional studies Contractor shall perform the work necessary to prepare a new base map of the Site on a scale of 1-inch equals 60 feet. At a minimum, the map shall identify and include the following:

- Current topographic surfaces with a contour line resolution of 1-foot,
- Existing buildings, paved areas, and significant features of the Site,
- Locations of underground and aboveground utilities and pipelines,
- Property boundaries,
- Public access roads into the Site area,
- Locations of sample borings collected during RI activities, and
- Other features necessary to allow the development of design drawings.

The survey shall be performed using aerial surveying techniques with ground-based calibration and verification. The Contractor shall submit an aerial photograph and develop a computer-generated topographic surface of the Site. At a minimum, the computer-generated surface shall be used for the following:

- Generating and identifying soil-sampling locations for additional Site characterization activities,
- Generating soil excavation maps, and
- Calculating soil excavation quantities.

3.2.2 Design Development (WE 2.2)

The cleanup design and corresponding cleanup action developed by the Implementation Contractor(s) is recommended by PADEP to include the following engineering considerations:

- Site preparation as necessary (WE 1.3),
- Sequencing during soil excavation,
- Waste stream segregation,

- Backfilling, grading, and revegetation,
- Disposal of excavated soil,
- Decontamination requirements for personnel and equipment, and
- Handling of investigation derived waste

The Contractor shall develop streamlined engineering design documents consistent with the design/build process. The Contractor shall develop drawings and specifications as needed to successfully implement the project. In addition, the Contractor shall update the technical specifications included with this Statement of Work to make them consistent with the detailed design. Drawings, specifications, and other products developed shall comply with PADEP and U.S. Army Corp of Engineer standards.

Design Development

The Contractor shall develop design development level drawings and documents as necessary to describe project features. The design development level will reflect approximately 50 percent design completion. The work will include:

- Developing a site layout drawing,
- Preparing and maintaining a project calculation notebook,
- Preparing new design drawings to a design development level,
- Preparing draft construction specifications that will be included in the project manual,
- Preparing a written summary of the major features included in the project,
- Preparing an updated soil segregation decision logic diagram, and
- Submitting the design development documents for review and approval,

Sequencing During Excavation

The Contractor shall design and implement a plan for excavation sequencing of contaminated soil. The Contractor's excavation sequencing plan shall be generally consistent with the plan outlined in this section.

The objectives of excavation sequencing through the use of soil management areas are as follows:

- Subdivides the Site into manageable soil excavation areas,
- Allows excavation activities to progress systematically from one end of the Site to the other, and
- Provides logical units for compositing soil confirmation samples.

The Site is divided into seven SMAs as shown on Figure 4. Each SMA consists of between 10 to 15 grid cells. Each of the cells is 50-foot by 50-foot in dimension, except for partial cells around the Site perimeter and adjacent to the buildings. Further segregation of indi vidual 50-foot by 50-foot cells into ten foot cells (Figure 7) is suggested for cells where the central sample result for total PCBs and Mercury exceed the LDR or TCLP threshold values or other site specific threshold developed during the methods applicabi lity analysis. The cost benefit of additional sampling and contaminant delineation at these grid sites outweighs the increased disposal costs for PCBs and Mercury if the entire 50-foot by 50-foot grid were remediated.

The grid cells with relatively similar contaminant characteristics are treated as a unit and grouped into the same SMA, which is expected to facilitate the planning and execution of sampling and soil removal.

It is anticipated that the Contractor will sequence excavation, confirmation sampling, and backfilling activities consistent with the breakdown of the SMAs. For example excavation, confirmation sampling, and backfilling could initially be completed in SMA No. 1 and then progress sequentially through SMA No. 6. Excavated soil could be segregated and stockpiled in Soil Management Area No. 7 where it would be sampled prior to loading and transport to the required treatment and disposal facility. However, the Contractor shall decide the order in which the SMAs are excavated and shall describe this sequencing in the detailed design documents.

The cleanup design shall address access routes to transport excavated soil from the soil management currently under excavation to the soil stockpiling area. The cleanup design shall also develop access points into and out of the Site that will allow the transport of clean backfill in and contaminated soil out as efficiently as possible.

Waste Stream Segregation

Figure 3 presents the preliminary decision logic for segregating soil into discrete piles in accordance with the anticipated treatment and disposal requirements. The Contractor shall design the temporary waste pile areas such that excavated material is be segregated into discrete piles, each waste type is collected in one location, waste disposal sampling is performed on a completed waste pile, and loading for off-site disposal can be easily implemented.

3.2.3 Construction Document Development (WE 2.3)

The Implementation Contractor(s) shall develop the project documents from the design development level to the construction document level, which shall reflect 100 percent design completion. At a minimum, the work shall include:

- Incorporating the results obtained during the refinement of decision criteria into the design and providing sufficient flexibility in the approach such that decision criteria can be refined as additional data are obtained,
- Preparing design drawings to the construction document level,
- Updating the project schedule for implementation of the construction work,
- Preparing construction specifications to the construction document level, and
- Preparing the final construction document package.

3.2.4 Detailed Cost Estimate (WE 2.4)

Following the completion of the Additional Studies program characterization and as a component of Task 2 – Detailed Design, the Implementation Contractor(s) shall prepare a detailed construction cost estimate for Site cleanup. The detailed construction cost estimate shall:

- Be organized consistent with the work breakdown structure described in this systematic plan and the bid schedule included with the SOW. Incorporate the results obtained from the additional Site characterization activities, which are expected to refine soil volume estimates as well as treatment and disposal requirements and options.
- Incorporate the costs associated with implementing the detailed design effort.
- Include valid cost quotations from selected vendors for the shipment, treatment, and disposal of excavated Site soil.

Following submission of the detailed construction cost estimate, PADEP will evaluate the economic viability of Site cleanup using the concepts described in this systematic plan. PADEP will then decide whether to implement the project as described in Task 3 – Soil Excavation and Disposal, revise the cleanup design, or evaluate other potential cleanup alternatives.

3.3 TASK 3 – SOIL EXCAVATION AND DISPOSAL (WE 3.0)

Under Task 3 – Soil Excavation and Disposal, the Implementation Contractor(s) shall perform Site cleanup activities in accordance with the results obtained from Task 1 – Additional Site Characterization and design documents developed from Task 2 - Detailed Design. The work elements associated with Task 3 are described below.

3.3.1 Contaminated Soil Excavation (WE 3.1)

The Implementation Contractor(s) shall implement contaminated soil excavation in accordance with the detailed design documents and Specification Section 02111 – Excavation and Handling of Contaminated Material, Specification Section 01355 – Environmental Protection, and Specification Section – 01356 Storm Water Pollution Prevention Measures.

3.3.2 Waste Stream Segregation and Stockpiling (WE 3.2)

The Implementation Contractor(s) shall segregate and stockpile excavated soil in accordance with the project planning and detailed design documents and Specification Section 01572 – Construction and Demolition Waste Management.

3.3.3 Transport, Treatment, and Disposal of Excavated Soil (WE 3.3)

The Implementation Contractor(s) shall arrange for the transportation, treatment, and disposal of excavated soil in accordance with the project planning and detailed design documents. PADEP will obtain a one-time RCRA waste generator identification number and sign any waste manifests for shipment and disposal of contaminated soil. Solid waste (e.g., non-hazardous waste) shall be disposed in accordance with PADEP requirements. Personal protective equipment (PPE) and solid waste shall be disposed of in a solid waste landfill. Hazardous wastes shall be disposed in accordance with the applicable section of Specification Section 02120 – Transportation and Disposal of Hazardous Materials, which includes manifesting and shipment to an approved Treatment, Storage, and Disposal (TSD) facility for disposal in accordance with applicable state and Federal land disposal restrictions. A copy of available sampling and analysis data shall be sent to the waste disposal facility to assist in their waste characterization.

3.3.4 Sampling, Analysis, and Disposal of Investigation Derived Wastes (WE 3.4)

The Contractor(s) shall be responsible for the disposal of investigation-derived wastes. Solvents and residuals generated from field-based sampling and analyses activities shall be disposed at a hazardous waste disposal facility. The Contractor(s) or its field laboratory Subcontractor shall be responsible for disposal of all laboratory-generated wastes. Unused soil samples shall be disposed along with excavated soil with similar contamination or along with soil from the same grid cell.

3.3.5 Backfilling, Grading, and Revegetation (WE 3.5)

The Implementation Contractor(s) shall implement backfilling, grading, and revegetation activities in accordance with the design documents and Specification Section 02111–Excavation and Handling of Contaminated Material, Specification Section 02370–Soil Surface Erosion Control, and Specification Section 02921-Seeding. If definitive confirmation sampling shows that additional excavation is not necessary, the Contractor(s) shall backfill excavated areas with clean, imported soil. Following backfill placement and compaction the Site shall be rough graded in accordance with the design drawings. During the rough grading portion of the project, the Contractor(s) shall install appropriate run-on and runoff controls including features, such as drainage ditches, swales, or drainage piping. After completing backfilling and rough grading activities, the Contractor shall install a topsoil cover layer, implement final grading, and revegetate the Site.

3.4 TASK 4 – CONSTRUCTION COMPLETION REPORT (WE 4.0)

The Implementation Contractor(s) shall prepare a construction completion report that will serve as the executive record summarizing the cleanup activities implemented at the Site. Specification Section 02111–Excavation and Handling of Contaminated Material, Specification Section 01780–Closeout Submittals, and Specification Section 01451–Contractor Quality Control describe these requirements in detail. The construction completion report, at a minimum, shall include:

- Detailed records of the work activities implemented during the cleanup action,
- Progress photographs taken throughout the field activities,
- Additional Site characterization results database,
- As-built drawings of soil excavation areas,
- Final grading plan drawings based on an as-built survey of the Site,
- Details of soil treatment and disposal,
- As-built cost summary for the project consistent with the work breakdown structure described in this systematic plan,
- Significant design or concept changes implemented during construction, and
- Site closure letter issued from PADEP.

3.5 TASK 5 - PROJECT MANAGEMENT (WE 5.0)

The Contractor(s) shall implement the project management procedures needed to successfully implement Site cleanup. At a minimum, project management activities shall address the following:

- Establishing and maintaining a project team,
- Establishing roles and responsibilities within the project team,
- Developing, updating, and tracking the project schedule,
- Controlling project costs,
- Managing and submitting invoices,
- Coordinating, attending, and documenting project meetings,
- Coordinating project issues with project stakeholders

Project management requirements are described in Specification Section 01312–Quality Control System, Specification Section 01320–Project Schedule, Specification Section 01330–Submittal Procedures, Specification Section 01451–Contractor Quality Control, and Specification Section 01780–Closeout Submittals.

3.5.1 Project Scheduling and Coordination (WE 5.1)

The Contractor(s) shall prepare, update, and maintain a project schedule for use in project planning. The project scheduling requirements are described in Specification Section 01320–Project Scheduling.

References

U.S. Environmental Protection Agency (EPA). 2002. Guidance on Choosing a Sampling Design for Environmental Data Collection for Use in Developing Quality Assurance Project Plan. EPA QA/G-5S. December.

ENCLOSURE #1
RELATIONAL DATABASE AND STATISTICAL ANALYSIS

Enclosure #1
Part 1-1
Table of Contents

Enclosure #1 Table of Contents

Enclosure #1
Part 1-2
Development of the Marino Brothers Scrap Yard Database

DEVELOPMENT OF THE MARINO BROTHERS SCRAP YARD DATABASE, SUMMARY STATISTICS, AND STATISTICAL PLOTS

Development of the Database and Site Statistics

The database for the Marino Brothers Scrap Yard was created based on a nonrelational Microsoft Access database received from Baker Environmental (Baker) on January 1, 2002. Data was also received in a spreadsheet format. Many of the fields useful for data sorting and manipulation were included in the sample identification number. This practice is common in the environmental industry, however it can make data analysis difficult. Tetra Tech EM Inc. (Tetra Tech) split out this important information, such as sample depth and type of sample (such as temporary well point versus soil sample) into separate fields to facilitate querying of the data and to permit a more straightforward approach when preparing statistics, cross sections, and maps used during the systematic planning process.

A number of lookup tables were created to support the relational database. A diagram of the relationships included in the database and the lookup tables is provided in the electronic database folder, in the attached compact disc, and as hard copy in Enclosure 1. Also included is a brief data dictionary. A copy of the restructured database is provided in an electronic form as a file called "New Marino Database" provided within the database folder. The restructured database is not provided in hardcopy.

The x,y, coordinates and sample depth information compiled for each sample location or monitoring well was identified based on a review of well construction or geoprobe information provided by Baker. Sample type and point type information was compiled from the "Baker electronic data deliverable (EDD)" and other documentation and phone conversations with Baker personnel.

After construction of the database was complete, Tetra Tech statisticians queried the data to develop a specific data set for unsaturated soil and groundwater. The unsaturated soil data set contains information for soil sampling locations that range in depth from 0-12 feet below ground surface, while the groundwater data set contained groundwater data from on-site monitoring and temporary wells. The data sets were exported into an Excel format, where they were reviewed for completeness and prepared for analysis using the U.S. Environmental Protection Agency (EPA) Guidance for Data Quality Assessment (EPA QA/G-9 2000 update). Additional quality assurance checks were not performed. It was assumed that the data provided by Baker had been validated and the database verified prior to receipt by Tetra Tech.

After removal of quality control sample results and verification of the unsaturated soil and groundwater data were completed, the data was imported into STATISTICA, a statistical program used by Tetra Tech to develop summary statistics and plots for each data set. Summary statistics were completed for all compounds and analytes listed in the unsaturated soil and groundwater data sets. Summary statistics included the detection frequency, mean, median, geometric mean, minimum and maximum detected concentrations, the minimum and maximum reporting limits, standard deviation, variance, and 95 percent upper confidence level (95UCL).

Unsaturated Soil Statistics and Chemicals of Potential Concern (COPC)

For the unsaturated soil data set, the appropriate reference value was chosen following Pennsylvania Department of Environmental Protection (PDEP) guidance for selecting an appropriate media-specific concentration (MSC) for each compound detected at the site. Appropriate MSC reference values were selected by taking the lower value of the soil direct-contact value (Act 2, Technical Guidance, PADEP 2002) and the soil-to-groundwater value, then comparing that value to the generic MSC and taking the higher of those two values. The MSC values used for preliminary identification of COPCs are provided in bold text in the soil summary statistics table (see electronic and hardcopy provided in Enclosure 1). After completion of the summary statistics for the unsaturated soil data set; box-and-whisker plots, histograms, and probability plots were developed for any compound or analyte where the maximum concentration exceeded the residential MSC reference value identified for use. Maximum detected concentrations, means, and 95UCLs that exceed the MSC reference value are listed on the table in bold red text.

Based on discussions with PADEP and an analysis of the statistical plots developed for COPCs that exceeded the selected MSCs, several site-specific decisions were made. It was decided that saturated soil would not be addressed as part of the soil remedy, and that residential MSCs were economically prohibitive and overly protective based on the proposed reuse of the site. The presence of low levels of arsenic is likely related to the slag used as fill at the site and in much of the surrounding area to the depth of the groundwater table. Arsenic was the principal COPC that controlled the decision concerning the need not to remediate to residential MSCs. Based on these considerations PADEP requested that Tetra Tech work to develop site-specific standards for COPCs identified as exceeding the selected residential MSCs based on a more realistic reuse and exposure scenario. It was also decided that no future use of groundwater beneath the site would be allowed. Based on the results of the site-specific standards development work presented in Enclosure 2, a second set of statistical comparisons were developed and are presented as a separate tab (soil data new vs. site specific tab) in the soil summary statistics workbook provided in Enclosure 1.

Based on the policy of PADEP to remediate any locations where a sample exceeds an MSC or site-specific standard, statistical analysis using the 95UCL was also employed to evaluate attainment of cleanup goals in a third and final statistical data set developed by Tetra Tech. This data set is also provided in the soil summary statistics table as a tuncated data set, and is the third tab in the soil summary statistics workbook (truncated soil data). This data represents the statistical characteristics of the data population that are below the site-specific action levels developed by Tetra Tech. These statistics represent the data distributions that are expected once remediation of soil above the site-specific standards has been completed. This data will be used should PADEP decide to have EPA assist during the development of a statement of work and cost-benefit analysis for remediation at the site. The data will be used to estimate the numbers of samples required during excavation and the evaluation of attainment for the site after restoration is completed. It should be noted that truncated data sets were only developed for those constituents with the widest distribution and that would likely be used to drive the need for treatment. Additional truncated data set statistics for the remaining COPCs identified based on exceedances of the site-specific standards may need to be developed prior to determining attainment.

Screening of COPCs based on residential MSCs and the maximum-detected concentration of the chemical constituents suspected to be present as a result of site activities yielded following COPCs initially retained: antimony, arsenic, cadmium, cobalt, iron, lead, mercury, nickel, selenium, silver, thallium, zinc, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260, Isophorone, Bis (2-Ethylhexyl) Phthathlate, Dibenzo (A,H) Anthracene, Naphthalene, Indeno (1,2,3-CD) Pyrene, Benzo (A) Anthracene, Benzo (A) Pyrene, and Benzo (B) Fluoranthene.

After development of site-specific action levels and the subsequent statistical analysis and comparison with the maximum-detected concentration, the following COPCs were retained: antimony, arsenic, cadmium, iron, lead, mercury, Aroclor 1248, and Aroclor 1254.

Groundwater Statistics

The residential MSC was used to identify potential COPCs in groundwater. Constituents with maximum values exceeding the residential MSC were retained to evaluate any potential that groundwater could impact surface water, and to evaluate the general nature of groundwater contamination at the site, should reclamation or any future use be reconsidered. After completion of the summary statistics for the groundwater data set, box–and-whisker plots, histograms, and probability plots were developed for any compound or analyte where the maximum concentration exceeded the groundwater MSC value. Maximum-detected concentrations, means, and 95UCLs that exceed the MSC reference value are listed in bold red text in the statistical tables provided for groundwater in Enclosure1, Part 1-4.

Based on the statistics developed for groundwater, the following inorganics were retained for purposes of modeling the potential impact of groundwater to the Ohio River: aluminum, iron, lead, manganese, nickel, and thallium. In addition, the following organic constituents were also retained: Aroclor 1248, Aroclor 1260, Aroclor 1254, Dibenzo (A,H) Anthracene, Indeno (1,2,3-CD) Pyrene, Benzo (A) Anthracene, Benzo (A) Pyrene, Benzo(B) Fluoranthene, Benzo (K) Fluoranthene, and Benzo (G,H,I) Perylene. Bis (2-ethylhexyl) Phthalate is a common laboratory contaminant and was not retained for additional analysis.

Enclosure #1
Part 1-3
Database

STRUCTURE OF MARINO ACCESS ENVIRONMENTAL DATABASE

1. All data entered into the attribute database should be entered exclusively in UPPERCASE.

2. Any column name preceded by an asterisk (*) is required and must be entered into the database.

3. Any column name preceded by a pound symbol (#) is CONDITIONALLY required. The description of the column explains when an entry is required.

4. Any column name preceded by an ampersand (&) is DERIVED. No data entry should occur for this column. This column will be calculated or completed by the computer.

5. The information in the column labeled DATA TYPE defines the database fields as follows:

   - (Cn)—indicates a text field n characters long, where n is any integer greater than 0.
   - (Nn,m)—indicates a numeric field n digits long with m digits after the decimal place. A data type of (N8) indicates a long integer field (no decimal places). A data type of (N12,4) indicates a decimal field with total of 12 digits, both to the left and right of the decimal point. There are 4 digits to the right of the decimal point.
   - (DATE)—indicates a date field. Date fields in Access can be entered in several formats, such as MM/DD/YY, or converted to Julian dates.

Data Dictionary

REQ	COLUMN NAME	DATA TYPE	DESCRIPTION		
POINT Table:					
*	PT_KEY	(N7)	Primary key issued by the AUTO NUMBER.		
*	PT_NAME	(C15)	The name of the location from which the data were collected (for example, a well name or a node on a sampling grid). For QC samples (TB, ER, and FB only) the PT_NAME must be 'QC SAMPLE.' Field duplicates (SAMPLE.SMP_TYPE = 'FD') should reference their true PT_NAME, not 'QC_SAMPLE.'		
*	PT_TYPE	(C10)	The type of location from which the data was collected, as defined in the PT_TYPE_LU table.		
*	ORIGINATING_CONSULTANT	(C6)	Consulting company that originally established the point in the field as described by the code list below:		
			'TTEMI'	Tetra Tech E M, Inc.	
			'BAKER’	Baker Corp.	
			'USGS'	United States Geological Survey	
&	PT_READY	(C1)	The ready state of this row for external access and viewing as described by the code list below:		
			'N'	No	Default state
			'Y'	Yes	QA/QC has been conducted and supporting documentation is filed and retrievable.
#	ORIGIN_DATE	(DATE)	Date that this point was established.		
#	ORIGINAL_NAME	(C15)	First PT_NAME assigned to the point if the name was later changed.		
#	PT_DEPTH_FT	(N6,2)	The total depth of the point (not the sample depth). This field should be completed for PT_TYPE='MW,' 'SB,' 'CPT,' 'HP,' 'GP,' 'SPUNCH,' or 'EXCV'. If PT_TYPE = 'EXCV', enter the average depth of any excavation.		
*	EASTING	(N12,4)	The easting of the field point in state plane coordinates. The number -8888888 is used for QC samples.		
*	NORTHING	(N12,4)	The northing of the field point in state plane coordinates. The number -888888 is used for QC samples.		
#	ELEV	(C10,4)	The elevation of the location from which the data was collected.		
SAMPLE Table:					
*	SMP_KEY	(N7)	Primary key issued by the AUTO NUMBER		
*	PT_KEY	(N7)	Foreign key for joining the SAMPLE table to the POINT table		
*	SMP_ID	(C25)	The sample identification (ID) listed on the chain of custody.		
*	SMP_DATE	DATE	The date the sample was collected.		
*	SMP_MED	(C15)	The medium of the material collected and identified by the field sampler, as described by the code list below:		
			'SOIL'	Naturally developed soil, alluvium, colluvium, or other fill material	
			'WATER'	Ground water or surface water	
			'SEDIMENT'	Wet or dry	
			‘SLUDGE’		
			'SOIL GAS'		

Data Dictionary

REQ	COLUMN NAME	DATA TYPE	DESCRIPTION
			'AIR'
			'PRODUCT' — Free product
			'WIPE'
			'ANIMAL TISSUE'
			'PLANT TISSUE'
*	SMP_CMPY	(C6)	Company affiliation of the field sampler, as defined in the ORGANIZATION_LU table.
*	GRAB_COMP	(C4)	Indicates whether the sample was a grab sample or a time or depth composited sample, as described by the code list below. 'GRAB' — Grab sample 'COMP' — Composite sample
*	SMP_TYPE	(C5)	The type of location from which the data were collected, as defined in the SMP_TYPE_LU table.
*	INVESTIG	(C12)	The investigation under which a sample was collected. This should typically reference the field sampling plan or work plan from which the sampling was conducted. Do not enter the report for which these data are extracted or used.
#	INSITU	(C1)	Indicates whether a site characterization sample remains in situ and indicative of site characteristics, as described by the code list below: 'Y' — Yes — Material that the sample characterized remains in place 'N' — No — Material that the sample characterized has been removed or remediated in place. The sample is of historical value, but no longer characterizes its surroundings. The removal date must be completed.
&	SMP_READY	(C1)	The ready state of this row for external access and viewing, as described by the code list below: 'N' — No — Default state 'Y' — Yes — QA/QC has been conducted, and supporting documentation is filed and retrievable.
#	FIELD_ID	(C25)	An alternate sample ID used in some investigations when the samples are submitted blind to the laboratory. This sample ID is typically constructed from the point name, site ID, sample date, or sample medium.
	SMP_TIME	(C4)	The time the sample was collected. Time should be represented in military format and without any punctuation. For example, 2:45 pm should be entered as '1445'.
#	SMP_DEPTOP_FT	(N7,1)	The top of the sampled interval if the sampled media is soil, sediment, or surface water. This depth should be the depth below the natural air (or water) and sample media interface. A sample collected at the interface should have a depth of zero.
#	SMP_DEPBOT_FT	(N7,1)	The bottom of the sampled interval as measured from the air (or water) and sample media interface. If the sample was collected at a discrete depth (and not an interval), this column should be null.
	CTO	(C4)	Contract task order (CTO) under which a sample was collected, if any.
#	REMOVAL_DATE	(DATE)	If INSITU = 'N', this column must be completed with the date that the material containing the original site characterization sample was removed or remediated.
#	DUP_ID	(C25)	The SMP_ID of the other half of a duplicate sample pair. The normal sample (SMP_TYPE = 'NORM') should be entered first, followed by the duplicate (SMP_TYPE = 'FD'). If the SMP_TYPE is 'FD,' DUP_ID must be completed with a previously entered SMP_ID.

Data Dictionary

REQ	COLUMN NAME	DATA TYPE	DESCRIPTION		
ANALYSIS Table:					
*	ANLY_KEY	(N7)	Primary key issued by the ANLY_SEQUENCE generator (anly_sequence.nextval)		
*	SMP_KEY	(N7)	Foreign key for joining the ANALYSIS table to the SAMPLE table		
*	VAL_STATUS	C8)	Validation status of the analytical results as defined in the VAL_STATUS_LU table		
*	ANLYGROUP	(C10)	Analytical group, as defined in the ANLYGROUP_LU table.		
*	LAB_CODE	(C6)	Initial laboratory that received the chain-of-custody record, as defined in the ORGANIZATION_LU table. If samples were later subcontracted to another laboratory, only the original laboratory should be entered in this column.		
&	ANLY_READY	(C1)	The ready state of this row for external access and viewing, as described by the code list below:		
			'N'	No	Default state
			'Y'	Yes	QA/QC has been conducted, and supporting documentation is filed and retrievable.
#	SDG	(C12)	Laboratory sample delivery group. Required to locate data validation reports and appropriate Quality Control Summary Report. This information will not always be available when the row is first created, but it is required once laboratory results are received.		
#	ANLY_MATRIX	(C15)	Matrix as reported by the laboratory and as defined in the MEDIA_LU table. Will not always be available when row is first created, but it is required after laboratory results are received.		
#	FILTER_MICRON	(N5,2)	Filter size in microns, for filtered samples only.		
CHEMRES Table:					
*	CHEMRES_KEY	(N7)	Primary key issued by the CHEMRES_SEQUENCE generator (chemres_sequence.nextval).		
*	ANLY_KEY	(N7)	Foreign key for joining the CHEMRES table to the ANALYSI S table.		
*	PAR_KEY	(N7)	Foreign key for joining the CHEMRES table to the PARCODES table.		
*	CONC_LAB	(N18,5)	Concentration as reported by the laboratory.		
*	RPTD_UNITS	(C10)	Units of measure reported by the laboratory.		
*	TIC	(C1)	Indicates whether the result is for a tentatively-identified compound (TIC), as described by the code list below. TICs identified solely as 'UNKNOWN' by the laboratory will not be entered into the database.		
			'N'	No	Result is not for a TIC
			'Y'	Yes	Result is for a TIC
*	LAB_SMP_ID	(C15)	Sample ID is assigned by the laboratory upon receipt of the sample. This sample ID should correspond to the sample ID on the hard-copy report from the laboratory.		
&	CHEM_READY	(C1)	The ready state of this row for external access and viewing, as described by the code list below:		
			'N'	No	Default state
			'Y'	Yes	QA/QC has been conducted, and supporting documentation is filed and retrievable.
*	CHEMNAME_LAB	(C40)	The analyte name, as reported on the laboratory reporting sheet. This field is for data tracking and management purposes.		

Data Dictionary

REQ	COLUMN NAME	DATA TYPE	DESCRIPTION
#	METHOD_CODE	(C20)	Analytical method used to determine results. This information should only be provided for results if it is readily and easily available. Methods must be selected from the METHOD-CODE_LU table.
*	METHOD	(C35)	The method is reported by the laboratory.
#	ANLY_DATE	(DATE)	Date the sample was analyzed. This date should be entered for all samples collected. If this information is readily and easily available for historical data, it should also be entered.
#	REPLIM_LAB	(N14,5)	Laboratory reporting limit, when applicable. This column should generally be completed for any new data, except for pH, eH, and similar data. This information is not expected for historical data. For radionuclides, this column should contain the minimum detectable activity.
#	QUAL_LAB	(C15)	Qualifier or laboratory flag reported by the laboratory.
#	CONC_VAL	(N18,5)	Concentration reported by the validator or original CONC_LAB. This depends on whether the validator changed the laboratory concentration or accepted it. This column should always be populated if VAL_STATUS = 'VAL_CMPL'. It should be empty if VAL_STATUS is not equal to 'VAL CMPL.'
#	QUAL_VAL	(C8)	Validation qualifier, if any, reported by the validator. This column should only be populated if VAL_STATUS = 'VAL CMPL' and a validation qualifier(s) was reported by the validators.
#	QUAL_COMMENT	(C5)	Subqualifier or validator's comment. This column should contain only the letters A, B, C, D, E, F, G, or H or some combination of these. This column can only be populated if VAL_STATUS = 'VAL_CMPL'.
	RETENTIME_TIC	(6,2)	The retention time reported for a TIC in minutes.
&	CONVERTED_CONC_LAB	(N18,5)	Laboratory result converted to standard units. This column is derived and calculated by the computer based on the standard units for the analyte from the CONVERSION table.
&	CONVERTED_CONC_VAL	(N18,5)	Validation result converted to standard units. This column is derived and calculated by the computer based on the standard units for the analyte from the CONVERSION table.
&	CONVERTED_REPLIM_LAB	(N14,5)	The laboratory reporting limit converted to standard units. This column is derived and calculated by the computer based on the standard units for the analyte from the CONVERSION table.
&	STD_UNITS	(C10)	Standard units from the CONVERSION table after the conversion to standard units has been done and CONVERTED_CONC_LAB, CONVERTED_CONC_VAL, and CONVERTED_REPLIM_LAB have been populated.
	EXTR_DATE	(DATE)	Extraction date (if any) of the sample for the primary analytical method. This column should not contain the toxicity characteristic leaching procedure or whole effluent toxicity extraction date.
#	RAD_ERROR	(N16,8)	Error value associated with radionuclides. This column must be completed for any radionuclide analyses and should be null for all other analyses.
#	DIL_FACT	(N10,2)	Multiplicative factor by which the sample was diluted. If not diluted, this should be 1.
PARCODES Table:			
*	PAR_KEY	(N7)	Primary key issued by the PAR_SEQUENCE generator (par_sequence.nextval).
*	STD_CHEMNAME	(C40)	Standardized full chemical name. Not necessarily the chemical name reported by the laboratory. This column must be unique.
#	CASNO	(C11)	The Chemical Abstract Service (CAS) number for the compound. If the compound does not have a CAS number, none should be entered. Unofficial CAS numbers are not allowed.

Data Dictionary

REQ	COLUMN NAME	DATA TYPE	DESCRIPTION		
LOOK-UP TABLES					
ANLYGROUP_LU Table:					
*	ANLYGROUP	(C10)	Analytical group		
*	ANLYGROUP_DESC	(C55)	Analytical group description		
*	FILTER_REQ	(C1)	Determine if filter size is required for the FILTER_MICRON field in the ANALYSIS table, as described by the code list below.		
			‘N’	No	FILTER_MICRON field has to be NULL.
			‘Y’	Yes	FILTER_MICRON field must contain a value.
INVESTIG_LU Table:					
*	INVESTIG	(C12)	The investigation under which a sample was collected. This should typically reference the field sampling plan or work plan from which the sampling was conducted. Do not enter the report for which these data are extracted or used.		
*	INVESTIG_DESC	(C65)	Field investigation description.		
METHOD_CODE_LU Table:					
*	METHOD_CODE	(C20)	Analytical method code used to determine results.		
*	METHOD_REFERENCE	(C80)	Analytical method description.		
PT_TYPE_LU Table:					
*	PT_TYPE	(C10)	The type of location from which the data was collected, as described by the code list below:		
			'MW'	Monitoring well	
			'CW'	Cluster well (multiple wells sharing a single oversized boring). If multiple wells are in close proximity but have individual borings, they should be typed as 'MW').	
			'SB'	Soil boring. This may be established by a hand auger, drill rig, or sediment collection device. If a GeoProbe® is used for soil data, the 'GP' (not 'SB') PT_TYPE should be entered.	
			'SL'	Surface grab location	
			'CPT'	Cone penetrometer (no sample)	
			'HP'	HydroPunch® (water data only)	
			'GP'	GeoProbe® (soil or water data)	
			'SPUNCH'	Any push technology or probe designed to collect soil samples.	
			'TANK'	An underground storage tank (UST). Samples were collected from WITHIN the tank. Any object referenced as ‘TANK’ is expected to be stored in a polygon coverage with a label point at its center.	

Data Dictionary

REQ	COLUMN NAME	DATA TYPE	DESCRIPTION	
			'EXCV'	An excavation pit, including excavations around the outside of a UST, from which samples were collected. Any object referenced as "EXCV" is expected to be stored in a polygon coverage with a label point at its center.
			'MHSD'	Storm drain system
			'MHSS'	Sanitary sewer manhole
			'QC'	A placeholder PT_TYPE for all field QC samples, such as trip blanks, equipment rinsates, and field blanks. Do not use this code for field duplicates.
*	PT_TYPE_DESCRIPTION	(C50)	Description of type of location from which the data was collected.	
SMP_TYPE_LU Table:				
*	SMP_TYPE	(C5)	Type of sample collected as described by the code list below:	
			'NORM'	Normal site characterization sample
			'FD'	Field duplicate
			'TB'	Trip blank
			'ER'	Equipment rinsate
			'FB'	Field blank. May include samples referred to as reagent blanks, source water blanks, and temperature blanks.
*	SMP_TYPE_DESCRIPTION	(C50)	Description of the type of sample collected.	
MEDIA_LU Table:				
*	MEDIA	(C15)	If sample matrix = 'Y', the medium of the material collected and identified by the field sampler, as described by the code list below:	
			'SOIL'	Naturally developed soil, alluvium, colluvium, or other fill material.
			'WATER'	Ground water or surface water
			'SEDIMENT'	Wet or dry
			'SLUDGE'	Wet or dry
*	MEDIA (Continued)	(C15)	'SOIL GAS'	
			'AIR'	
			'PRODUCT'	Free product
			'WIPE'	
			'ANIMAL TISSUE'	
			'PLANT TISSUE'	
			If analytical matrix = 'Y,' the matrix as reported by the laboratory and as described by the code list below. Will not always be available when row is first created, but it is required after laboratory results are received.	
			'SOIL'	

Data Dictionary

REQ	COLUMN NAME	DATA TYPE	DESCRIPTION		
			'WATER'		
			'AIR'		
			'TCLP'		
			'WET'		
			'TISSUE'		
*	MEDIA_DESCRIPTION	(C45)	Description of the medium of the material collected		
*	SAMPLE_MATRIX	(C1)	Determine whether media illustrates the medium of the sample collected, as described by the code list below:		
			'N'	No	Media is not sample medium
			'Y'	Yes	Media is sample medium
#	ANALYTICAL_MATRIX	(C1)	Determine whether media illustrates the matrix as reported by the laboratory, and as described by the code list below:		
			'N'	No	Matrix is not analytical matrix
			'Y'	Yes	Media is analytical matrix
&	MEDIA_MOD_USER	(C12)	First 12 characters of the Oracle USER (pseudo-column) who last modified this row.		
&	MEDIA_MOD_DATE	(DATE)	The system date of the last modification to this row.		
ORGANIZATION_LU Table:					
*	ORGANIZATION	(C6)	Company affiliation of the surveyor, field sampler, or analytical laboratory with examples described by the code list below:		
			'TTEMI'	Tetra Tech EM Inc.	
			'USGS'	United States Geological Survey	
			'CDM'	Camp Dresser & McKee, Inc.	
*	ORGANIZATION NAME	(C70)	Description of the company affiliation.		
*	ORG_TYPE	(C10)	Type of company affiliation as described by the code list below:		
			'LAB'	Organization describes an analytical laboratory company affiliation.	
			'SAMPLE'	Organization describes a field sampler company affiliation.	
			'SURVEY'	Organization describes a surveyor company affiliation.	
&	ORGANIZATION_MOD_USER	(C12)	First 12 characters of the Oracle USER (pseudo-column) who last modified this row.		
&	ORGANIZATION_MOD_DATE	(DATE)	The system date of the last modification to this row		
INSTRUMENT_LU Table:					
*	ICODE	(C10)	Name/number/code of instrument used to take the field parameter measurement		
*	INSTRUMENT_TYPE	(C30)	Name/type of instrument used to take the field parameter measurement		

Data Dictionary

REQ	COLUMN NAME	DATA TYPE	DESCRIPTION	
*	INSTRUMENT_DESC	(C50)	Description of the type of instrument used to take the field parameter measurement	
&	INSTR_MOD_USER	(C12)	First 12 characters of the Oracle USER (pseudo-column) who last modified this row	
&	INSTR_MOD_DATE	(DATE)	The system date of the last modification to this row	
VAL_STATUS_LU Table:				
*	VAL_STATUS	(C8)	Validation status of analytical results as described by the code list below	
			'LAB PEND'	Laboratory results pending
			'VAL PEND'	Laboratory results received and entered, validation results pending
			'VAL CMPL'	Laboratory and validation results received and entered
			'VAL NONE'	Laboratory results received and entered; validation results not ordered, not necessary, not possible, or not known
*	VAL_STATUS_DESC	(C80)	Description of the validation status of the analytical results.	
&	VAL_STATUS_MOD_USER	(C12)	First 12 characters of the Oracle USER (pseudo-column) who last modified this row.	
&	VAL_STATUS_MOD_DATE	(DATE)	The system date of the last modification to this row.	

Enclosure #1
Part 1-4
Soil Statistics

MARINO BROTHER'S SCRAPYARD
UNSATURATED SOILS (0-12) FEET BELOW GROUND SURFACE
SUMMARY STATISTICS VS. RESIDENTIAL MEDIUM-SPECIFIC CONCENTRATIONS (MSCs)

METHOD	Number of Samples	Number of Detections	%Detection	CHEM_NAME [1]	Soil Direct Contact[1] MSC (MG/KG)	Soil to Groundwater Value (MG/KG)[2] (MG/KG) 100XGW MSC	Generic	CASNO	MEAN	MEDIAN	GEOMEAN	MIN DETECT	MAX DETECT	REPORT LIMIT MIN	REPORT LIMIT MAX	STD	VARIANCE	95%UCL
SW 846 Method 6000/7000	291	291	100%	Aluminum	**190,000.00**	N/A	N/A	7429-90-5	8,548.28	7,590.00	7,297.61	950.00	41,200.00	21.00	224.00	5,306.16	28,155,379.80	9,160.49
SW 846 Method 6000/7000	281	261	93%	**Antimony**	88.00	0.60	**27.00**	7440-36-0	26.46	2.90	4.54	0.30	**1,560.00**	1.00	24.00	112.95	12,757.40	**39.72**
SW 846 Method 6000/7000	291	291	100%	**Arsenic**	**12.00**	5.00	150.00	7440-38-2	**27.67**	20.50	20.78	1.00	**210.00**	1.00	24.00	23.52	553.23	**30.38**
SW 846 Method 6000/7000	291	291	100%	Barium	15,000.00	200.00	**8,200.00**	7440-39-3	312.33	201.00	181.63	7.70	4,840.00	21.00	489.00	481.77	232,102.43	367.91
SW 846 Method 6000/7000	291	279	96%	Beryllium	440.00	0.40	**320.00**	7440-41-7	0.79	0.67	0.63	0.06	4.40	0.00	5.30	0.61	0.37	0.86
SW 846 Method 6000/7000	291	263	90%	**Cadmium**	47.00	0.50	**38.00**	7440-43-9	**41.30**	2.40	4.17	0.06	**618.00**	0.00	6.90	77.66	6,031.11	**50.26**
SW 846 Method 6000/7000	291	291	100%	Calcium	N/A	N/A	N/A	7440-70-2	16,685.23	5,690.00	6,636.46	441.00	212,000.00	524.00	3,690.00	29,198.82	852,570,922.40	20,054.09
SW 846 Method 6000/7000	291	291	100%	Chromium	**190,000.00**	10.00	**190,000.00**	7440-47-3	233.93	29.00	57.28	1.60	3,120.00	0.00	12.00	429.64	184,592.03	283.50
SW 846 Method 6000/7000	291	291	100%	**Cobalt**	4,400.00	**73.00**	8.10	7440-48-4	27.32	16.20	18.66	1.10	**239.00**	5.00	52.70	28.21	795.98	30.57
SW 846 Method 6000/7000	291	291	100%	Copper	N/A	N/A	N/A	7440-50-8	2,282.86	63.20	172.19	0.53	117,000.00	2.00	149.00	8,672.07	75,204,777.54	3,283.41
SW 846 Method 6000/7000	291	291	100%	**Iron**	**66,000.00**	N/A	N/A	7439-89-6	**116,208.42**	56,300.00	70,824.89	2,740.00	**505,000.00**	10.00	244.00	112,192.03	12,587,050,562.32	**129,152.76**
SW 846 Method 6000/7000	291	290	100%	**Lead**	500.00	0.50	**450.00**	7439-92-1	**1,715.57**	157.00	225.43	2.00	**31,600.00**	0.00	36.00	3,255.24	10,596,577.38	**2,091.15**
SW 846 Method 6000/7000	291	291	100%	Magnesium	N/A	N/A	N/A	7439-95-4	2,782.45	2,140.00	1,962.87	99.90	26,700.00	524.00	1,200.00	2,867.76	8,224,027.21	3,113.33
SW 846 Method 6000/7000	291	291	100%	Manganese	**31,000.00**	N/A	N/A	7439-96-5	1,633.30	1,120.00	1,130.78	44.60	12,900.00	1.00	95.00	1,498.36	2,245,086.68	1,806.17
SW 846 Method 6000/7000	291	284	98%	**Mercury**	66.00	0.20	**10.00**	7439-97-6	**38.82**	0.45	1.27	0.01	**939.00**	0.00	27.00	95.48	9,116.86	**49.83**
SW 846 Method 6000/7000	291	290	100%	**Nickel**	4,400.00	10.00	**650.00**	7440-02-0	212.98	29.80	62.67	0.53	**2,680.00**	4.00	24.00	352.17	124,020.29	253.61
SW 846 Method 6000/7000	291	291	100%	Potassium	N/A	N/A	N/A	7440-09-7	818.74	767.00	711.88	63.10	3,560.00	524.00	1,200.00	447.45	200,208.52	870.36
SW 846 Method 6000/7000	291	226	78%	**Selenium**	1,100.00	5.00	**26.00**	7782-49-2	11.97	1.50	2.21	0.29	**477.00**	0.00	14.00	48.63	2,364.78	17.58
SW 846 Method 6000/7000	285	169	59%	**Silver**	1,100.00	10.00	**84.00**	7440-22-4	4.06	0.36	1.01	0.11	**92.60**	0.00	1.00	9.86	97.26	5.21
SW 846 Method 6000/7000	291	264	91%	Sodium	N/A	N/A	N/A	7440-23-5	549.25	194.00	209.11	28.40	20,900.00	524.00	1,200.00	1,748.86	3,058,497.42	751.03
SW 846 Method 6000/7000	291	147	51%	**Thallium**	15.00	0.20	**14.00**	7440-28-0	3.21	1.40	1.81	0.44	**23.30**	1.00	29.00	3.67	13.47	3.64
SW 846 Method 6000/7000	291	291	100%	Vanadium	**1,500.00**	26.00	26,000.00	7440-62-2	31.96	22.20	23.60	2.40	1,090.00	5.00	122.00	66.23	4,386.93	39.60
SW 846 Method 6000/7000	291	290	100%	**Zinc**	66,000.00	200.00	**12,000.00**	7440-66-6	**13,428.98**	416.00	753.38	6.20	**349,000.00**	1.00	652.00	41,665.65	1,736,026,530.30	**18,236.22**
SW 846 Method 6000/7000	289	138	48%	Cyanide (Total)	N/A	N/A	N/A	57-12-5	2.76	0.34	0.83	0.63	103.00	0.00	3.20	9.93	98.54	3.91
SW 846 Method 8082	289	3	1%	**AROCLOR 1242**	**36.00**	0.13	16.00	53469-21-9	6.31	0.02	0.11	1.00	**100.00**	0.04	210.00	60.64	3,676.67	13.33
SW 846 Method 8082	289	1	0%	AROCLOR 1016	**15.00**	0.26	72.00	12674-11-2	6.29	0.02	0.11	1.20	1.20	0.04	210.00	60.64	3,676.73	13.31
SW 846 Method 8082	290	98	34%	**AROCLOR 1248**	**9.90**	0.04	18.00	12672-29-6	**28.82**	0.02	0.21	0.03	**2,700.00**	0.04	210.00	224.84	50,553.66	**54.81**
SW 846 Method 8082	291	126	43%	**AROCLOR 1260**	**30.00**	0.11	500.00	11096-82-5	13.16	0.05	0.27	0.02	**470.00**	0.03	210.00	70.52	4,973.47	21.30
SW 846 Method 8082	288	150	52%	**AROCLOR 1254**	**4.40**	0.04	75.00	27323-18-8	**188.42**	0.09	0.38	0.01	**42,000.00**	0.03	210.00	2,494.25	6,221,289.20	**477.71**
SW 846 Method 8260	58	1	2%	CHLOROBENZENE	4,400.00	**10.00**	6.10	108-90-7	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00
SW 846 Method 8260	58	1	2%	CHLOROMETHANE	N/A	N/A	N/A	74-87-3	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.00	0.00	0.01
SW 846 Method 8260	58	1	2%	TRICHLOROETHENE	N/A	N/A	N/A	79-01-6	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
SW 846 Method 8260	58	5	9%	ETHYLBENZENE	10,000.00	**70.00**	46.00	100-41-4	0.01	0.00	0.00	0.00	0.07	0.01	0.01	0.01	0.00	0.01
SW 846 Method 8260	58	7	12%	2-BUTANONE	N/A	N/A	N/A	78-93-3	0.01	0.01	0.01	0.00	0.01	0.02	0.05	0.00	0.00	0.01
SW 846 Method 8260	58	8	14%	BENZENE	41.00	**0.50**	0.13	71-43-2	0.00	0.00	0.00	0.00	0.03	0.01	0.01	0.00	0.00	0.01
SW 846 Method 8260	58	8	14%	TOLUENE	7,600.00	**100.00**	44.00	108-88-3	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00
SW 846 Method 8260	58	10	17%	CARBON DISULFIDE	10,000.00	**190.00**	160.00	75-15-0	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00
SW 846 Method 8260	58	10	17%	XYLENES (TOTAL)	8,000.00	**1,000.00**	990.00	1330-20-7	0.01	0.00	0.00	0.00	0.23	0.01	0.01	0.03	0.00	0.02
SW 846 Method 8260	58	1	2%	TETRACHLOROETHENE	N/A	N/A	N/A	127-18-4	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
SW 846 Method 8260	58	52	90%	ACETONE	10,000.00	**370.00**	41.00	67-64-1	0.01	0.01	0.01	0.00	0.06	0.02	0.05	0.01	0.00	0.01
SW 846 Method 8270	293	1	0%	1,3-DICHLOROBENZENE	6,600.00	60.00	**61.00**	541-73-1	1.29	0.23	0.45	0.03	0.03	0.35	260.00	7.69	59.12	2.18
SW 846 Method 8270	293	1	0%	4-NITROPHENOL	1,800.00	**6.00**	4.10	100-02-7	**6.32**	1.10	2.19	0.07	0.07	1.70	1,300.00	38.39	1,474.03	**10.73**
SW 846 Method 8270	293	1	0%	4-CHLOROANILINE	N/A	N/A	N/A	106-47-8	1.29	0.23	0.45	0.07	0.07	0.35	260.00	7.69	59.12	2.18
SW 846 Method 8270	293	9	3%	4-NITROANILINE	N/A	N/A	N/A	100-01-6	6.20	1.05	2.05	0.07	0.91	1.70	1,300.00	38.40	1,474.64	10.61
SW 846 Method 8270	293	6	2%	2,4-DIMETHYLPHENOL	4,400.00	**73.00**	32.00	105-67-9	1.29	0.22	0.45	0.04	0.23	0.35	260.00	7.69	59.13	2.17
SW 846 Method 8270	293	7	2%	PHENOL	130,000.00	**400.00**	66.00	108-95-2	1.29	0.22	0.45	0.03	2.70	0.35	260.00	7.69	59.14	2.17
SW 846 Method 8270	293	6	2%	4-METHYLPHENOL	N/A	N/A	N/A	106-44-5	1.29	0.23	0.45	0.04	0.86	0.35	260.00	7.69	59.13	2.18
SW 846 Method 8270	293	3	1%	1,2,4-TRICHLOROBENZENE	2,200.00	7.00	**27.00**	120-82-1	1.28	0.23	0.45	0.18	0.45	0.35	260.00	7.69	59.12	2.17
SW 846 Method 8270	293	10	3%	2-METHYLPHENOL	N/A	N/A	N/A	95-48-7	1.28	0.22	0.43	0.02	0.33	0.35	260.00	7.69	59.15	2.16
SW 846 Method 8270	293	5	2%	DIMETHYL PHTHALATE	N/A	N/A	N/A	131-11-3	1.31	0.23	0.46	0.40	9.40	0.35	260.00	7.70	59.35	2.20
SW 846 Method 8270	293	2	1%	1,2-DICHLOROBENZENE	3,800.00	**60.00**	59.00	95-50-1	1.29	0.23	0.45	0.03	0.06	0.35	260.00	7.69	59.12	2.18
SW 846 Method 8270	293	4	1%	N-NITROSODIPHENYLAMINE	3,700.00	13.00	**20.00**	86-30-6	1.28	0.23	0.45	0.04	0.31	0.35	260.00	7.69	59.13	2.17
SW 846 Method 8270	293	11	4%	DIETHYL PHTHALATE	10,000.00	**500.00**	160.00	84-66-2	1.29	0.23	0.44	0.05	0.88	0.35	260.00	7.69	59.13	2.17
SW 846 Method 8270	293	10	3%	DI-N-OCTYL PHTHALATE	N/A	N/A	N/A	117-84-0	1.28	0.22	0.44	0.05	6.00	0.35	260.00	7.69	59.21	2.16
SW 846 Method 8270	293	25	9%	**ISOPHORONE**	10,000.00	**10.00**	1.90	78-59-1	1.39	0.23	0.44	0.03	**38.00**	0.35	260.00	7.98	63.76	2.31
SW 846 Method 8270	294	76	26%	BUTYL BENZYL PHTHALATE	10,000.00	270.00	**10,000.00**	85-68-7	1.21	0.22	0.37	0.01	8.90	0.35	260.00	7.70	59.25	2.09
SW 846 Method 8270	294	75	26%	DI-N-BUTYL PHTHALATE	10,000.00	370.00	**1,500.00**	84-74-2	1.46	0.22	0.37	0.02	180.00	0.35	260.00	10.91	119.00	2.71
SW 846 Method 8270	293	136	46%	CARBAZOLE	900.00	3.30	**21.00**	86-74-8	1.10	0.21	0.31	0.02	17.00	0.35	260.00	7.68	58.94	1.98
SW 846 Method 8270	294	137	47%	DIBENZOFURAN	N/A	N/A	N/A	132-64-9	1.18	0.21	0.30	0.02	54.00	0.35	260.00	8.20	67.17	2.13
SW 846 Method 8270	295	161	55%	2-METHYLNAPHTHALENE	4,400.00	73.00	**2,900.00**	91-57-6	1.41	0.22	0.35	0.03	91.00	0.35	260.00	9.24	85.38	2.47
SW 846 Method 8270	294	210	71%	**BIS(2-ETHYLHEXYL) PHTHALATE**	1,300.00	0.60	**130.00**	117-81-7	8.26	0.21	0.33	0.02	**2,200.00**	0.35	260.00	128.27	16,453.07	22.99
SW 846 Method 8270	577	495	86%	PYRENE	6,600.00	13.00	**2,200.00**	129-00-0	2.46	0.51	0.45	0.00	56.00	0.01	260.00	7.69	59.14	3.09
SW 846 Method 8310	537	201	37%	ACENAPHTHENE	13,000.00	220.00	**2,700.00**	83-32-9	1.04	0.20	0.20	0.00	75.00	0.04	260.00	6.59	43.47	1.60
SW 846 Method 8310	99	7	7%	**DIBENZO(A,H)ANTHRACENE**	**2.50**	0.01	41.00	53-70-3	0.47	0.08	0.07	0.00	**5.10**	0.01	9.20	0.97	0.94	0.66
SW 846 Method 8310	574	319	56%	FLUORENE	8,800.00	150.00	**3,000.00**	86-73-7	0.90	0.19	0.11	0.00	70.00	0.01	260.00	6.36	40.43	1.43
SW 846 Method 8310	438	232	53%	ACENAPHTHYLENE	13,000.00	220.00	**2,500.00**	208-96-8	0.94	0.21	0.21	0.01	17.00	0.04	260.00	6.41	41.09	1.54
SW 846 Method 8310	576	400	69%	ANTHRACENE	66,000.00	6.60	**350.00**	120-12-7	0.91	0.19	0.13	0.00	36.00	0.01	260.00	5.83	34.04	1.39
SW 846 Method 8310	574	380	66%	**NAPHTHALENE**	4,400.00	10.00	**25.00**	91-20-3	1.23	0.22	0.22	0.00	**160.00**	0.04	260.00	9.09	82.68	1.98
SW 846 Method 8310	573	432	75%	**INDENO(1,2,3-CD)PYRENE**	**25.00**	0.09	7,000.00	193-39-5	0.93	0.22	0.20	0.00	**130.00**	0.01	260.00	5.69	32.32	1.40
SW 846 Method 8310	576	427	74%	BENZO(GHI)PERYLENE	13,000.00	0.03	**180.00**	191-24-2	0.93	0.22	0.21	0.00	14.00	0.01	260.00	5.63	31.72	1.39
SW 846 Method 8310	576	474	82%	CHRYSENE	2,500.00	0.19	**230.00**	218-01-9	1.52	0.30	0.27	0.00	34.00	0.01	260.00	6.14	37.67	2.02
SW 846 Method 8310	576	457	79%	BENZO(K)FLUORANTHENE	**250.00**	0.06	610.00	207-08-9	1.14	0.22	0.21	0.00	41.00	0.01	260.00	6.01	36.08	1.63
SW 846 Method 8310	520	451	87%	**BENZO(A)ANTHRACENE**	**25.00**	0.09	79.00	56-55-3	1.30	0.33	0.27	0.00	**30.00**	0.01	38.00	2.99	8.94	1.56
SW 846 Method 8310	576	467	81%	**BENZO(A)PYRENE**	**2.50**	0.02	46.00	50-32-8	1.44	0.27	0.26	0.00	**60.00**	0.01	260.00	6.52	42.54	1.97
SW 846 Method 8310	568	485	85%	FLUORANTHENE	8,800.00	26.00	**3,200.00**	206-44-0	3.62	0.65	0.54	0.00	110.00	0.01	260.00	10.86	118.00	4.52
SW 846 Method 8310	576	478	83%	**BENZO(B)FLUORANTHENE**	**25.00**	0.09	120.00	205-99-2	1.64	0.33	0.31	0.00	**58.00**	0.01	260.00	6.75	45.55	2.20
SW 846 Method 8310	577	496	86%	PHENANTHRENE	66,000.00	110.00	**10,000.00**	85-01-8	2.73	0.39	0.39	0.00	210.00	0.01	260.00	12.15	147.68	3.72

MARINO BROTHER'S SCRAPYARD

UNSATURATED SOILS (0-12) FEET BELOW GROUND SURFACE

SUMMARY STATISTICS VS. SITE SPECIFIC STANDARDS

METHOD	Number of Samples	Number of Detections	%Detection	CHEM_NAME [1]	Site Specific Standards	CASNO	MEAN	MEDIAN	GEOMEAN	MIN	MAX	STD	VARIANCE	95%UCL
SW 846 Method 6000/7000	281	261	93%	**Antimony**	520.00	7440-36-0	26.46	2.90	4.54	0.30	**1,560.00**	112.95	12,757.40	39.72
SW 846 Method 6000/7000	291	291	100%	**Arsenic**	196.00	7440-38-2	27.67	20.50	20.78	1.00	**210.00**	23.52	553.23	30.38
SW 846 Method 6000/7000	291	263	90%	**Cadmium**	2,059.00	7440-43-9	41.30	2.40	4.17	0.06	**618.00**	77.66	6,031.11	50.26
SW 846 Method 6000/7000	291	291	100%	**Iron**	389,944.00	7439-89-6	116,208.42	56,300.00	70,824.89	2,740.00	**505,000.00**	112,192.03	12,587,050,562.32	129,152.76
SW 846 Method 6000/7000	291	290	100%	**Lead**	1,300.00	7439-92-1	**1,715.57**	157.00	225.43	0.22	**31,600.00**	3,255.24	10,596,577.38	**2,091.15**
SW 846 Method 6000/7000	291	284	98%	**Mercury**	390.00	7439-97-6	38.82	0.45	1.27	0.01	**939.00**	95.48	9,116.86	49.83
SW 846 Method 6000/7000	291	290	100%	Zinc	389,944.00	7440-66-6	13,428.98	416.00	753.38	0.50	349,000.00	41,665.65	1,736,026,530.30	18,236.22
SW 846 Method 8082	290	98	34%	**AROCLOR 1248**	59.00	12672-29-6	28.82	0.02	0.21	0.02	**2,700.00**	224.84	50,553.66	54.81
SW 846 Method 8082	288	150	52%	**AROCLOR 1254**	59.00	27323-18-8	**188.42**	0.09	0.38	0.01	**42,000.00**	2,494.25	6,221,289.20	**477.71**

Note

[1] Constituents shown in red exceed the site-specific standard for at least one detected value

Summary Statistics for Site-Specific COPCs [1]
Truncated Below Site-Specific Action Level

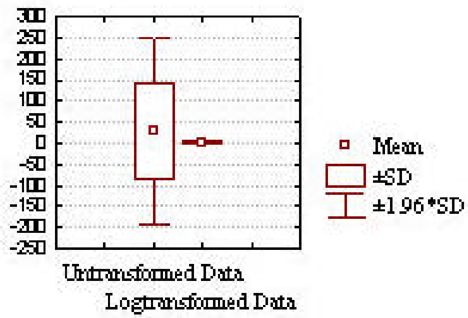
METHOD	Number of Samples	Number of Detections	%Detection	CHEM NAME	Site Specific Standards	CASNO	MEAN	MEDIAN	GEOMEAN	MIN DETECT	MAX DETECT	REPORT LIMIT MIN	REPORT LIMIT MAX	STD	VARIANCE	95%UCL
SW 846 Method 6000/7000	282	282	100%	Iron	389,944.00	7439-89-6	105,920.74	53,300.00	66,826.71	2,740.00	372,000.00	10.00	244.00	97,587.95	9,523,407,588.41	117,359.91
SW 846 Method 6000/7000	189	188	99%	Lead	1,300.00	7439-92-1	153.66	35.00	50.62	2.00	1,170.00	0.32	3.50	254.96	65,005.44	190.25
SW 846 Method 6000/7000	286	279	98%	Mercury	390.00	7439-97-6	29.37	0.40	1.14	0.01	333.00	0.04	27.00	58.76	3,452.28	36.21
SW 846 Method 8082	282	92	33%	Aroclor 1248	59.00	12672-29-6	4.02	0.02	0.17	0.03	58.00	0.04	92.00	9.67	93.59	5.15
SW 846 Method 8082	268	132	49%	Aroclor 1254	59.00	27323-18-8	4.69	0.04	0.23	0.01	54.00	0.04	23.00	9.77	95.51	5.87
SW 846 Method 8082	279	118	42%	Aroclor 1260	59.00	11096-82-5	3.35	0.04	0.21	0.02	53.00	0.04	77.00	7.41	54.94	4.23

Note

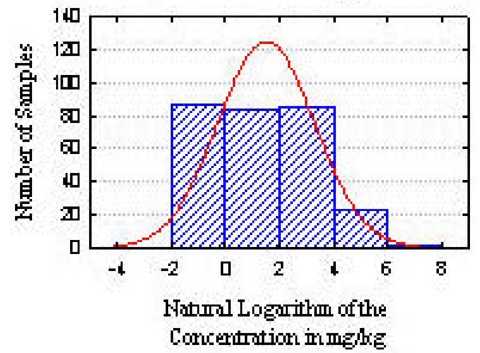
1 Statistics shown in this table were not used during the development of the preliminary conceptual site model. The truncated data set will be used to calculate the numbers of sample required during characterization efforts to be conducted in support of remediation

Marino Brothers Scrap Yard
Antimony in Unsaturated Soil

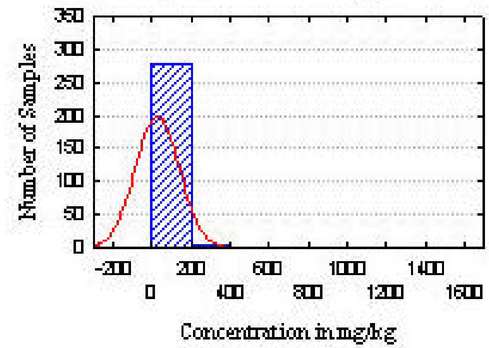
Antimony in Unsaturated Soil
Box & Whisker Plot



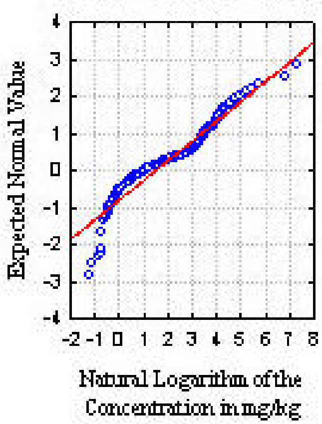
Antimony in Unsaturated Soil
Histogram Logtransformed Data
K-S d=.12410, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.92474, p=.00000



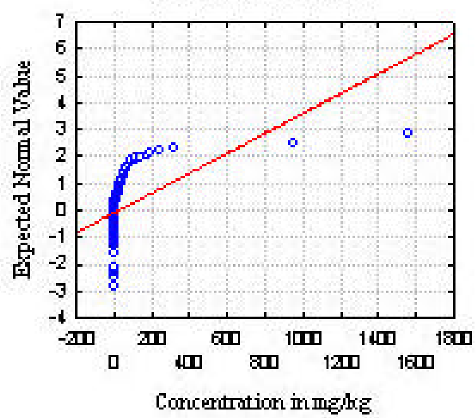
Antimony in Unsaturated Soil
Histogram Untransformed Data
K-S d=.40842, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.18579, p=0.0000



Antimony in Unsaturated Soil
Lognormal Probability Plot

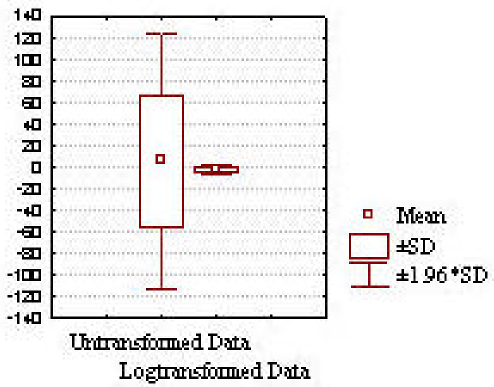


Antimony in Unsaturated Soil
Normal Probability Plot

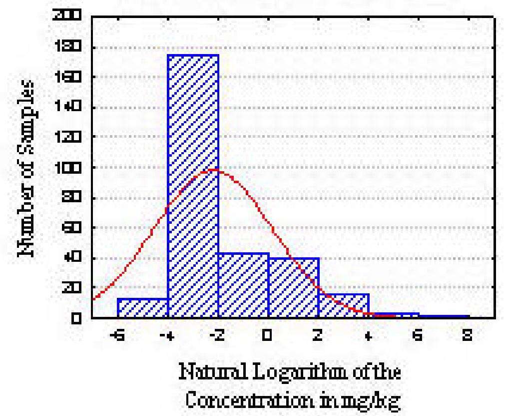


Marino Brothers Scrapyard
Arochlor 1242 in Unsaturated Soil

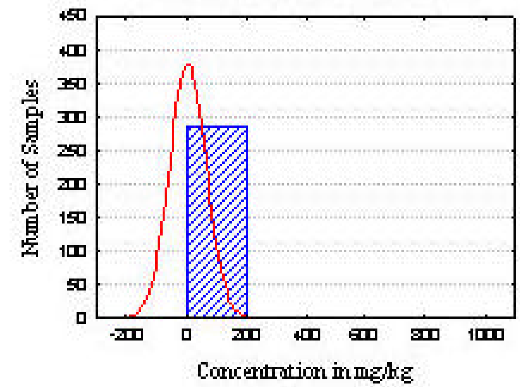
Arochlor 1242 in Unsaturated Soil
Box & Whisker Plot



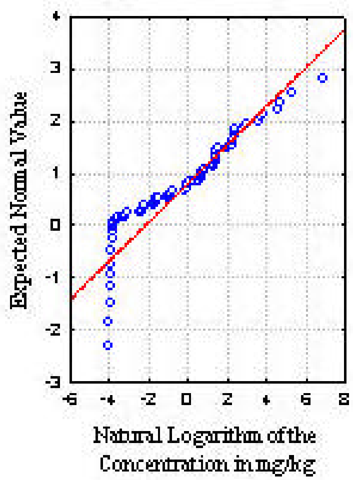
Arochlor 1242 in Unsaturated Soil
Histogram Logtransformed Data
K-S d=.28808, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.76892, p=0.0000



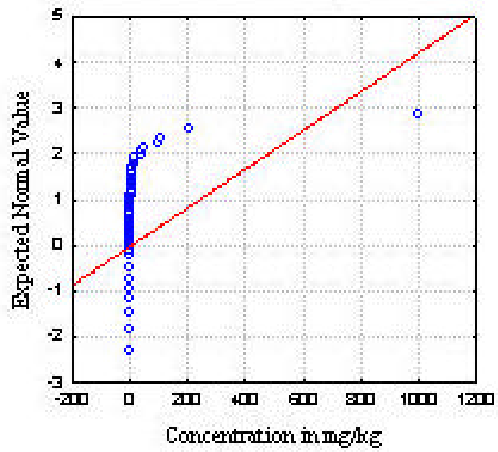
Arochlor 1242 in Unsaturated Soil
Histogram Untransformed Data
K-S d=.45864, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.07338, p=0.0000



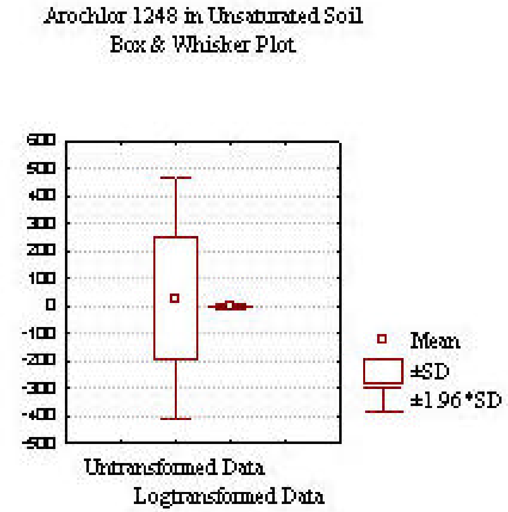
Arochlor 1242 in Unsaturated Soil
Lognormal Probability Plot

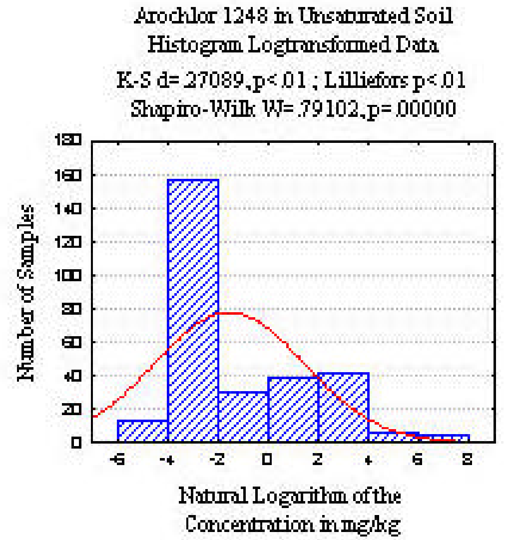


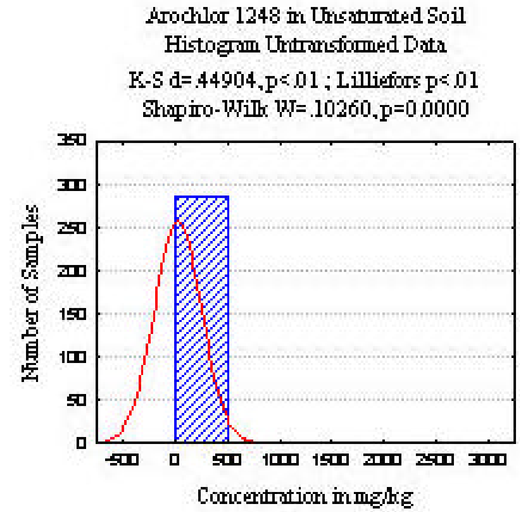
Arochlor 1242 in Unsaturated Soil
Normal Probability Plot

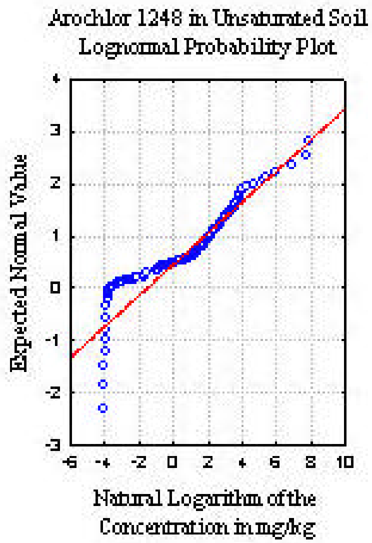


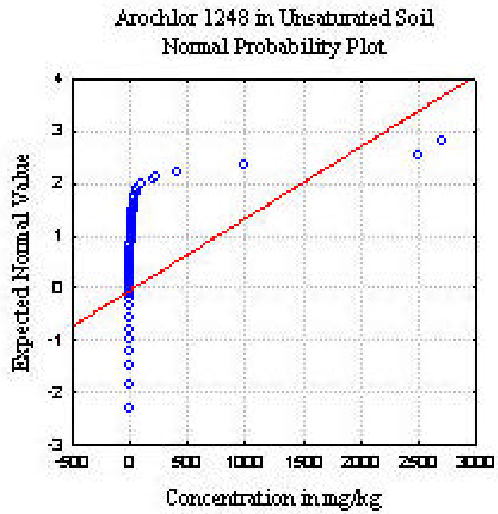
Marino Brothers Scrapyard
Arochlor 1248 in Unsaturated Soil





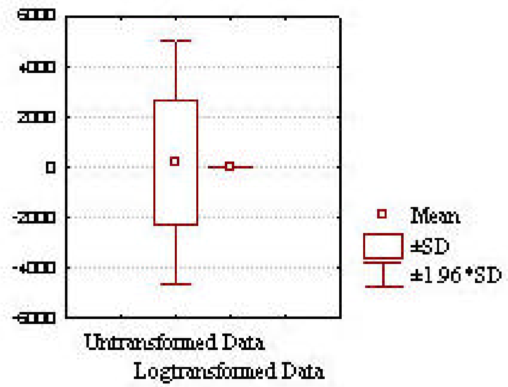




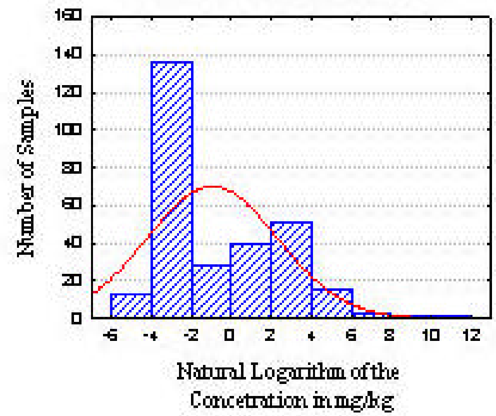


Marino Brothers Scrapyard
Arochlor 1254 in Unsaturated Soil

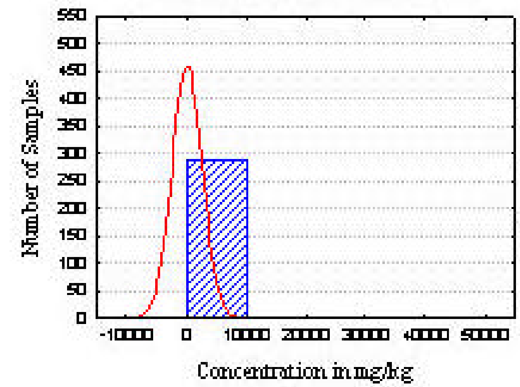
Arochlor 1254 in Unsaturated Soil
Box & Whisker Plot



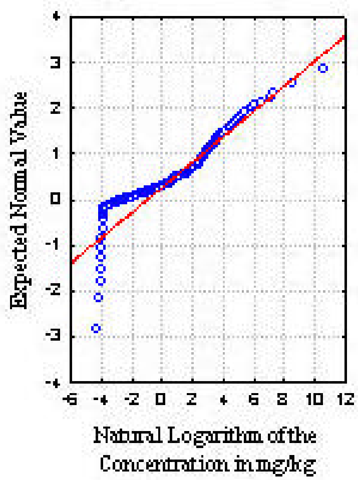
Arochlor 1254 in Unsaturated Soil
Histogram Logtransformed Data
K-S d=.22920, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.83838, p=.00000



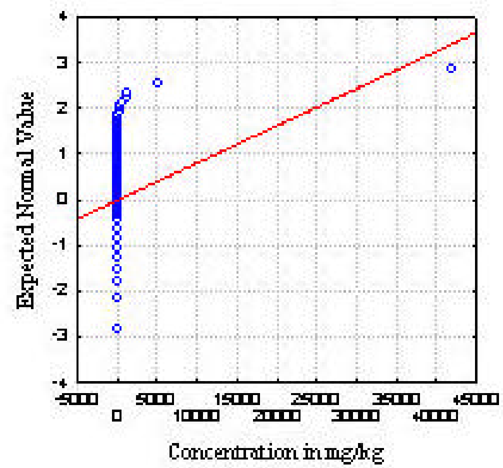
Arochlor 1254 in Unsaturated Soil
Histogram Untransformed Data
K-S d=.47170, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.04737, p=0.0000



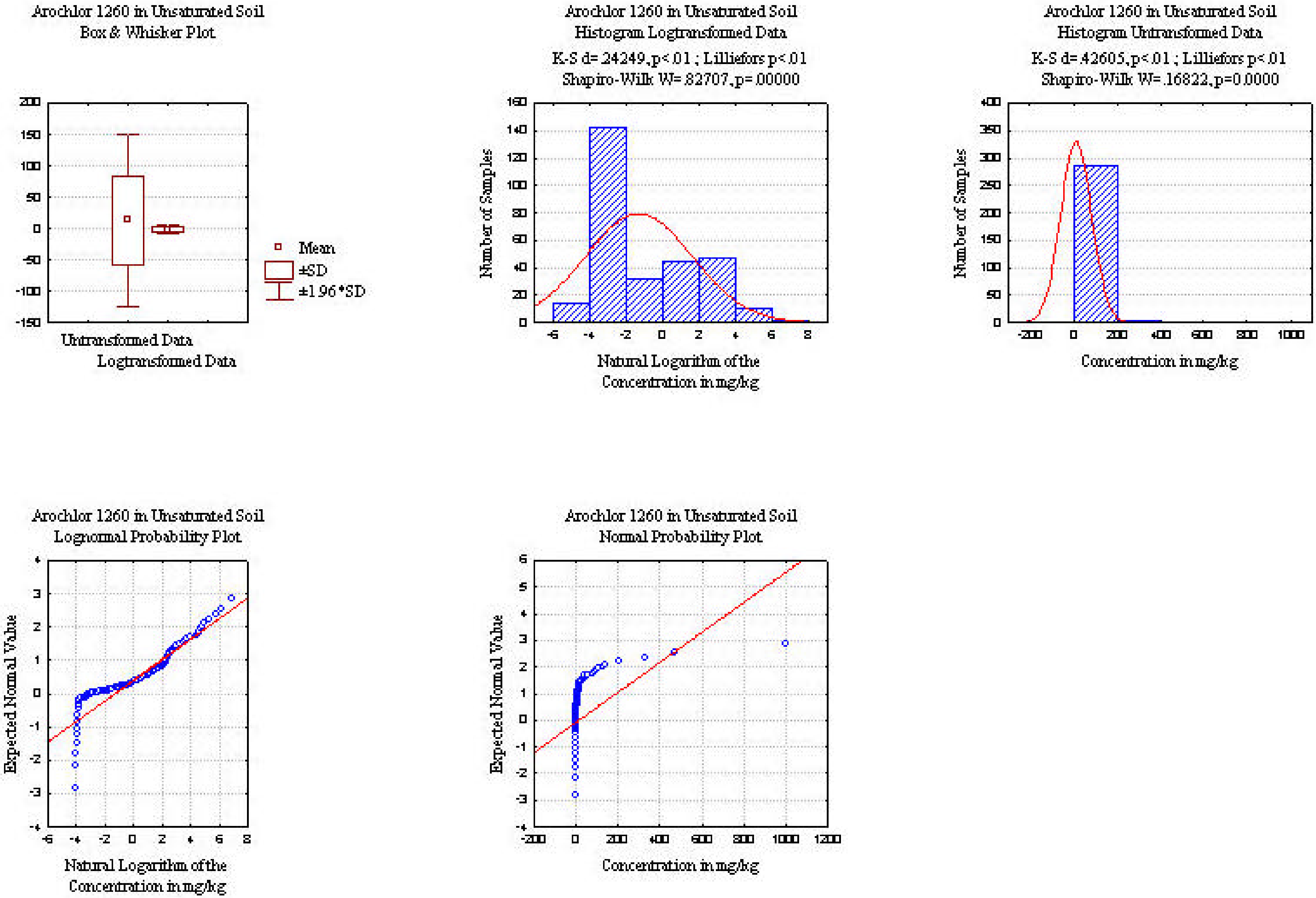
Arochlor 1254 in Unsaturated Soil
Lognormal Probability Plot



Arochlor 1254 in Unsaturated Soil
Normal Probability Plot

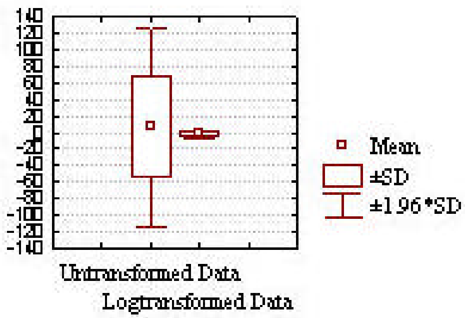


Marino Brothers Scrapyard
Arochlor 1260 in Unsaturated Soil

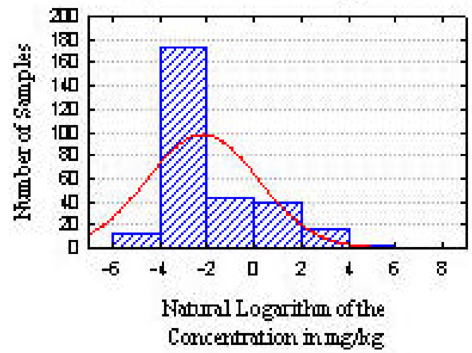


Marino Brothers Scrap Yard
Aroclor 1242 in Unsaturated Soil

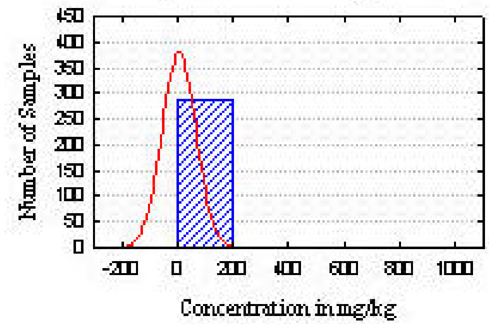
Aroclor 1242 in Unsaturated Soil
Box & Whisker Plot



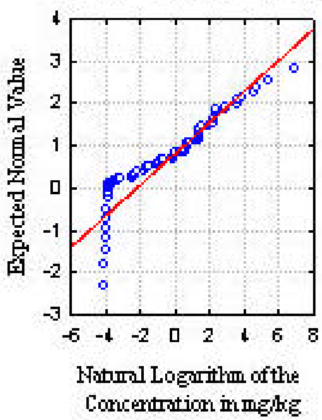
Aroclor 1242 in Unsaturated Soil
Histogram Logtransformed Data
K-S d=.28808, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.76892, p=0.0000



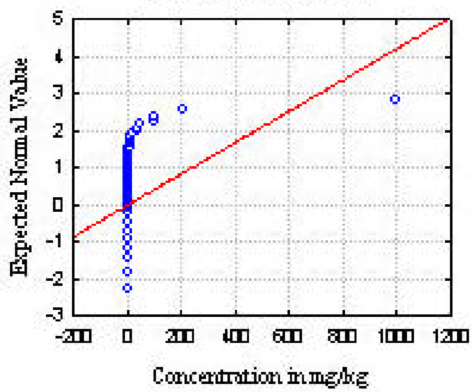
Aroclor 1242 in Unsaturated Soil
Histogram Untransformed Data
K-S d=.45864, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.07338, p=0.0000



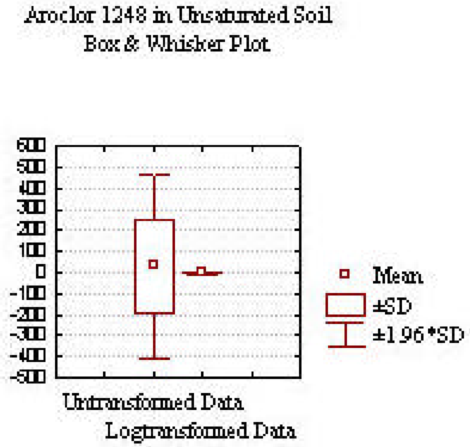
Aroclor 1242 in Unsaturated Soil
Lognormal Probability Plot

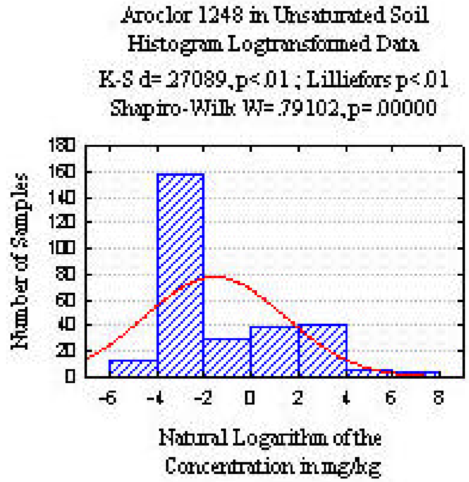


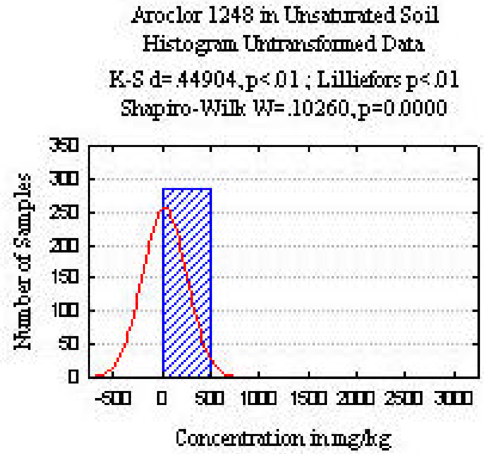
Aroclor 1242 in Unsaturated Soil
Normal Probability Plot

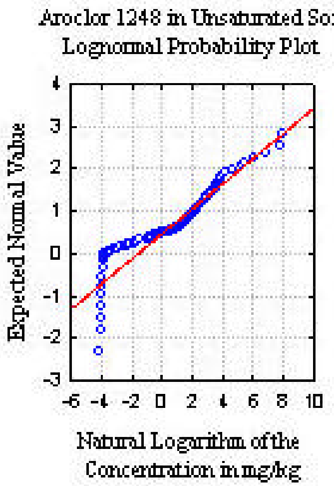


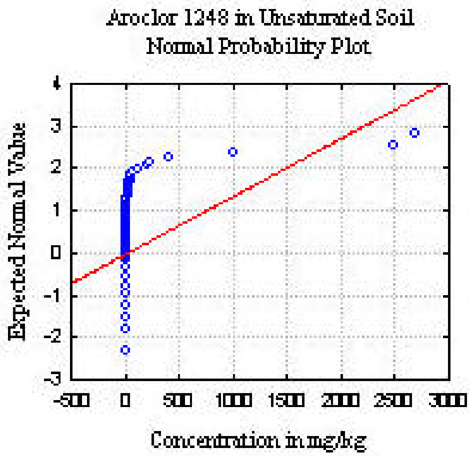
Marino Brothers Scrap Yard
Aroclor 1248 in Unsaturated Soil





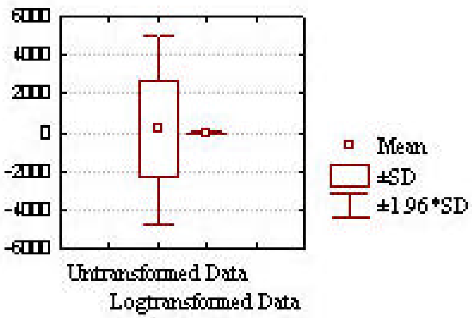




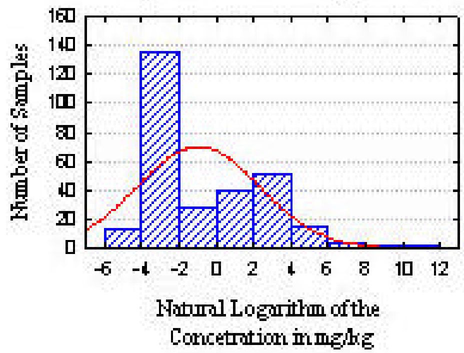


Marino Brothers Scrap Yard
Aroclor 1254 in Unsaturated Soil

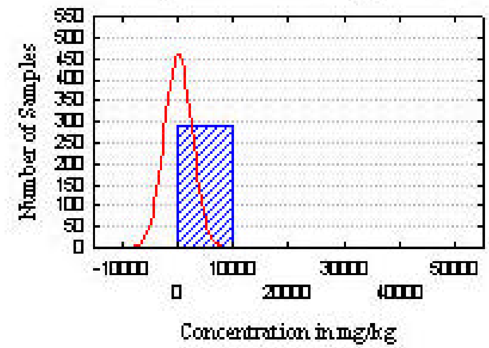
Aroclor 1254 in Unsaturated Soil
Box & Whisker Plot



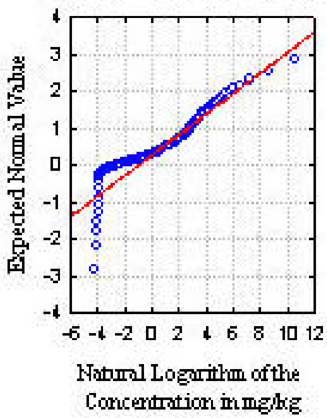
Aroclor 1254 in Unsaturated Soil
Histogram Logtransformed Data
K-S d=.22920, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.83838, p=.00000



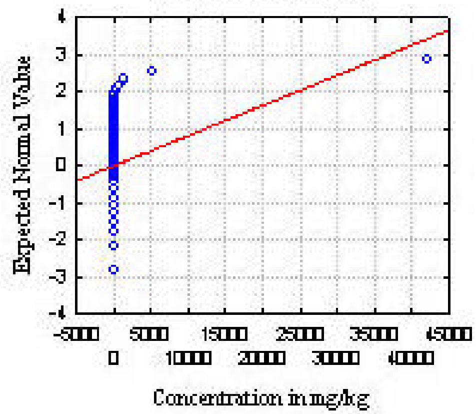
Aroclor 1254 in Unsaturated Soil
Histogram Untransformed Data
K-S d=.47170, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.04737, p=0.0000



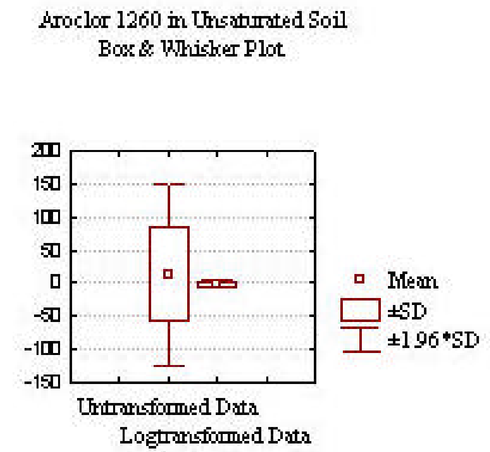
Aroclor 1254 in Unsaturated Soil
Lognormal Probability Plot

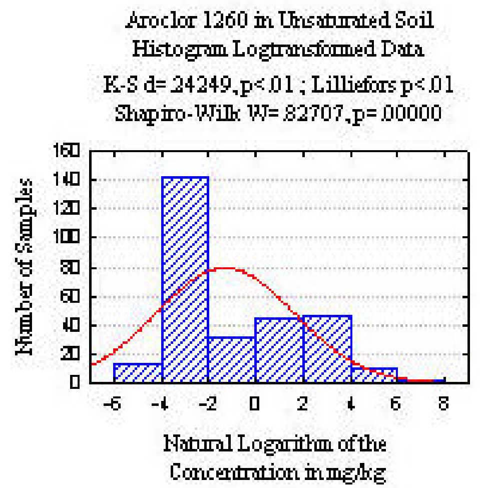


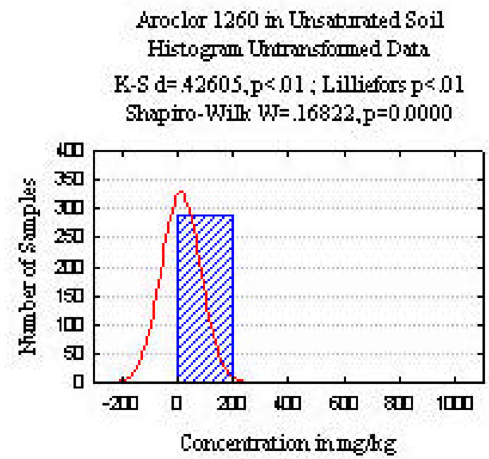
Aroclor 1254 in Unsaturated Soil
Normal Probability Plot

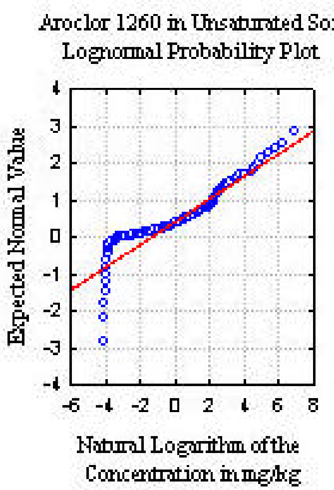


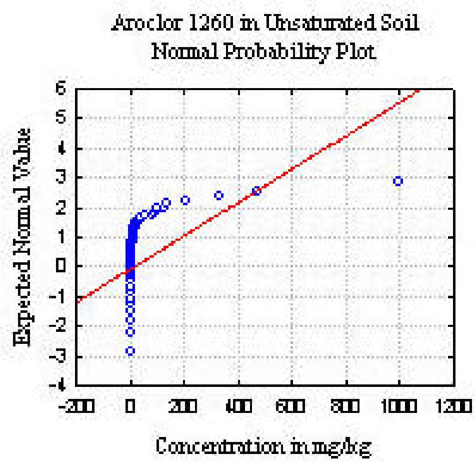
Marino Brothers Scrap Yard
Aroclor 1260 in Unsaturated Soil





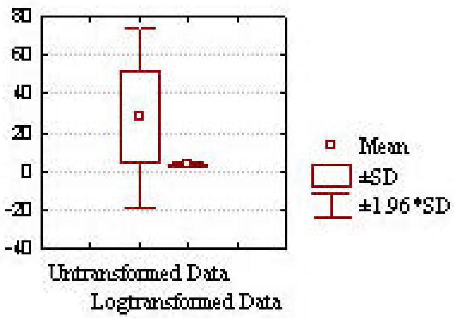




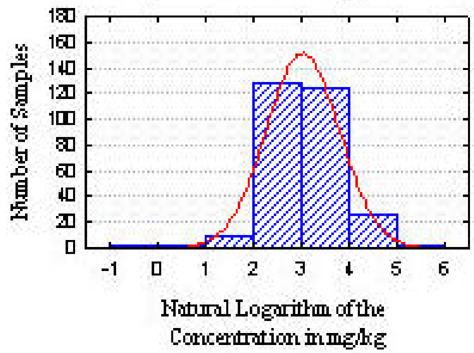


Marino Brothers Scrap Yard
Arsenic in Unsaturated Soil

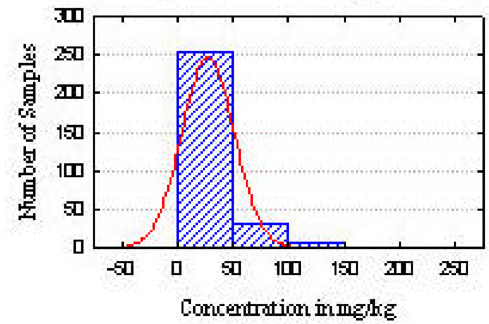
Arsenic in Unsaturated Soil
Box & Whisker Plot



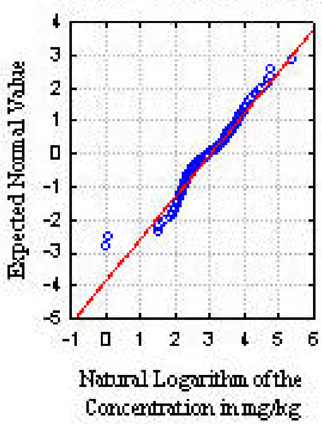
Arsenic in Unsaturated Soil
Histogram Logtransformed Data
K-S d=.07617, p<.10 ; Lilliefors p<.01
Shapiro-Wilk W=.97209, p=.00002



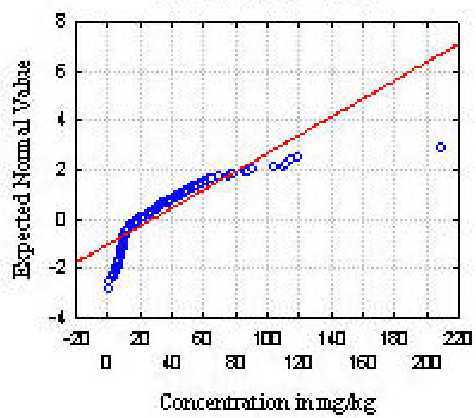
Arsenic in Unsaturated Soil
Histogram Untransformed Data
K-S d=.16225, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.76749, p=0.0000



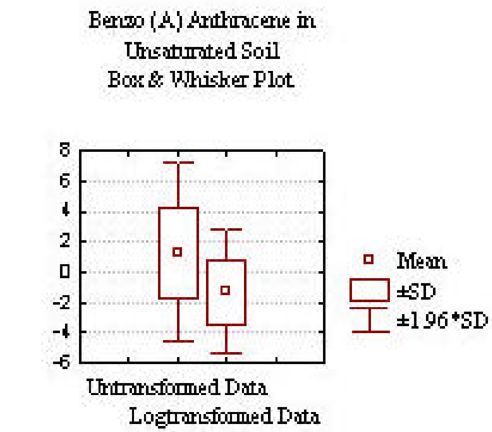
Arsenic in Unsaturated Soil
Lognormal Probability Plot

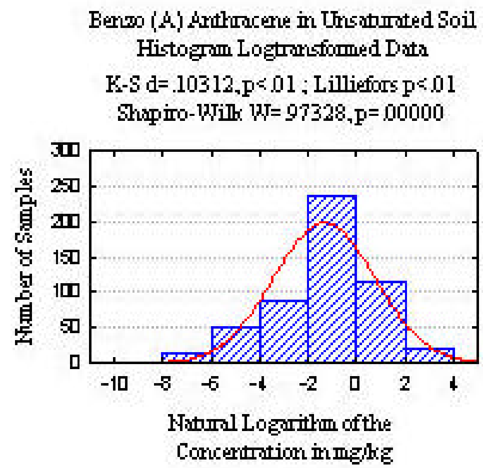


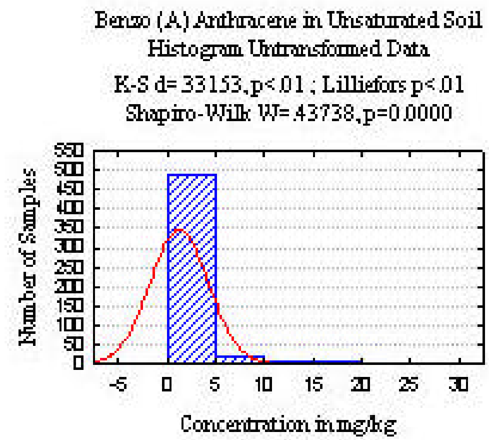
Arsenic in Unsaturated Soil
Normal Probability Plot

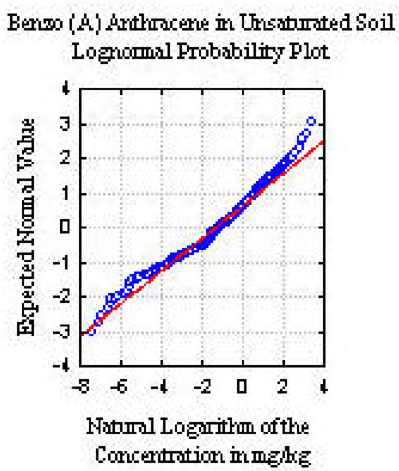


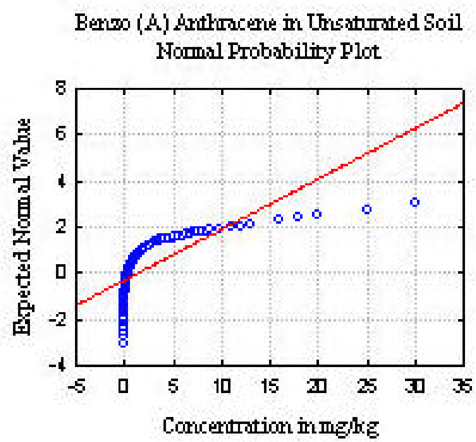
Marino Brothers Scrap Yard
Benzo (A) Anthracene in Unsaturated Soil



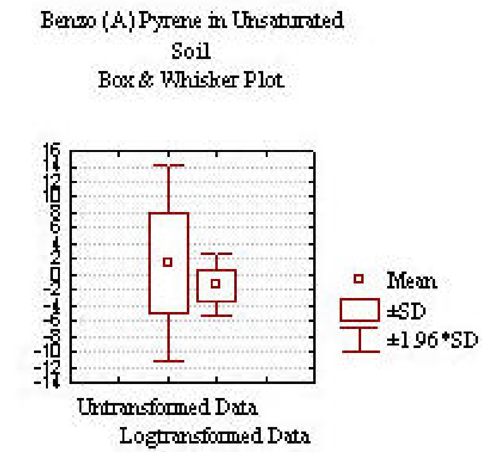


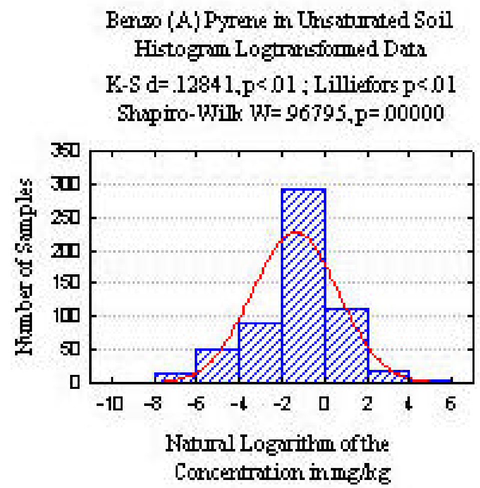


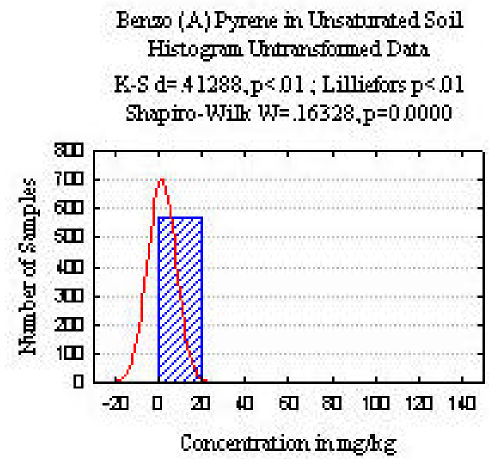


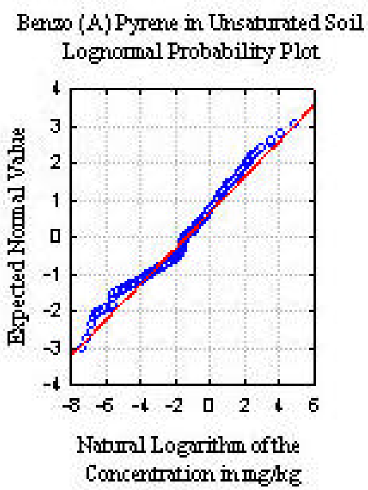


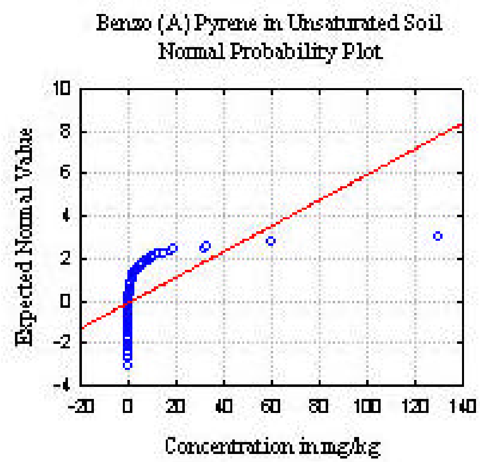
Marino Brothers Scrap Yard
Benzo (A) Pyrene in Unsaturated Soil



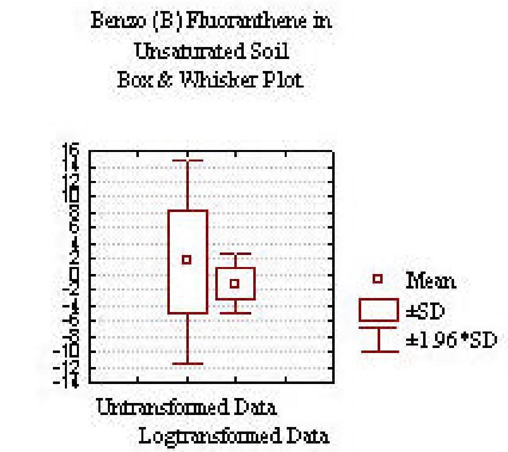


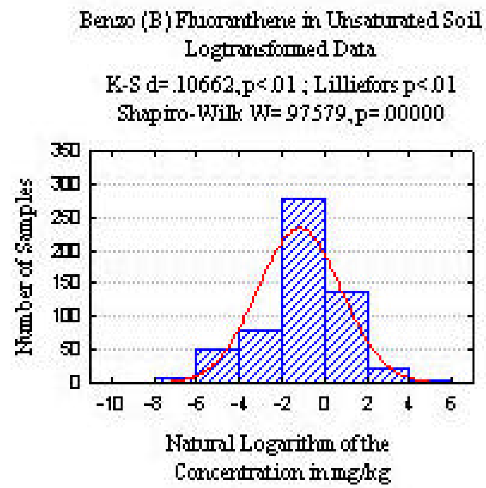


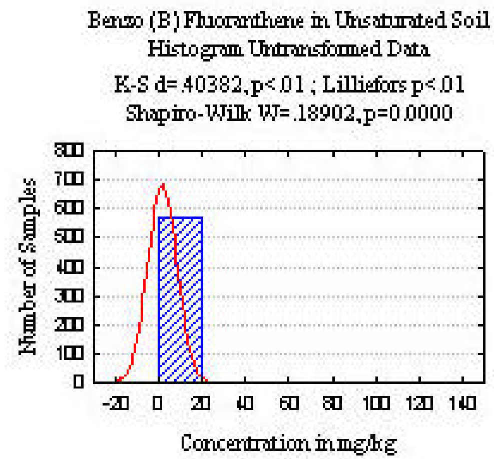


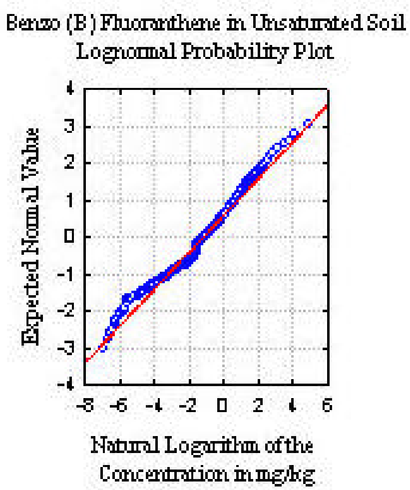


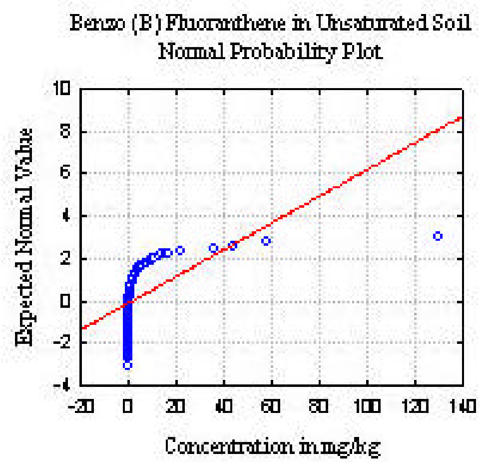
Marino Brothers Scrap Yard
Benzo (B) Fluoranthene in Unsaturated Soil



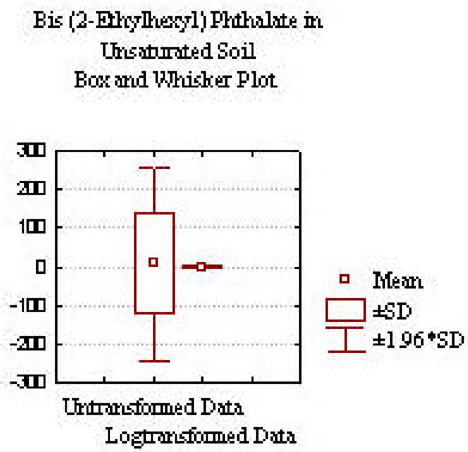


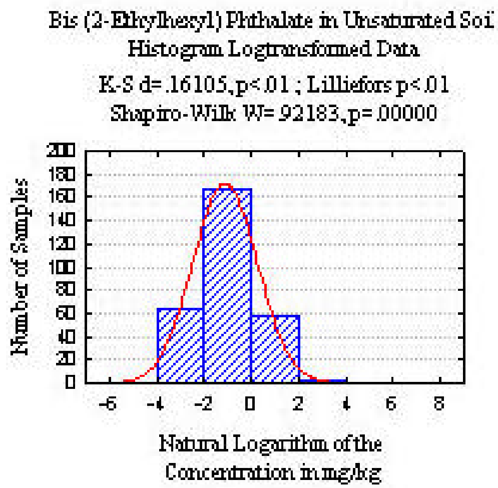


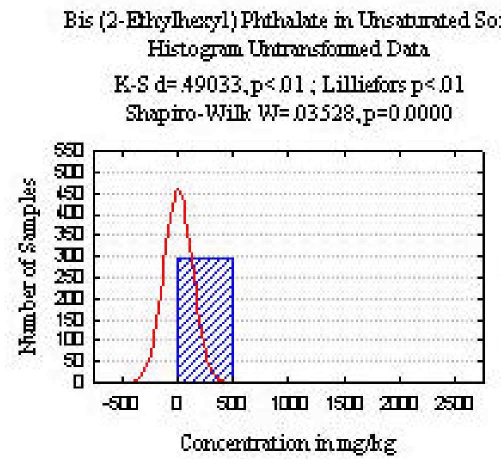


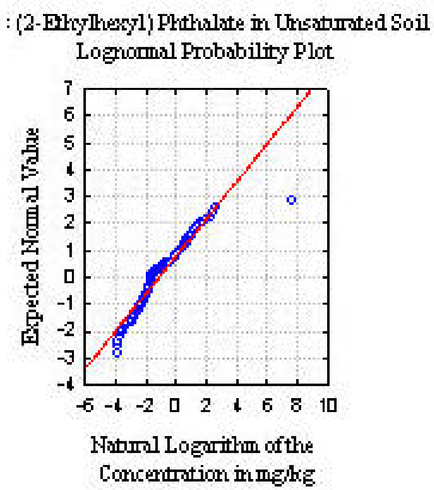


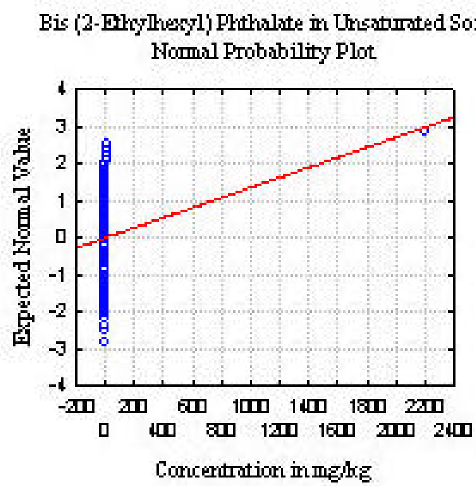
Marino Brothers Scrap Yard
Bis (2-Ethylhexyl) Phthalate in Unsaturated Soil



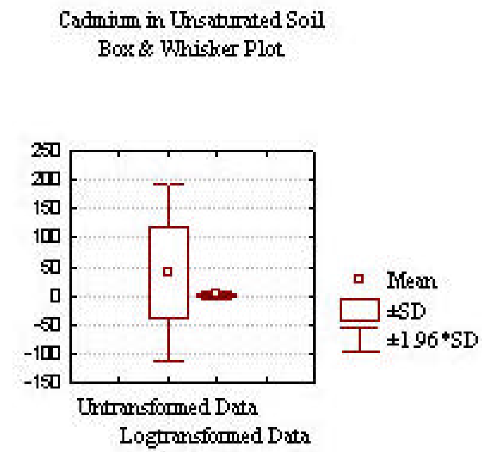


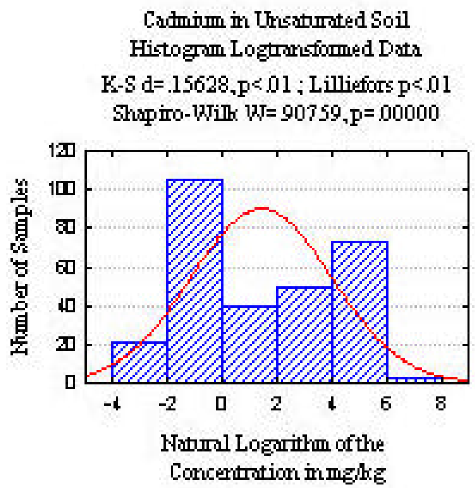


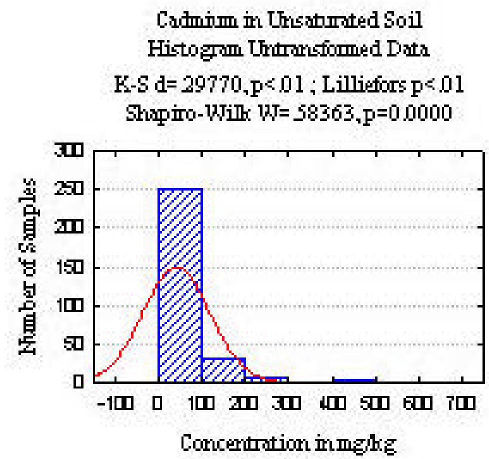


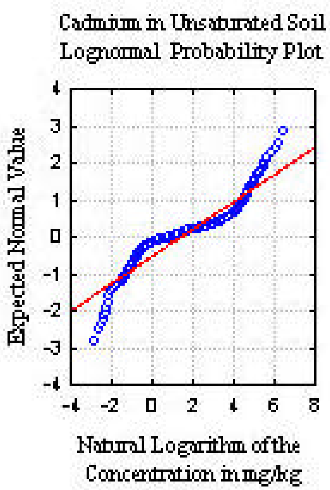


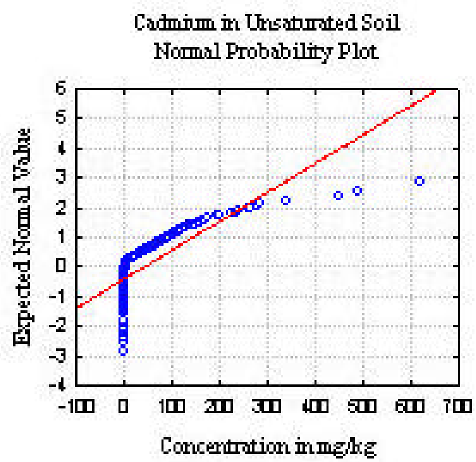
Marino Brothers Scrap Yard
Cadmium in Unsaturated Soil



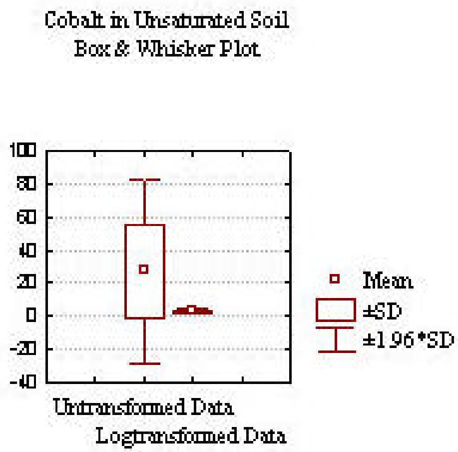


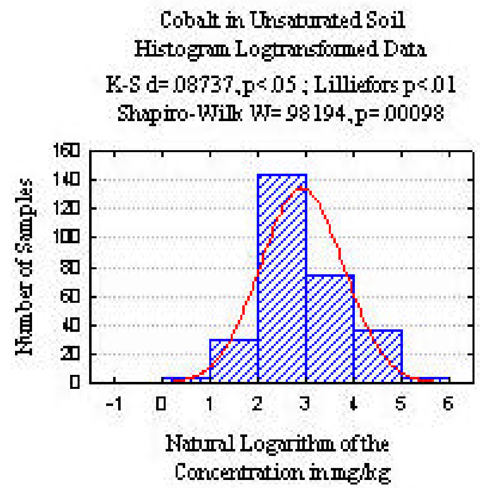


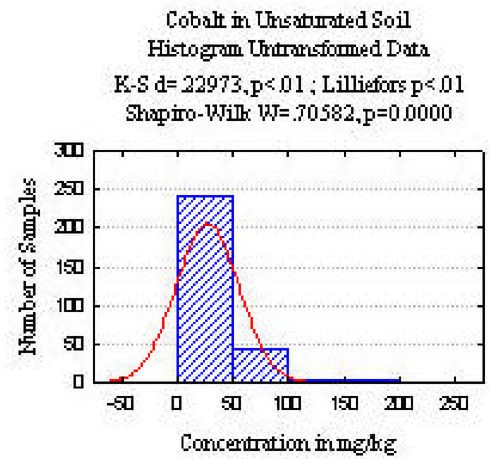


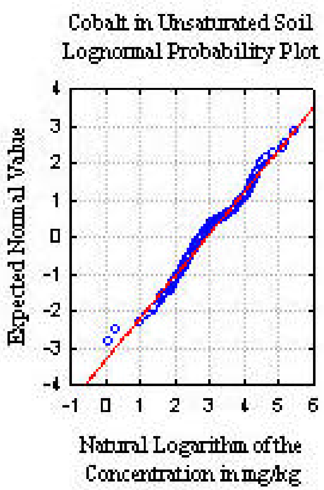


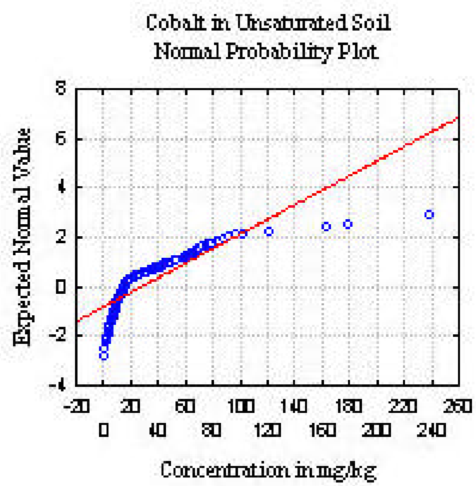
Marino Brothers Scrap Yard
Cobalt in Unsaturated Soil



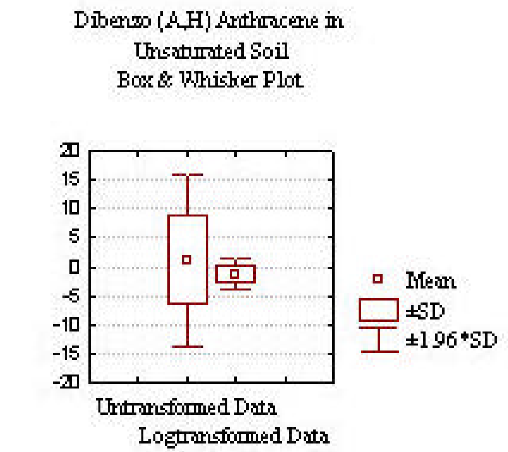


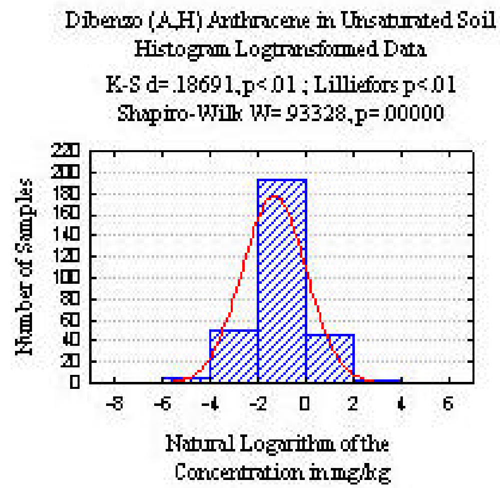


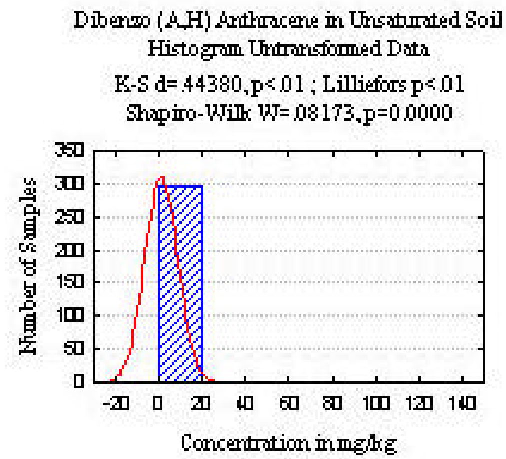


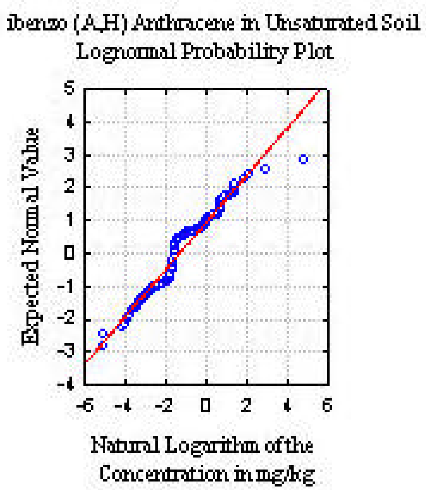


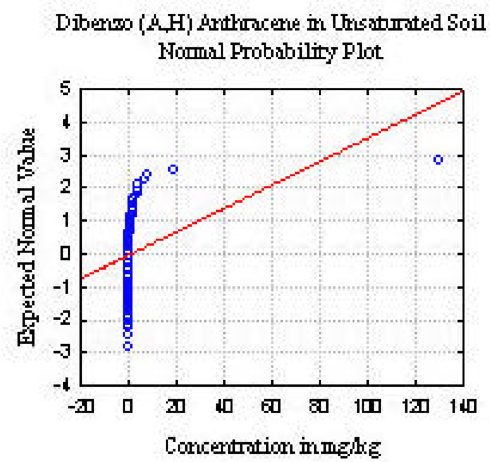
Marino Brothers Scrap Yard
Dibenzo (A,H) Anthracene in Unsaturated Soil



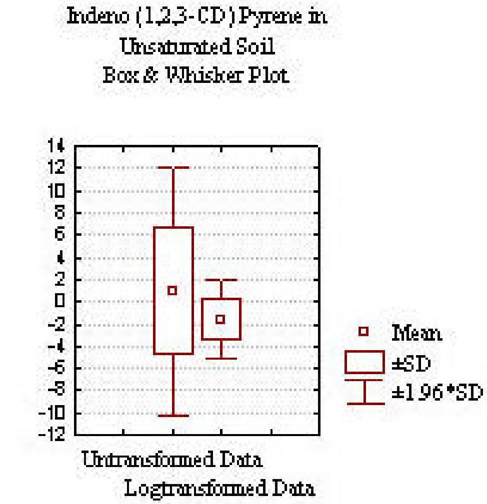


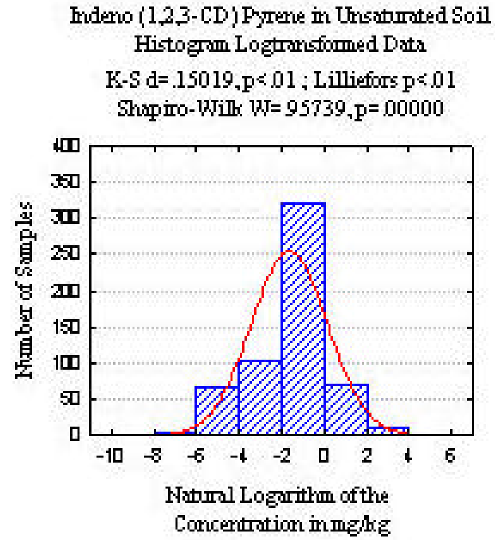


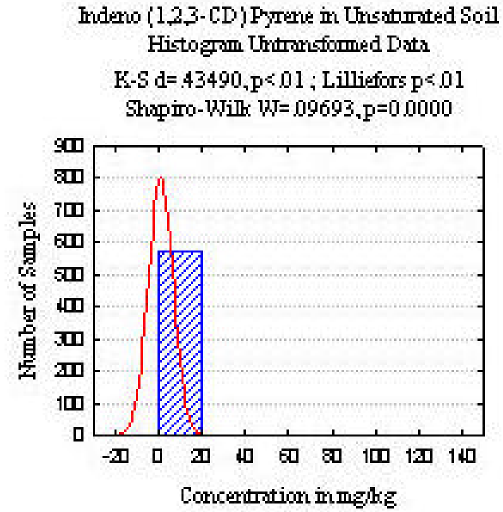


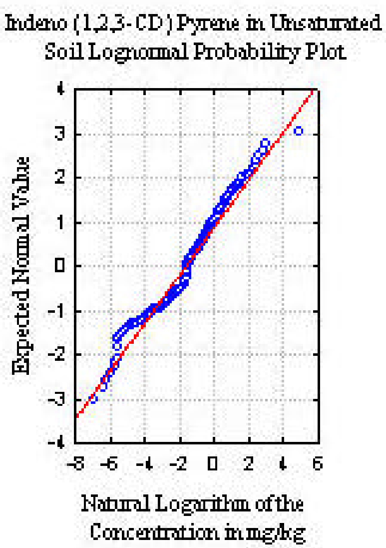


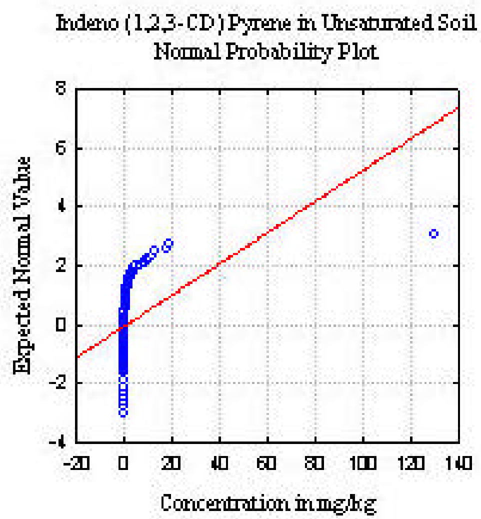
Marino Brothers Scrap Yard
Indeno (1,2,3-CD) Pyrene in Unsaturated Soil





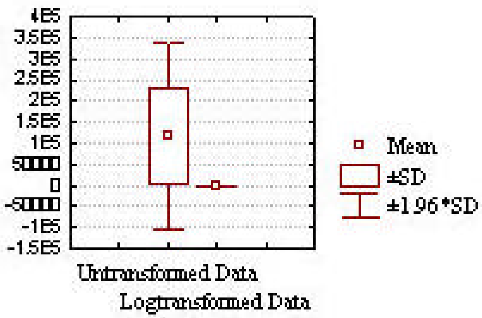




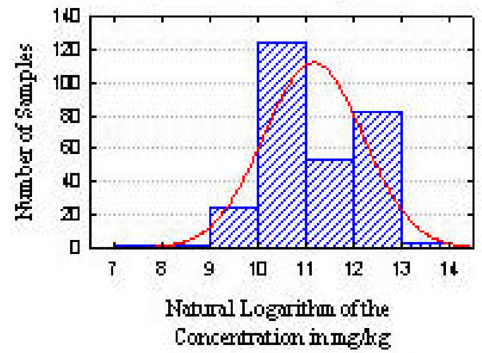


Marino Brothers Scrap Yard
Iron in Unsaturated Soil

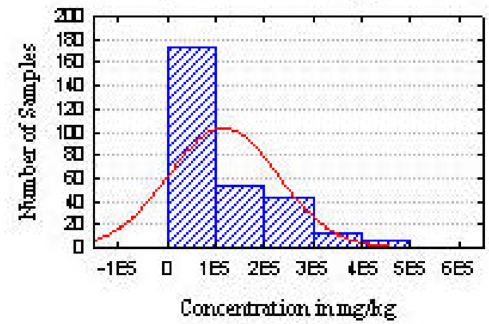
Iron in Unsaturated Soil
Box & Whisker Plot



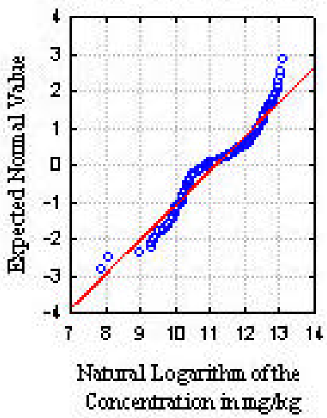
Iron in Unsaturated Soil
Histogram Logtransformed Data
K-S d=.12719, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.94500, p=.00000



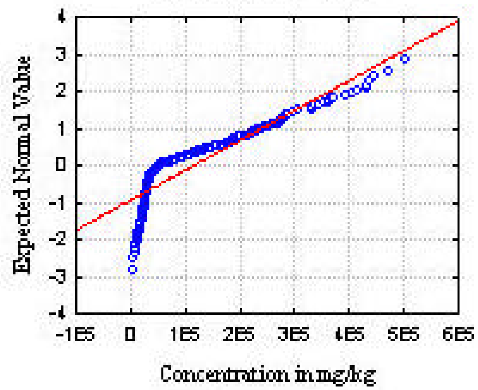
Iron in Unsaturated Soil
Histogram Untransformed Data
K-S d=.21758, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.82457, p=.00000



Iron in Unsaturated Soil
Lognormal Probability Plot

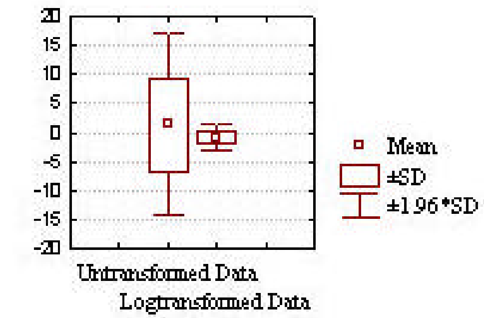


Iron in Unsaturated Soil
Normal Probability Plot

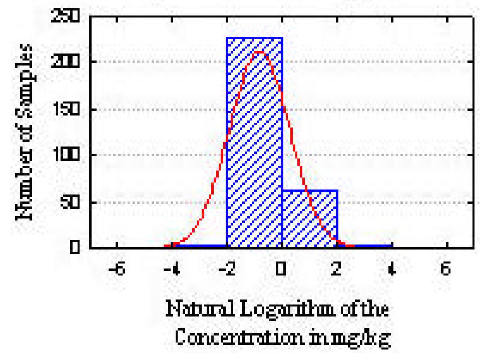


Marino Brothers Scrap Yard
Isophorone in Unsaturated Soil

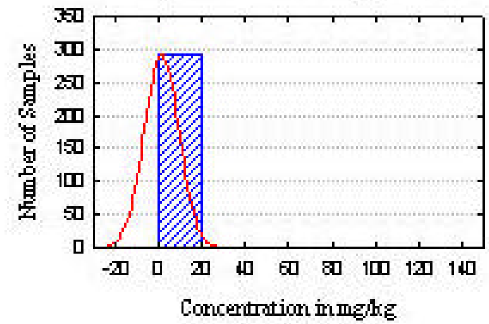
Isophorone in Unsaturated Soil
Box & Whisker Plot



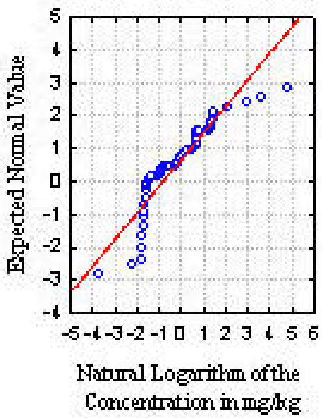
Isophorone in Unsaturated Soil
Histogram Logtransformed Data
K-S d=.24506, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.81158, p=.00000



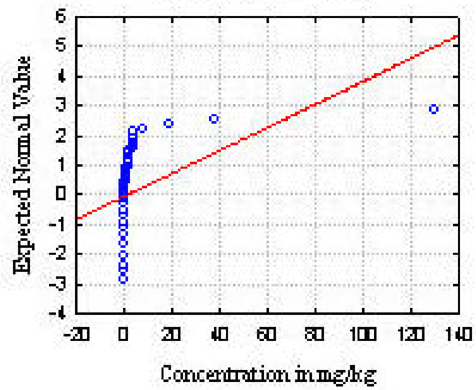
Isophorone in Unsaturated Soil
Histrogram Untransformed Data
K-S d=.43269, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.10525, p=0.0000



Isophorone in Unsaturated Soil
Lognormal Probability Plot

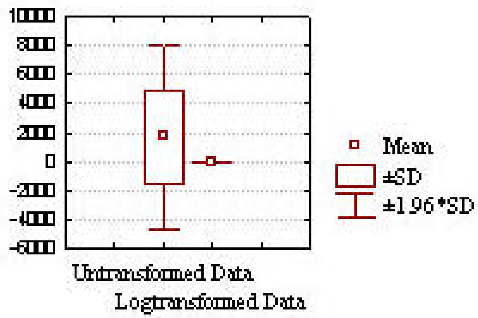


Isophorone in Unsaturated Soil
Normal Probability Plot

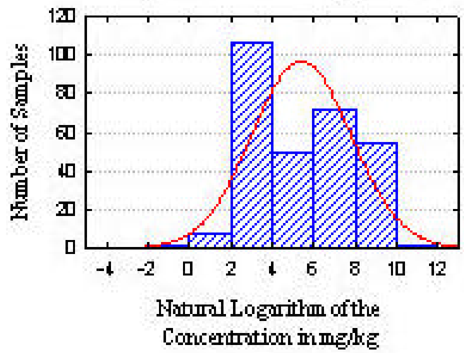


Marino Brothers Scrap Yard
Lead in Unsaturated Soil

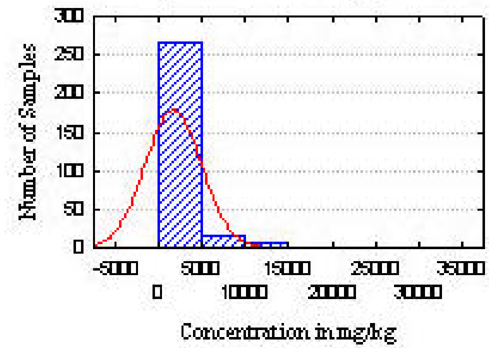
Lead in Unsaturated Soil
Box & Whisker Plot



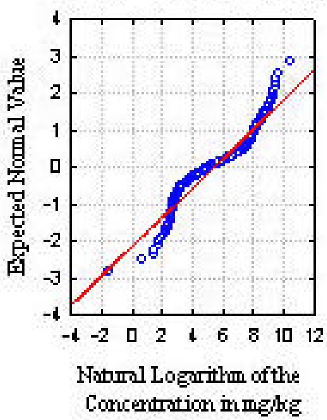
Lead in Unsaturated Soil
Histogram Logtransformed Data
K-S d=.11841, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.92782, p=.00000



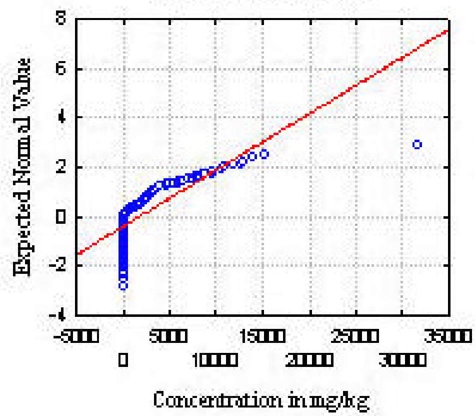
Lead in Unsaturated Soil
Histogram Untransformed Data
K-S d=.29911, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.56545, p=0.0000



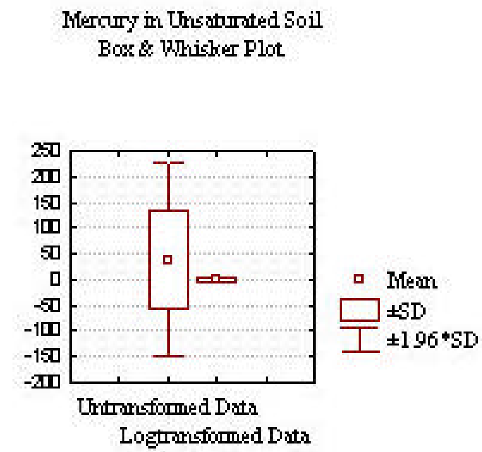
Lead in Unsaturated Soil
Lognormal Probability Plot

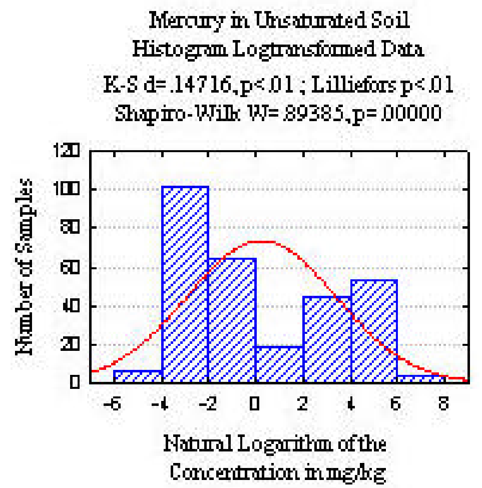


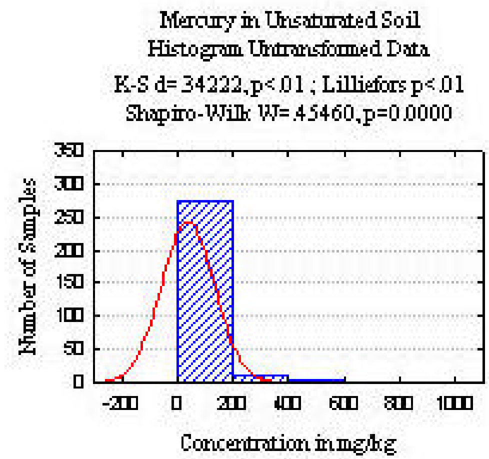
Lead in Unsaturated Soil
Normal Probability Plot

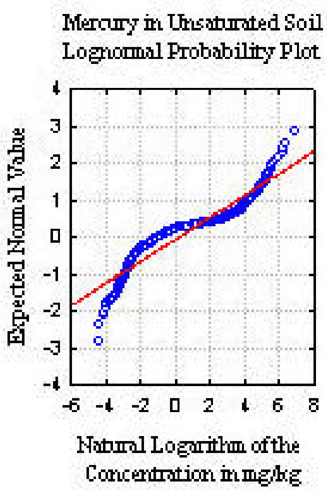


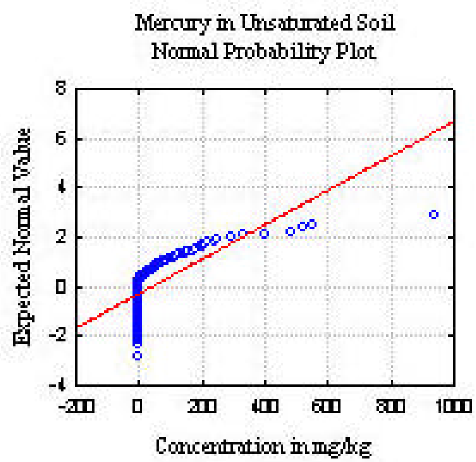
Marino Brothers Scrap Yard
Mercury in Unsaturated Soil





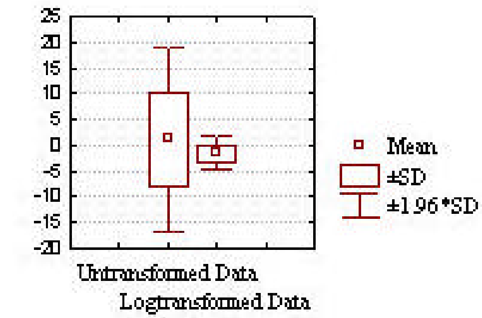




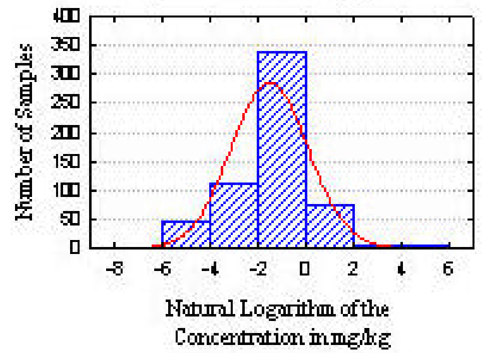


Marino Brothers Scrap Yard
Naphthalene in Unsaturated Soil

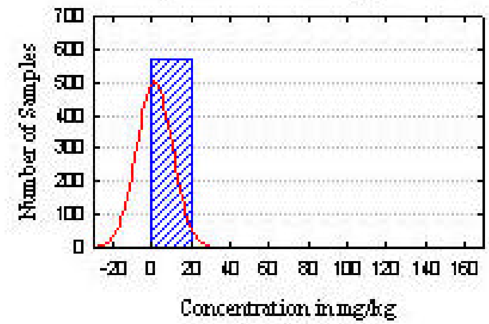
Naphthalene in Unsaturated Soil
Box & Whisker Plot



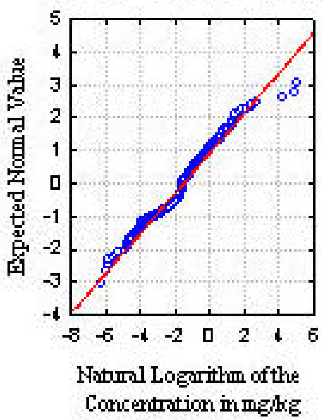
Naphthalene in Unsaturated Soil
Histogram Logtransformed Data
K-S d=.13266, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.97011, p=.00000



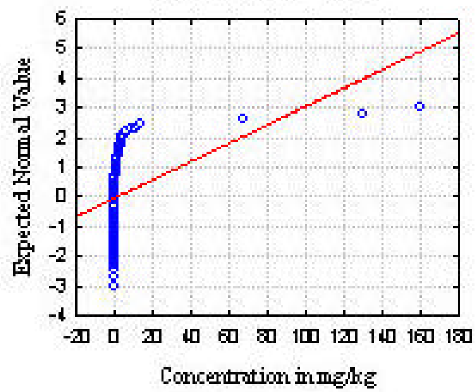
Naphthalene in Unsaturated Soil
Histogram Unstransformed Data
K-S d=.44622, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.08392, p=0.0000



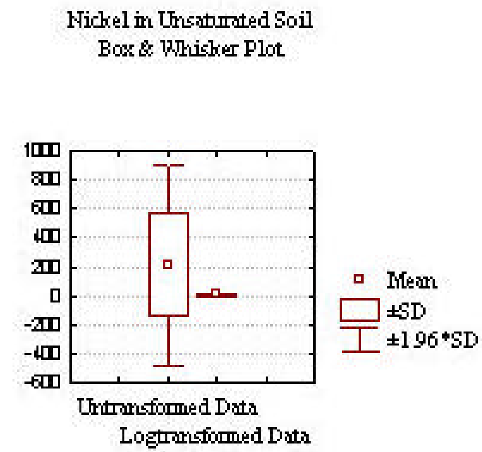
Naphthalene in Unsaturated Soil
Lognormal Probability Plot

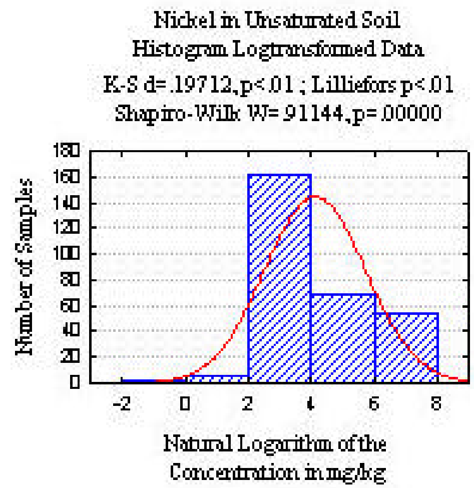


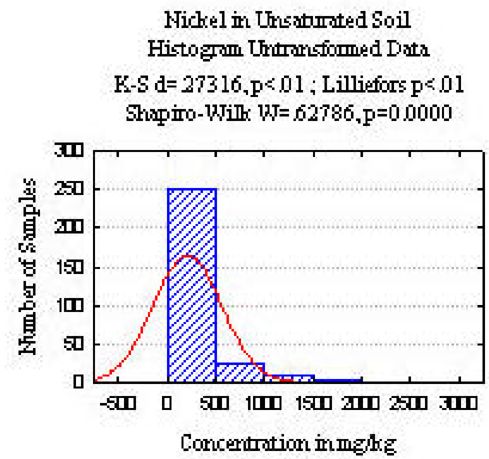
Naphthalene in Unsaturated Soil
Normal Probability Plot

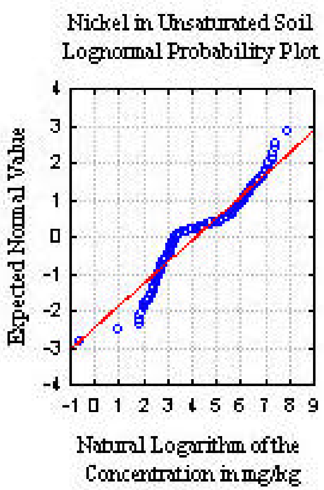


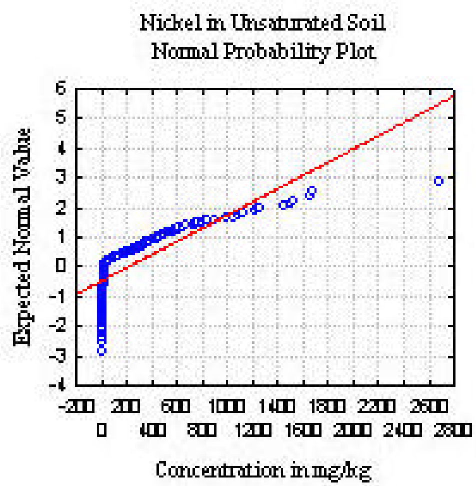
Marino Brothers Scrap Yard
Nickel in Unsaturated Soil





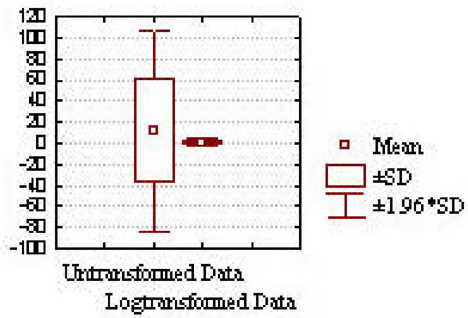




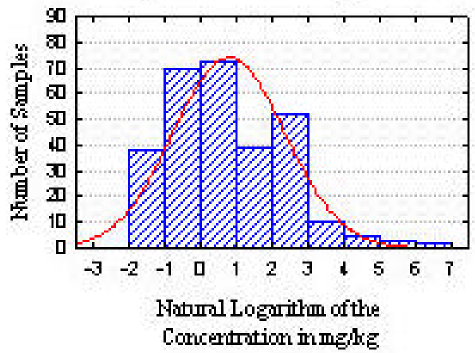


Marino Brothers Scrap Yard
Selenium in Unsaturated Soil

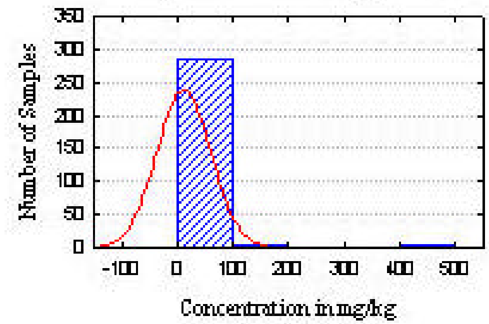
Selenium in Unsaturated Soil
Box & Whisker Plot



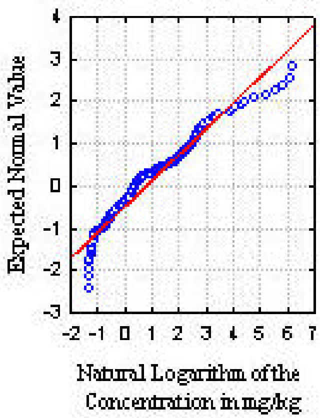
Selenium in Unsaturated Soils
Histogram Logtransformed Data
K-S d=.12485, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.93723, p=.00000



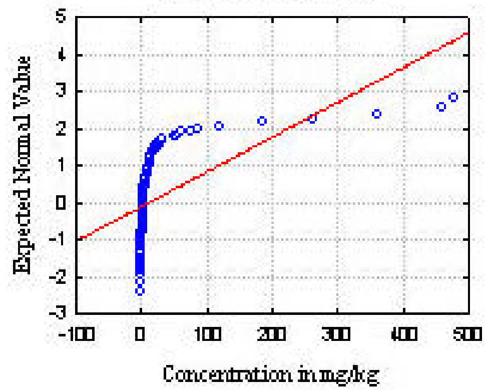
Selenium in Unsaturated Soil
Histogram Untransformed Data
K-S d=.40489, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.21702, p=0.0000



Selenium in Unsaturated Soil
Lognormal Probability Plot

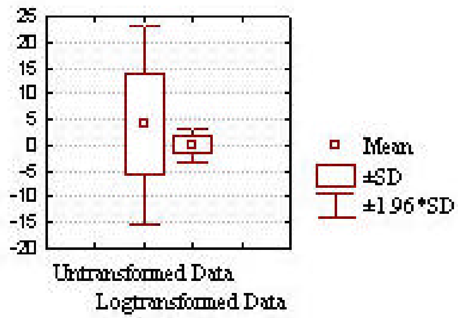


Selenium in Unsaturated Soil
Normal Probability Plot

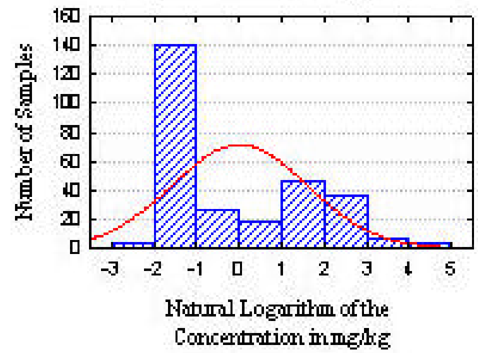


Marino Brothers Scrap Yard
Silver in Unsaturated Soil

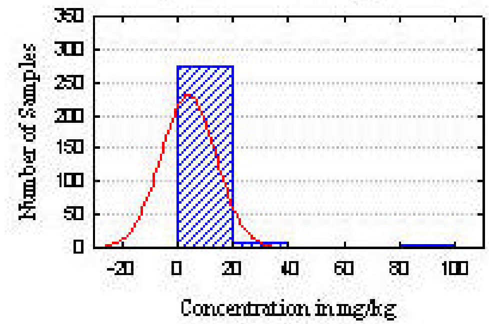
Silver in Unsaturated Soil
Box & Whisker Plot



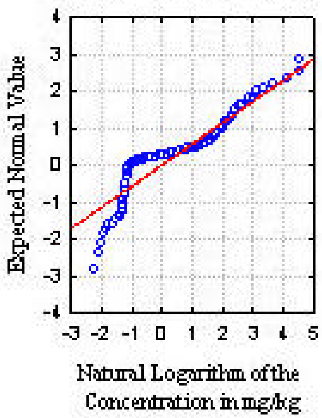
Silver in Unsaturated Soil
Histogram Logtransformed Data
K-S d=.25111, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.84665, p=.00000



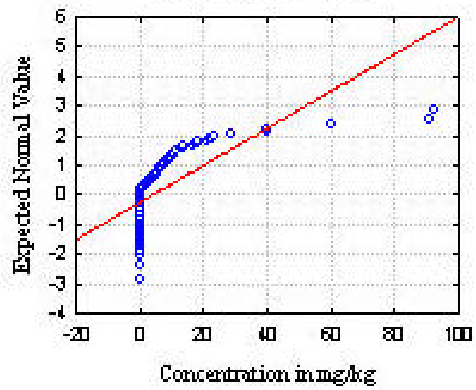
Silver in Unsaturated Soil
Histogram Untransformed Data
K-S d=.34448, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.39423, p=0.0000



Silver in Unsaturated Soil
Lognormal Probability Plot

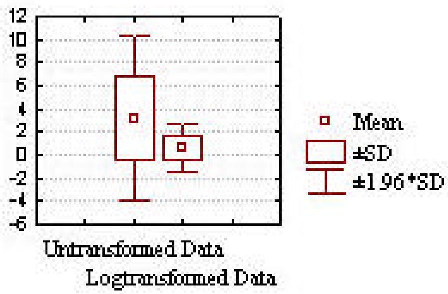


Silver in Unsaturated Soil
Normal Probability Plot

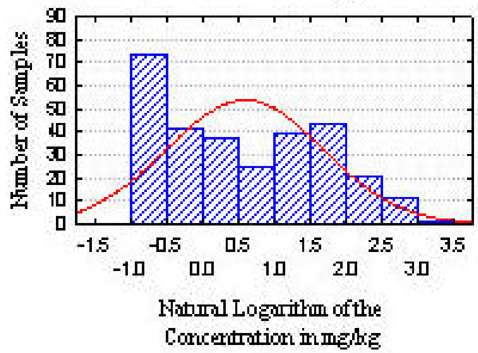


Marino Brothers Scrap Yard
Thallium in Unsaturated Soil

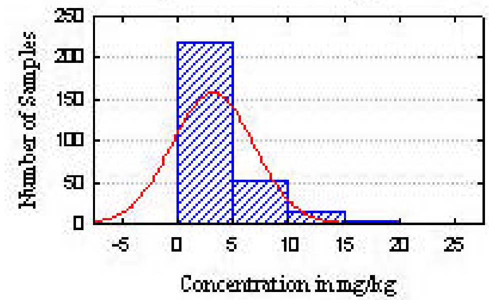
Thallium in Unsaturated Soil
Box & Whisker Plot



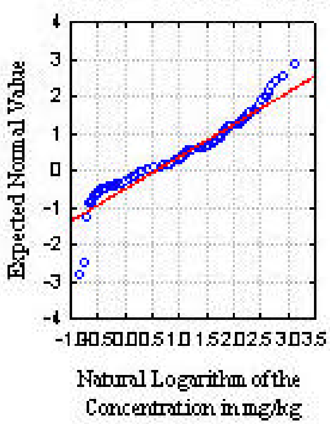
Thallium in Unsaturated Soil
Histogram Logtransformed Data
K-S d=.12387, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.91489, p=.00000



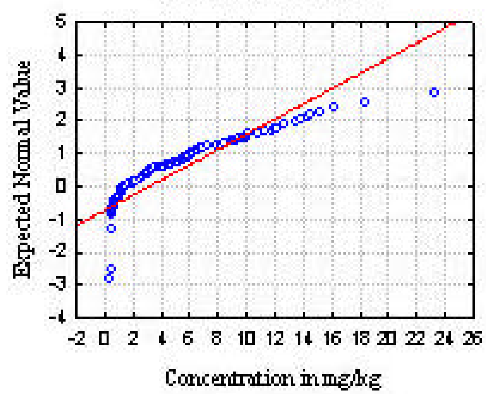
Thallium in Unsaturated Soil
Histogram Untransformed Data
K-S d=.22497, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.75057, p=0.0000



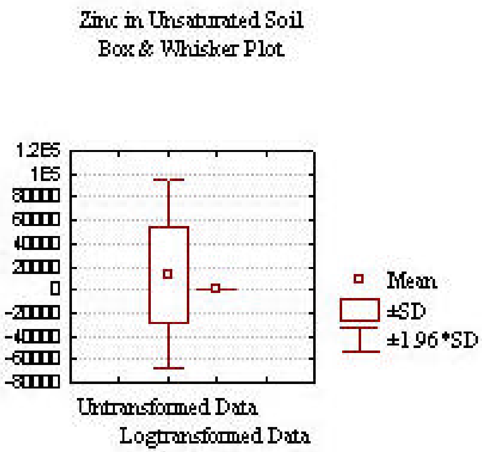
Thallium in Unsaturated Soil
Lognormal Probability Plot

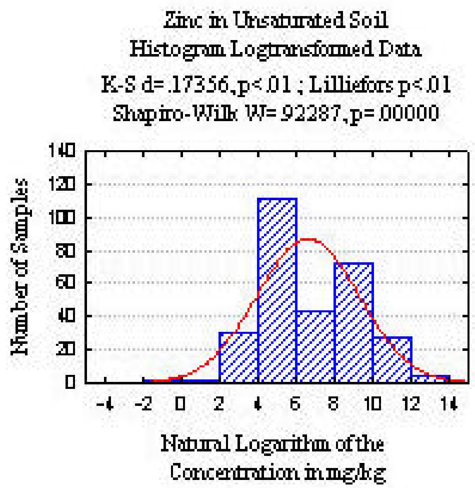


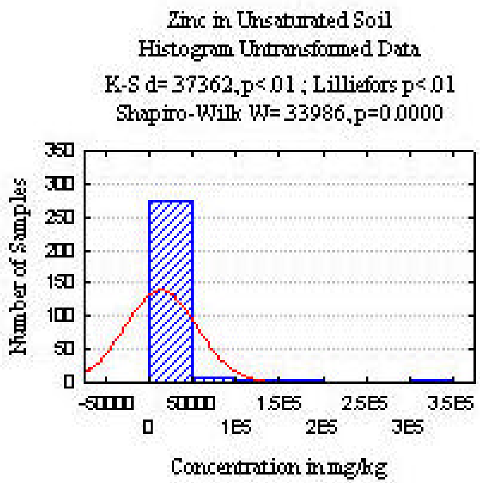
Thallium in Unsaturated Soil
Normal Probability Plot

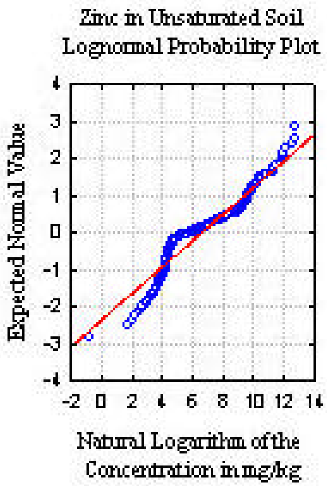


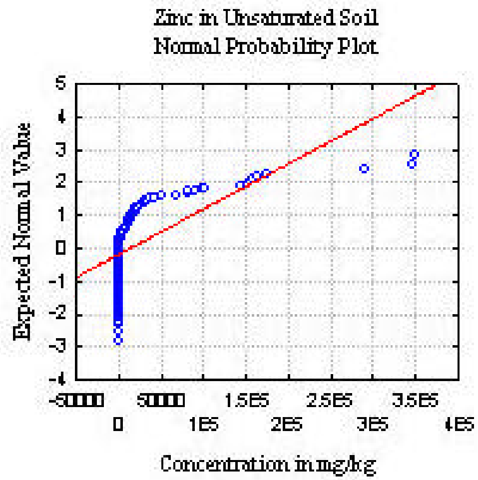
Marino Brothers Scrap Yard
Zinc in Unsaturated Soil











Enclosure #1
Part 1-5
Groundwater Statistics

MARINO BROTHERS SCRAP YARD

GROUNDWATER

SUMMARY STATISTICS VS. GROUNDWATER MEDIUM-SPECIFIC CONCENTRATIONS (MSCs)

METHOD	Number of Samples	Number of Detections	%Detection	CHEM_NAME[1]	GROUNDWATER MSC (µg/L)	CASNO	MEAN	GEOMEAN	MEDIAN	MIN DETECT	MAX DETECT	REPORT LIMIT MIN	REPORT LIMIT MAX	STD	VARIANCE	95UCL
SW 846 Method 6000/7000	45	30	67%	**Aluminum**	**200***	7429-90-5	62.33	44.70	41.90	13.00	**250.00**	Blank	200.00	51.02	2,603.46	77.66
SW 846 Method 6000/7000	45	10	22%	Antimony	6.00	7440-36-0	4.31	4.01	5.00	1.50	2.50	Blank	10.00	1.32	1.75	4.70
SW 846 Method 6000/7000	45	27	60%	Arsenic	50.00	7440-38-2	5.91	5.36	5.00	2.60	18.10	Blank	10.00	3.14	9.87	6.85
SW 846 Method 6000/7000	45	45	100%	Barium	2,000.00	7440-39-3	131.63	107.40	126.00	18.10	298.00	Blank	200.00	75.08	5,637.34	154.19
SW 846 Method 6000/7000	45	30	67%	Beryllium	4.00	7440-41-7	0.94	0.39	0.21	0.08	0.27	Blank	5.00	1.11	1.24	1.28
SW 846 Method 6000/7000	45	9	20%	Cadmium	5.00	7440-43-9	2.34	2.27	2.50	0.86	3.30	Blank	5.00	0.46	0.21	2.48
SW 846 Method 6000/7000	45	45	100%	Calcium	N/A	7440-70-2	151,068.89	138,240.89	142,000.00	53,100.00	316,000.00	Blank	5,000.00	62,315.87	3,883,267,646.46	169,790.65
SW 846 Method 6000/7000	45	39	87%	Chromium	100.00	7440-47-3	3.47	2.92	2.50	1.00	20.70	Blank	5.00	2.96	8.73	4.36
SW 846 Method 6000/7000	45	31	69%	Cobalt	730.00	7440-48-4	14.33	10.78	10.60	3.20	50.30	Blank	50.00	10.52	110.63	17.49
SW 846 Method 6000/7000	45	15	33%	Copper	1,000.00	7440-50-8	10.02	8.70	12.50	2.20	12.90	Blank	25.00	4.09	16.72	11.25
SW 846 Method 6000/7000	45	45	100%	**Iron**	**300***	7439-89-6	**4,176.58**	1,303.12	2,590.00	21.60	**15,900.00**	Blank	100.00	4,689.78	21,994,037.93	**5,585.55**
SW 846 Method 6000/7000	45	25	56%	**Lead**	**5.00**	7439-92-1	3.05	2.42	2.10	2.00	**14.70**	Blank	3.00	2.87	8.22	3.91
SW 846 Method 6000/7000	45	45	100%	Magnesium	N/A	7439-95-4	34,975.56	31,875.74	30,800.00	15,700.00	101,000.00	Blank	5,000.00	18,474.25	341,297,797.98	40,525.83
SW 846 Method 6000/7000	45	45	100%	**Manganese**	**50***	7439-96-5	**9,437.87**	6,206.18	7,490.00	103.00	**21,400.00**	Blank	15.00	6,757.21	45,659,926.12	**11,467.96**
SW 846 Method 6000/7000	45	18	40%	Mercury	2.00	7439-97-6	0.09	0.09	0.10	0.05	0.16	Blank	0.20	0.02	0.00	0.10
SW 846 Method 6000/7000	45	33	73%	**Nickel**	**100.00**	7440-02-0	18.40	15.34	18.20	6.20	**112.00**	Blank	40.00	16.03	256.99	23.22
SW 846 Method 6000/7000	45	44	98%	Potassium	N/A	7440-09-7	6,836.44	5,282.64	4,510.00	1,100.00	21,100.00	Blank	5,000.00	5,332.08	28,431,114.34	8,438.38
SW 846 Method 6000/7000	45	6	13%	Selenium	50.00	7782-49-2	5.07	4.11	2.50	2.50	12.80	Blank	25.00	3.74	14.00	6.20
SW 846 Method 6000/7000	45	30	67%	Silver	100.00	7440-22-4	1.97	1.88	2.10	0.98	2.80	Blank	5.00	0.55	0.30	2.13
SW 846 Method 6000/7000	45	45	100%	Sodium	N/A	7440-23-5	98,991.11	79,084.66	65,500.00	18,300.00	444,000.00	Blank	10,000.00	78,680.06	6,190,551,282.83	122,629.22
SW 846 Method 6000/7000	45	2	4%	**Thallium**	**2.00**	7440-28-0	**10.34**	8.14	5.00	6.20	**34.30**	Blank	50.00	8.29	68.74	**12.84**
SW 846 Method 6000/7000	45	21	47%	Vanadium	260.00	7440-62-2	14.92	9.67	25.00	1.90	4.50	Blank	50.00	10.91	119.09	18.20
SW 846 Method 6000/7000	45	42	93%	Zinc	2,000.00	7440-66-6	48.93	22.10	14.70	3.60	242.00	Blank	20.00	64.60	4,173.31	68.34
SW 846 Method 6000/7000	46	2	4%	Cyanide (Total)	N/A	57-12-5	5.33	5.20	5.00	11.30	13.70	10.00	10.00	1.57	2.46	5.79
SW 846 Method 8082	45	7	16%	AROCLOR 1242	1.30	53469-21-9	0.82	0.53	0.50	0.28	0.70	1.00	30.00	2.16	4.68	**1.47**
SW 846 Method 8082	45	0	0%	AROCLOR 1016	2.60	12674-11-2	0.82	0.54	0.50	NA	NA	1.00	30.00	2.16	4.67	1.47
SW 846 Method 8082	45	1	2%	**AROCLOR 1248**	**0.37**	12672-29-6	**1.20**	0.55	0.50	32.00	**32.00**	1.00	30.00	4.70	22.05	**2.61**
SW 846 Method 8082	45	10	22%	**AROCLOR 1260**	**1.10**	11096-82-5	**6.34**	0.65	0.50	0.15	**250.00**	1.00	30.00	37.18	1,382.10	**17.51**
SW 846 Method 8082	45	5	11%	**AROCLOR 1254**	**0.37**	27323-18-8	**0.83**	0.54	0.50	0.28	**1.10**	1.00	30.00	2.16	4.68	**1.48**
SW 846 Method 8260	47	1	2%	CHLOROBENZENE	100.00	108-90-7	2.77	2.60	2.50	15.00	15.00	5.00	5.00	1.82	3.32	3.30
SW 846 Method 8260	47	0	0%	CHLOROMETHANE	N/A	74-87-3	5.00	5.00	5.00	NA	NA	10.00	10.00	0.00	0.00	NA
SW 846 Method 8260	47	2	4%	TRICHLOROETHENE	N/A	79-01-6	2.54	2.53	2.50	3.00	4.00	5.00	5.00	0.23	0.05	2.61
SW 846 Method 8260	47	0	0%	ETHYLBENZENE	700.00	100-41-4	2.50	2.50	2.50	NA	NA	5.00	5.00	0.00	0.00	NA
SW 846 Method 8260	47	0	0%	2-BUTANONE	N/A	78-93-3	10.00	10.00	10.00	NA	NA	20.00	20.00	0.00	0.00	NA
SW 846 Method 8260	47	0	0%	BENZENE	5.00	71-43-2	2.50	2.50	2.50	NA	NA	5.00	5.00	0.00	0.00	NA
SW 846 Method 8260	47	0	0%	TOLUENE	1,000.00	108-88-3	2.50	2.50	2.50	NA	NA	5.00	5.00	0.00	0.00	NA
SW 846 Method 8260	47	0	0%	CARBON DISULFIDE	1,900.00	75-15-0	2.50	2.50	2.50	NA	NA	5.00	5.00	0.00	0.00	NA
SW 846 Method 8260	47	0	0%	XYLENES (TOTAL)	10,000.00	1330-20-7	2.50	2.50	2.50	NA	NA	5.00	5.00	0.00	0.00	NA
SW 846 Method 8260	47	5	11%	TETRACHLOROETHENE	N/A	127-18-4	2.91	2.67	2.50	1.70	17.00	5.00	5.00	2.16	4.68	3.54
SW 846 Method 8260	47	28	60%	ACETONE	3,700.00	67-64-1	5.53	4.16	3.70	1.40	5.40	20.00	20.00	3.82	14.62	6.65
SW 846 Method 8270	44	0	0%	1,3-DICHLOROBENZENE	600.00	541-73-1	209.47	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	**621.74**
SW 846 Method 8270	44	0	0%	4-NITROPHENOL	60.00	100-02-7	1,024.58	29.79	25.00	NA	NA	50.00	88,000.00	6,629.46	43,949,712.59	**3,040.12**
SW 846 Method 8270	44	0	0%	4-CHLOROANILINE	N/A	106-47-8	209.47	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	621.74
SW 846 Method 8270	44	0	0%	4-NITROANILINE	N/A	100-01-6	1,024.58	29.79	25.00	NA	NA	50.00	88,000.00	6,629.46	43,949,712.59	3,040.12
SW 846 Method 8270	44	0	0%	2,4-DIMETHYLPHENOL	730.00	105-67-9	209.47	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	621.74
SW 846 Method 8270	44	0	0%	PHENOL	4,000.00	108-95-2	209.47	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	621.74
SW 846 Method 8270	44	0	0%	4-METHYLPHENOL	N/A	106-44-5	209.47	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	621.74
SW 846 Method 8270	44	0	0%	1,2,4-TRICHLOROBENZENE	70.00	120-82-1	**209.47**	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	**621.74**
SW 846 Method 8270	44	0	0%	2-METHYLPHENOL	N/A	95-48-7	209.47	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	621.74
SW 846 Method 8270	44	0	0%	DIMETHYL PHTHALATE	N/A	131-11-3	209.47	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	621.74
SW 846 Method 8270	44	0	0%	1,2-DICHLOROBENZENE	600.00	95-50-1	209.47	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	**621.74**
SW 846 Method 8270	44	0	0%	N-NITROSODIPHENYLAMINE	130.00	86-30-6	**209.47**	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	**621.74**
SW 846 Method 8270	44	0	0%	DIETHYL PHTHALATE	5,000.00	84-66-2	209.47	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	621.74
SW 846 Method 8270	44	0	0%	DI-N-OCTYL PHTHALATE	N/A	117-84-0	209.47	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	621.74
SW 846 Method 8270	44	0	0%	ISOPHORONE	100.00	78-59-1	**209.47**	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	**621.74**
SW 846 Method 8270	44	0	0%	BUTYL BENZYL PHTHALATE	2,700.00	85-68-7	209.47	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	621.74
SW 846 Method 8270	44	0	0%	DI-N-BUTYL PHTHALATE	NA	84-74-2	209.47	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	621.74
SW 846 Method 8270	44	0	0%	CARBAZOLE	33.00	86-74-8	**209.47**	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	**621.74**

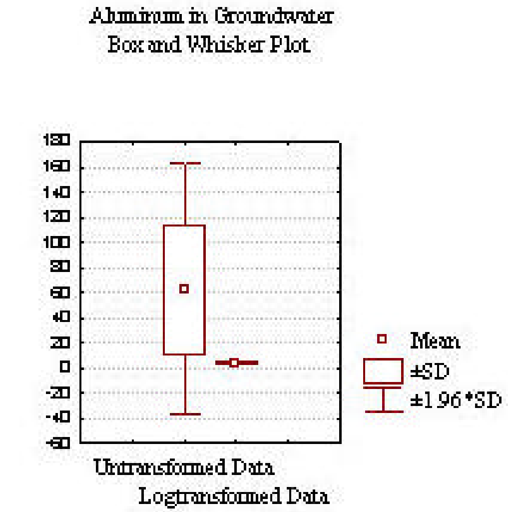
SW 846 Method 8270	44	0	0%	DIBENZOFURAN	N/A	132-64-9	209.47	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	621.74
SW 846 Method 8270	44	0	0%	2-METHYLNAPHTHALENE	730.00	91-57-6	209.47	5.97	5.00	NA	NA	10.00	18,000.00	1,356.04	1,838,849.97	621.74
SW 846 Method 8270	44	8	18%	**BIS(2-ETHYLHEXYL) PHTHALATE**	**6.00**	117-81-7	**209.46**	5.94	5.00	4.10	**6.60**	10.00	18,000.00	1,356.04	1,838,853.88	**621.73**
SW 846 Method 8270	48	21	44%	PYRENE	130.00	129-00-0	0.49	0.14	0.10	0.03	4.00	0.20	150.00	1.17	1.38	0.83
SW 846 Method 8310	48	4	8%	ACENAPHTHENE	2,200.00	83-32-9	0.73	0.55	0.50	0.06	2.20	1.00	750.00	0.94	0.89	1.00
SW 846 Method 8310	46	1	2%	**DIBENZO(A,H)ANTHRACENE**	**0.09**	53-70-3	**0.10**	0.10	0.10	0.15	**0.15**	0.20	150.00	0.01	0.00	**0.10**
SW 846 Method 8310	46	6	13%	FLUORENE	1,500.00	86-73-7	0.18	0.11	0.10	0.05	2.90	0.20	150.00	0.43	0.19	0.31
SW 846 Method 8310	46	11	24%	ACENAPHTHYLENE	2,200.00	208-96-8	1.18	0.51	0.50	0.04	29.00	0.26	750.00	4.22	17.78	2.43
SW 846 Method 8310	46	6	13%	ANTHRACENE	66.00	120-12-7	0.71	0.12	0.10	0.09	24.00	0.20	150.00	3.56	12.69	1.77
SW 846 Method 8310	47	13	28%	NAPHTHALENE	100.00	91-20-3	0.71	0.48	0.50	0.05	1.60	1.00	750.00	1.26	1.60	1.08
SW 846 Method 8310	47	10	21%	**INDENO(1,2,3-CD)PYRENE**	**0.90**	193-39-5	0.34	0.12	0.10	0.02	**1.80**	0.20	150.00	1.32	1.73	0.73
SW 846 Method 8310	46	11	24%	**BENZO(GHI)PERYLENE**	**0.26**	191-24-2	0.15	0.11	0.10	0.04	**1.70**	0.20	150.00	0.24	0.06	0.22
SW 846 Method 8310	46	9	20%	CHRYSENE	1.90	218-01-9	0.13	0.10	0.10	0.02	1.50	0.20	150.00	0.21	0.04	0.19
SW 846 Method 8310	46	9	20%	**BENZO(K)FLUORANTHENE**	**0.55**	207-08-9	0.34	0.11	0.10	0.02	**2.20**	0.20	18.00	1.34	1.80	**0.74**
SW 846 Method 8310	46	9	20%	**BENZO(A)ANTHRACENE**	**0.90**	56-55-3	0.33	0.11	0.10	0.03	**1.40**	0.20	18.00	1.32	1.75	0.72
SW 846 Method 8310	46	14	30%	**BENZO(A)PYRENE**	**0.20**	50-32-8	**0.23**	0.10	0.10	0.03	**5.30**	0.20	150.00	0.78	0.61	**0.46**
SW 846 Method 8310	46	19	41%	FLUORANTHENE	260.00	206-44-0	0.22	0.11	0.10	0.03	4.30	0.20	150.00	0.63	0.40	0.41
SW 846 Method 8310	46	4	9%	**BENZO(B)FLUORANTHENE**	**0.90**	205-99-2	**4.25**	0.13	0.10	0.13	**190.00**	0.20	150.00	28.00	783.78	**12.56**
SW 846 Method 8310	46	15	33%	PHENANTHRENE	1,100.00	85-01-8	0.22	0.10	0.10	0.02	5.10	0.20	150.00	0.74	0.55	0.44

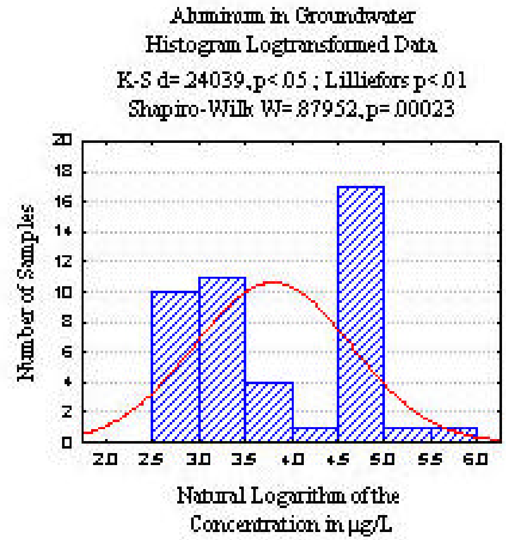
NOTES

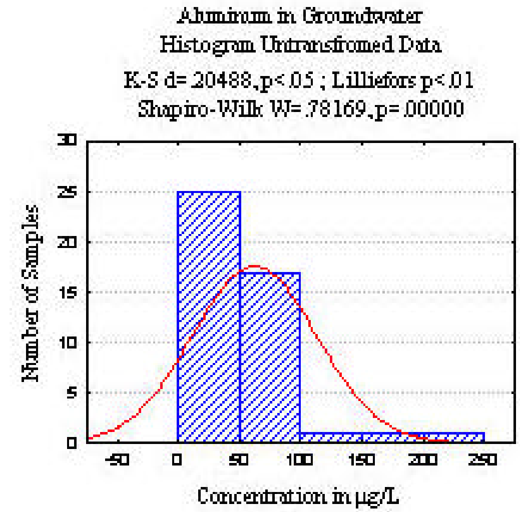
* Secondary Maximum Contaminant Level

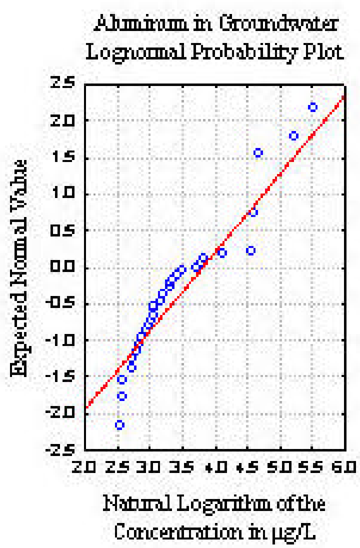
[1] Constituents Shown in Red Exceed Medium-Specific Concentrations at least once

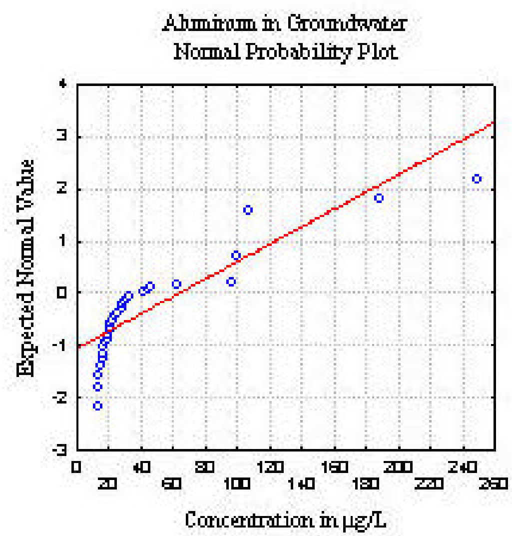
Marino Brothers Scrap Yard
Aluminum in Groundwater



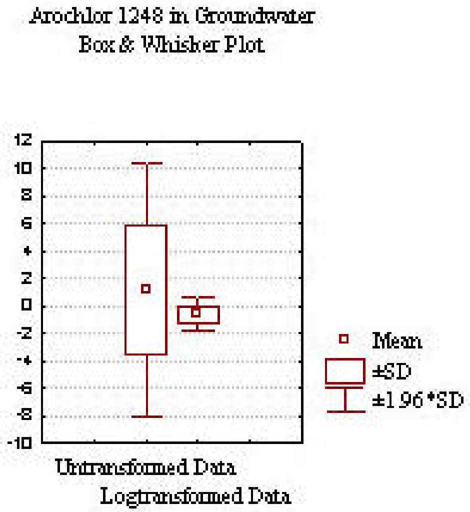


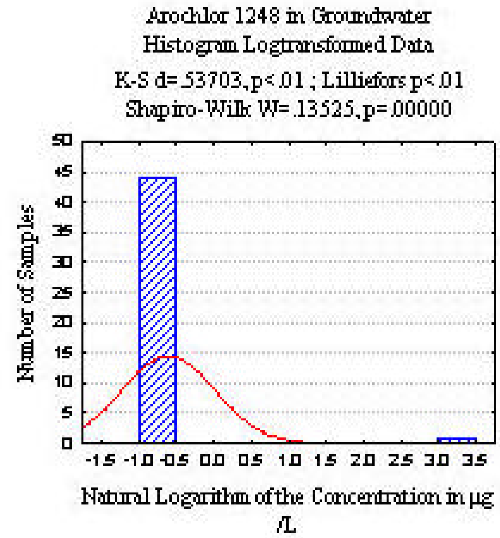


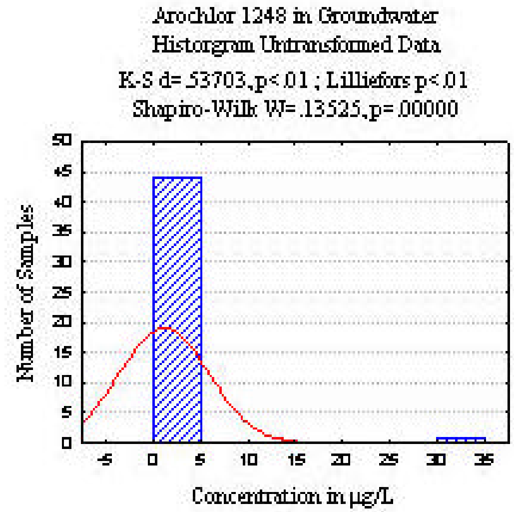


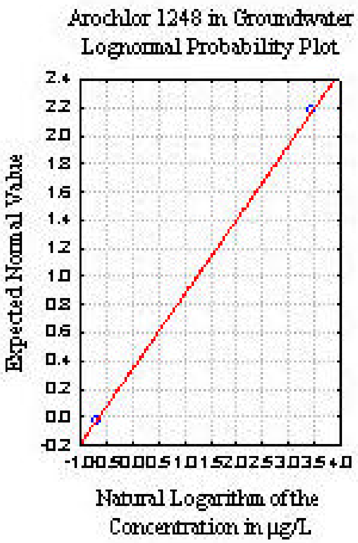


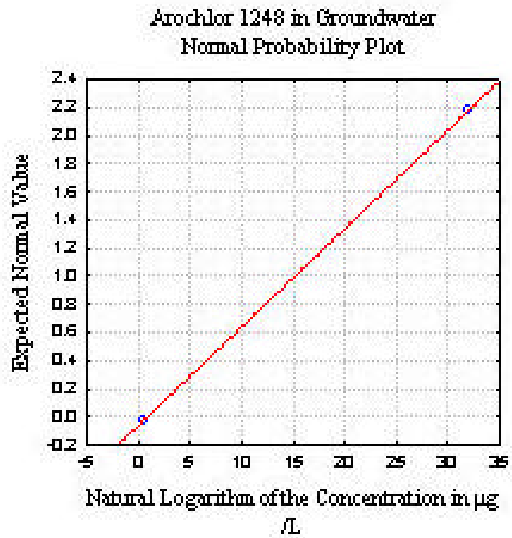
Marino Brothers Scrapyard
Arochlor 1248 in Groundwater



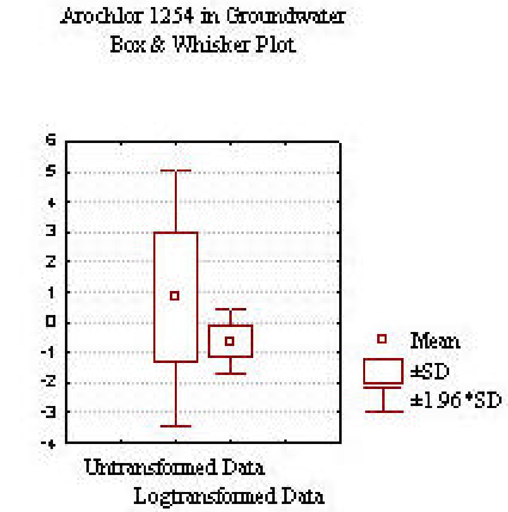


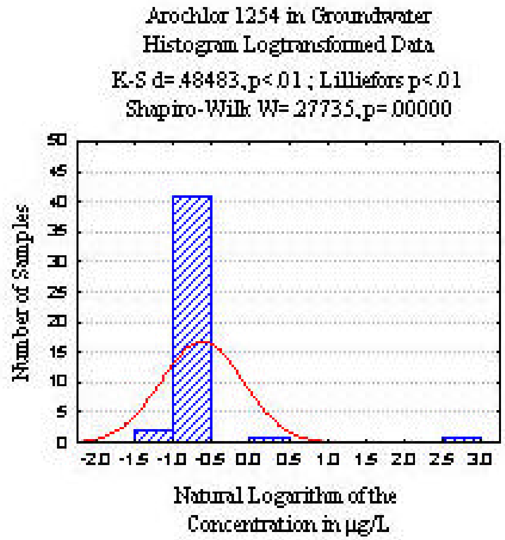


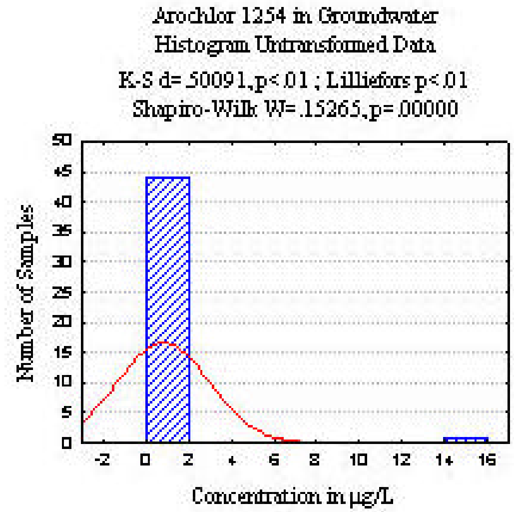


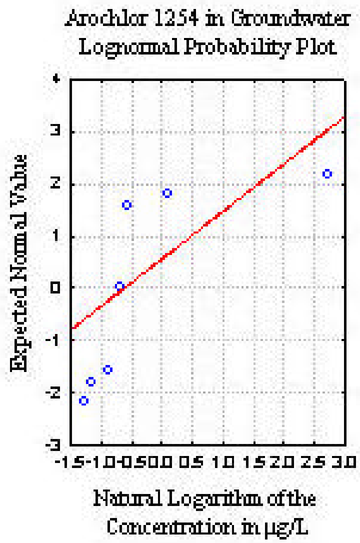


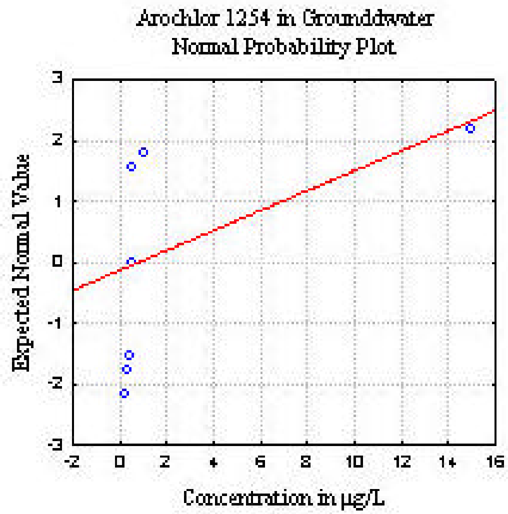
Marino Brothers Scrapyard
Arochlor 1254 in Groundwater



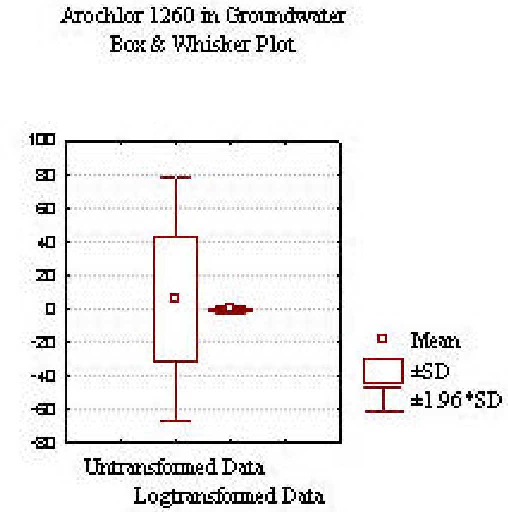


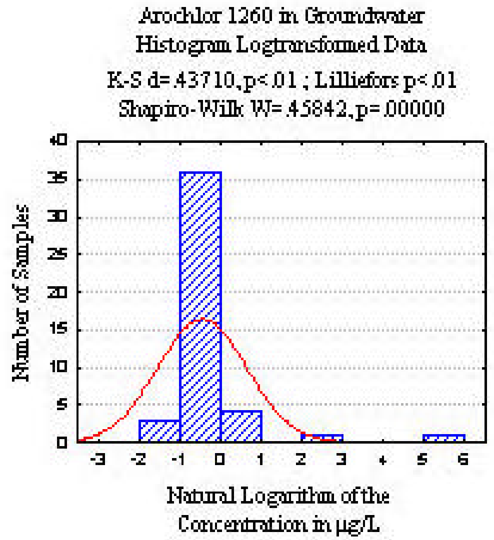


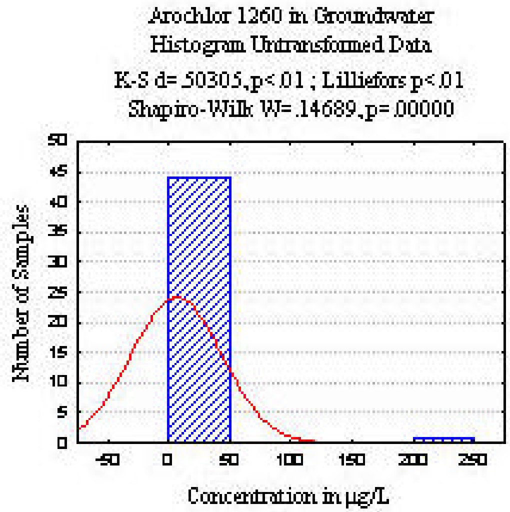


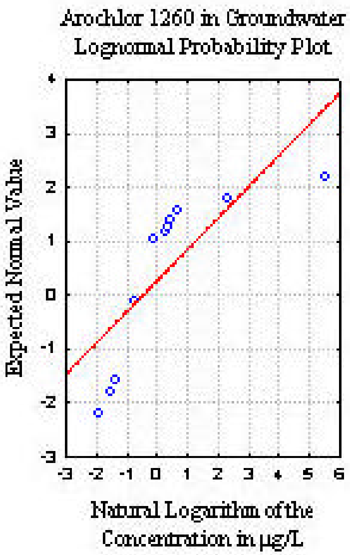


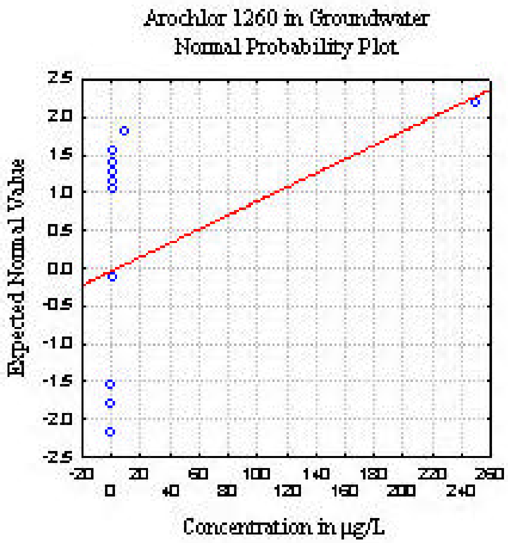
Marino Brothers Scrapyard
Arochlor 1260 in Groundwater





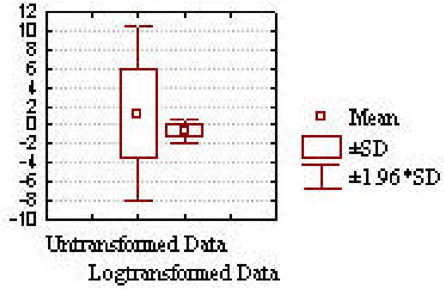




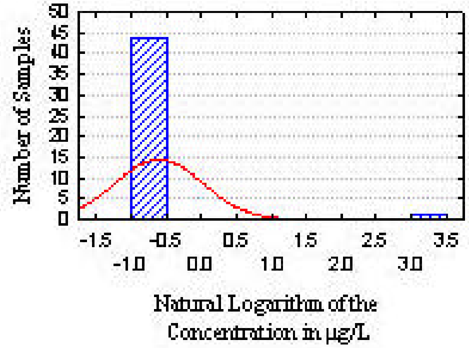


Marino Brothers Scrap Yard
Aroclor 1248 in Groundwater

Aroclor 1248 in Groundwater
Box & Whisker Plot



Aroclor 1248 in Groundwater
Histogram Logtransformed Data
K-S d=.53703, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.13525, p=.00000



Aroclor 1248 in Groundwater
Historgram Untransformed Data
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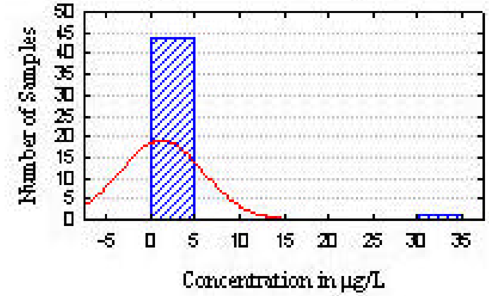
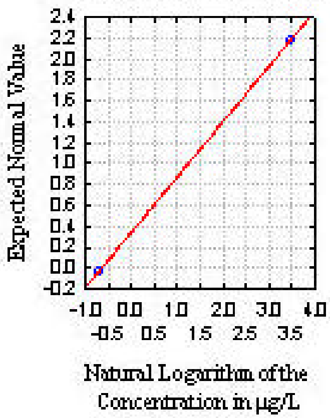
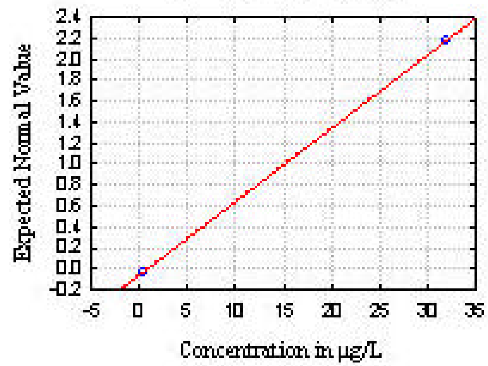
Shapiro-Wilk W=.13525, p=.00000



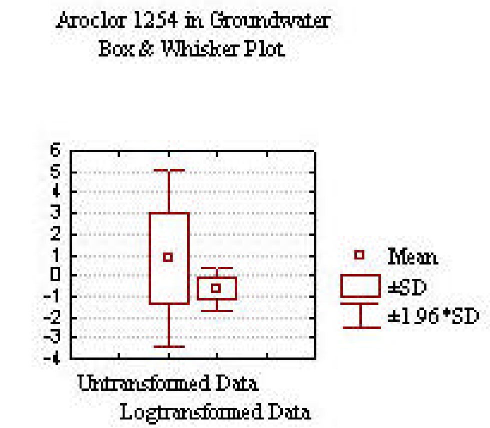
Aroclor 1248 in Groundwater
Lognormal Probability Plot

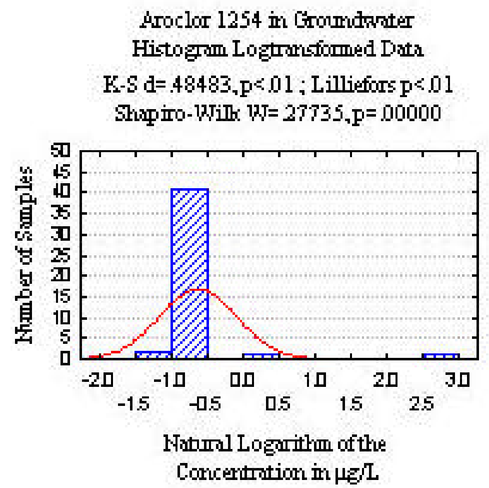


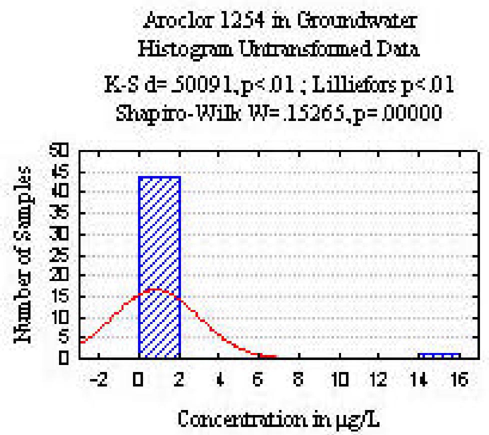
Aroclor 1248 in Groundwater
Normal Probability Plot

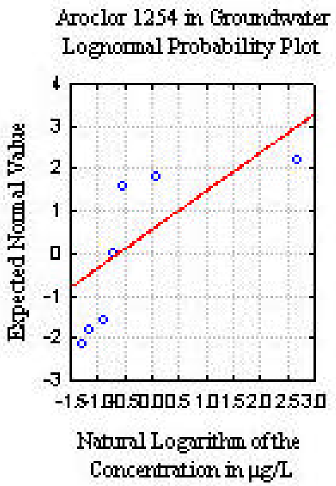


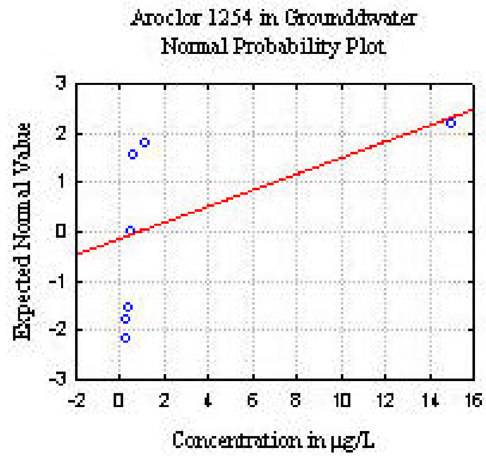
Marino Brothers Scrap Yard
Aroclor 1254 in Groundwater



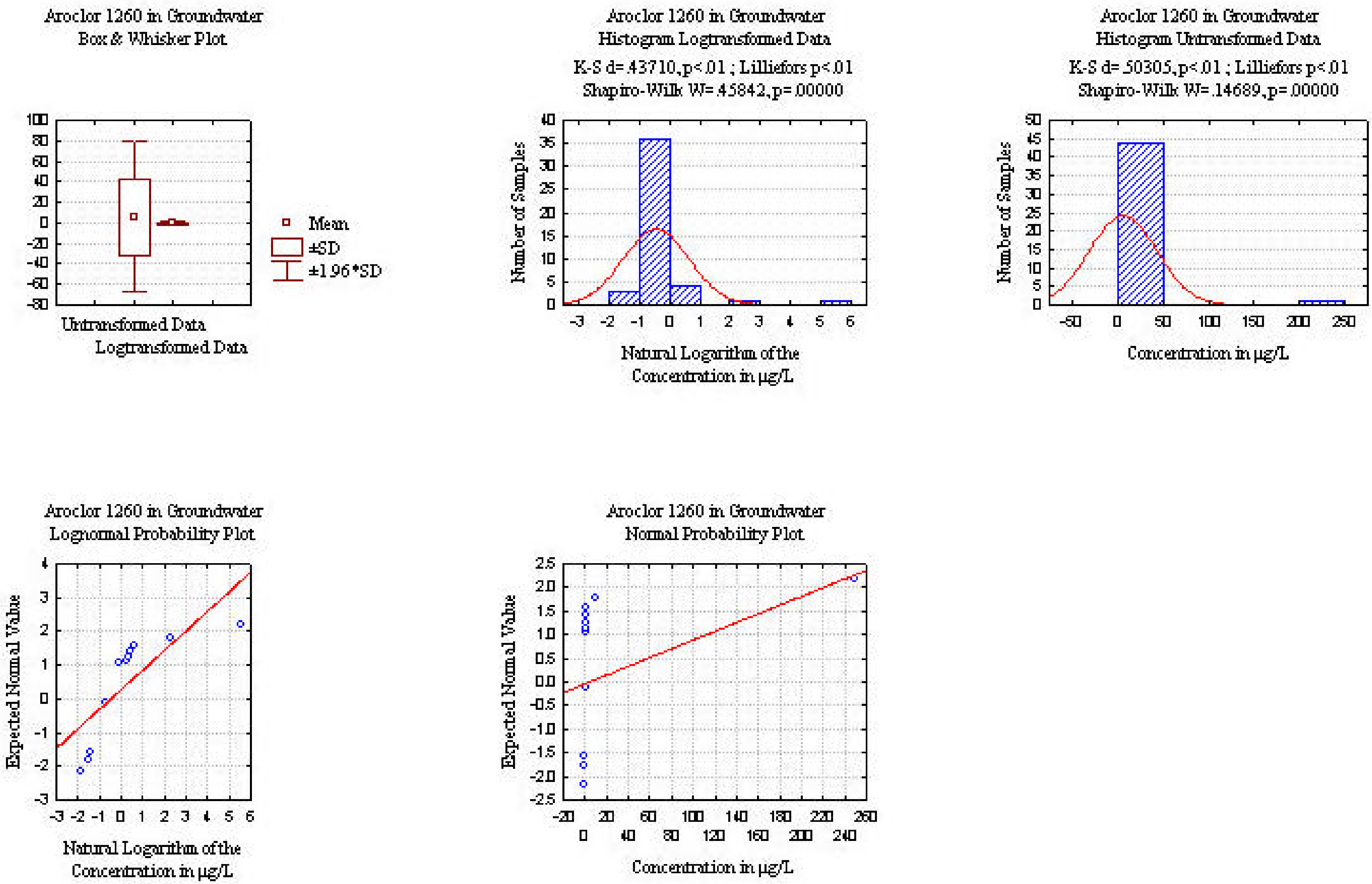




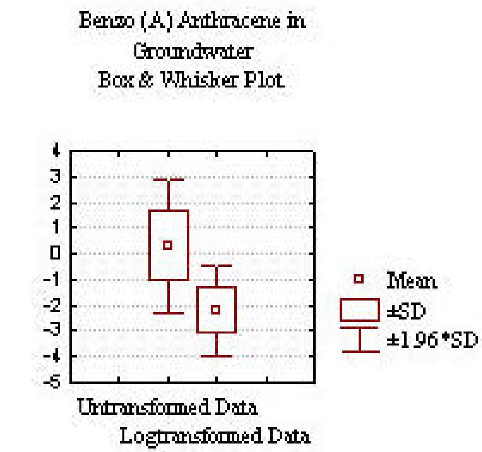


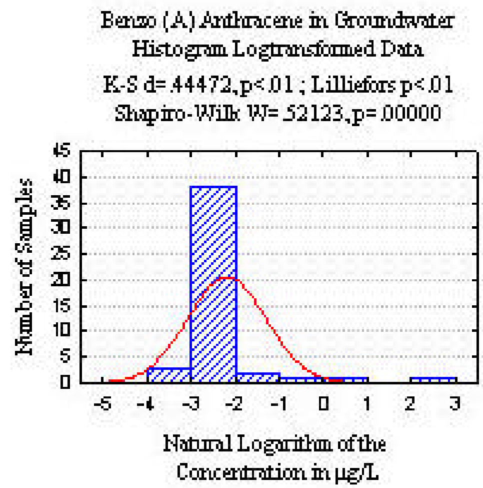


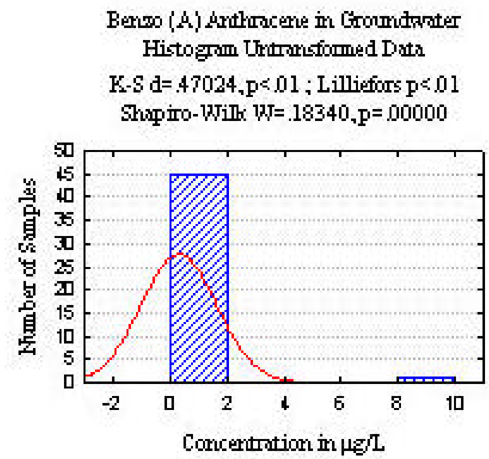
Marino Brothers Scrap Yard
Aroclor 1260 in Groundwater

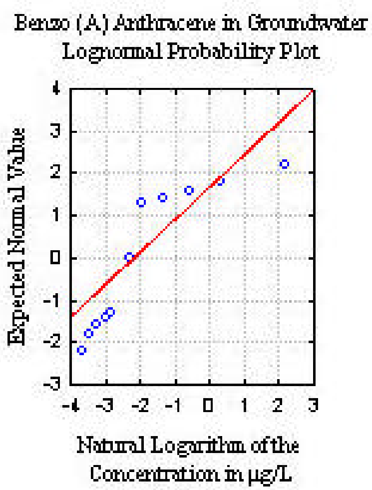


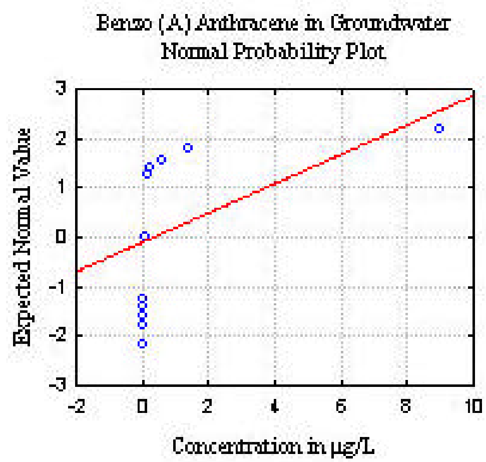
Marino Brothers Scrap Yard
Benzo (A) Anthracene in Groundwater



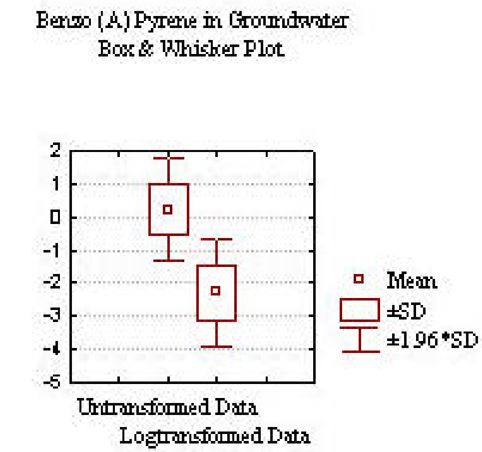


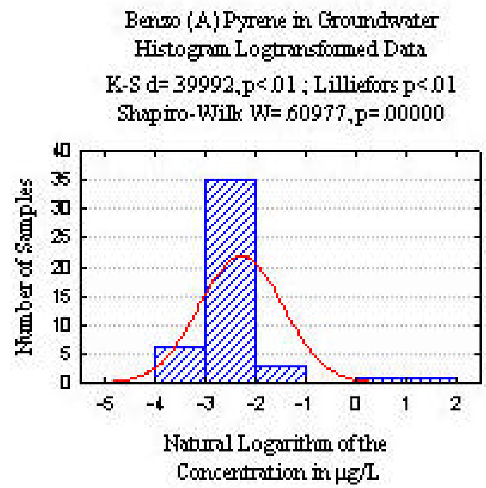


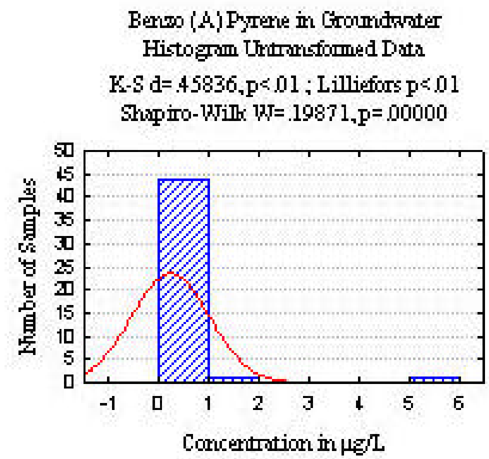


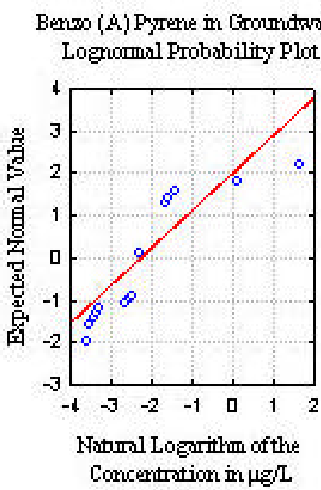


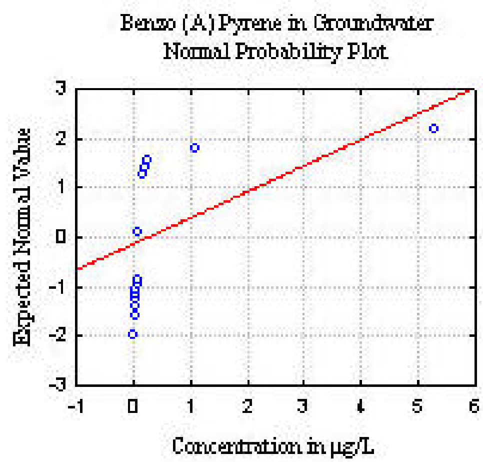
Marino Brothers Scrap Yard
Benzo (A) Pyrene in Groundwater



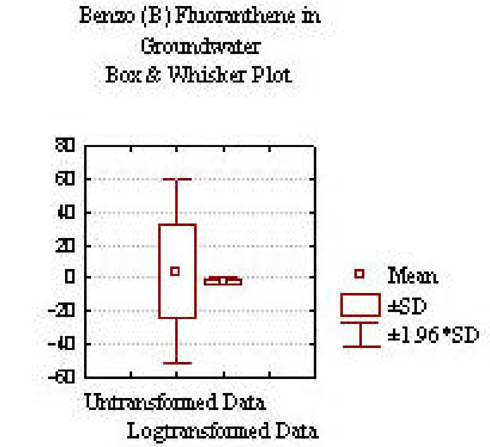


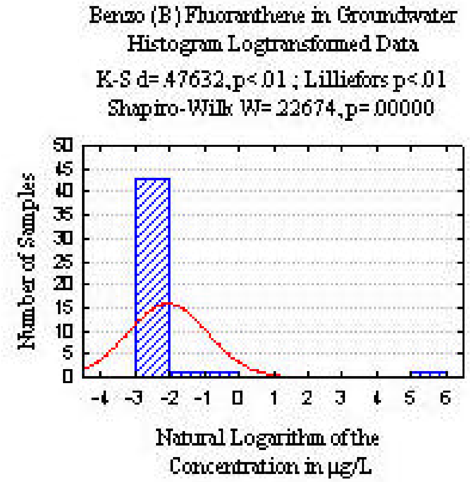


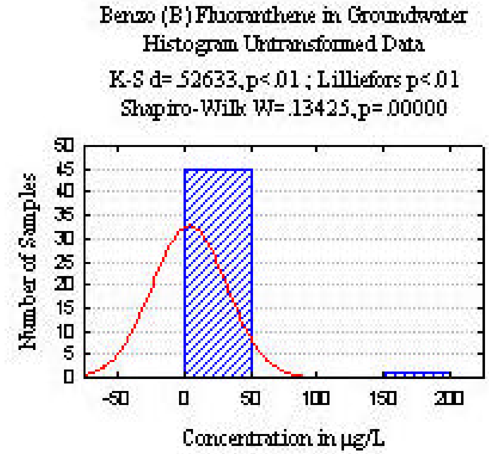


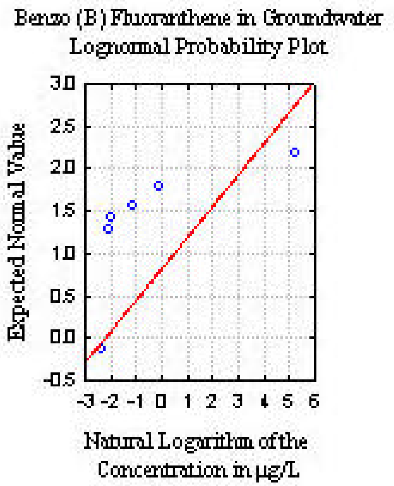


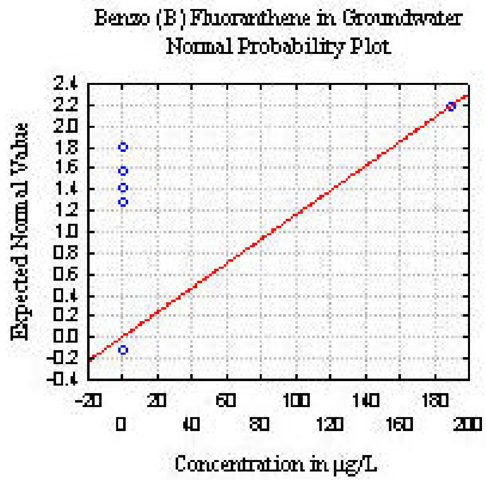
Marino Brothers Scrap Yard
Benzo (B) Fluoranthene in Groundwater



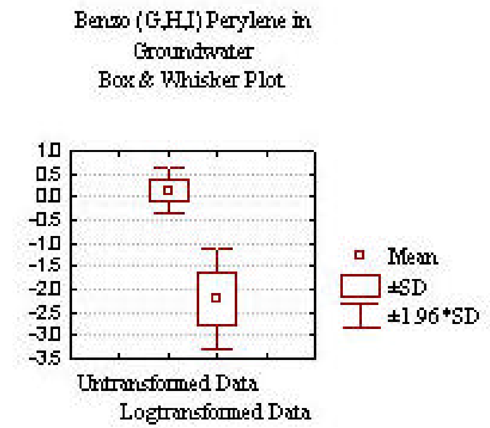


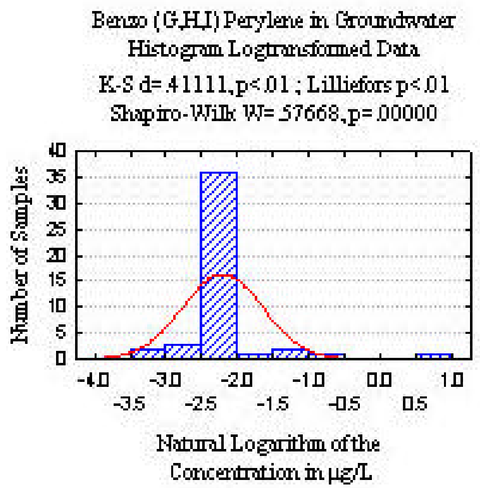


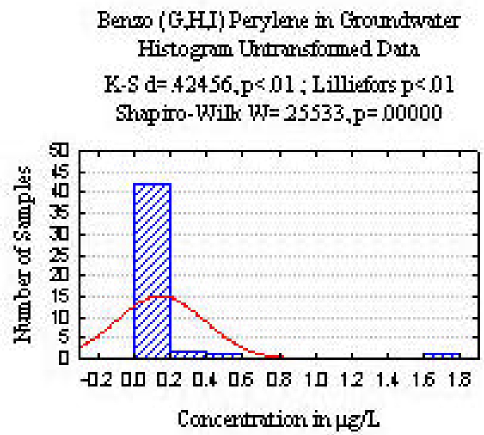


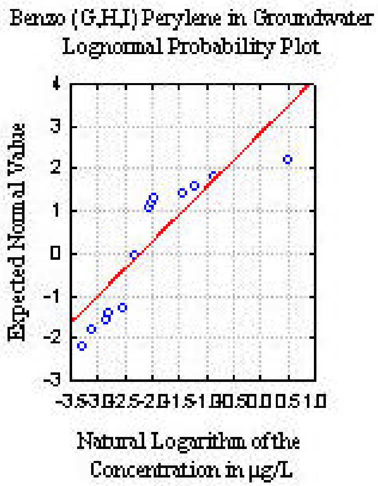


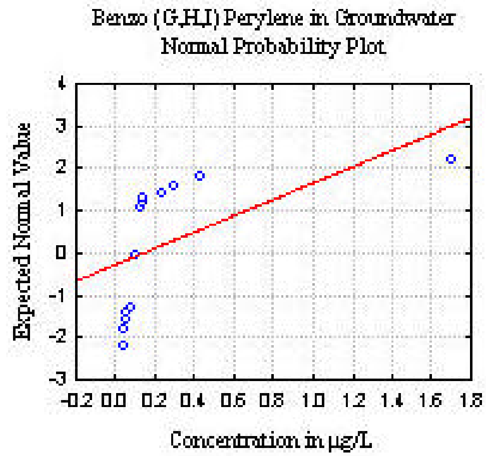
Marino Brothers Scrap Yard
Benzo (G,H,I) Perylene in Groundwater





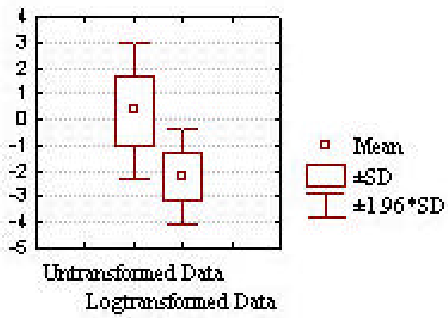




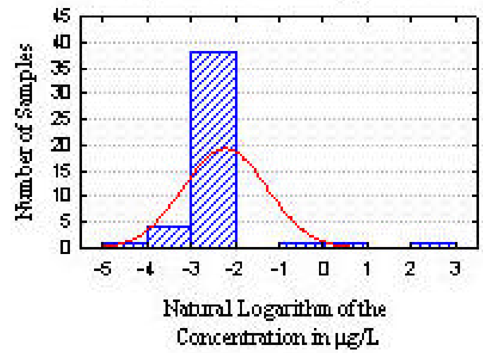


Marino Brothers Scrap Yard
Benzo (K) Fluoranthene in Groundwater

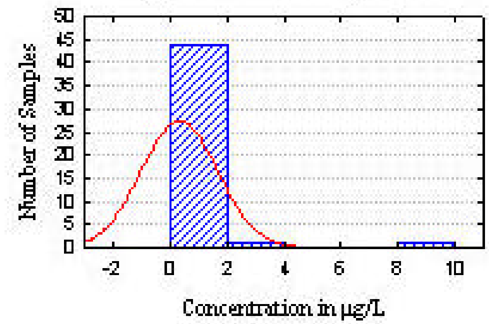
Benzo (K) Fluoranthene in Groundwater
Box & Whisker Plot



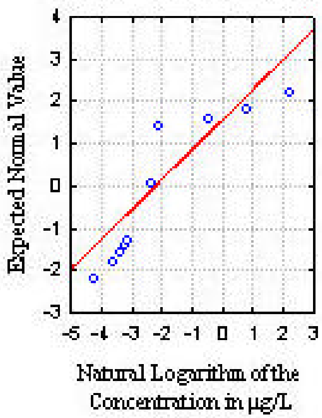
Benzo (K) Fluoranthene in Groundwater
Histogram Logtransformed Data
K-S d=.44603, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.51089, p=.00000



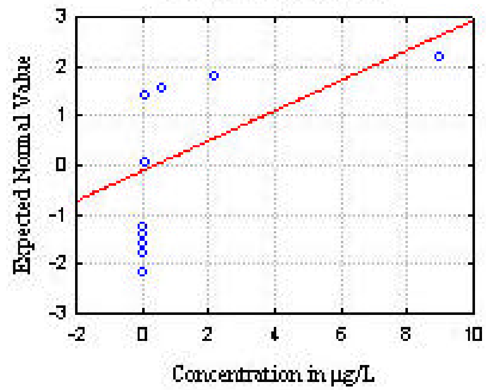
Benzo (K) Fluoranthene in Groundwater
Histogram Untransformed Data
K-S d=.50092, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.19715, p=.00000



Benzo (K) Fluoranthene in Groundwater
Lognormal Probability Plot

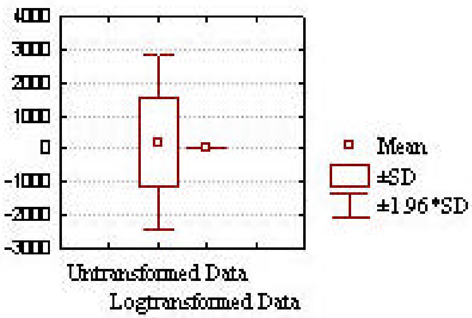


Benzo (K) Fluoranthene in Groundwater
Normal Probability Plot

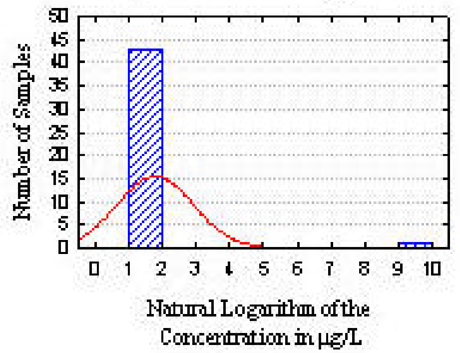


Marino Brothers Scrap Yard
Bis (2-Ethylhexyl) Phthalate in Groundwater

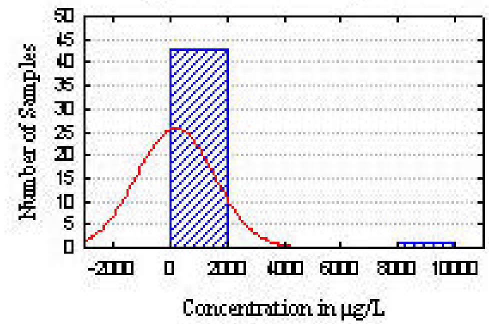
Bis (2-Ethylhexyl) Phthalate in Groundwater
Box & Whisker Plot



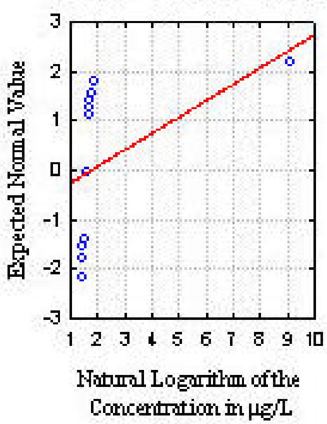
Bis (2-Ethylhexl) Phthalate in Groundwater
Histogram Logtransformed Data
K-S d=.45911, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.17199, p=.00000



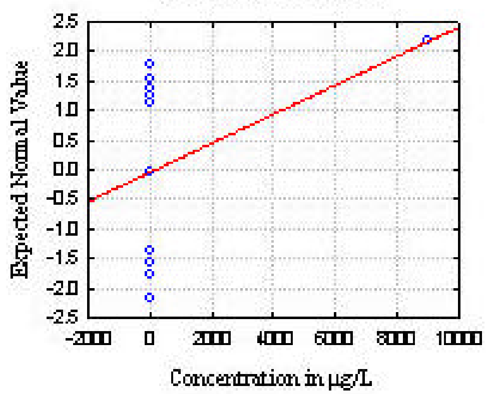
Bis (2-Ethylhexyl) Phthalate in Groundwater
Histogram Untransformed Data
K-S d=.53673, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.13758, p=.00000



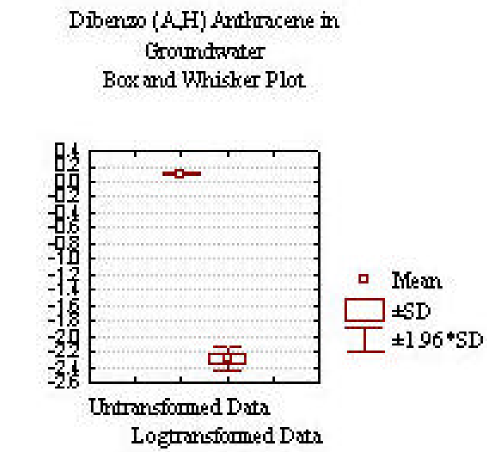
Bis (2-Ethylhexl) Phthalate in Groundwater
Lognormal Probability Plot

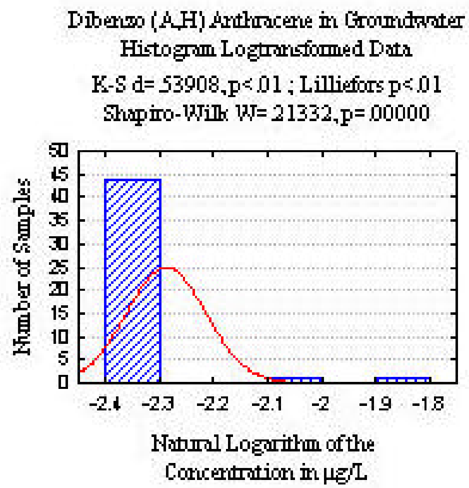


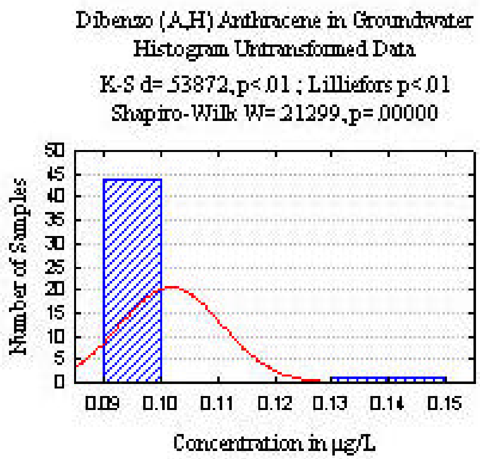
Bis (2-Ethylhexyl) Phthalate in Groundwater
Normal Probability Plot

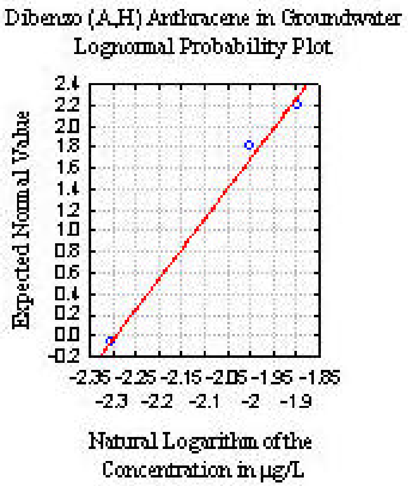


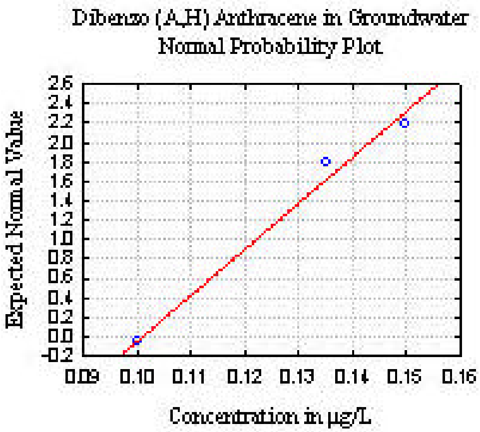
Marino Brothers Scrap Yard
Dibenzo (A,H) Anthracene in Groundwater



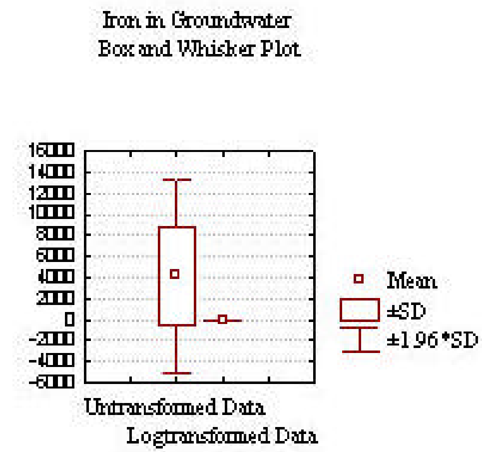


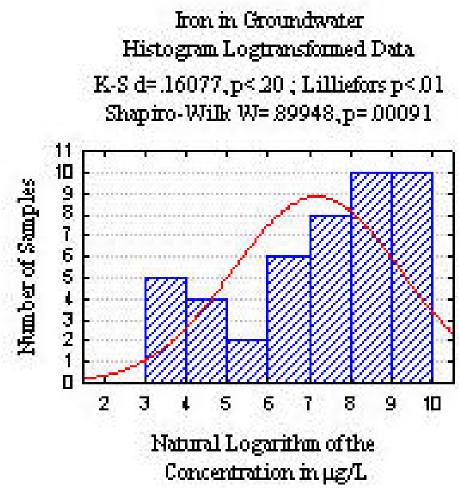


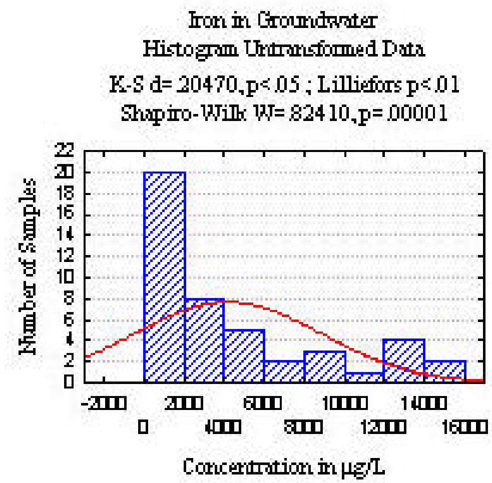


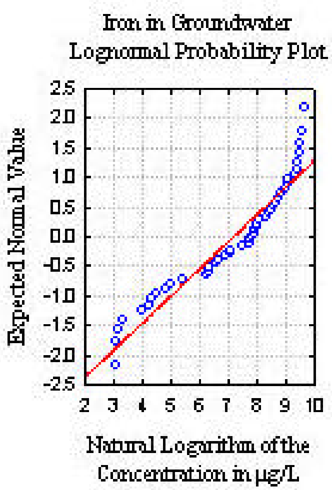


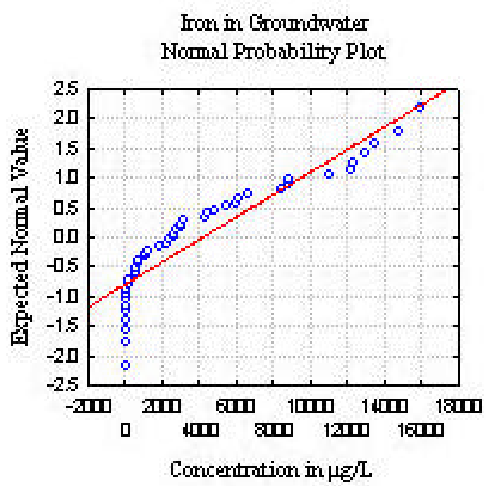
Marino Brothers Scrap Yard
Iron in Groundwater





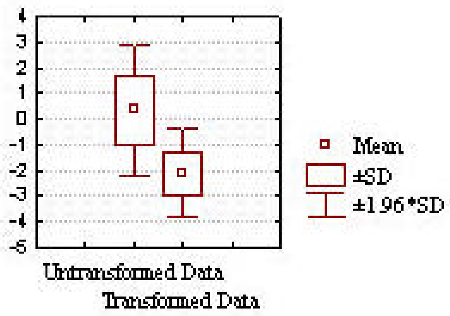




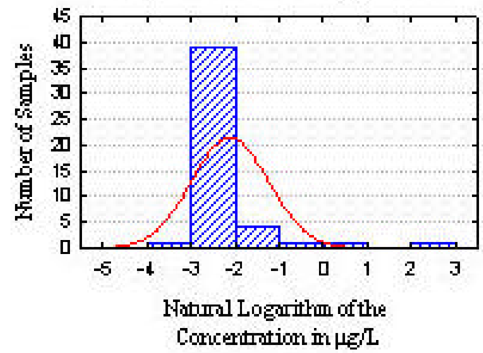


Marino Brothers Scrap Yard
Indeno (1,2,3-CD) Pyrene in Groundwater

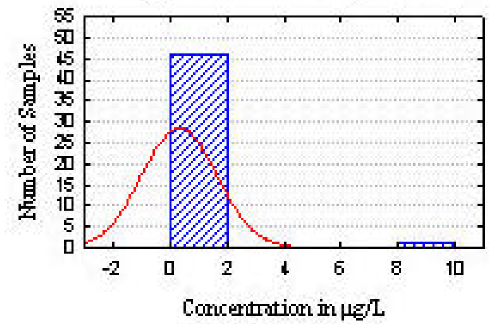
Indeno (1,2,3-CD) Pyrene in Groundwater
Box & Whisker Plot



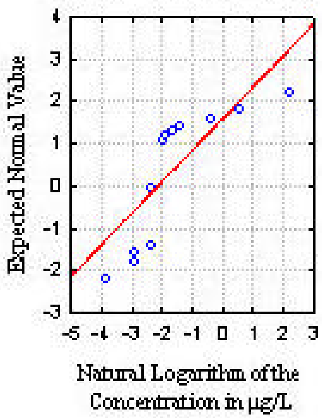
Indeno (1,2,3-CD) Pyrene in Groundwater
Histogram Logtransformed Data
K-S d=.43778, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.48244, p=.00000



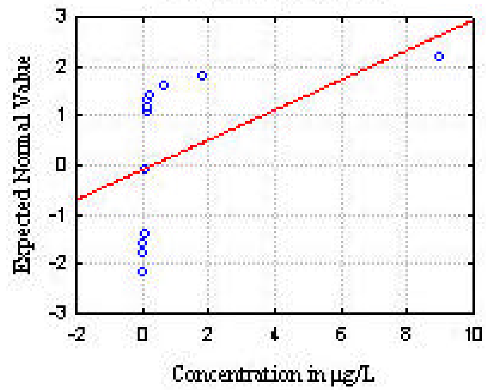
Indeno (1,2,3-CD) Pyrene in Groundwater
Histogram Untransformed Data
K-S d=.46698, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.19087, p=.00000



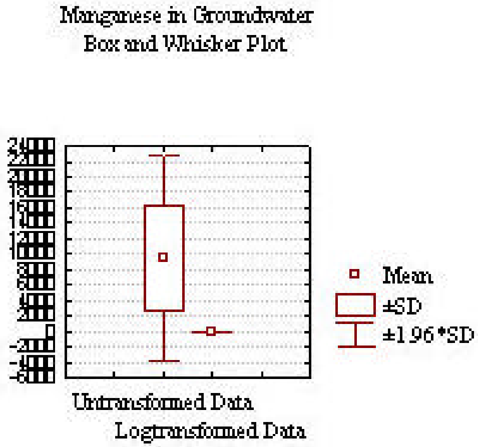
Indeno (1,2,3-CD) Pyrene in Groundwater
Lognormal Probability Plot

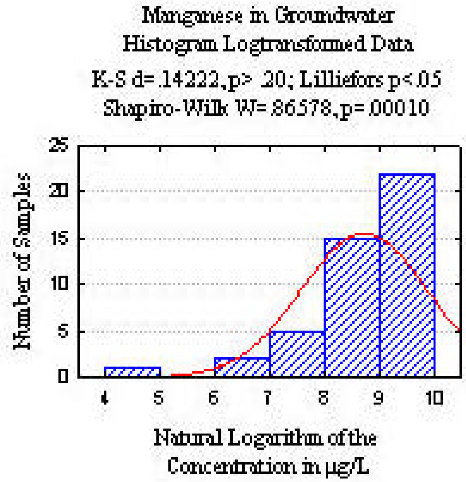


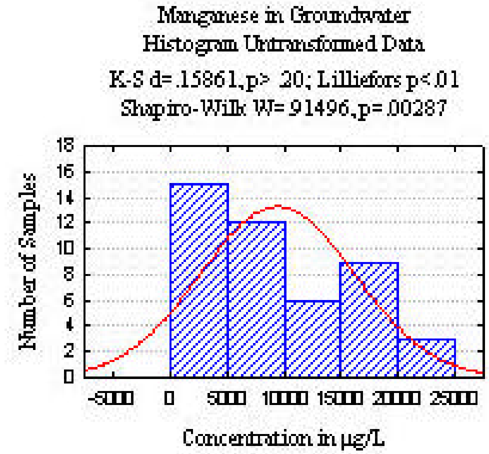
Indeno (1,2,3-CD) Pyrene in Groundwater
Normal Probability Plot

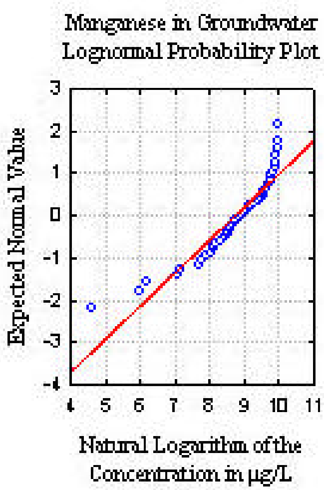


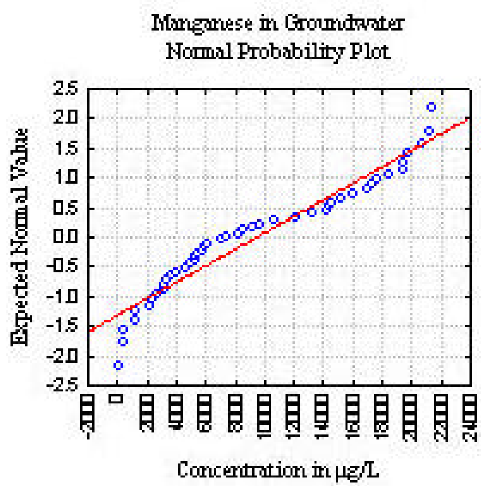
Marino Brothers Scrap Yard
Manganese in Groundwater



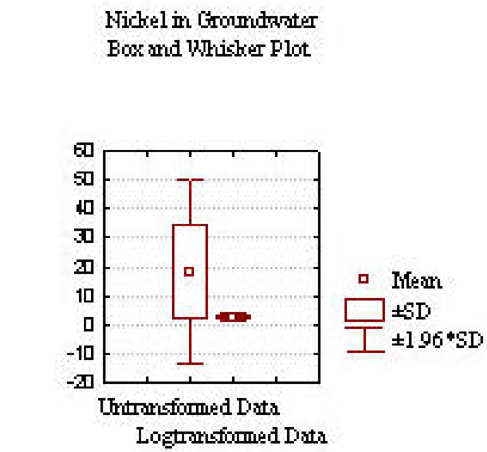


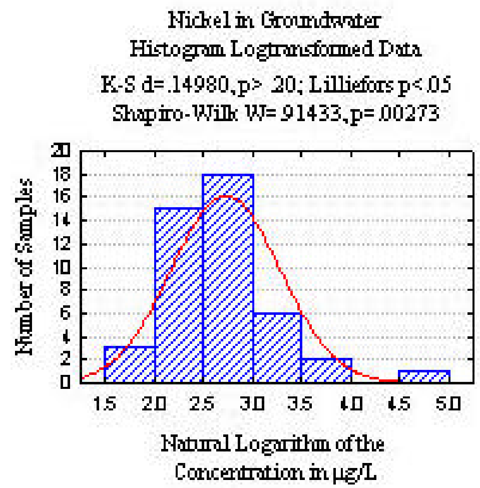


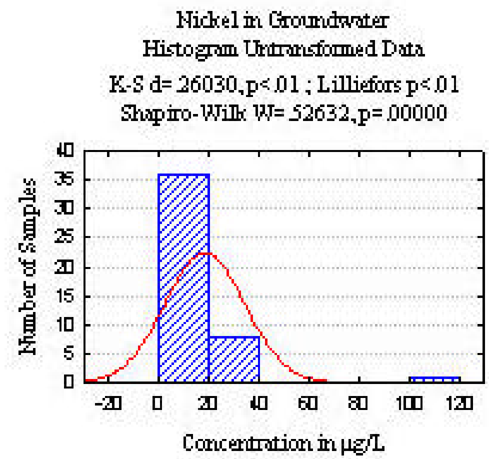


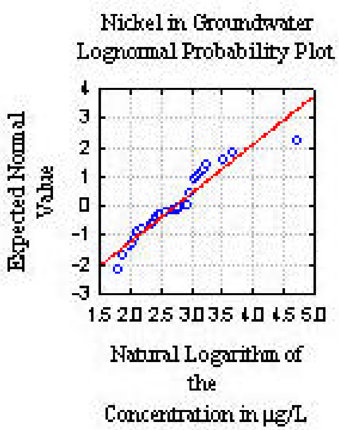


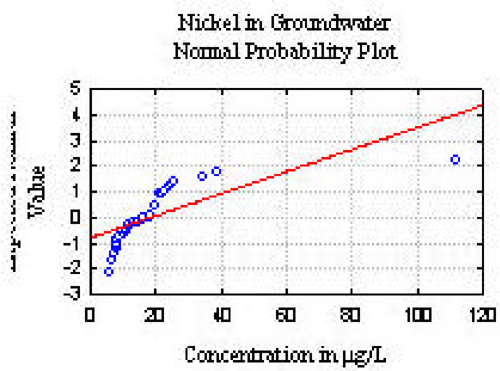
Marino Brothers Scrap Yard
Nickel in Groundwater





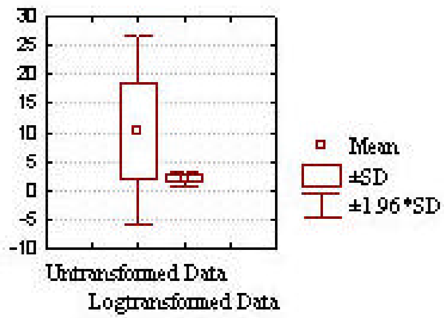




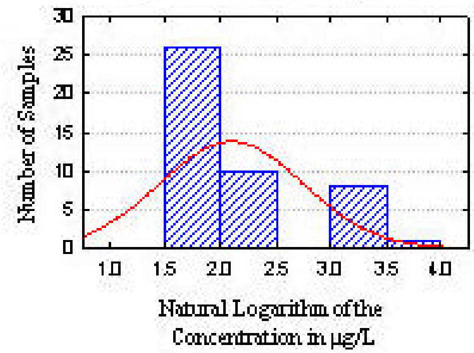


Marino Brothers Scrap Yard
Thallium in Groundwater

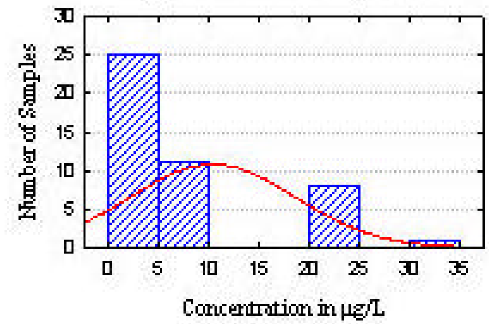
Thallium in Groundwater
Box & Whisker Plot



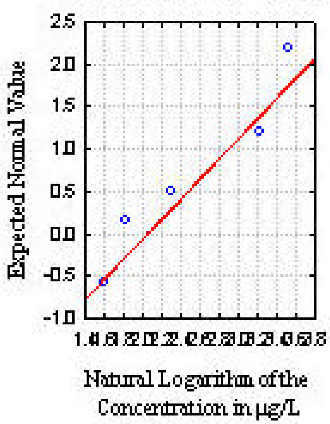
Thallium in Groundwater
Histogram Logtransformed Data
K-S d=.32911, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.72215, p=.00000



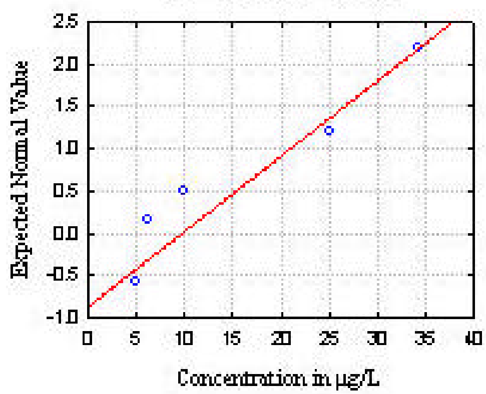
Thallium in Groundwater
Histogram Untransformed Data
K-S d=.31657, p<.01 ; Lilliefors p<.01
Shapiro-Wilk W=.66161, p=.00000



Thallium in Groundwater
Lognormal Probability Plot



Thallium in Groundwater
Normal Probability Plot



ENCLOSURE #2
SCREENING LEVEL RISK ANALYSIS

Enclosure #2
Part 2-1
Table of Contents

Enclosure #2 Contents

1) Enclosure #2 Contents (Word)

2) Approach for the Development of Site-Specific Standards (Word)

3) Exposure Assumptions (Excel)

4) Site Specific Standards (Excel)

Enclosure #2
Part 2-2
Approach for the Development of Site-Specific Standards

DEVELOPMENT OF SITE-SPECIFIC STANDARDS FOR SOIL RISK DRIVERS AT THE MARINO LANDFILL SITE

Site-specific soil standards were developed for all chemicals in soil determined to be risk drivers. Risk drivers in soil were identified by comparing the maximum concentration to the lower of the direct-contact medium-specific concentration (MSC) or soil-to-groundwater (S/G) value. The direct-contact MSC is designed to protect individuals from any adverse impacts associated with direct contact with the soil, particularly inadvertent soil ingestion. The S/G value is designed to protect the quality of underlying groundwater. Any chemical with a maximum concentration less than both the direct contact MSC and the S/G value was eliminated as a potential risk driver. The resulting list of inorganic and organic risk drivers is shown in Table 1.

Site-specific soil standards were developed for each risk driver shown in Table 1. Calculation of these standards differs from the soil MSCs, mainly in that they assume a recreational rather than a residential exposure scenario for the site. The standards were conservatively based on the exposure occurring to a hypothetical 6-year-old child and include exposure occurring through incidental soil ingestion, dermal contact with soil, and inhalation of soil particulates. The exposure scenario is designed to protect a child who would play at the site 2 hours per day (hr/day), 2 days/week, for 6 months out of the year (52 days/year). A recreational soil ingestion value was derived by adjusting the standard value used for residential exposure (200 mg/day) based on 2 hours/day exposure instead of a 16 hr/day exposure, resulting in a value of 25 mg/day per visit. A recreational inhalation rate value of 3.5 cubic meters per day (m^3/day) is based on an inhalation rate for child 6-13 years old engaged in moderate activity levels (U.S. Environmental Protection Agency [EPA] 1997). This rate assumes a child breathes at the rate of 1.74 m^3/hr for 2 hours while at the site.

For carcinogenic chemicals, the standard used is the lower of the standard based on noncancer effects or the level based on cancer effects. An acceptable target risk of 1E-05 was used for carcinogenic chemicals. The equations used to calculate the site-specific standards for both carcinogenic and noncarcinogenic chemicals are shown in Equation 1 and 2. Table 2 lists all the exposure parameter values used in the calculations. The site-specific standard for lead was calculated using the *Integrated Exposure Uptake Biokinetic Model for Lead in Children* (EPA 1994). The final site-specific standards are summarized in Table 1.

References

EPA.1994. Integrated Exposure Uptake Biokinetic Model for Lead in Children. Office of Research and Development. Washington, D.C.

EPA.1997. Exposure Factors Handbook. Volume 1. General Factors. EPA/600/P-95/002Fa. Office of Research and Development. Washington, D.C.

Equation 1

Equation Used to Calculate Site-Specific Soil Standards for Carcinogenic Chemicals

$$SSS = \frac{TR \ x \ BW \ x \ AT}{EF \ x \ ED \left[\left(\frac{IRS \ x \ CSF_o}{10^6 \ mg/kg} \right) + \left(\frac{SA \ x \ AF \ x \ ABS \ x \ CSF}{10^6 \ mg/kg} \right) + \left(\frac{IRA \ x \ CSF_i}{PEF} \right) \right]}$$

Equation 2

Equation Used to Calculate Site-Specific Soil Standards for Noncarcinogenic Chemicals

$$SSS = \frac{THQ \ x \ BW \ x \ AT}{EF \ x \ ED \left[\left(\frac{IRS}{RfD_o \ x \ 10^6 \ mg/kg} \right) + \left(\frac{SA \ x \ AF \ x \ ABS}{RfD_o \ x \ 10^6 \ mg/kg} \right) + \left(\frac{IRA}{RfD_i \ x \ PEF} \right) \right]} \text{ SSS}$$

Where:

SSS	=	site-specific soil standard (mg/kg)
IRS	=	ingestion rate of soil (mg/kg)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
THQ	=	target hazard quotient (unitless)
TR	=	target risk (unitless)
BW	=	body weight (kg)
AT	=	averaging time (days)
SA	=	skin surface area (cm^2)
AF	=	adherence factor (mg/cm^2)
ABS	=	dermal absorption factor (unitless)
IRA	=	inhalation rate (m^3/day)
PEF	=	particulate emission factor (m^3/kg)
CSF_o	=	oral route cancer slope factor (unitless)
CSF_i	=	inhalation route cancer slope factor (unitless)
RfD_o	=	oral route Reference Dose (mg/kg/day)
RfD_i	=	inhalation route Reference Dose (mg/kg/day)
AF	=	adherence factor (mg/cm^2)
ABS	=	dermal absorption (unitless)

Enclosure #2
Part 2-3
Site-Specific Standards

Table 1

Site-Specific Standards for Risk Drivers in Soil

Chemical Risk Driver	Site-Specific Standard (mg/kg)
Inorganics	
Antimony	520
Arsenic	196
Cadmium	2,059
Iron	389,944
Lead	1,300
Mercury	390
Thallium	86
Organics	
Aroclor 1248	59
Aroclor 1254	59

Notes:

mg/kg   milligram per kilogram

Enclosure #2
Part 2-4
Exposure Assumptions

Table 2
Human Health Exposure Parameters Used to Calculate Site-Specific Standards

Exposure Parameter	Notation	Units	Value	Reference
Child body weight	BW	kg	15	EPA (2000a)
Averaging time (carcinogens)	AT	days	25,550	EPA (2000a)
Averaging time (noncarcinogens)	AT	days	2,190	EPA (2000a)
Exposure frequency	EF	days/yr	52	See text.
Exposure duration	ED	yr	6	EPA (2000a)
Child soil ingestion rate	IRS	mg/day	25	See text.
Cancer slope factor-oral	CSFo	risk per mg/kg/day	chemical specific	EPA (2000b)
Cancer slope factor-inhalation	CSFi	risk per mg/kg/day	chemical specific	EPA (2000b)
Reference dose-oral	RfDo	mg/kg/day	chemical specific	EPA (2000b)
Reference dose-inhalation	RfDi	mg/kg/day	chemical specific	EPA (2000b)
Child skin surface area	SA	cm^2	2,800	EPA (2000a)
Skin adherence factor	AF	mg/cm^2	0.2	EPA (2000a)
Dermal absorption efficiency	ABS	unitless	chemical specific	EPA (2000a)
Child inhalation rate	IRA	m^3/day	3.5	See text.
Particulate emission factor	PEF	m^3/kg	1.32E+09	EPA (2000a)

NA = Not applicable.
kg = kilograms
mg = milligrams
cm^2 = square centimeters
m^3 = cubic meters
EPA (2000a). Region 9 Preliminary Remediation Goals
EPA (2000b). Integrated Risk Information System (IRIS) (www.epa.gov/iris)

ENCLOSURE #3
ISOCONCENTRATION MAPS AND CROSS-SECTIONS

Enclosure #3
Part 3-1
Table of Contents

Enclosure #3 Table of Contents

1) Iron in Soil vs. Residential MSCs 0-2 Foot Interval (PDF)
2) Iron in Soil vs. Residential MSCs 2-4 Foot Interval (PDF)
3) Iron in Soil vs. Residential MSCs 6-8 Foot Interval (PDF)
4) Iron in Soil vs. Residential MSCs 10-12 Foot Interval (PDF)

h) Lead (Folder)
1) Lead in Soil vs. Residential MSCs 0-2 Foot Interval (PDF)
2) Lead in Soil vs. Residential MSCs 2-4 Foot Interval (PDF)
3) Lead in Soil vs. Residential MSCs 6-8 Foot Interval (PDF)
4) Lead in Soil vs. Residential MSCs 10-12 Foot Interval (PDF)

i) Mercury (Folder)
1) Mercury in Soil vs. Residential MSCs 0-2 Foot Interval (PDF)
2) Mercury in Soil vs. Residential MSCs 2-4 Foot Interval (PDF)

j) Zinc (Folder)
1) Zinc in Soil vs. Residential MSCs 0-2 Foot Interval (PDF)
2) Zinc in Soil vs. Residential MSCs 2-4 Foot Interval (PDF)

3-3) Cross-Sections for Primary COPC's Based on Site-Specific Standards (Folder)

a) Cross Section Development (Word)
b) PDF Cross Sections (Folder)
1) Cross Section Reference (PDF)
2) Aroclor 1248 (Folder)
a) Aroclor 1248 in Soil Transects A to A' (PDF)
b) Aroclor 1248 in Soil Transects B to B' (PDF)
c) Aroclor 1248 in Soil Transects C to C' (PDF)
d) Aroclor 1248 in Soil Transects D to D' (PDF)
e) Aroclor 1248 in Soil Transects E to E' (PDF)
f) Aroclor 1248 in Soil Transects F to F' (PDF)
3) Aroclor 1254 (Folder)
a) Aroclor 1254 in Soil Transects A to A' (PDF)
b) Aroclor 1254 in Soil Transects B to B' (PDF)
c) Aroclor 1254 in Soil Transects C to C' (PDF)
d) Aroclor 1254 in Soil Transects D to D' (PDF)
e) Aroclor 1254 in Soil Transects E to E' (PDF)
f) Aroclor 1254 in Soil Transects F to F' (PDF)
4) Arsenic (Folder)
a) Arsenic in Soil Transects A to A' (PDF)
b) Arsenic in Soil Transects B to B' (PDF)
c) Arsenic in Soil Transects C to C' (PDF)
d) Arsenic in Soil Transects D to D' (PDF)
e) Arsenic in Soil Transects E to E' (PDF)
f) Arsenic in Soil Transects F to F' (PDF)
5) Iron (Folder)
a) Iron in Soil Transects A to A' (PDF)
b) Iron in Soil Transects B to B' (PDF)
c) Iron in Soil Transects C to C' (PDF)
d) Iron in Soil Transects D to D' (PDF)
e) Iron in Soil Transects E to E' (PDF)
f) Iron in Soil Transects F to F' (PDF)
6) Lead (Folder)
a) Lead in Soil Transects A to A' (PDF)
b) Lead in Soil Transects B to B' (PDF)
c) Lead in Soil Transects C to C' (PDF)
d) Lead in Soil Transects D to D' (PDF)
e) Lead in Soil Transects E to E' (PDF)
f) Lead in Soil Transects F to F' (PDF)
7) Mercury (Folder)

a) Mercury in Soil Transects A to A’ (PDF)
b) Mercury in Soil Transects B to B’ (PDF)
c) Mercury in Soil Transects C to C’ (PDF)
d) Mercury in Soil Transects D to D’ (PDF)
g) Mercury in Soil Transects E to E’ (PDF)
h) Mercury in Soil Transects F to F’ (PDF)

Enclosure #3
Part 3-2
Site Maps

Mapping Constituents Using FIELDS

MAPPING CONSTITUENTS USING FIELDS

FIELDS is a software system developed by the U.S. Environmental Protection Agency (EPA) to support sampling and remedial decision-making. This project used FIELDS to assist in the development of a preliminary systematic plan for remediation at the Marino Scrap Yard site (the site).

FIELDS Software

FIELDS was developed on an ArcView platform using many ArcView commands, but FIELDS incorporates additional modules, several of which were used during the course of this project. FIELDS is intended to provide a means to:

- Query a database and develop shapefiles
- Contour data
- Create maps
- Calculate removal volumes

Each one of these steps is discussed in detail below.

Querying the Database and Process Shapefiles

FIELDS' query tool can be used to select data to meet specific criteria, then process the data into shapefiles to be used as themes in ArcView. The Query dialog box indicates data can be selected by identifying a depth interval and analyte, and choosing one of several query options. The query options include: select the maximum concentration of a constituent in a specific depth interval; select the maximum concentration of a constituent at a single location; average the concentrations of a constituent within a specific depth interval; or average all data for a constituent at one location. The resulting 2 dimensional array of values can be converted to a shapefile for contouring through the "save as" command.

In practice, the query tool was unable to sort by analyte or depth interval, requiring these steps to be conducted external to the FIELDS program. This deficiency has been reported to the software developers, who are working to correct it for the next version.

Contour the Data

Two themes (shapefiles) must be loaded prior to running one of the contouring algorithms: a point theme (created in the previous step) and a polygon theme (which can be imported or created in FIELDS using ArcView tools). The point theme contains the scattered data (constituent concentrations) to be contoured. The polygon theme provides the boundary within which the contours will be calculated. Two contouring algorithms are currently available in FIELDS: natural neighbor and inverse distance. Natural neighbor was selected based on the recommendations of the FIELDS development team. The natural neighbor algorithm calculates a concentration value at each node based on the surrounding measured data values; the measured values are weighted according to their proximity to the node (neighboring values carry the most weight). FIELDS currently supports only 2 dimensional contouring.

Creating the Maps

Maps created with the FIELDS contouring algorithms can be sent to a plotter or plotted to a postscript file for later conversion to portable document format (PDF) format. The ArcView platform provides substantial flexibility in output options. Layouts can be saved and reused for different analytes and depth intervals. Aerial photos and AutoCAD base maps can be incorporated into output plots.

Calculating Volumes of Soil Exceeding Site-Specific Standards

FIELDS provides several tools to analyze and evaluate remedial options. These include a mass/volume calculator that calculates the volume enclosed within a contour interval specified by the user. The user can specify the site-specific standard to provide an estimate of the volume of soil to be removed within a specified depth interval.

APPLICATION TO MARINO SCRAP YARD PROJECT

FIELDS mapping and analysis was conducted to support the development of a systematic plan for remediation at the site.

Processing of Soil Data

Data were processed using Microsoft Access before entry into FIELDS because the query tool did not perform as expected. The soil data were analyzed using STATISTICA to identify those constituents with maximum reported values that exceeded the appropriate Pennsylvania Department of Environmental Protection (PADEP) medium-specific concentrations (MSC) from the Act 2 Technical Guidance (PADEP, 2002). Analytes that had maximums exceeding the PADEP MSCs were considered chemicals of potential concern (COPC) and were evaluated using FIELDS.

Because FIELDS is a 2 dimensional mapping program, the data were grouped into the following 2-foot depth intervals for mapping and analysis: 0.0 to 2.0 feet below ground surface (bgs), 2.0 to 4.0 feet bgs, 6.0 to 8.0 feet bgs, and 10 to 12 feet bgs. These intervals correspond to the greatest data density. The 4.0-to 6.0-foot interval, by contrast, contained too few data to contour. Attachment 1 provides a list of the COPCs for the site.

A contouring program, such as the natural neighbor algorithm used in FIELDS, interpolates between scattered data points to calculate concentrations at nodes on a regular grid. The resulting matrix of values is smoothed because of the averaging of multiple data points at each grid node. The greater the density of data, the more smoothing will occur. Therefore, the maximum calculated value is lower than the maximum point value in the input data set. However, this smoothing effect provides a more realistic estimate of ambient concentrations, particularly if used in a risk-based decision-making process. Maximum calculated values for each COPC and depth intervals that could be mapped are listed on the table provided as part of this attachment.

Analysis Based on PADEP Residential MSCs

Contour maps were created for each COPC and depth interval that had maximum calculated concentration exceeding the identified appropriate residential MSCs for soil based on PADEP's Act 2 Technical Guidance (PADEP, 2002). Twenty-seven maps depicting the areal extent of COPC concentrations that exceed PADEP residential MSCs were created. Ten COPCs were found to exceed PADEP residential MSCs in at least one of the four depth intervals. Lead, arsenic and iron exceeded the PADEP residential MSCs in all four depth intervals, while mercury, cadmium, and the three polychlorinated biphenyls (PCBs) only exceeded PADEP residential MSCs in the upper four feet; antimony exceeded the PADEP residential MSC in the upper three depth intervals.

The distribution and magnitude of some of the COPCs, such as lead, mercury and the PCBs (Aroclor 1248, 1254 and 1260), are indicative of site-related contamination. Certain inorganic COPCs, such as arsenic, however, may exceed the PADEP residential MSCs primarily as a result of high background concentrations created by the presence of slag commonly used as fill throughout the region.

Analysis Based on Site-Specific Standards

In order to provide a more realistic risk-based estimation of the remedial action possibly required at the site, site-specific standards were developed. A FIELDS analysis was again conducted by mapping COPC concentrations exceeding the site-specific standards. Less than half of the COPCs that exceeded the PADEP residential MSCs were found to exceed the site-specific standards. Arsenic, cadmium, and zinc drop off the list of COPCs when site-specific standards values are used. Only lead exceeds the site-specific standard at depths greater than 4 feet, and only near a single sample location.

Calculating Removal Volume with FIELDS

The mass/volume calculator included in FIELDS was used to provide a conservative estimate of the volume of soil removal necessary to bring soil concentrations below site-specific standards for all of the COPCs. The mass/volume calculator was used to develop a conservative estimate of soil volume to be removed (all soil exceeding site-specific standards is included in the total volume).

Lead was found to be the most widespread COPC. The maps developed for the site-specific standards showed that areas where other COPCs exceeded the site-specific standards were encompassed by the area where lead exceeded the standard. Therefore, lead was used as an indicator COPC for the purpose of performing volume calculations. Lead maps were used as the input data matrices; specifically, the matrices of calculated lead values in the 0.0 to 2.0-foot and the 2.0 to 4.0-foot depth intervals were input to the mass/volume calculator. The site-specific standard for lead (1,300 milligrams per kilogram [mg/kg]) was used as the cutoff; lead concentrations exceeding this value were assumed to require removal. These areas were multiplied by the 2 foot thickness to arrive at the volumes to be removed. FIELDs did not calculate a removal volume for the 6.0 to 8.0-foot interval. The estimated value for the missing depth interval (4.0 to 6.0 feet) was an arithmetic interpolation by Tetra Tech based on the adjacent depth intervals. This is a conservative approach because no removal volume was calculated for the lower interval. The total volume calculated to remove all soil exceeding site-specific standards is 18,043 cubic yards.

Index of Maps Prepared

Table 1

Cleanup Standards for Soil and FIELDS Results

Chemical Risk Driver	Site-Specific Standard (mg/kg)	PADEP Residential MSC[1] (mg/kg)	Depth Interval (feet)	Maximum Interpolated Concentration[2] (mg/kg)	Maps Made	
					Site-Specific Standard[3]	PADEP Residential MSC[3]
Antimony	520	27	0-2	1,461	X	X
			2-4	237		X
			6-8	37		X
			10-12	15		
Arsenic[4]	196	12	0-2	205		X
			2-4	86		X
			6-8	41		X
			10-12	53		X
Cadmium	2,059	38	0-2	602		X
			2-4	242		X
			6-8	33		
			10-12	57		X
Iron	389,944	66,000	0-2	511,842	X	X
			2-4	421,667	X	X
			6-8	280,626		X
			10-12	290,934		X
Lead	1,300	450	0-2	29,144	X	X
			2-4	9,422	X	X
			6-8	1,376	X	X
			10-12	1,100		X
Mercury	390	10	0-2	20,127	X	X
			2-4	72		X
			6-8	1.8		
			10-12	7.7		
Zinc	389,944	12,000	0-2	325,262		X
			2-4	74,247		X
			6-8	2,438		
			10-12	3,473		

Table 1

Cleanup Standards for Soil and FIELDS Results

Chemical Risk Driver	Site-Specific Standard (mg/kg)	PADEP Residential MSC[1] (mg/kg)	Depth Interval (feet)	Maximum Interpolated Concentration[2] (mg/kg)	Maps Made	
					Site-Specific Standard[3]	PADEP Residential MSC[3]
Aroclor 1248	59	9.9	0-2	2,449	X	X
			2-4	36.9		X
			6-8	0.7		
			10-12	3.1		
Aroclor 1254	59	4.4	0-2	33,009	X	X
			2-4	121	X	X
			6-8	2.5		
			10-12	1.5		
Aroclor 1260	59	4.4	0-2	1,753	X	X
			2-4	114	X	X
			6-8	4.8		X
			10-12	1		
Total Number of Maps:					**12**	**29**

Notes:

1 PADEP residential MSCs for arsenic, iron, aroclor 1248, aroclor 1254 and aroclor 1260 represent soil direct contact standards; remaining PADEP residential MSCs represent generic standards.

2 Maximum value interpolated by FIELDS' Natural Neighbor contouring algorithm. Contouring algorithm interpolates values of concentration at each node of a calculation grid by averaging all sample results and weighting sample results according to distance from node.

3 Only interpolated values greater than the standard (site-specific or PADEP residential MSCshown on maps. Maps were not made for constituents/depth intervals where interpolated values did not exceed the standard.

4 Contouring algorithm did not plot an area above the site-specific standard even though it assigned an upper bound of the highest contour interval above the site-specific standard of 196 mg/kg..

PADEP = Pennsylvania Department of Environmental Protection
MSC = Medium Specific Concentration

Table 1

Cleanup Standards for Soil and FIELDS Results

Chemical Risk Driver	Site-Specific Standard (mg/kg)	PADEP Residential MSC[1] (mg/kg)	Depth Interval (feet)	Maximum Interpolated Concentration[2] (mg/kg)	Maps Made	
					Site-Specific Standard[3]	PADEP Residential MSC[3]

mg/kg = milligrams per kilogram

Estimated Volume of Soil Requiring Removal Based on Areal Extent of Lead Above Site-Specific Standard

TABLE 2
Estimated Volume of Soil Requiring Removal
Based on Areal Extent of Lead Above Site-specific Standard

Depth Interval (feet)	Concentration Range (mg/kg)	Method of Estimation	Volume (cubic yards)
0.0 to 2.0	1,300.1 to 29,144	FIELDS[1]	11,750
2.0 to 4.0	1,300.1 to 9,422	FIELDS[1]	4,195
4.0 to 6.0	not calculated	averaged[2]	2097.5
6.0 to 8.0	1,300.1 to 1,376	FIELDS[1]	negligable[3]
Total			18,043

Notes:

1 FIELDS was used to interpolate and contour lead concentrations. Volume represents the contoured area above the site-specific standard multiplied by the thickness of the depth interval.

2 Data were too sparse to interpolate/contour constituent concentrations in the 4- to 6-foot interval. Volume is an average of the volumes calculated for adjoining depth intervals.

3 FIELDS mass/volume tool calculated did not calculate a volume for this depth interval because the areal extent of lead above the site-specific standard was negligable.

mg/kg = milligrams per kilogram

PDF Maps

Maps for COPCs that Exceed Site-Specific Standards

Antimony in Soil
Site Specific Standard
0.0 to 2.0-foot
Interval

Marino Brothers
Scrapyard site

Sample Point
0 to 2 feet bgs

Site Boundary

Antimony in mg/kg:

0 - 520*
520.1 - 1,461

Note: Nondetects were assigned the detection limit (practical quantitation limit).

* Site specific standard for antimony in soil.

Aroclor 1248 in Soil Site Specific Standard 0.0 to 2.0-foot Interval

Marino Brothers Scrapyard Site

Rochester, PA

Sample Point 0 to 2 feet bgs

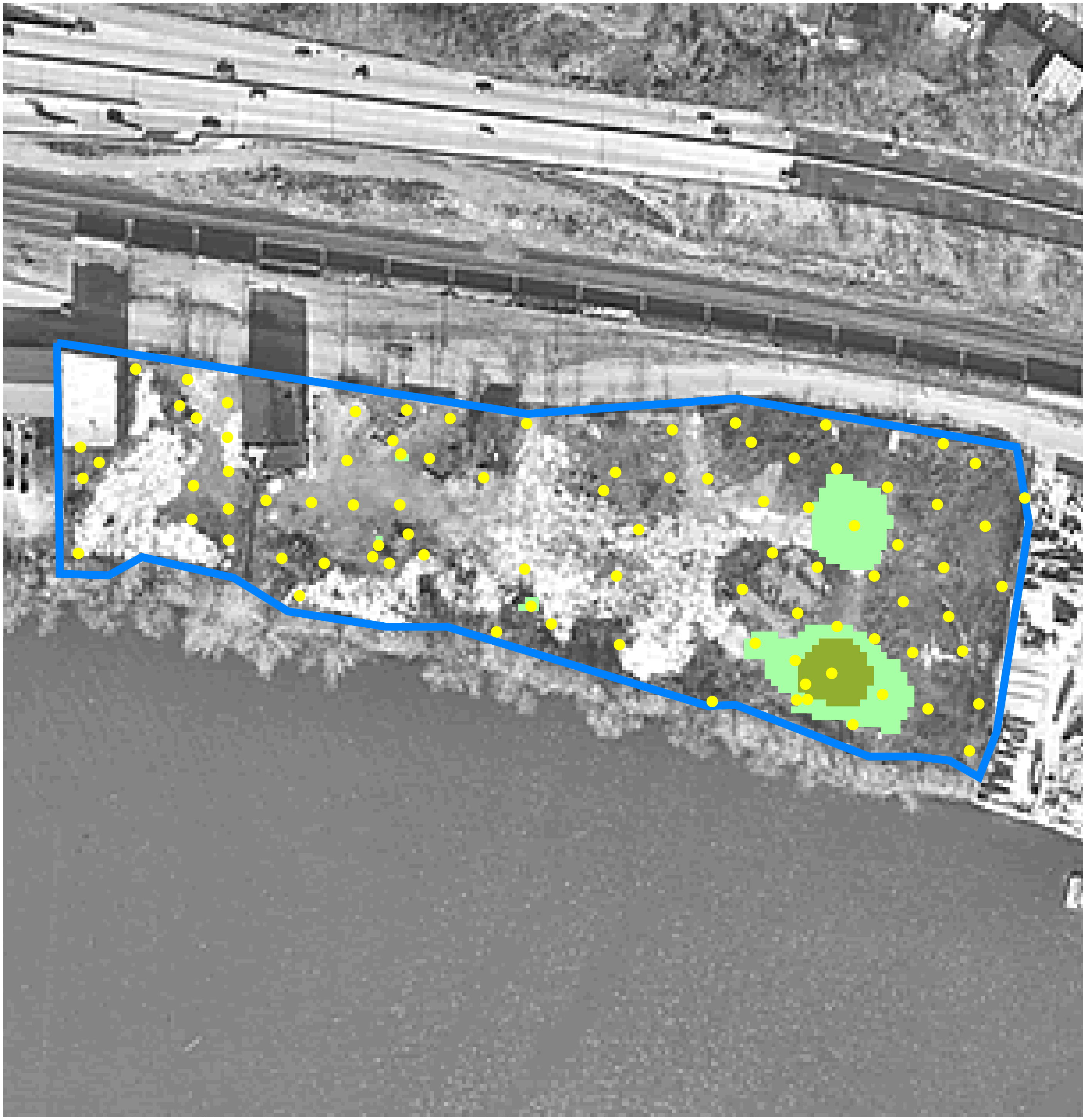
Site boundary

Aroclor 1248 in mg/kg:

- 0 - 59*
- 59.1 - 590
- 590.1 - 2,449

Notes: Nondetects were assigned the detection limit (practical quantitation limit).

* Site-specific standard for Aroclor 1248 in soil.



Aroclor 1254 in Soil Site Specific Standard 0.0 to 2.0-foot Interval

Marino Brothers Scrapyard Site

Rochester, PA

Sample Point 0 to 2 feet bgs

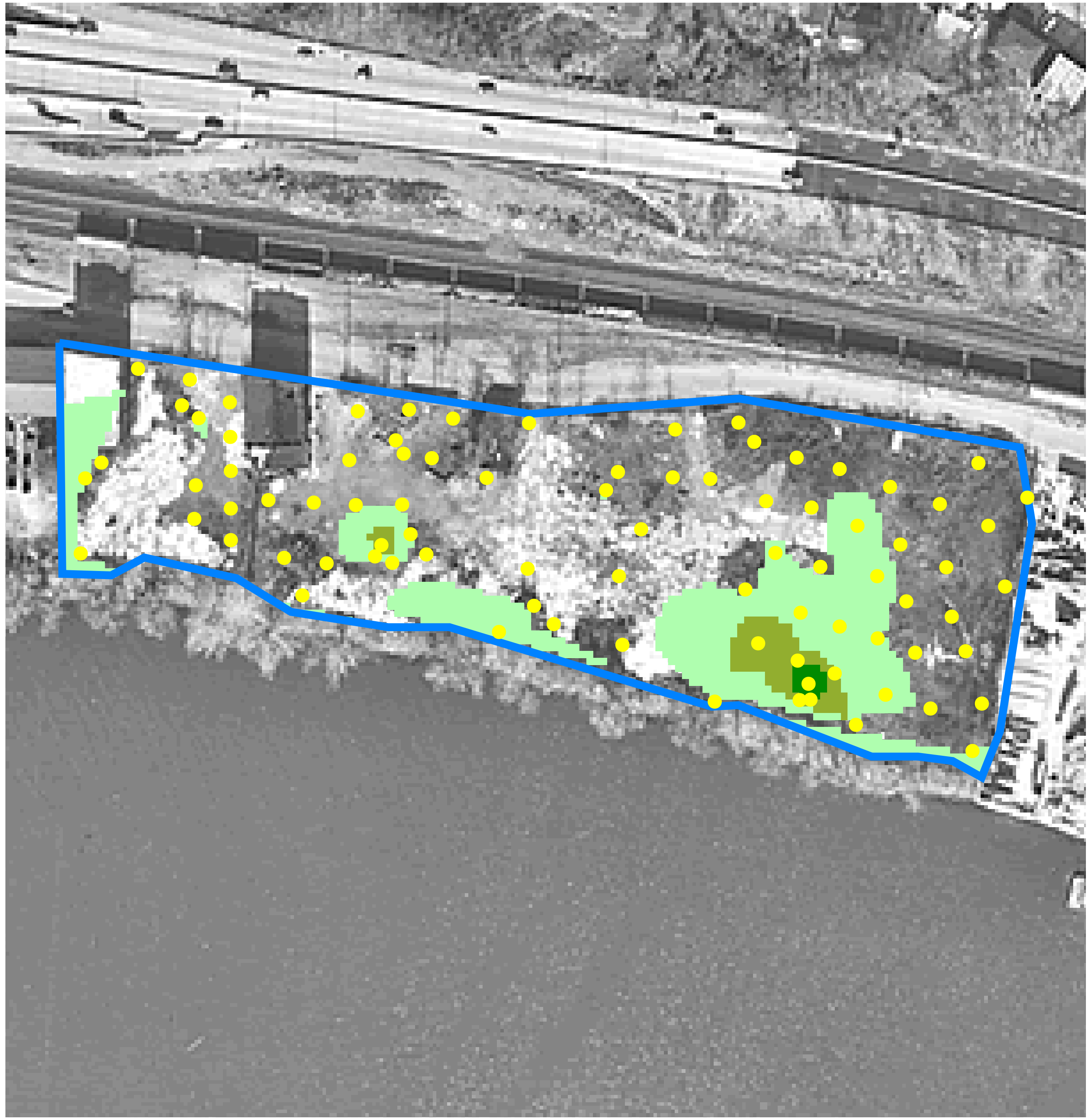
Site boundary

Aroclor 1254 in mg/kg:

- 0 - 59*
- 59.1 - 590
- 590.1 - 5,900
- 5,900.1 - 33,009

Notes: Nondetects were assigned the detection limit (practical quantitation limit).

* Site-specific standard for Aroclor 1254 in soil.



Aroclor 1254 in Soil Site Specific Standard 2.0 to 4.0-foot Interval

Marino Brothers Scrapyard Site

Rochester, PA

Sample Point
2 to 4 feet bgs

Site boundary

Aroclor 1254 in mg/kg:

0 - 59*
59.1 - 121

Notes: Nondetects were assigned the detection limit (practical quantitation limit).

* Site-specific standard for Aroclor 1254 in soil.

Aroclor 1260 in Soil Site-Specific Standard 0.0 to 2.0-foot Interval

Marino Brothers Scrapyard Site

Rochester, PA

Sample Point 0 to 2 feet bgs

Site boundary

Aroclor 1260 in mg/kg:

- 0 - 59*
- 59.1 - 590
- 590.1 - 1,627

Notes: Nondetects were assigned the detection limit (practical quantitation limit).

* Site-specific standard for Aroclor 1260 in soil.

Aroclor 1260 in Soil Site-Specific Standard 2.0 to 4.0-foot Interval

Marino Brothers Scrapyard Site

Rochester, PA

Sample Point 2 to 4 feet bgs

Site boundary

Aroclor 1260 in mg/kg:

0 - 59*
59.1 - 114

Notes: Nondetects were assigned the detection limit (practical quantitation limit).

* Site-specific standard for Aroclor 1260 in soil.

Iron in Soil
Site Specific Standard
0.0 to 2.0-foot
Interval

Marino Brothers
Scrapyard site

Rochester, PA

Sample Point
0 to 2 feet bgs

Site Boundary

Iron in mg/kg:

0 - 389,944*
389,944.1 - 511,842

Note:

* Site specific standard
for iron in soil.

Iron in Soil
Site Specific Standard
2.0 to 4.0-foot
Interval

Marino Brothers
Scrapyard site

Rochester, PA

Sample Point
2 to 4 feet bgs

Site Boundary

Iron in mg/kg:

0 - 389,944*
389,944.1 - 421,667

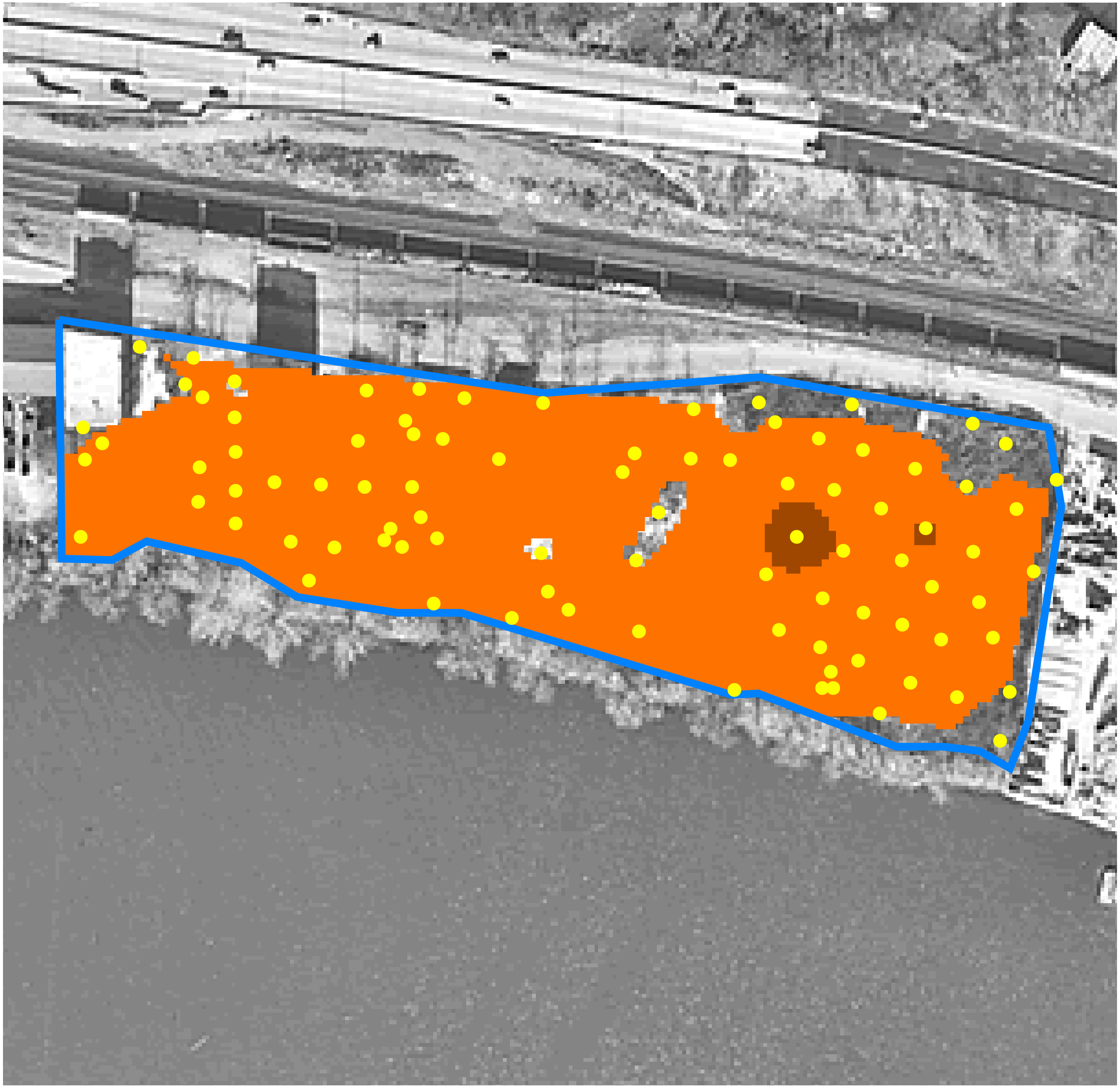
Note:

* Site specific standard
for iron in soil.

Lead in Soil
Site-Specific Standard
0.0 to 2.0-foot
Interval

Marino Brothers
Scrapyard Site

Rochester, PA



Sample Point
0 to 2 feet bgs

Site Boundary

Lead in mg/kg:

0 - 1,300*
1,300.1 - 13,000
13,000.1 - 29,144

Notes:

* Site specific standard for lead in soil.

Lead in Soil Site-Specific Standard 2.0 to 4.0-foot Interval

Marino Brothers Scrapyard Site

Rochester, PA

Sample Point 2 to 4 feet bgs

Site Boundary

Lead in mg/kg:

0 - 1,300*

1,300.1 - 9,422

Notes: Nondetects were assigned the detection limit (practical quantitation limit).

* Site-specific standard for lead in soil.

Lead in Soil
Site-Specific Standard
6.0 to 8.0-foot
Interval

Marino Brothers
Scrapyard Site

Rochester, PA

Sample Point
6 to 8 feet bgs

Site Boundary

Lead in mg/kg:

0 - 1,300*
1,300.1 - 1,376

Notes:

* Site-specific standard for lead in soil.

Mercury in Soil
Site-specific standard
0.0 to 2.0-foot
Interval

Marino Brothers
Scrapyard Site

Sample Point
0 to 2 feet bgs

Site Boundary

Mercury in mg/kg:

0 - 390
390.1 - 858

Note:

* Site-specific standard for mercury in soil.

Maps for COPCs that Exceed Residential MSCs

Antimony in Soil Residential MSC 0.0 to 2.0-foot Interval

Marino Brothers Scrapyard site

Sample Point
0 to 2 feet bgs

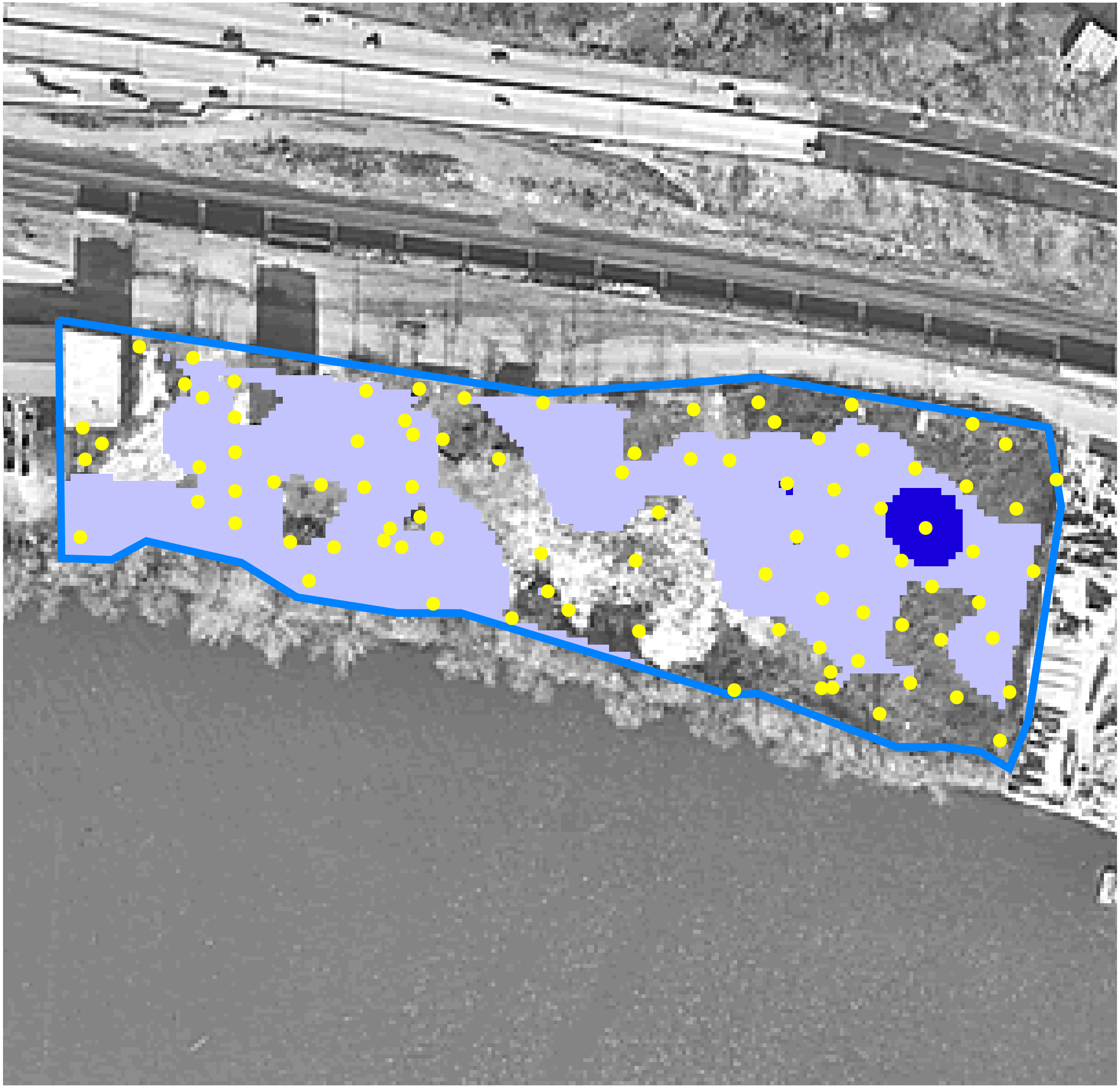
Site Boundary

Antimony in mg/kg:

0 - 27*
27.1 - 270
270.1 - 1,461

Note: Nondetects were assigned the detection limit (practical quantitation limit).

* PADEP Residential Medium Specific Concentration (MSC) for antimony in soil.



Antimony in Soil Residential MSC 2.0 to 4.0-foot Interval

Marino Brothers Scrapyard site

Sample Point 2 to 4 feet bgs

Site Boundary

Antimony in mg/kg:

0 - 27*

27.1 - 237

Note: Nondetects were assigned the detection limit (practical quantitation limit).

* PADEP Residential Medium Specific Concentration (MSC) for antimony in soil.

Antimony in Soil Residential MSC 6.0 to 8.0-foot Interval

Marino Brothers Scrapyard site

Sample Point 6 to 8 feet bgs

Site Boundary

Antimony in mg/kg:

0 - 27*

27.1 - 37

Note: Nondetects were assigned the detection limit (practical quantitation limit).

* PADEP Residential Medium Specific Concentration (MSC) for antimony in soil.

Aroclor 1248 in Soil Residential MSC 0.0 to 2.0-foot Interval

Marino Brothers Scrapyard Site

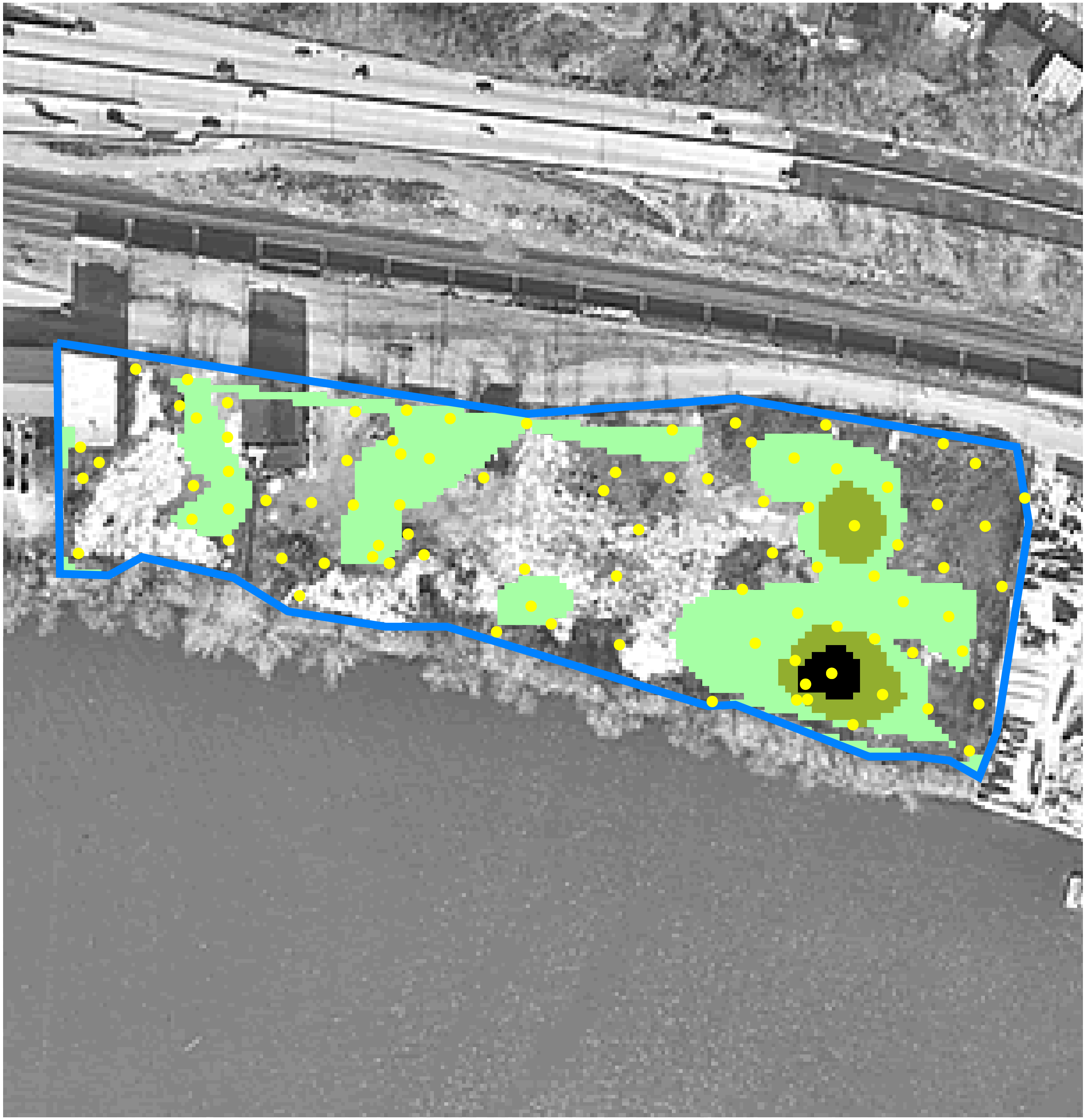
Rochester, PA

Sample Point
0 to 2 feet bgs

Site boundary

Aroclor 1248 in mg/kg:

0 - 9.9*
9.91 - 99
99.1 - 999
999.1 - 2,449



Notes: Nondetects were assigned the detection limit (practical quantitation limit).

* PADEP Residential Medium Specific Concentration (MSC) for Aroclor 1248 in soil.

Aroclor 1248 in Soil Residential MSC 2.0 to 4.0-foot Interval

Marino Brothers Scrapyard Site

Rochester, PA

Sample Point
2 to 4 feet bgs

Site boundary

Aroclor 1248 in mg/kg:

0 - 9.9*
9.91 - 36.9

Notes: Nondetects were assigned the detection limit (practical quantitation limit).

* PADEP Residential Medium Specific Concentration (MSC) for Aroclor 1248 in soil.

Aroclor 1254 in Soil Residential MSC 0.0 to 2.0-foot Interval

Marino Brothers Scrapyard Site

Rochester, PA

Sample Point
0 to 2 feet bgs

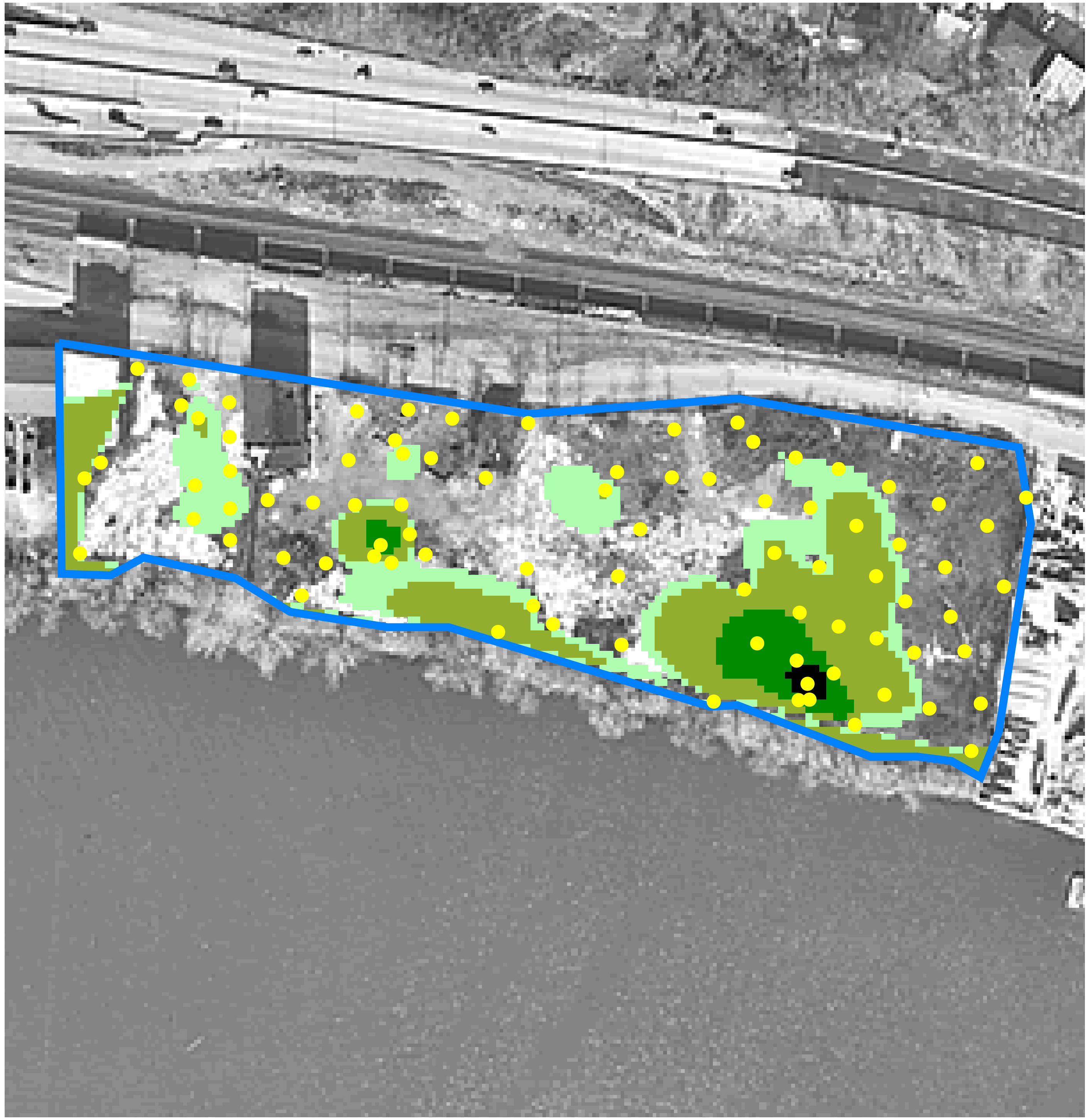
Site boundary

Aroclor 1254 in mg/kg:

0 - 4.4*
4.41 - 44
44.1 - 440
440.1 - 4400
4400.1 - 33,009

Notes: Nondetects were assigned the detection limit (practical quantitation limit).

* PADEP Residential Medium Specific Concentration (MSC) for Aroclor 1254 in soil.



Aroclor 1254 in Soil Residential MSC 2.0 to 4.0-foot Interval

Marino Brothers Scrapyard Site

Rochester, PA

Sample Point
2 to 4 feet bgs

Site boundary

Aroclor 1254 in mg/kg:

0 - 4.4*
4.41 - 44
44.1 - 121

Notes: Nondetects were assigned the detection limit (practical quantitation limit).

* PADEP Residential Medium Specific Concentration (MSC) for Aroclor 1254 in soil.

Aroclor 1260 in Soil Residential MSC 0.0 to 2.0-foot Interval

Marino Brothers Scrapyard Site

Rochester, PA

Sample Point 0 to 2 feet bgs

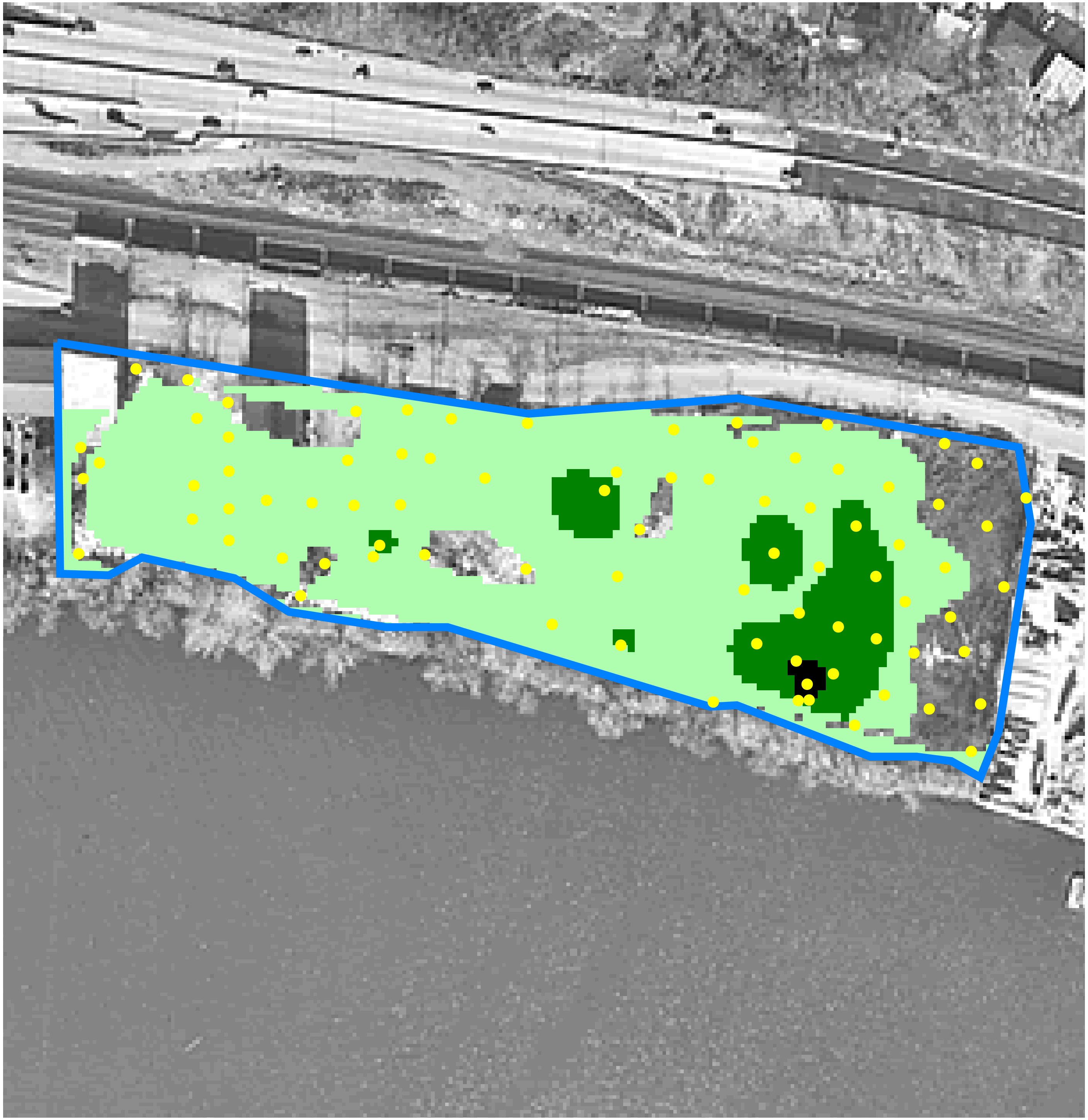
Site boundary

Aroclor 1260 in mg/kg:

0 - 4.4
4.41 - 44*
44.1 - 441
441.1 - 1,627

Notes: Nondetects were assigned the detection limit (practical quantitation limit).

* PADEP Residential Medium Specific Concentration (MSC) for Aroclor 1260 in soil.



Aroclor 1260 in Soil Residential MSC 2.0 to 4.0-foot Interval

Marino Brothers Scrapyard Site

Rochester, PA

Sample Point 2 to 4 feet bgs

Site boundary

Aroclor 1260 in mg/kg:

0 - 4.4*
4.41 - 44
44.1 - 114

Notes: Nondetects were assigned the detection limit (practical quantitation limit).

* PADEP Residential Medium Specific Concentration (MSC) for Aroclor 1260 in soil.

Aroclor 1260 in Soil Residential MSC 6.0 to 8.0-foot Interval

Marino Brothers Scrapyard Site

Rochester, PA

Sample Point
6 to 8 feet bgs

Site boundary

Aroclor 1260 in mg/kg:

0 - 4.4*
4.41 - 4.83

Notes: Nondetects were assigned the detection limit (practical quantitation limit).

* PADEP Residential Medium Specific Concentration (MSC) for Aroclor 1260 in soil.

Arsenic in Soil Residential MSC 0.0 to 2.0-foot Interval

Marino Brothers Scrapyard site

Sample Point 0 to 2 feet bgs

Site Boundary

Arsenic in mg/kg:

0 - 12*
12.1 - 120
120.1 - 205

Note:
* PADEP Residential Medium Specific Concentration (MSC) for arsenic in soil.

Arsenic in Soil Residential MSC 2.0 to 4.0-foot Interval

Marino Brothers Scrapyard site

Sample Point 2 to 4 feet bgs

Site Boundary

Arsenic in mg/kg:

0 - 12*

12.1 - 86

Note:
* PADEP Residential Medium Specific Concentration (MSC) for arsenic in soil.

Arsenic in Soil Residential MSC 6.0 to 8.0-foot Interval

Marino Brothers Scrapyard site

Sample Point 6 to 8 feet bgs

Site Boundary

Arsenic in mg/kg:

0 - 12*

12.1 - 41

Note:
* PADEP Residential Medium Specific Concentration (MSC) for arsenic in soil.

Arsenic in Soil Residential MSC 10.0 to 12.0-foot Interval

Marino Brothers Scrapyard site

Sample Point 10 to 12 feet bgs

Site Boundary

Arsenic in mg/kg:

0 - 12*

12.1 - 53

Note:
* PADEP Residential Medium Specific Concentration (MSC) for arsenic in soil.

Cadmium in Soil Residential MSC 0.0 to 2.0-foot Interval

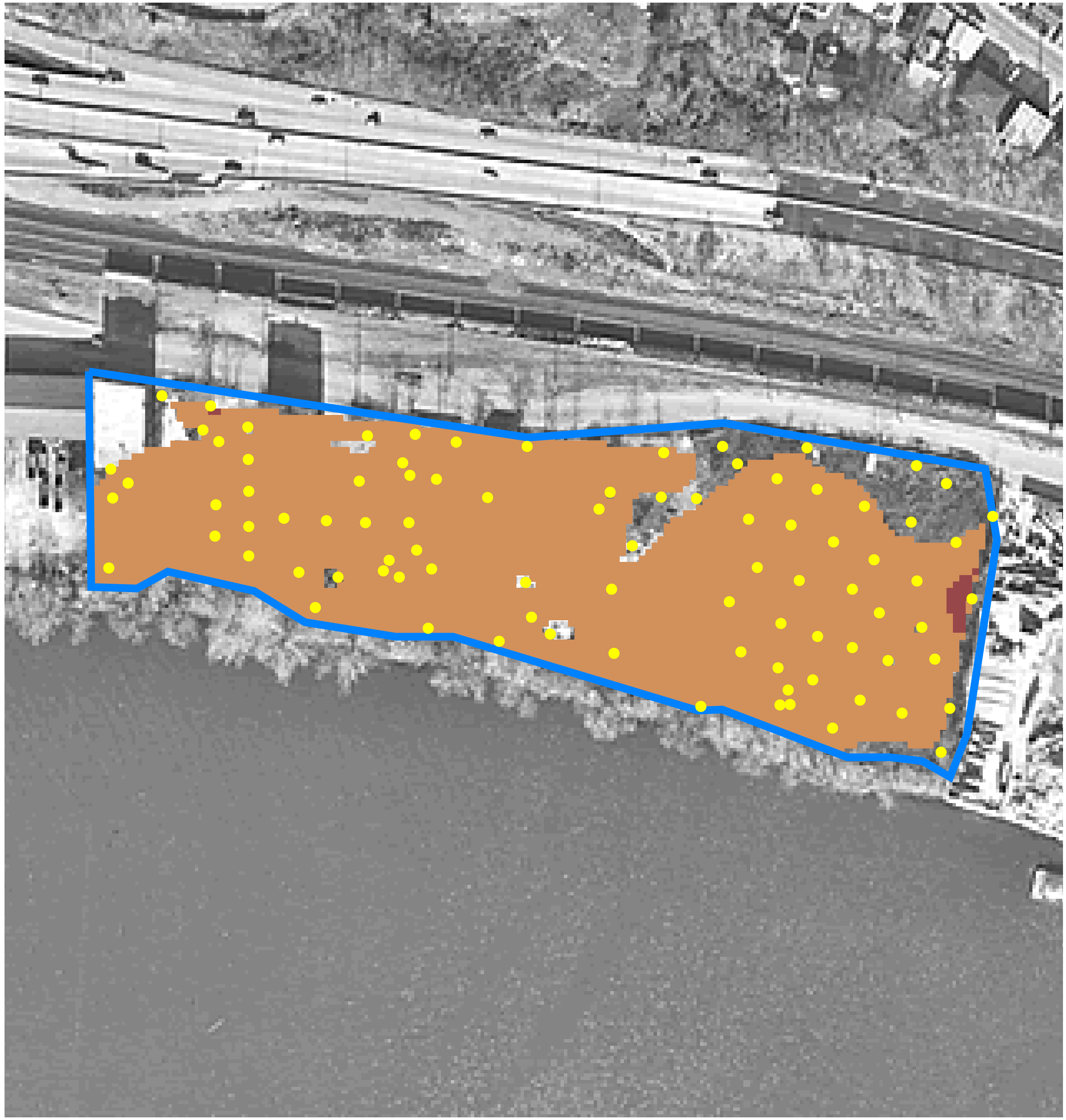
Marino Brothers Scrapyard site

Sample Point
0 to 2 feet bgs

Site Boundary

Cadmium in mg/kg:

0 - 38*
38.1 - 380
380.1 - 602



Note:

* PADEP Residential Medium Specific Concentration (MSC) for cadmium in soil.

Cadmium in Soil Residential MSC 2.0 to 4.0-foot Interval

Marino Brothers Scrapyard site

Sample Point 2 to 4 feet bgs

Site Boundary

Cadmium in mg/kg:

0 - 38*

38.1 - 242

Note: Nondetects were assigned the detection limit (practical quantitation limit).

* PADEP Residential Medium Specific Concentration (MSC) for cadmium in soil.

Cadmium in Soil Residential MSC 10.0 to 12.0-foot Interval

Marino Brothers Scrapyard site

Sample Point
10 to 12 feet bgs

Site Boundary

Cadmium in mg/kg:

0 - 38
38.1 - 57

Note: Nondetects were assigned the detection limit (practical quantitation limit).

* PADEP Residential Medium Specific Concentration (MSC) for cadmium in soil.

Iron in Soil
Residential MSC
0.0 to 2.0-foot
Interval

Marino Brothers
Scrapyard site

Rochester, PA

Sample Point
0 to 2 feet bgs

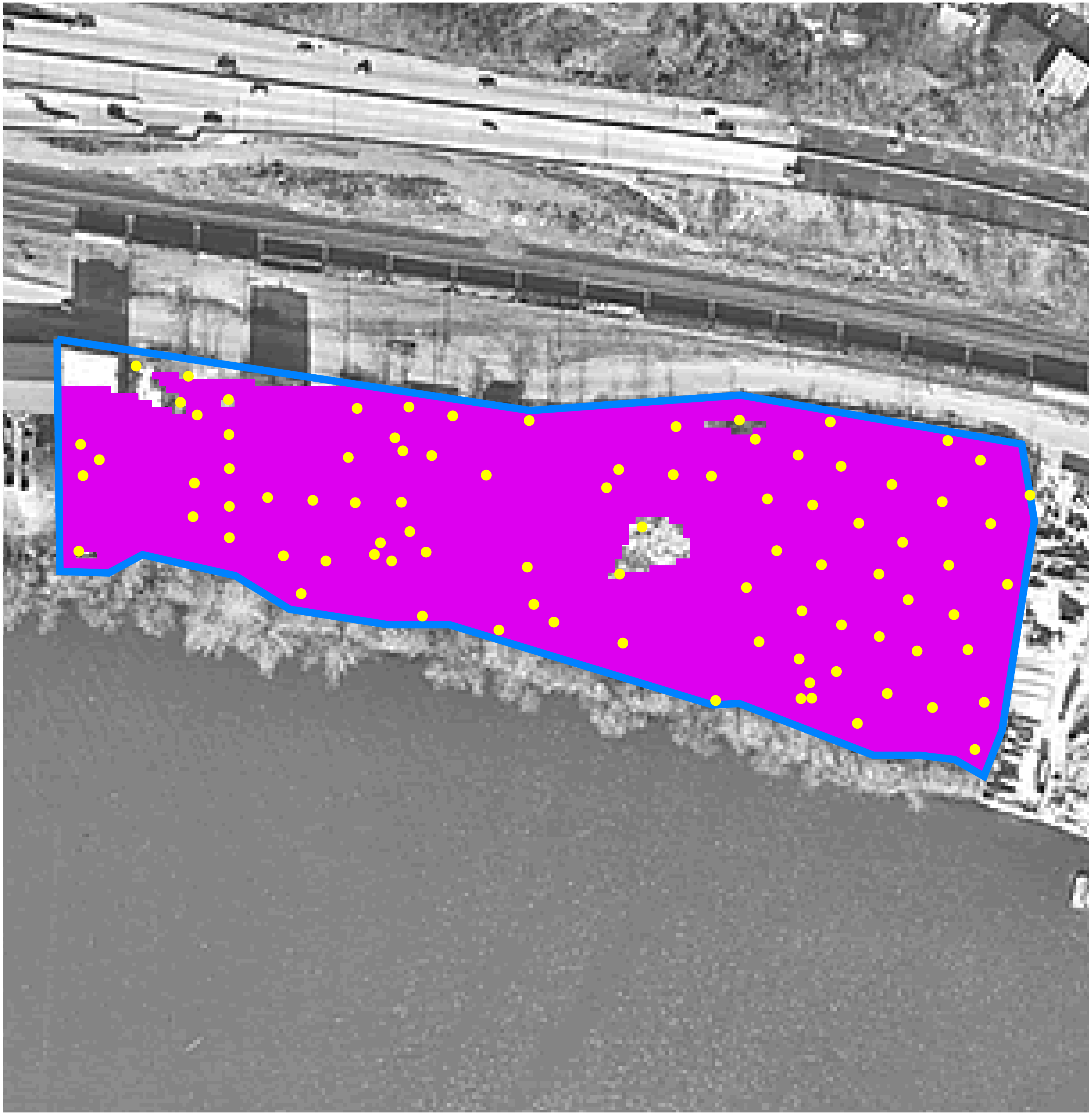
Site Boundary

Iron in mg/kg:

0 - 66,000*
66,000.1 - 511,842

Note:

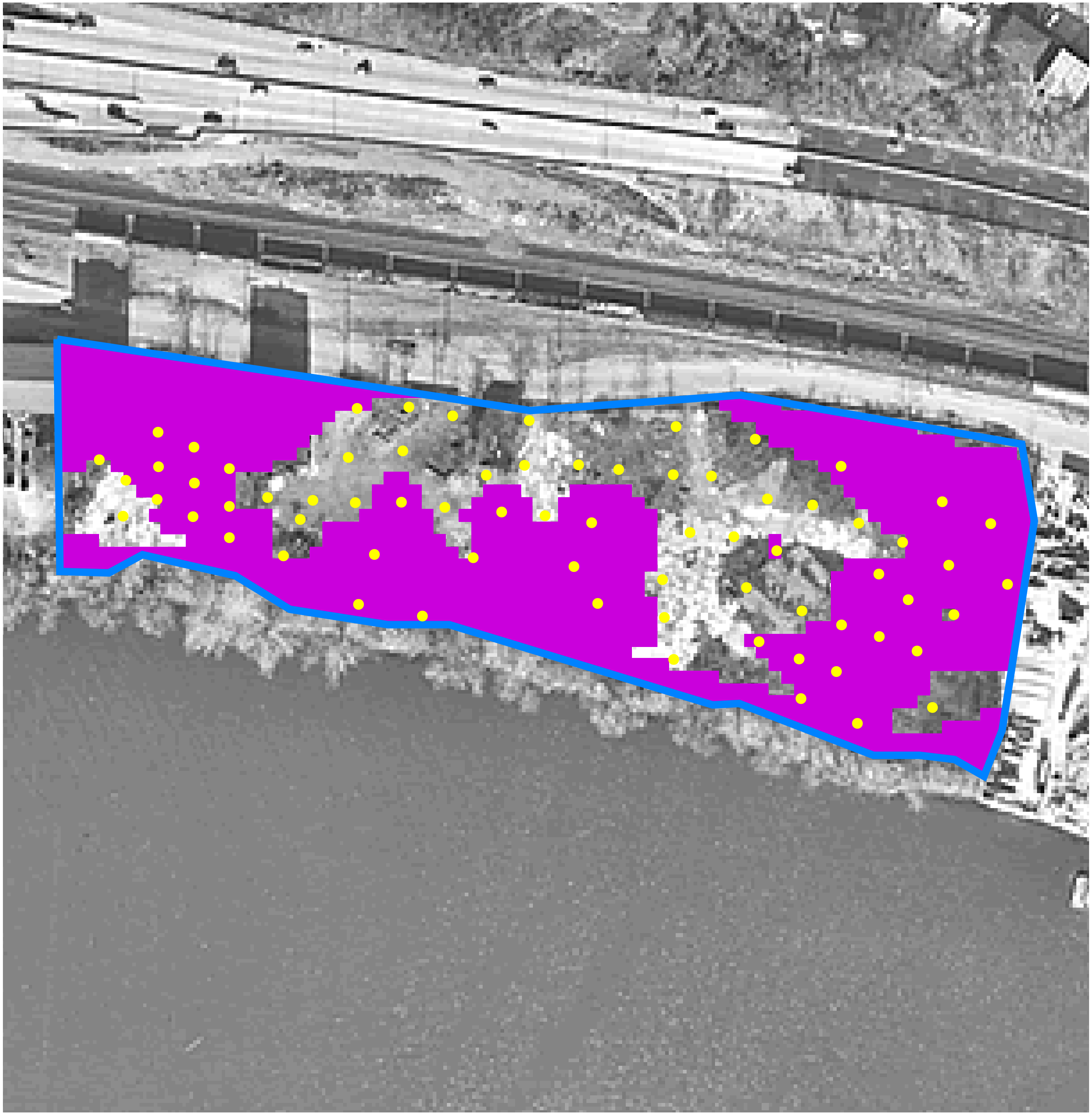
* PADEP Residential Medium Specific Concentration (MSC) for iron in soil.



Iron in Soil
Residential MSC
2.0 to 4.0-foot
Interval

Marino Brothers
Scrapyard site

Rochester, PA



Sample Point
2 to 4 feet bgs

Site Boundary

Iron in mg/kg:

0 - 66,000*
66,000.1 - 421,667

Note:

* PADEP Residential Medium Specific Concentration (MSC) for iron in soil.

Iron in Soil
Residential MSC
6.0 to 8.0-foot
Interval

Marino Brothers Scrapyard site

Rochester, PA

Sample Point
6 to 8 feet bgs

Site Boundary

Iron in mg/kg:

0 - 66,000*
66,000.1 - 280,626

Note:

* PADEP Residential Medium Specific Concentration (MSC) for iron in soil.

Iron in Soil
Residential MSC
10.0 to 12.0-foot
Interval

Marino Brothers
Scrapyard site

Rochester, PA

Sample Point
10 to 12 feet bgs

Site Boundary

Iron in mg/kg:

0 - 66,000*
66,000.1 - 290,934

Note:

* PADEP Residential Medium Specific Concentration (MSC) for iron in soil.

Lead in Soil
Residential MSC
0.0 to 2.0-foot
Interval

Marino Brothers
Scrapyard Site

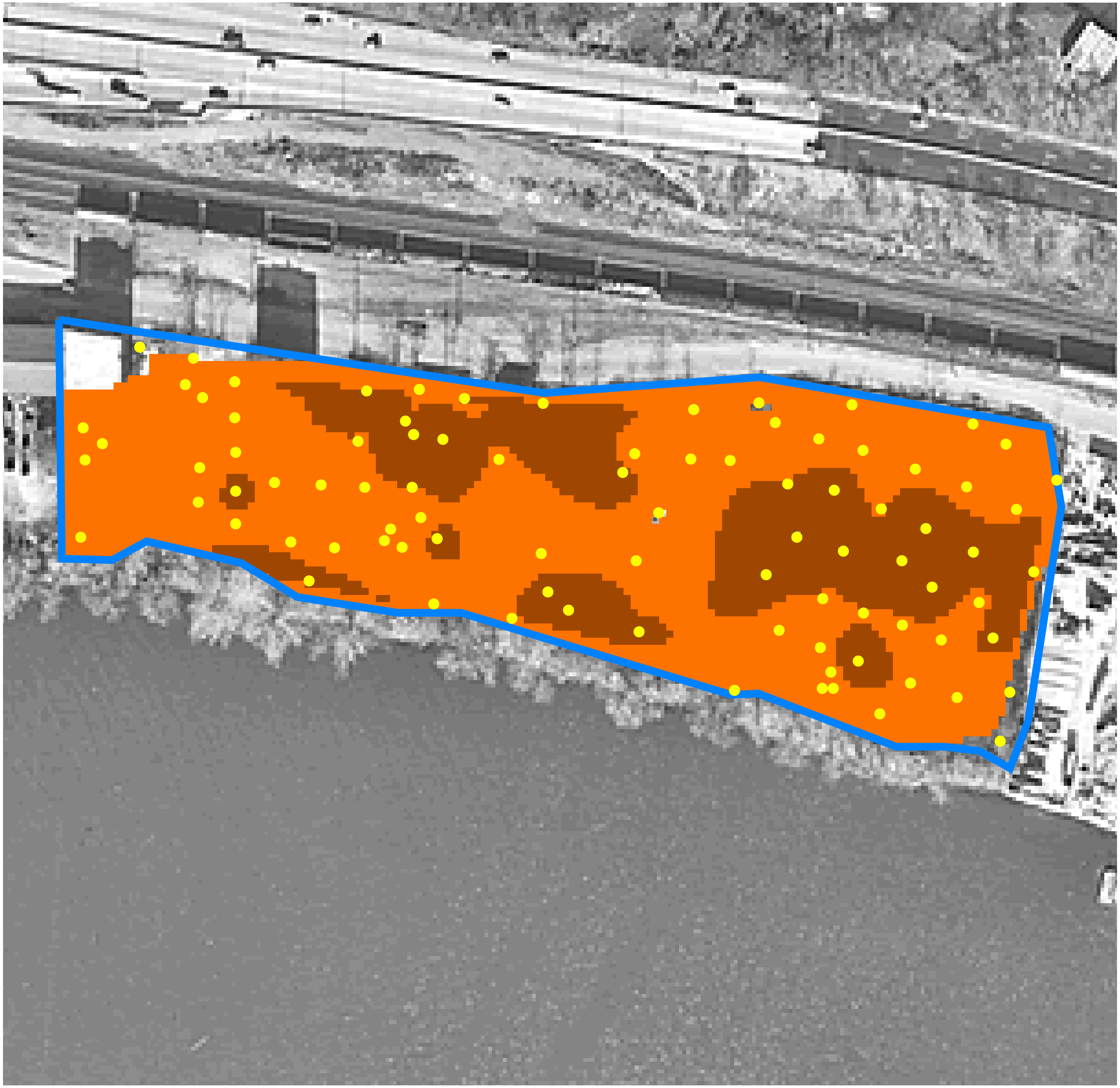
Rochester, PA

Sample Point
0 to 2 feet bgs

Site Boundary

Lead in mg/kg:

0 - 450*
450.1 - 4,500
4,500.1 - 29,144



Notes:

* PADEP Residential Medium Specific Concentration (MSC) for lead in soil.

Lead in Soil
Residential MSC
2.0 to 4.0-foot
Interval

Marino Brothers
Scrapyard Site

Rochester, PA

Sample Point
2 to 4 feet bgs

Site Boundary

Lead in mg/kg:

0 - 450*
450.1 - 4,500
4,500.1 - 9,422

Notes: Nondetects were assigned the detection limit (practical quantitation limit).

* PADEP Residential Medium Specific Concentration (MSC) for lead in soil.

Lead in Soil Residential MSC 6.0 to 8.0-foot Interval

Marino Brothers Scrapyard Site

Rochester, PA

Sample Point 6 to 8 feet bgs

Site Boundary

Lead in mg/kg:

0 - 450*
450 - 1,376

Notes:

* PADEP Residential Medium Specific Concentration (MSC) for lead in soil.

Lead in Soil
Residential MSC
10.0 to 12.0-foot
Interval

Marino Brothers
Scrapyard Site

Rochester, PA

Sample Point
10 to 12 feet bgs

Site Boundary

Lead in mg/kg:

0 - 450*
450 - 1,100

Notes:

* PADEP Residential Medium Specific Concentration (MSC) for lead in soil.

Mercury in Soil Residential MSC 0.0 to 2.0-foot Interval

Marino Brothers Scrapyard Site

Sample Point 0 to 2 feet bgs

Site Boundary

Mercury in mg/kg:

	0 - 10
	10.1 - 100
	100.1 - 858

Note:

* Residential Medium-Specific Concentration (MSC) for mercury in soil.

Mercury in Soil
Residential MSC
2.0 to 4.0-foot
Interval

Marino Brothers
Scrapyard Site

Sample Point
2 to 4 feet bgs

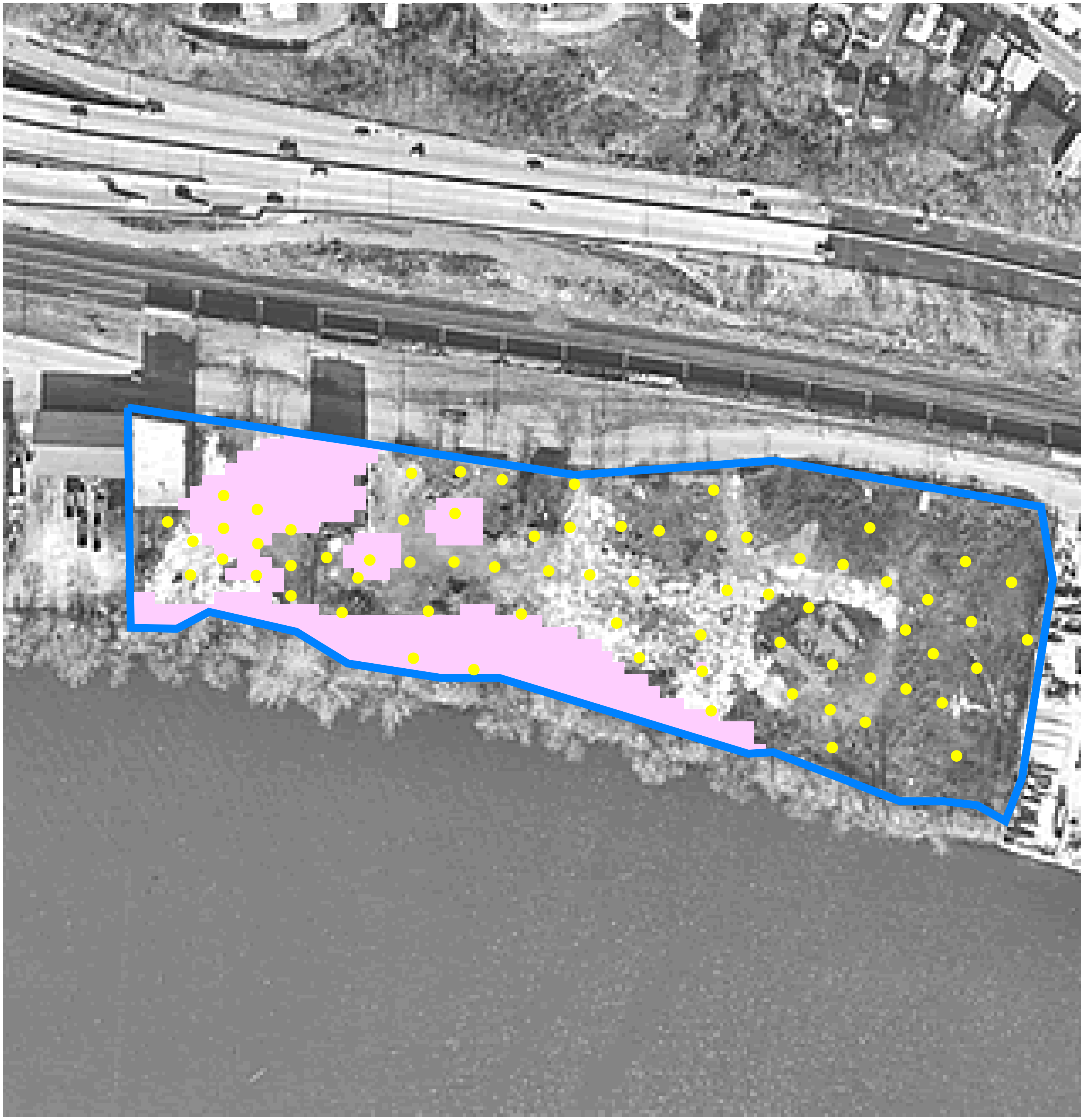
Site Boundary

Mercury in mg/kg:

0 - 10*
10.1 - 72

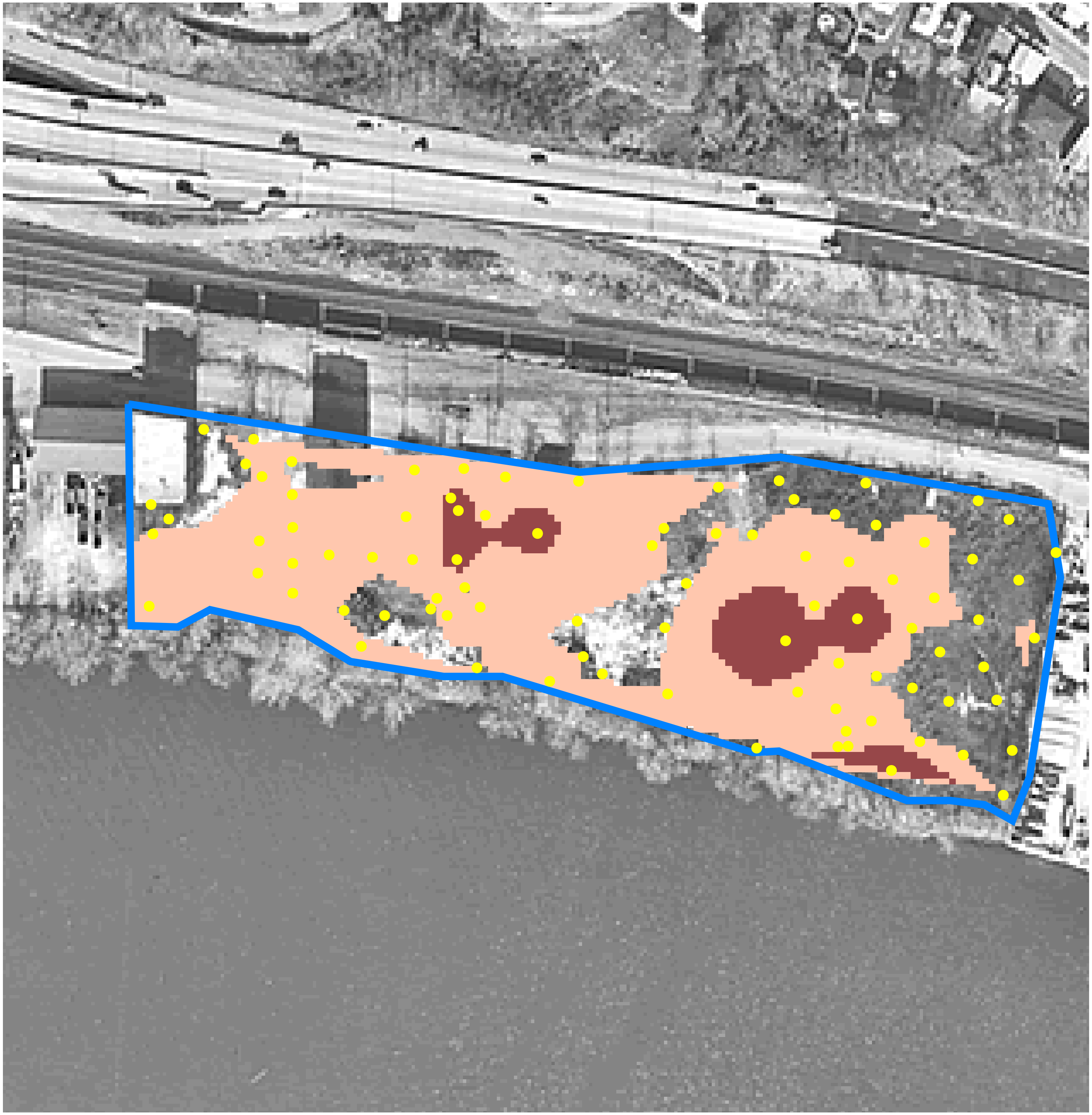
Notes: Nondetects were assigned the detection limit (practical quantitation limit).

* PADEP Residential Medium Specific Concentration (MSC) for mercury in soil.



Zinc in Soil Residential MSC 0.0 to 2.0-foot interval

Marino Brothers Scrapyard site



Sample Point
0 to 2 feet bgs

Site Boundary

Zinc in mg/kg:

0 - 12,000*
12,000.1 - 120,000
120,000.1 - 325,262

Note:

* PADEP Residential Medium Specific Concentration (MSC) for zinc in soil.

Zinc in Soil Residential MSC 2.0 to 4.0-foot interval

Marino Brothers Scrapyard site

Sample Point
2 to 4 feet bgs

Site Boundary

Zinc in mg/kg:

0 - 12,000*
12,000.1 - 74,247

Note: Nondetects were assigned the detection limit (practical quantitation limit).

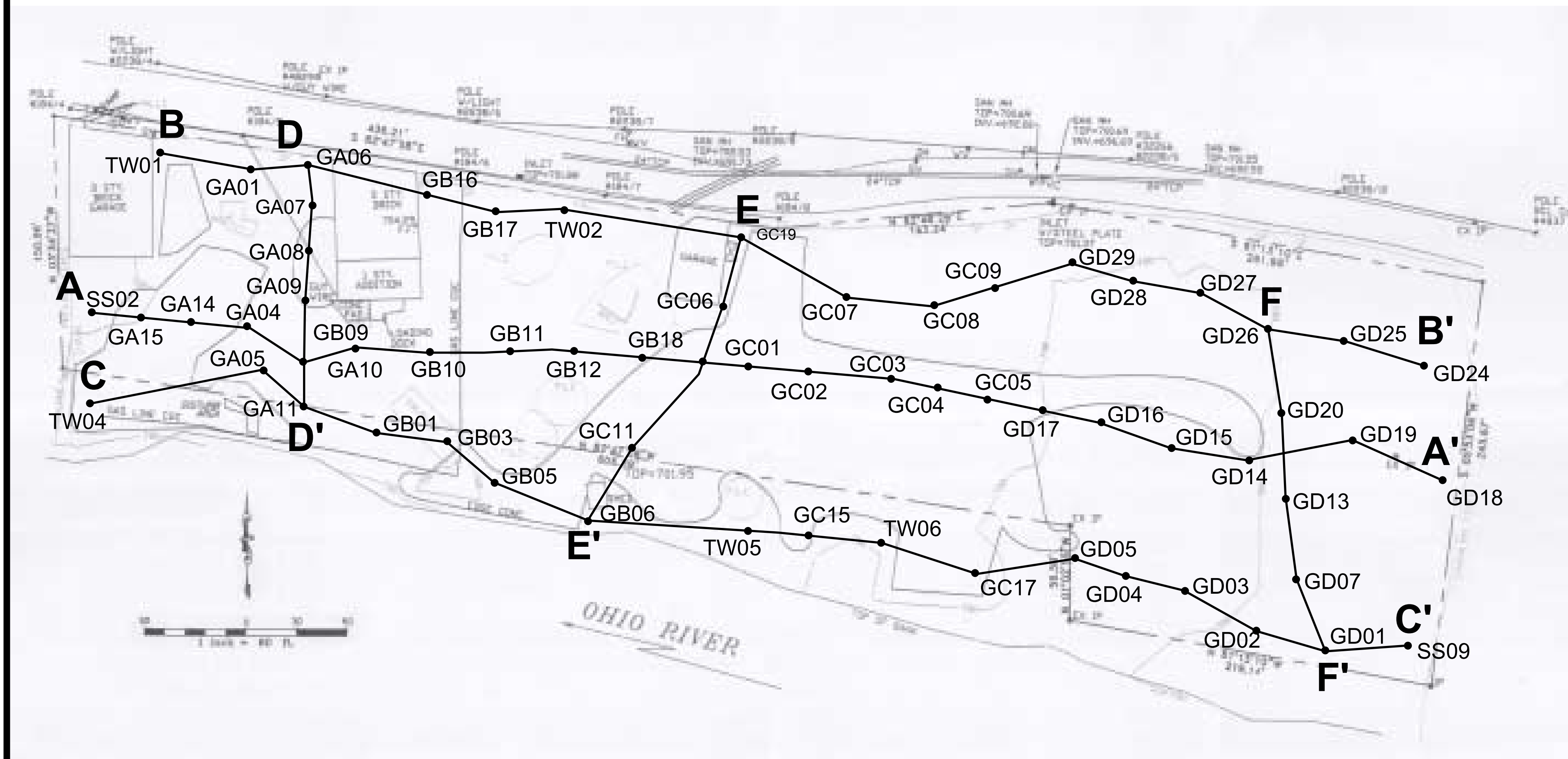
* PADEP Residential Medium Specific Concentration (MSC) for zinc in soil.

Enclosure #3
Part 3-3
Cross-Sections for Primary COPCs Based on Site-Specific Standards

CROSS-SECTION DEVELOPMENT

The distribution of soil contamination at the Marino Brothers Scrap Yard Site is presented as cross sections. The location of these cross sections (A-A' to F-F') is shown in the figure cross section reference. Cross sections depicting the soil contamination of lead, mercury, Aroclor 1254, Aroclor 1248, arsenic, and iron were created for each section line resulting in a total of 36 individual cross sections. Each cross section shows the soil sample locations and zones of soil contamination.

The soil samples are depicted on the cross sections in three different colors, depending on the contaminant concentration. A blue soil sample indicates that the contaminant concentration is less than the generic media-specific criteria (MSC). An orange soil sample indicates that the contaminant concentration is greater than the generic MSC and less than the site specific standard. The red soil sample exceeds the site-specific standard. The soil contamination levels were extrapolated across each cross-section in order to create zones of contamination. There are three different zones, based on the soil contaminant concentrations. Lead contamination in soil represents the largest zone of contamination exceeding the site-specific standard. In almost every location removal of lead-contaminated soil would ensure that other constituents exceeding the site-specific standard would also be removed.



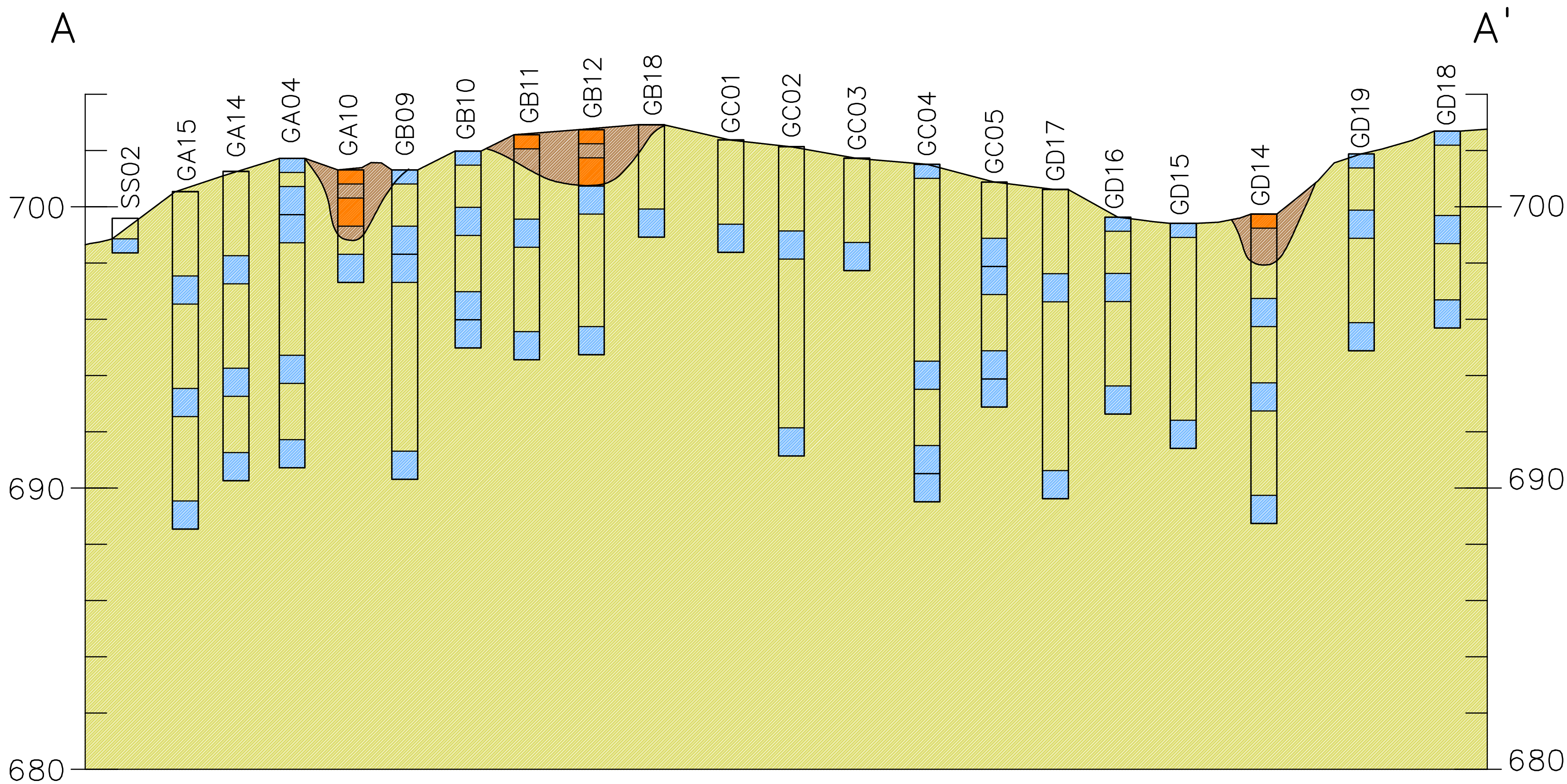
STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-1

APPROXIMATE LOCATION OF CROSS SECTIONS
AT MARINO BROTHERS SITE

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ A_aroclor1248.dwg 04/24/2002 marianne.turonek DN



LEGEND

SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR AROCLOR 1248 IS 9.9 mg/kg
SITE-SPECIFIC STANDARD FOR AROCLOR 1248 IS 59 mg/kg

3' 0 3' 6'

APPROXIMATE
VERTICAL SCALE: 1" = 6'

50' 0 50' 100'

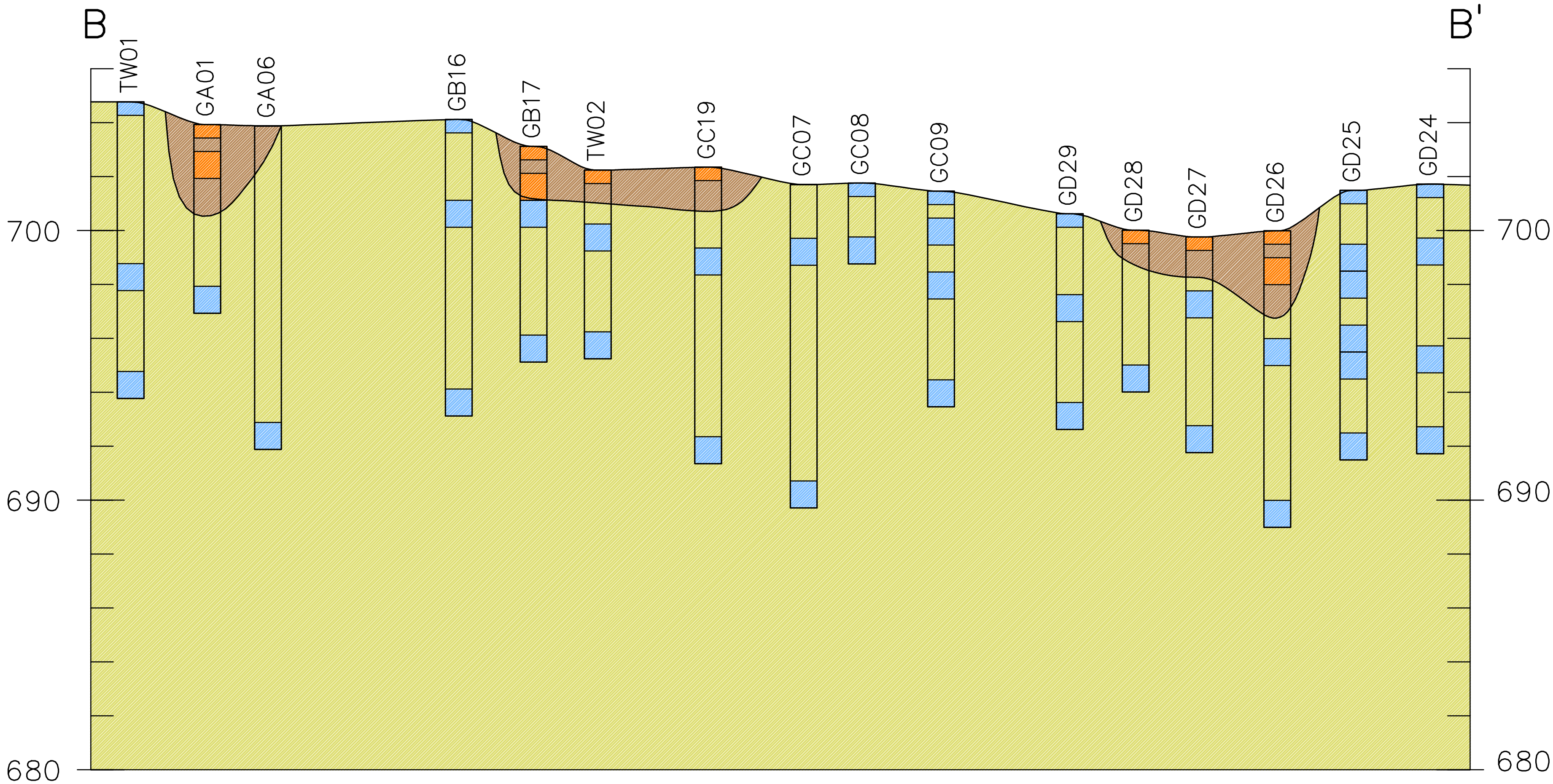
APPROXIMATE
HORIZONTAL SCALE: 1" = 100'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-5
AROCLOR 1248 CONCENTRATIONS (mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ B_aroclor1248.dwg 04/24/2002 marianne.turonek DN



3' 0 3' 6'

APPROXIMATE
VERTICAL SCALE: 1" = 6'

50' 0 50' 100'

APPROXIMATE
HORIZONTAL SCALE: 1" = 100'

LEGEND

SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

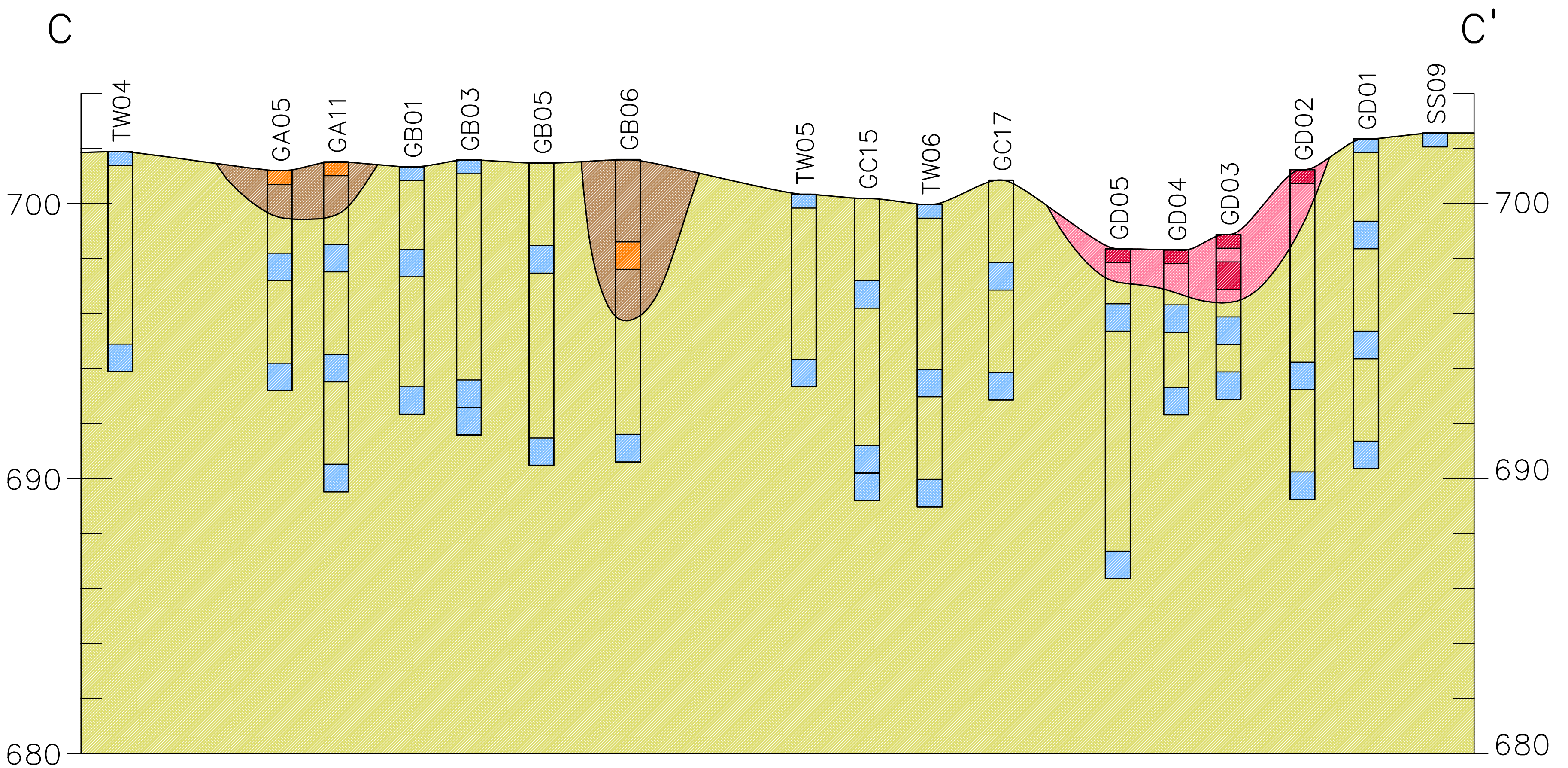
NOTE:
GENERIC MSC FOR AROCLOR 1248 IS 9.9 mg/kg
SITE-SPECIFIC STANDARD FOR AROCLOR 1248 IS 59 mg/kg

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-11
AROCLOR 1248 CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ C_aroclor1248.dwg 04/24/2002 marianne.turonek DN



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL SAMPLE CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR AROCLOR 1248 IS 9.9 mg/kg
SITE-SPECIFIC STANDARD FOR AROCLOR 1248 IS 59 mg/kg

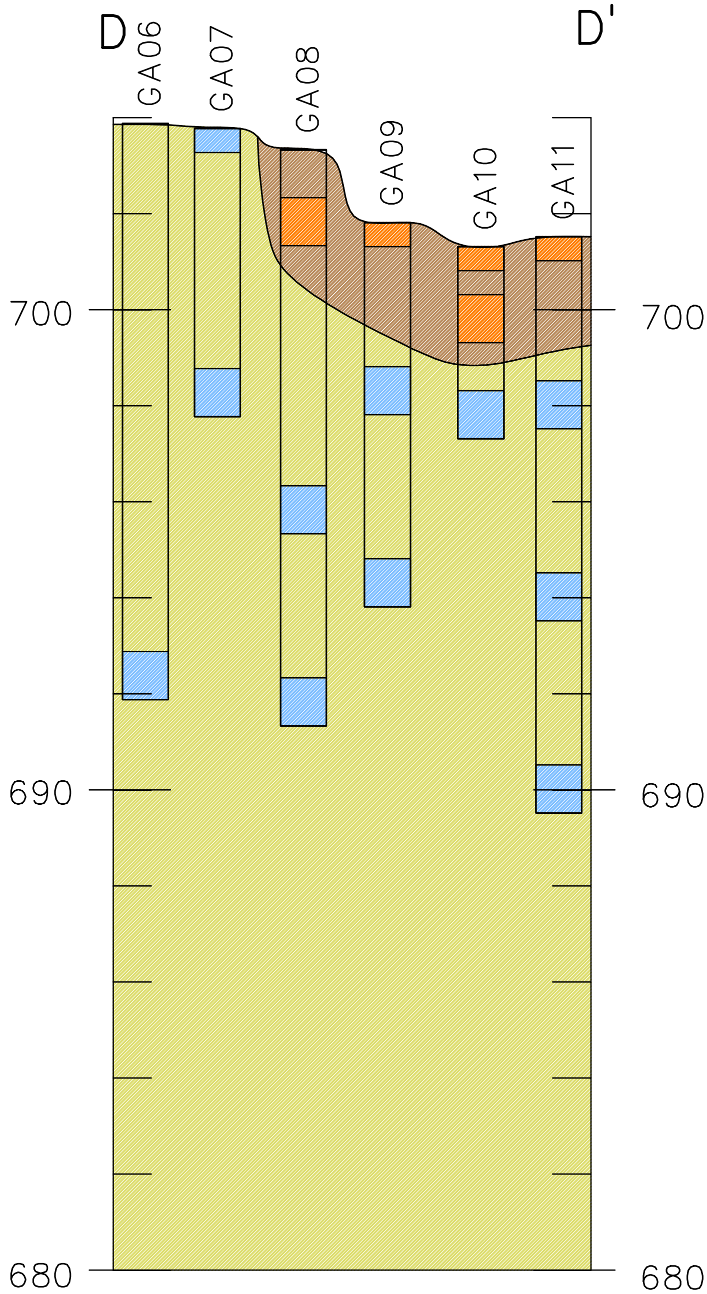
3' 0 3' 6'
APPROXIMATE
VERTICAL SCALE: 1" = 6'

50' 0 50' 100'
APPROXIMATE
HORIZONTAL SCALE: 1" = 100'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-17
AROCLOR 1248 CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR AROCLOR 1248 IS 9.9 mg/kg
SITE-SPECIFIC STANDARD FOR AROCLOR 1248 IS 59 mg/kg

2' 0 2' 4'
APPROXIMATE
VERTICAL SCALE: 1" = 4'

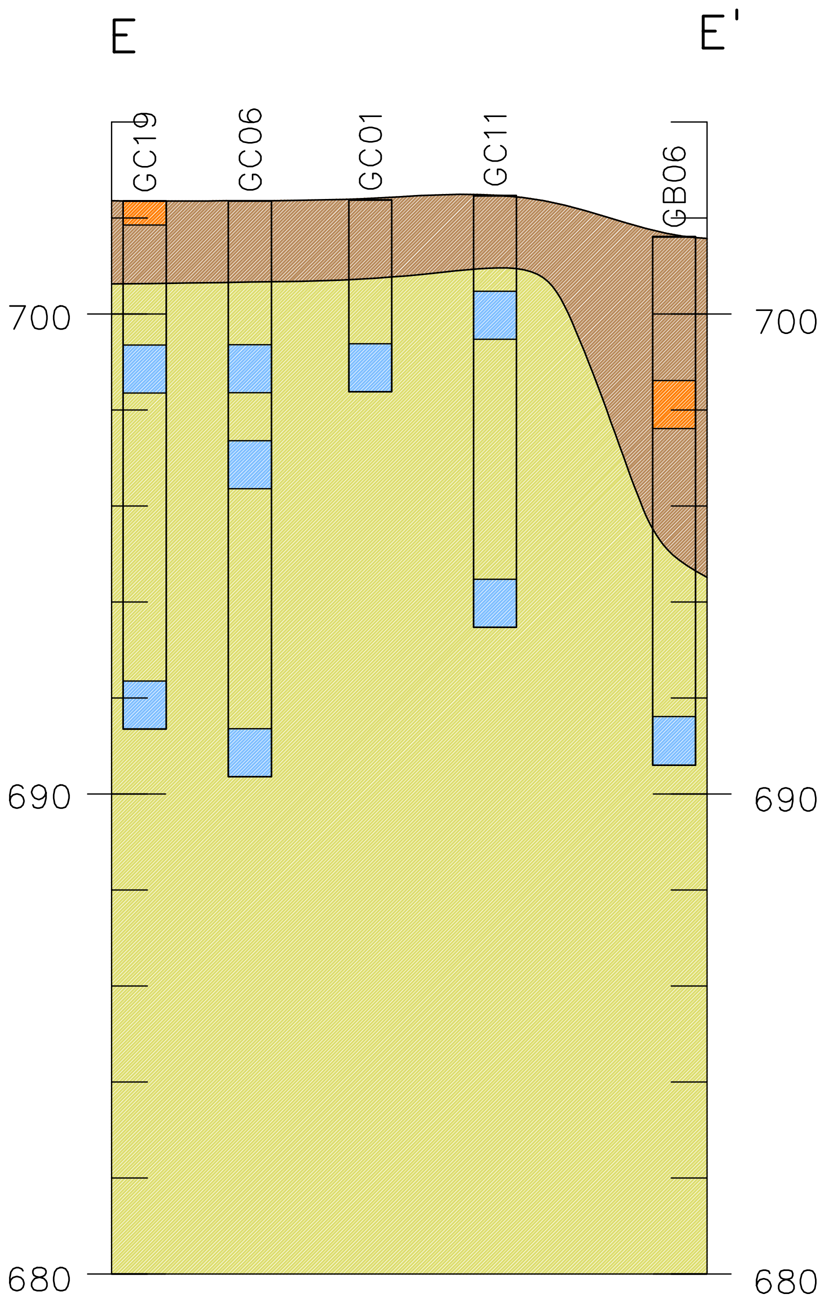
35' 0 35' 70'
APPROXIMATE
HORIZONTAL SCALE: 1" = 70'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-23
AROCLOR 1248 CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ D_aroclor1248.dwg 04/24/2002 marianne.turonek DN



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR AROCLOR 1248 IS 9.9 mg/kg
SITE-SPECIFIC STANDARD FOR AROCLOR 1248 IS 59 mg/kg

2' 0 2' 4'
APPROXIMATE
VERTICAL SCALE: 1" = 4'

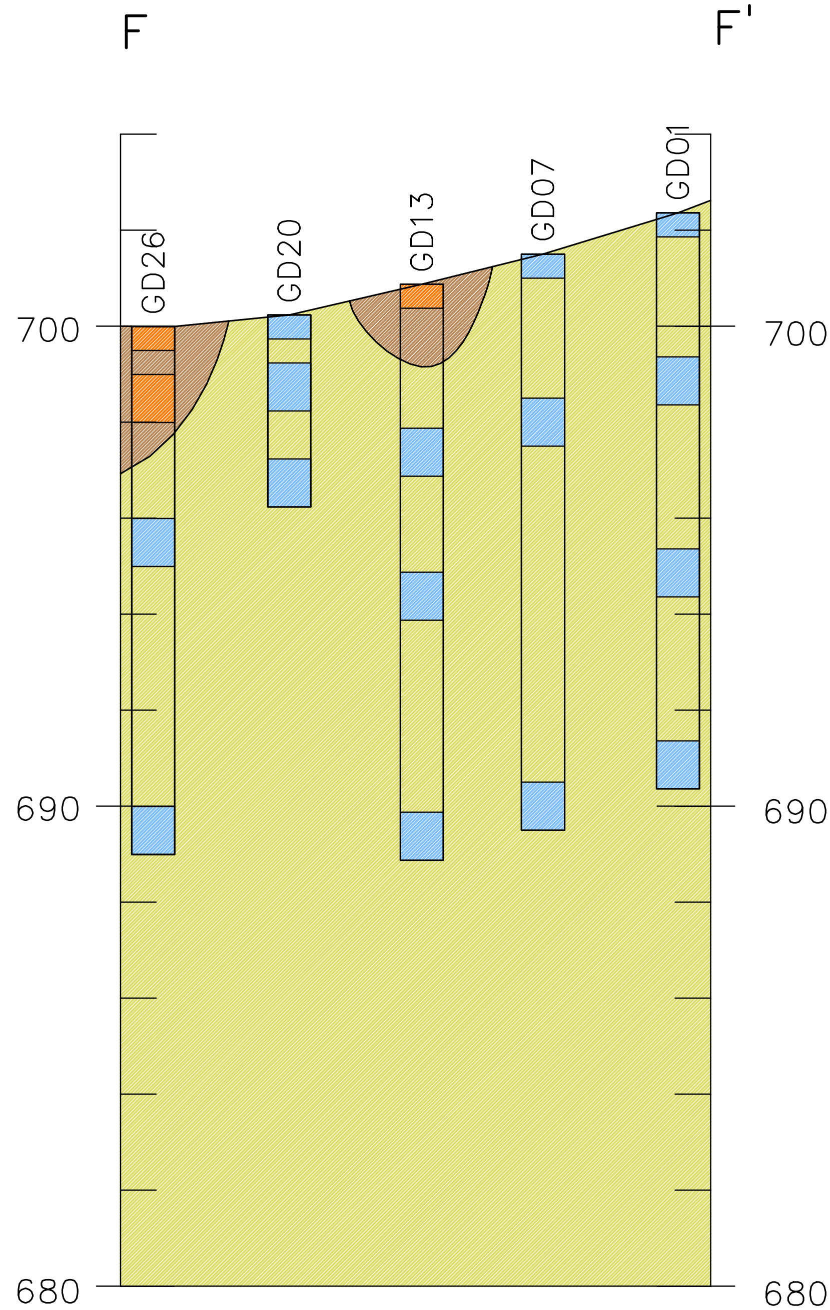
35' 0 35' 70'
APPROXIMATE
HORIZONTAL SCALE: 1" = 70'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-29
AROCLOR 1248 CONCENTRATIONS (mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ E_aroclor1248.dwg 04/24/2002 marianne.turonek DN



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR AROCLOR 1248 IS 9.9 mg/kg
SITE–SPECIFIC STANDARD FOR AROCLOR 1248 IS 59 mg/kg

2' 0 2' 4'

APPROXIMATE
VERTICAL SCALE: 1" = 4'

35' 0 35' 70'

APPROXIMATE
HORIZONTAL SCALE: 1" = 70'

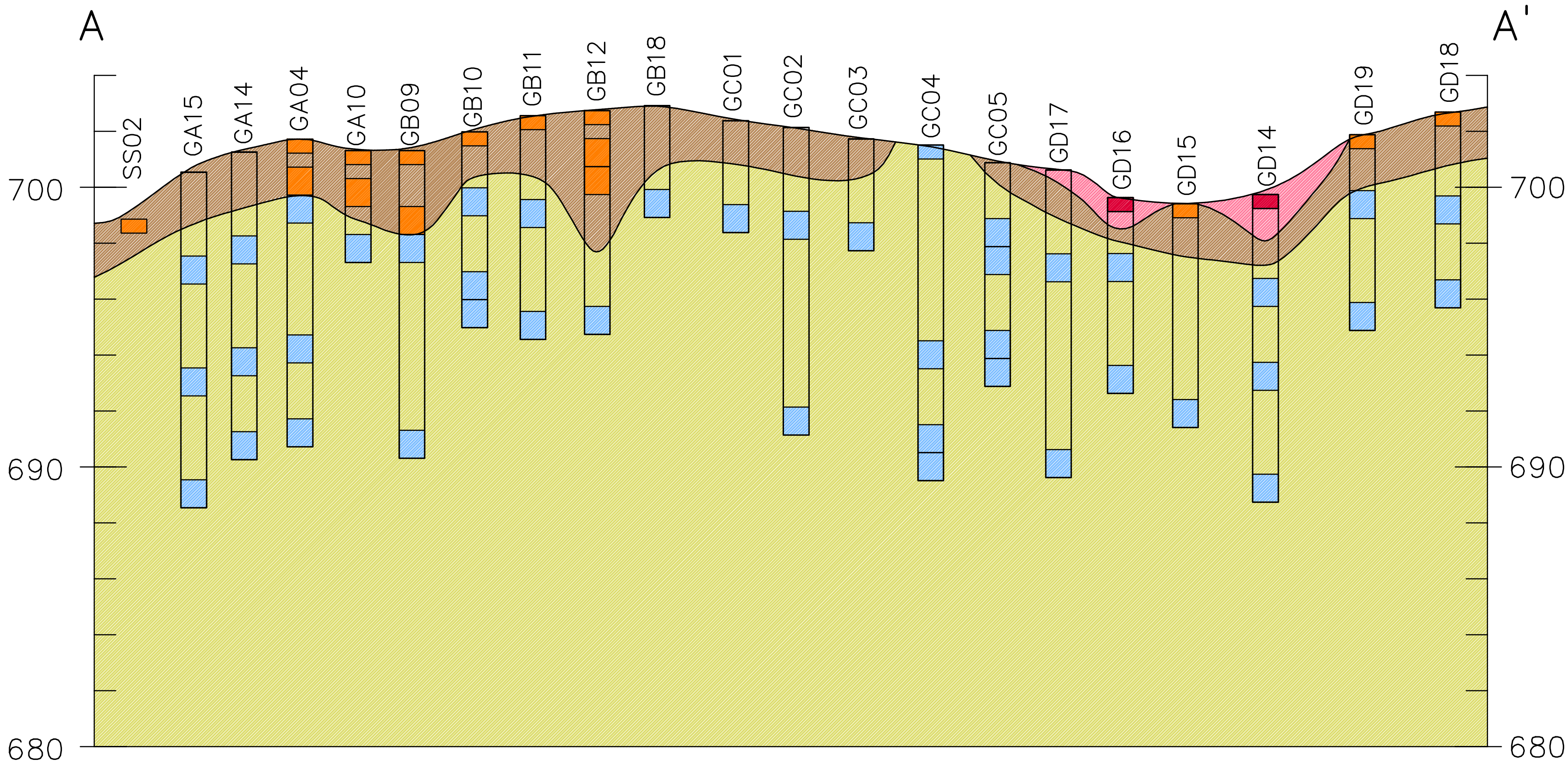
STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-35
AROCLOR 1248 CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ F_aroclor1248.dwg 04/24/2002 marianne.turonek DN

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ A_aroclor1254.dwg 04/24/2002 marianne.turonek DN



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL SAMPLE CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR AROCLOR 1254 IS 9.9 mg/kg
SITE-SPECIFIC STANDARD FOR AROCLOR 1254 IS 59 mg/kg

3' 0 3' 6'
APPROXIMATE
VERTICAL SCALE: 1" = 6'

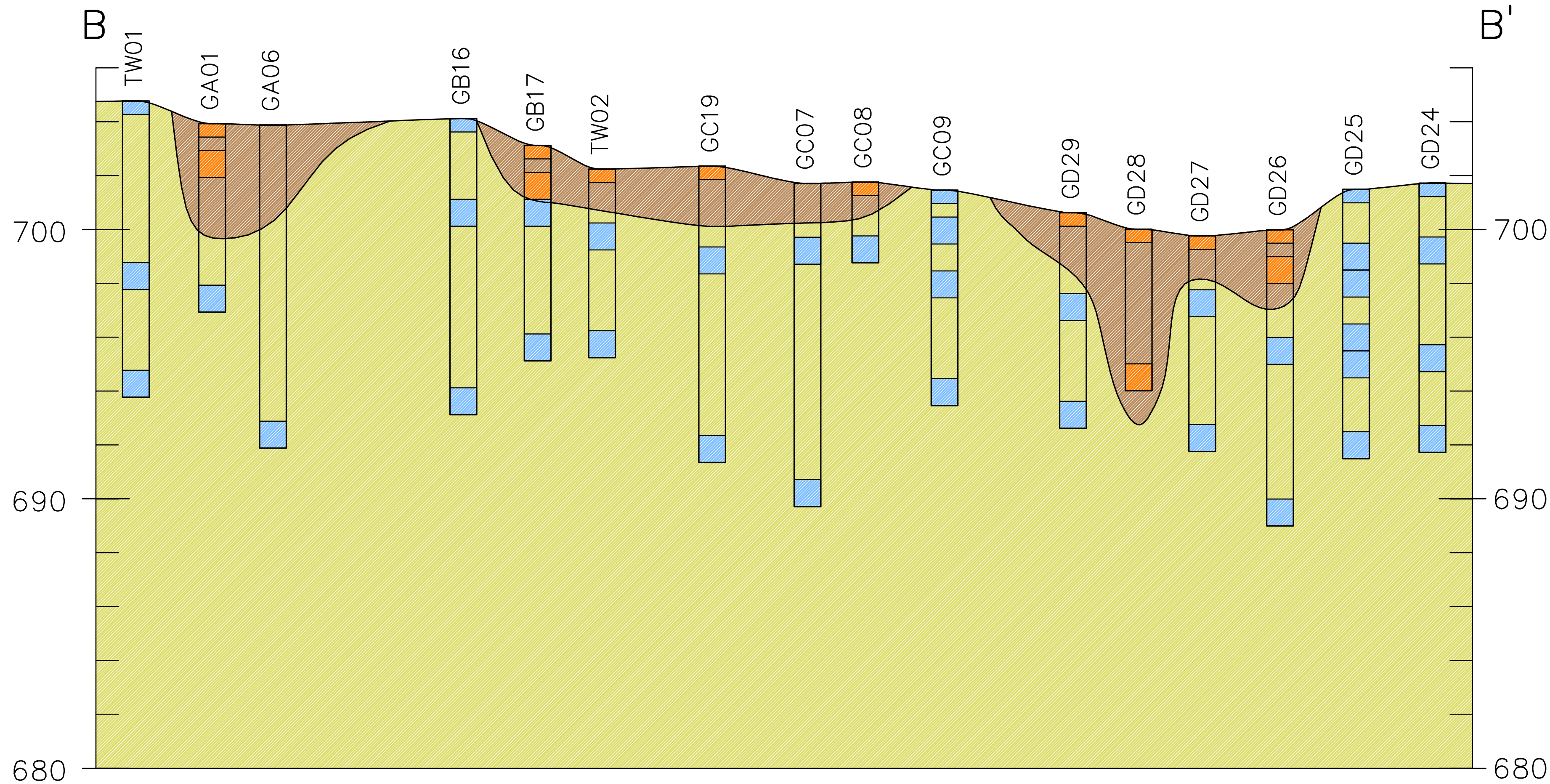
50' 0 50' 100'
APPROXIMATE
HORIZONTAL SCALE: 1" = 100'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-4
AROCLOR 1254 CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ B_aroclor1254.dwg 04/24/2002 marianne.turonek DN



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR AROCLOR 1254 IS 9.9 mg/kg
SITE-SPECIFIC STANDARD FOR AROCLOR 1254 IS 59 mg/kg

3' 0 3' 6'
APPROXIMATE
VERTICAL SCALE: 1" = 6'

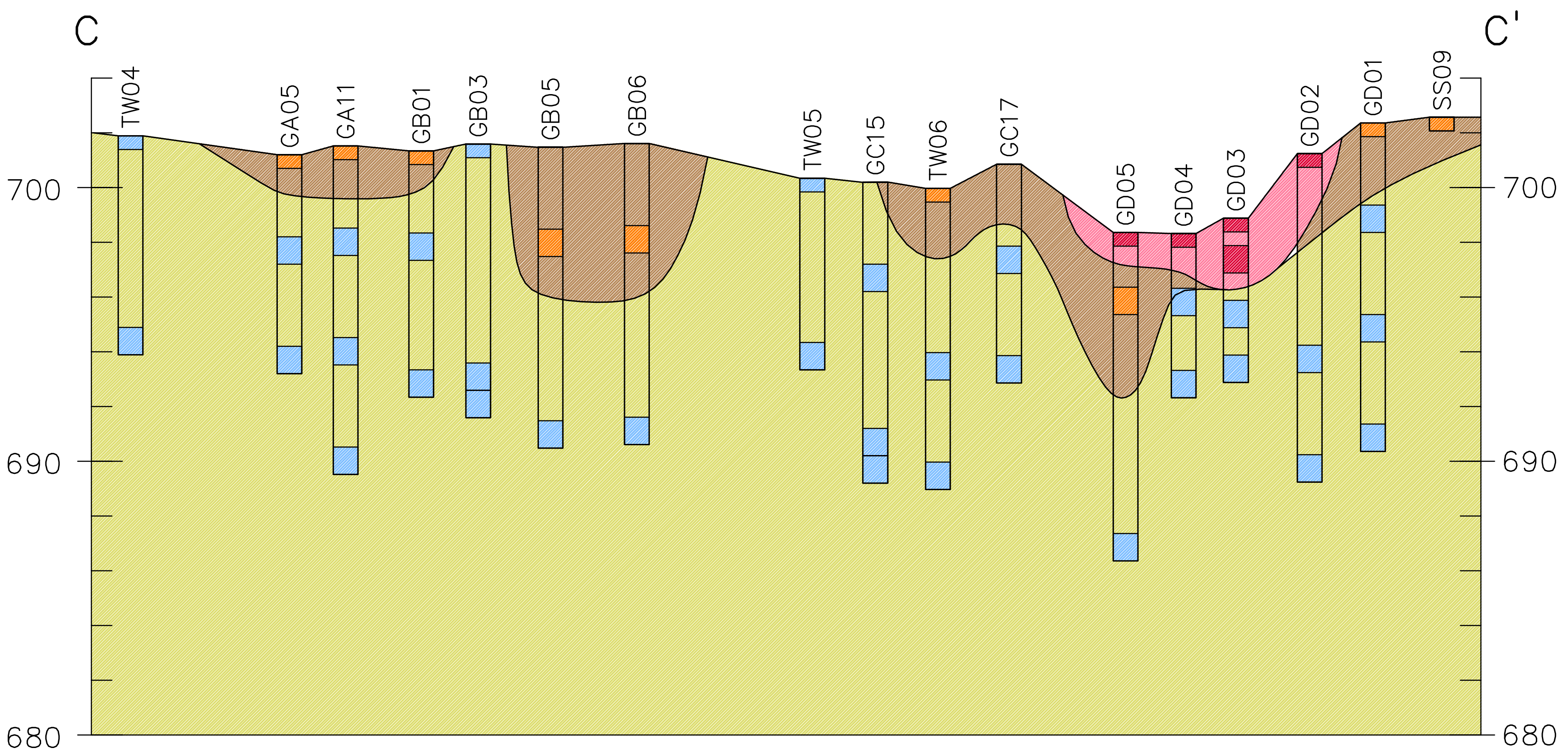
50' 0 50' 100'
APPROXIMATE
HORIZONTAL SCALE: 1" = 100'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-10
AROCLOR 1254 CONCENTRATIONS (mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ C_aroclor1254.dwg 04/24/2002 marianne.turonek DN



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL SAMPLE CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

3' 0 3' 6'
APPROXIMATE
VERTICAL SCALE: 1" = 6'

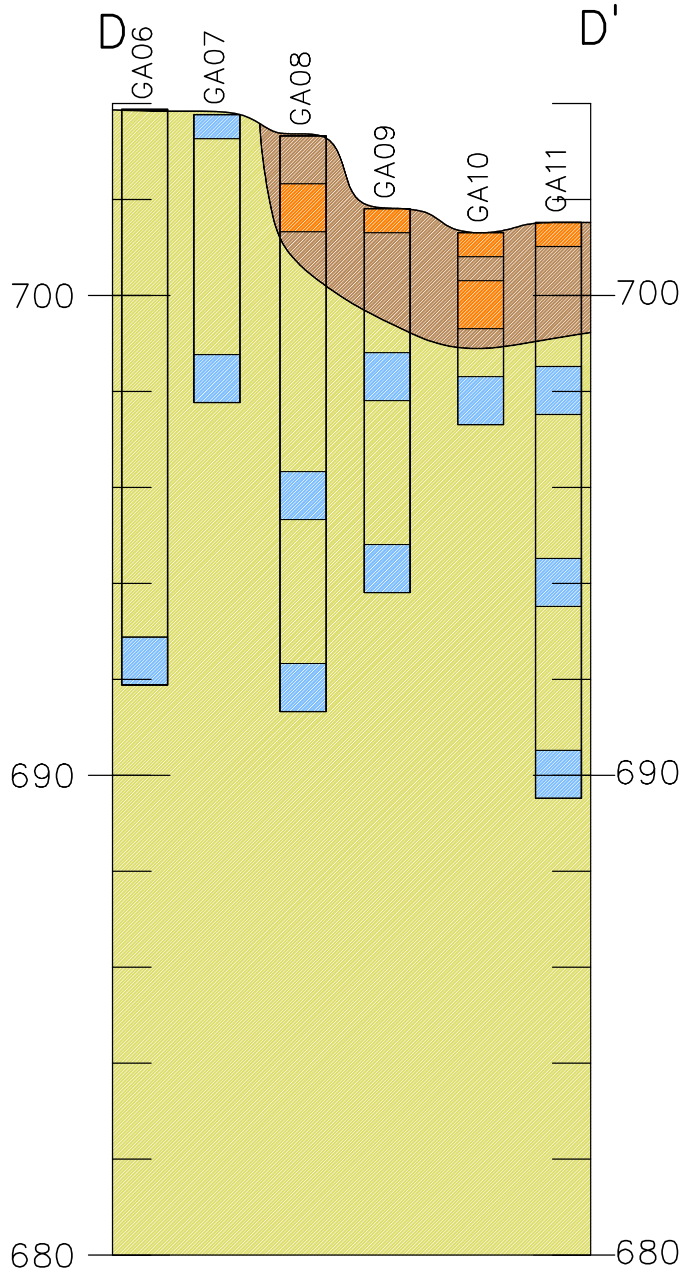
50' 0 50' 100'
APPROXIMATE
HORIZONTAL SCALE: 1" = 100'

NOTE:
GENERIC MSC FOR AROCLOR 1254 IS 9.9 mg/kg
SITE-SPECIFIC STANDARD FOR AROCLOR 1254 IS 59 mg/kg

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-16
AROCLOR 1254 CONCENTRATIONS (mg/kg) IN SOIL

Tetra Tech EM Inc.



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR AROCLOR 1254 IS 9.9 mg/kg
SITE–SPECIFIC STANDARD FOR AROCLOR 1254 IS 59 mg/kg

2' 0 2' 4'
APPROXIMATE
VERTICAL SCALE: 1" = 4'

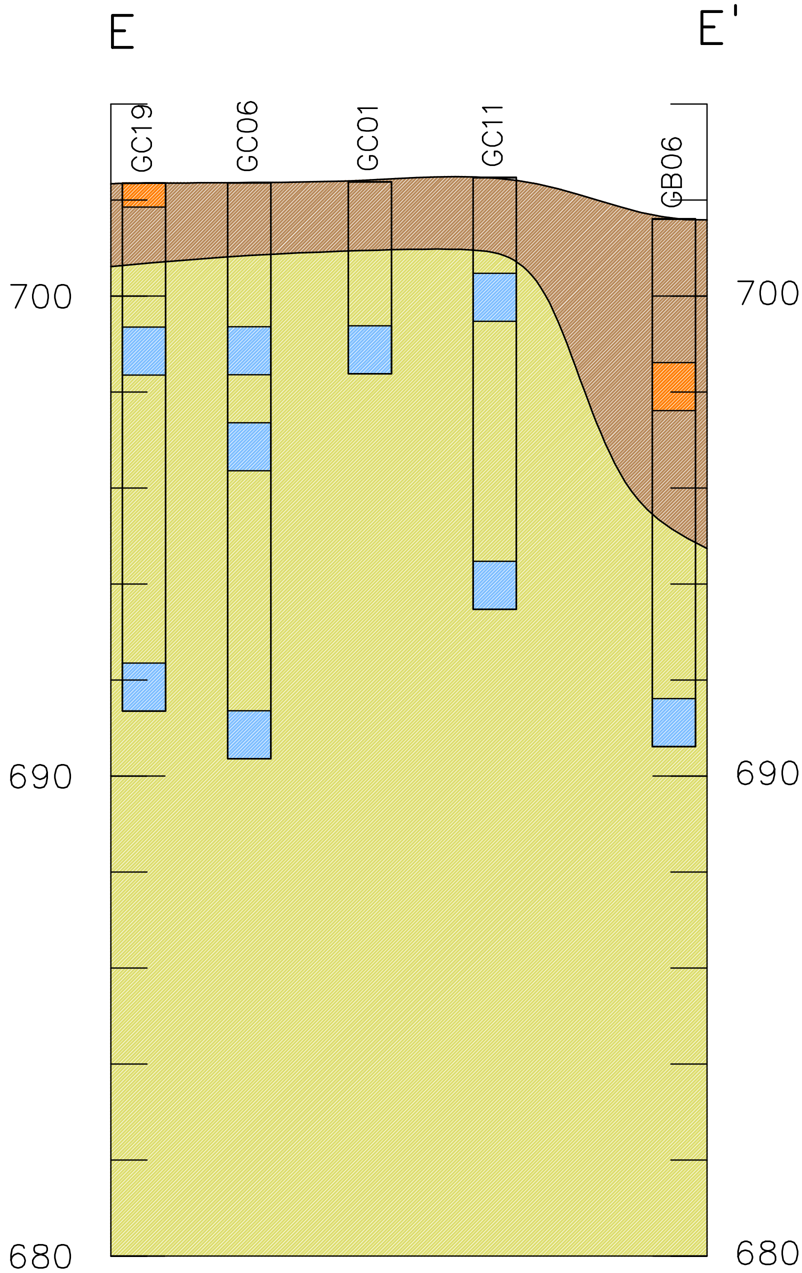
35' 0 35' 70'
APPROXIMATE
HORIZONTAL SCALE: 1" = 70'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A–22
AROCLOR 1254 CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino–Bros\Pasternak–Figs\SECTIONS\ D_aroclor1254.dwg 04/24/2002 marianne.turonek DN



LEGEND

- (blue) SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- (orange) SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- (yellow) SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- (brown) SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR AROCLOR 1254 IS 9.9 mg/kg
SITE-SPECIFIC STANDARD FOR AROCLOR 1254 IS 59 mg/kg

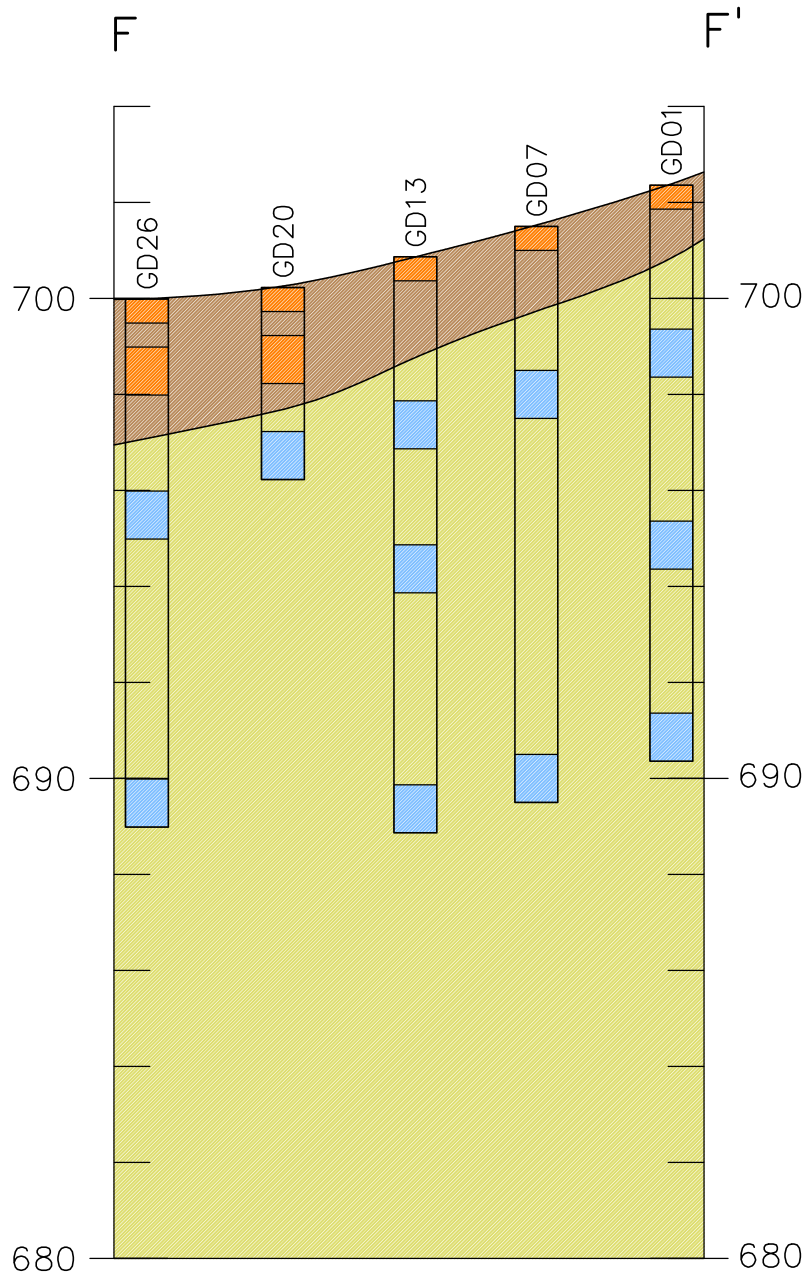
2' 0 2' 4'
APPROXIMATE
VERTICAL SCALE: 1" = 4'

35' 0 35' 70'
APPROXIMATE
HORIZONTAL SCALE: 1" = 70'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-28
AROCLOR 1254 CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.



LEGEND

Blue	SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
Orange	SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
Yellow	SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
Brown	SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
MSC	MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR AROCLOR 1254 IS 9.9 mg/kg
SITE-SPECIFIC STANDARD FOR AROCLOR 1254 IS 59 mg/kg

2' 0 2' 4'
APPROXIMATE
VERTICAL SCALE: 1" = 4'

35' 0 35' 70'
APPROXIMATE
HORIZONTAL SCALE: 1" = 70'

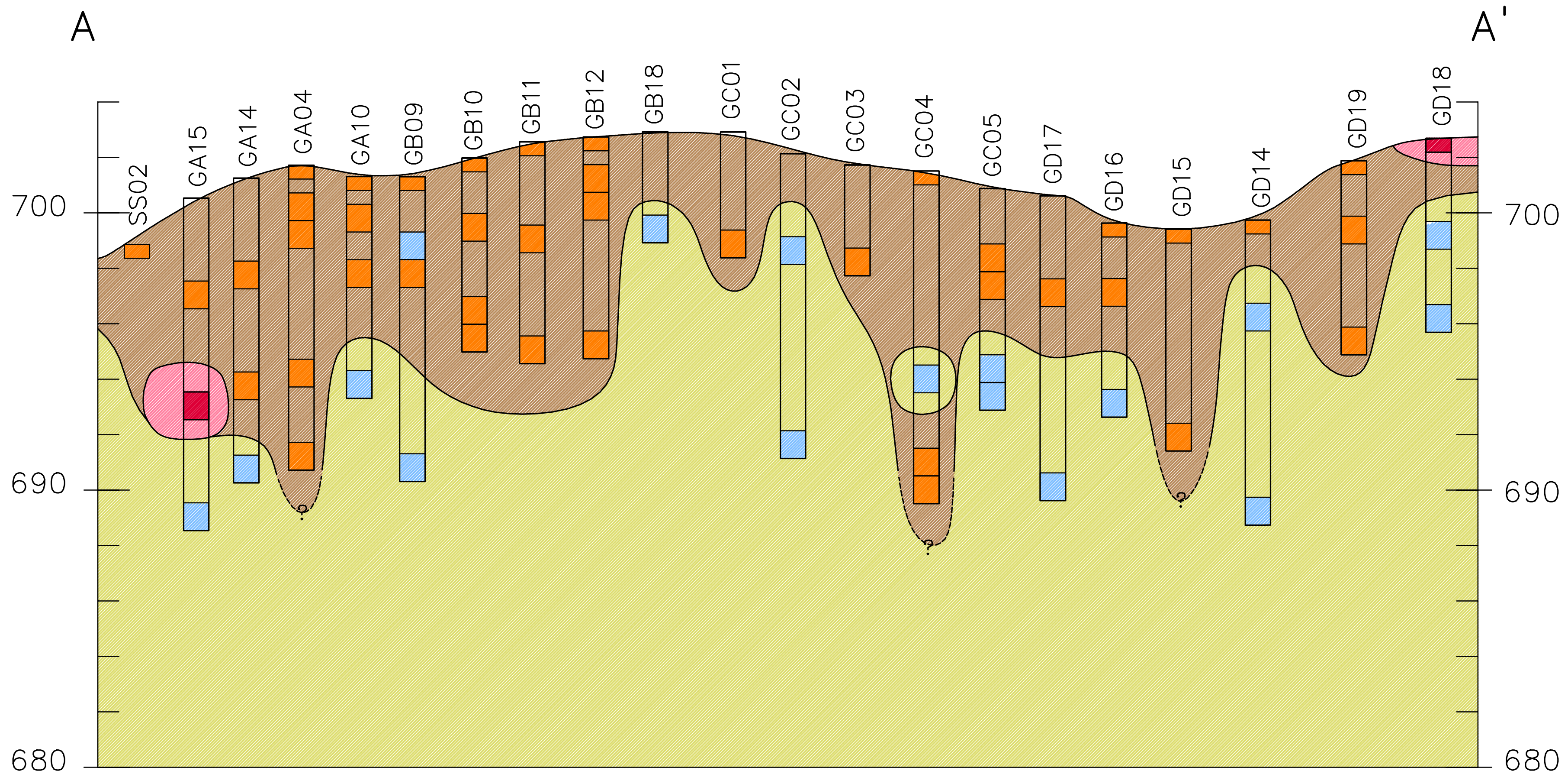
STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-33
AROCLOR 1254 CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ F_aroclor1254.dwg 04/24/2002 marianne.turonek DN

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ A_arsenic.dwg 04/24/2002 marianne.turonek DN



LEGEND

SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD

SOIL SAMPLE CONCENTRATION EXCEEDS THE SITE–SPECIFIC STANDARD

SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD

SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE SITE–SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

3' 0 3' 6'

APPROXIMATE
VERTICAL SCALE: 1" = 6'

50' 0 50' 100'

APPROXIMATE
HORIZONTAL SCALE: 1" = 100'

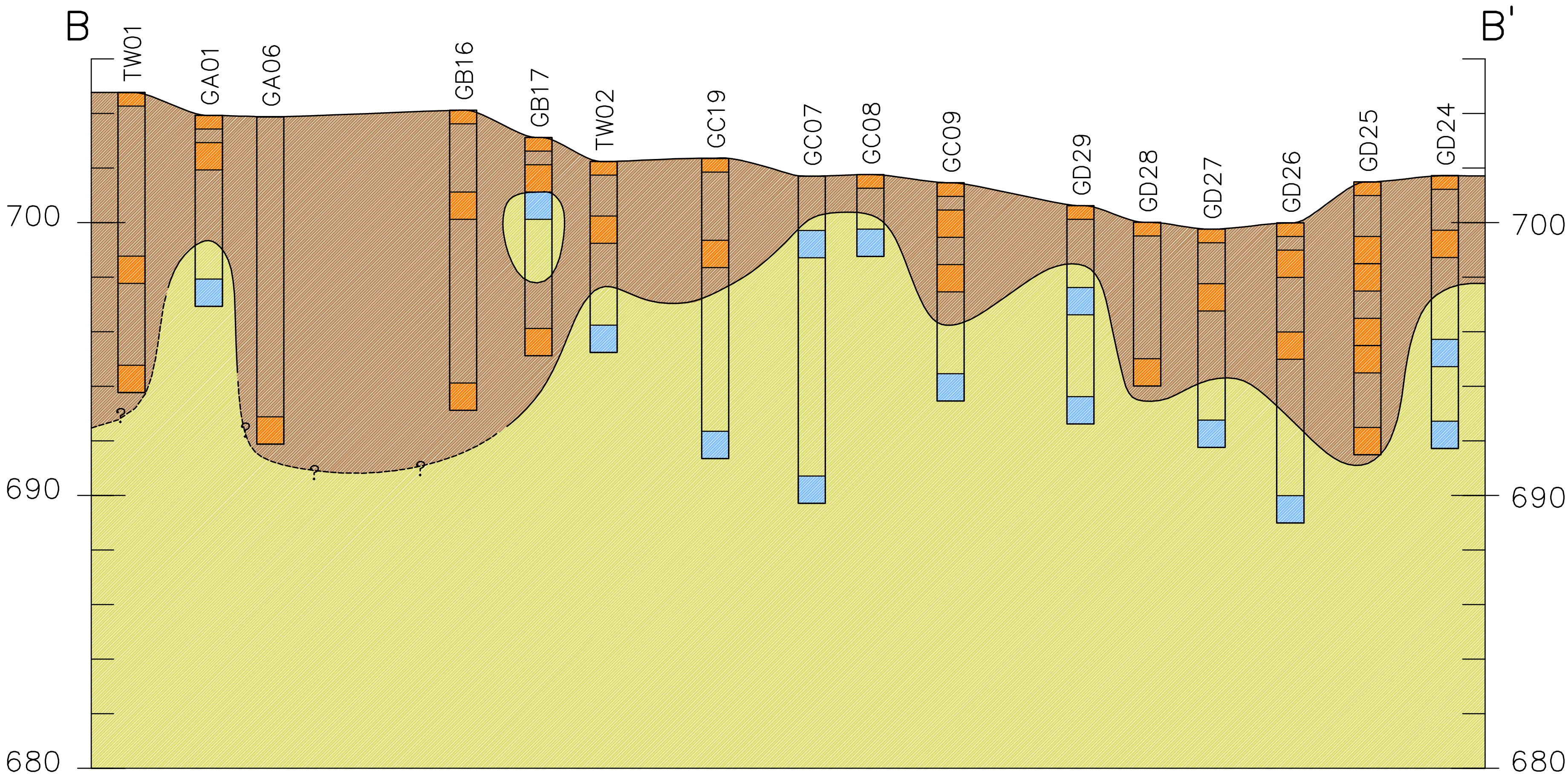
NOTE:
GENERIC MSC FOR ARSENIC IS 12 mg/kg
SITE–SPECIFIC STANDARD FOR ARSENIC IS 196 mg/kg

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-6
ARSENIC CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ B_arsenic.dwg 04/24/2002 marianne.turonek DN



LEGEND

SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR ARSENIC IS 12 mg/kg
SITE-SPECIFIC STANDARD FOR ARSENIC IS 196 mg/kg

3' 0 3' 6'
APPROXIMATE
VERTICAL SCALE: 1" = 6'

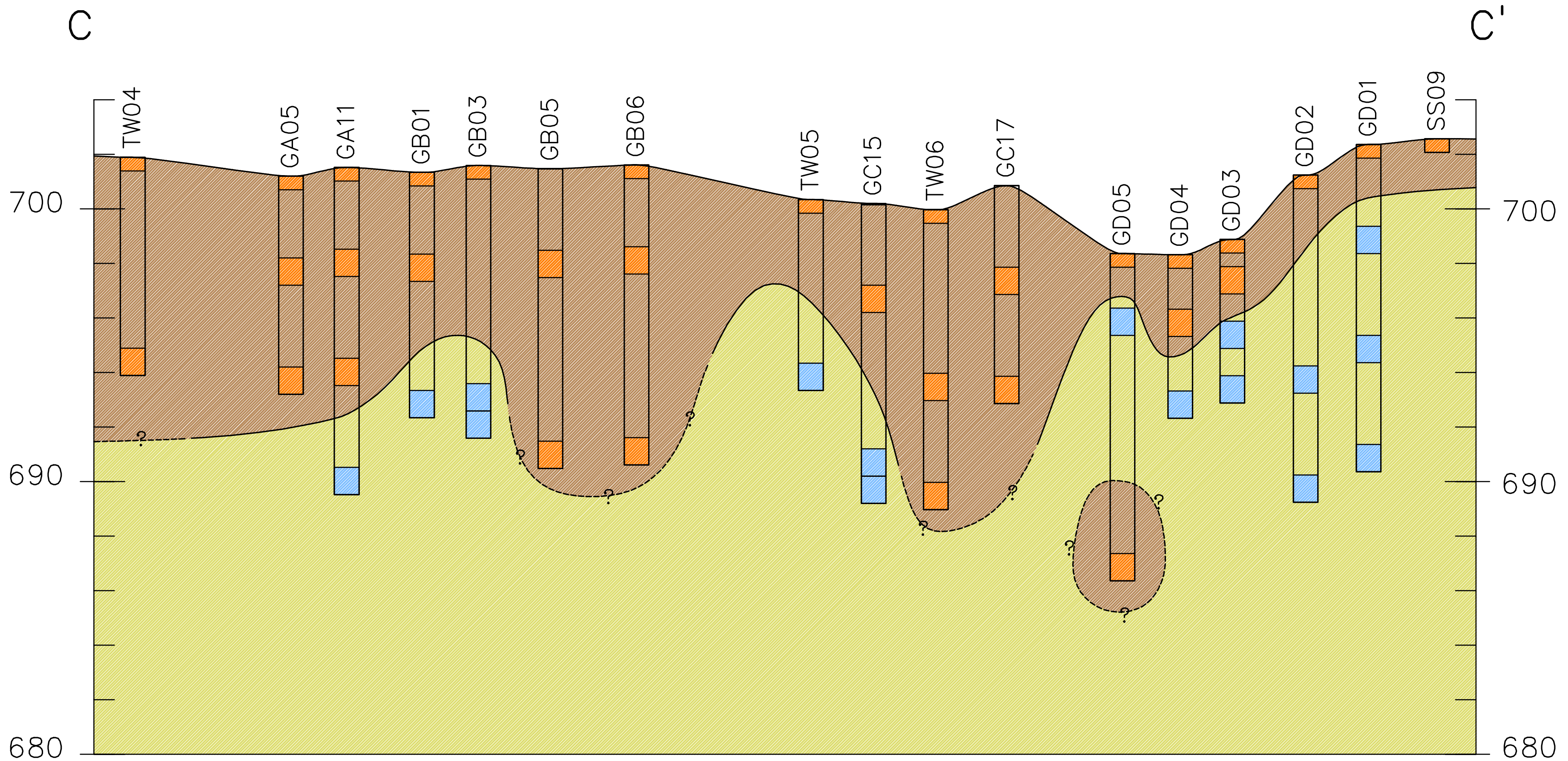
50' 0 50' 100'
APPROXIMATE
HORIZONTAL SCALE: 1" = 100'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-12
ARSENIC CONCENTRATIONS (mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ C_arsenic.dwg 04/24/2002 marianne.turonek DN



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

3' 0 3' 6'

APPROXIMATE VERTICAL SCALE: 1" = 6'

50' 0 50' 100'

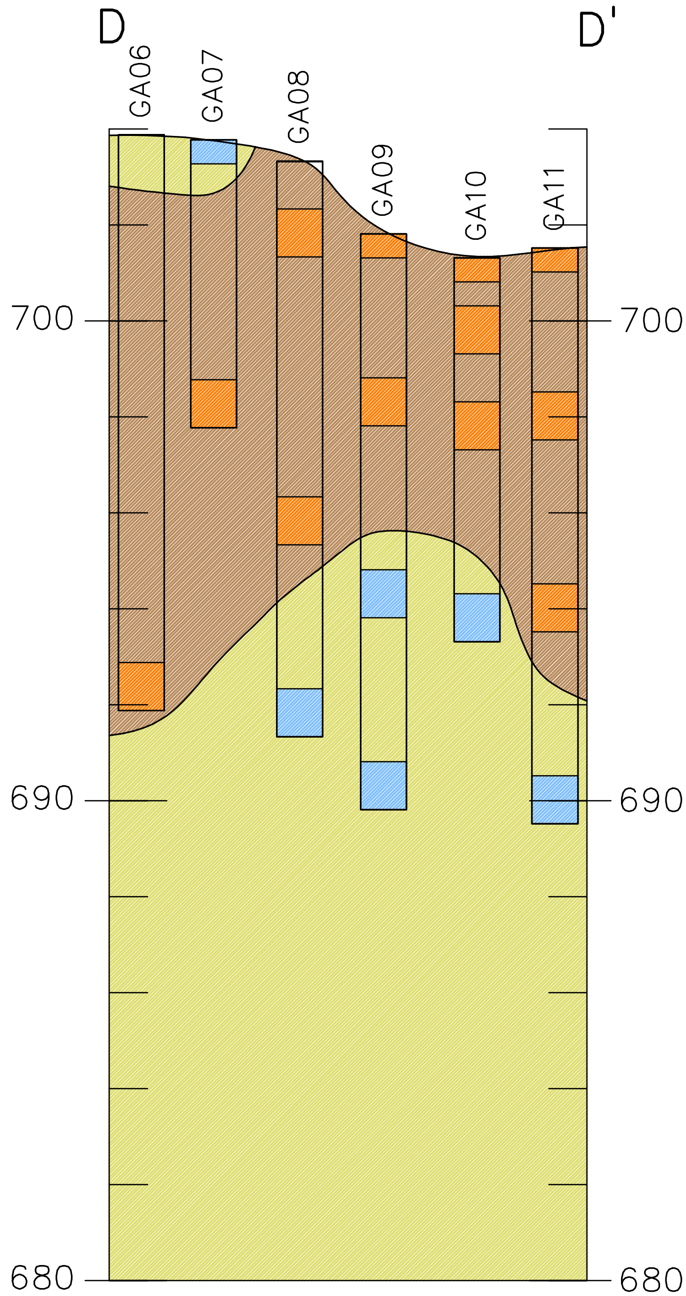
APPROXIMATE HORIZONTAL SCALE: 1" = 100'

NOTE:
GENERIC MSC FOR ARSENIC IS 12 mg/kg
SITE-SPECIFIC STANDARD FOR ARSENIC IS 196 mg/kg

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-18
ARSENIC CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR ARSENIC IS 12 mg/kg
SITE–SPECIFIC STANDARD FOR ARSENIC IS 196 mg/kg

2' 0 2' 4'

APPROXIMATE
VERTICAL SCALE: 1" = 4'

35' 0 35' 70'

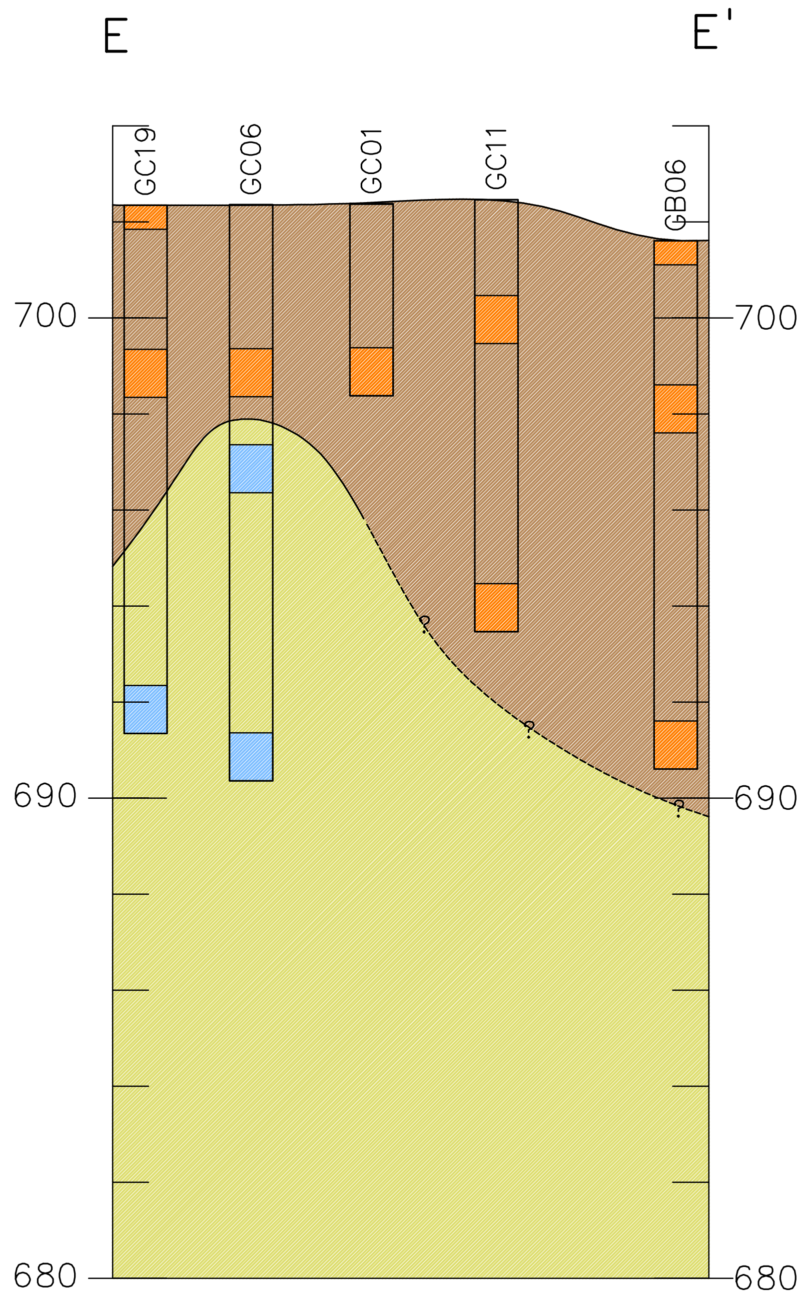
APPROXIMATE
HORIZONTAL SCALE: 1" = 70'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-24
ARSENIC CONCENTRATIONS (mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ D_arsenic.dwg 04/24/2002 marianne.turonek DN



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR ARSENIC IS 12 mg/kg
SITE–SPECIFIC STANDARD FOR ARSENIC IS 196 mg/kg

2' 0 2' 4'
APPROXIMATE VERTICAL SCALE: 1" = 4'

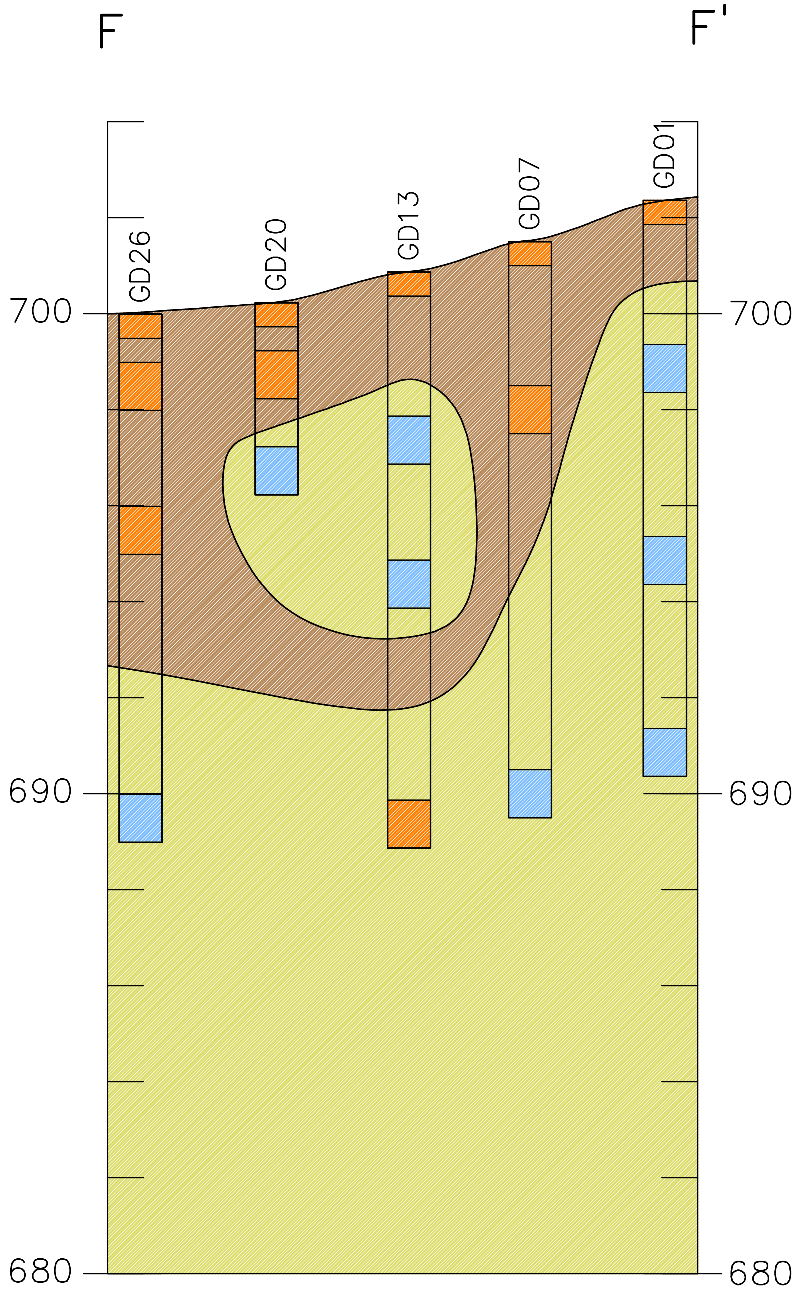
35' 0 35' 70'
APPROXIMATE HORIZONTAL SCALE: 1" = 70'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-30
ARSENIC CONCENTRATIONS (mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ E_arsenic.dwg 04/24/2002 marianne.turonek DN



LEGEND

SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD

SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR ARSENIC IS 12 mg/kg
SITE–SPECIFIC STANDARD FOR ARSENIC IS 196 mg/kg

2' 0 2' 4'
APPROXIMATE
VERTICAL SCALE: 1" = 4'

35' 0 35' 70'
APPROXIMATE
HORIZONTAL SCALE: 1" = 70'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-36
ARSENIC CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

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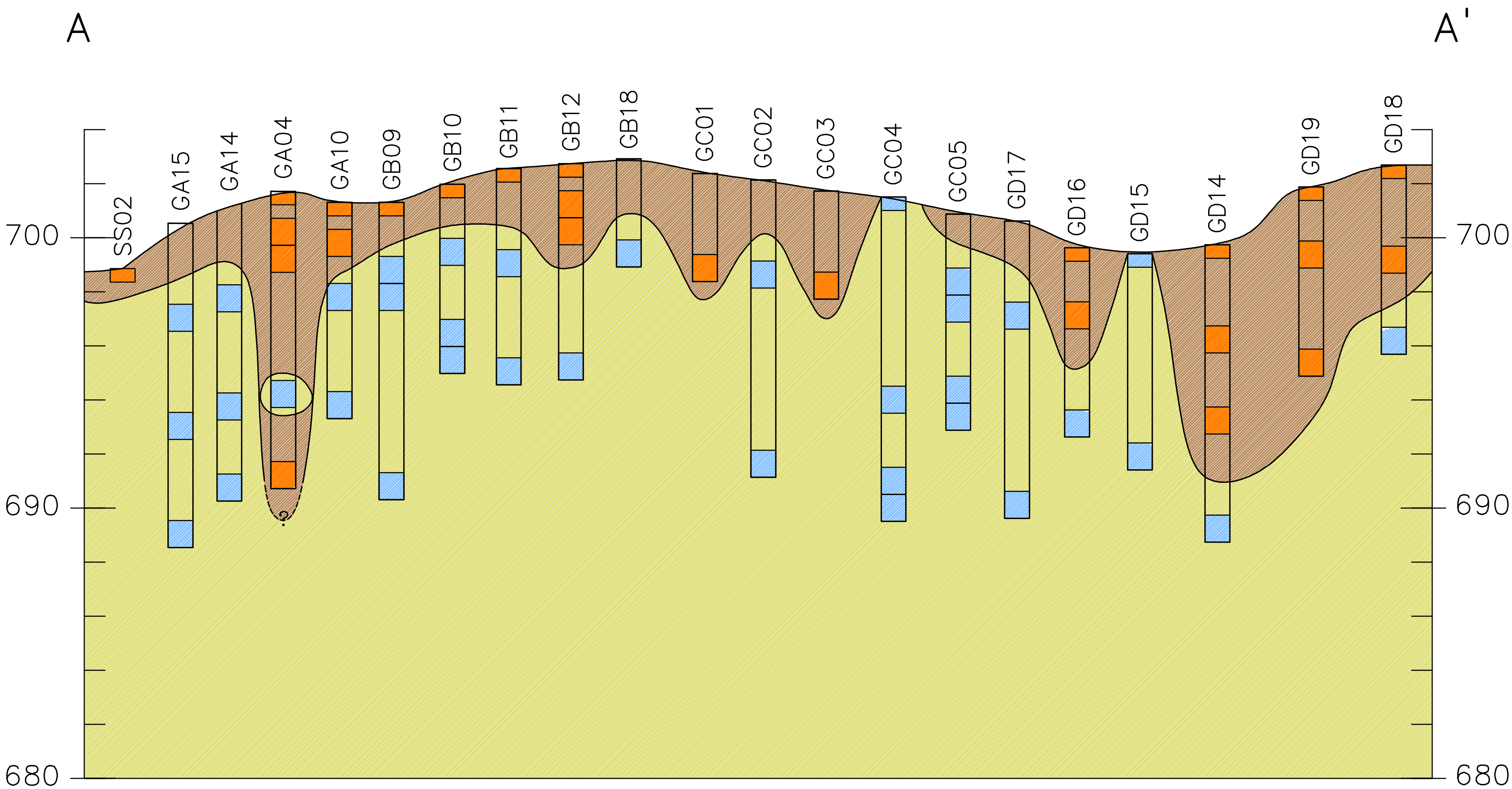
R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ A_iron.dwg 04/24/2002 marianne.turonek DN



LEGEND

SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

3' 0 3' 6'

APPROXIMATE
VERTICAL SCALE: 1" = 6'

50' 0 50' 100'

APPROXIMATE
HORIZONTAL SCALE: 1" = 100'

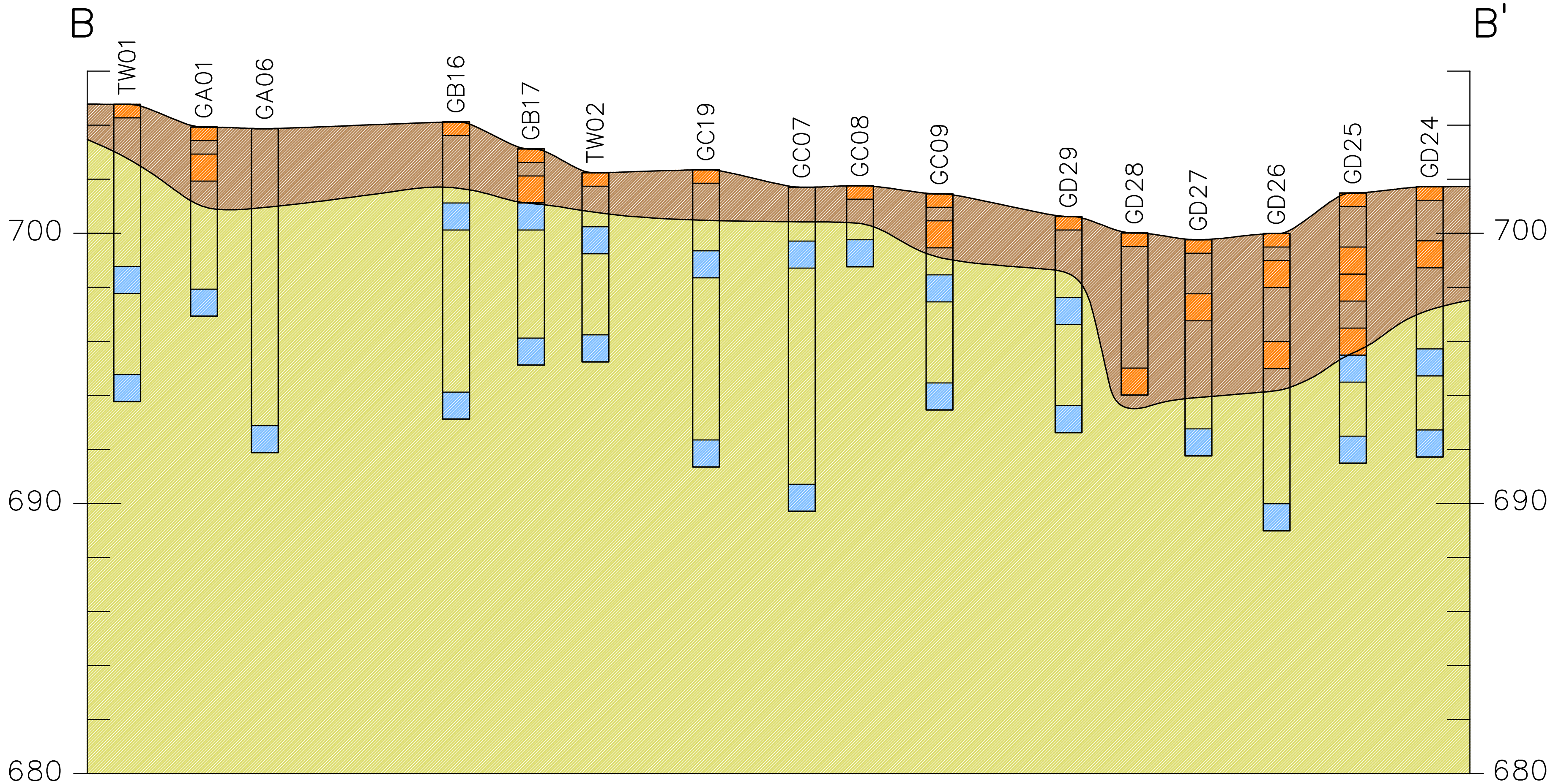
NOTE:
GENERIC MSC FOR IRON IS 66000 mg/kg
SITE-SPECIFIC STANDARD FOR IRON IS 389944 mg/kg

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-7
IRON CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ B_iron.dwg 04/24/2002 marianne.turonek DN



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR IRON IS 66000 mg/kg
SITE-SPECIFIC STANDARD FOR IRON IS 389944 mg/kg

3' 0 3' 6'
APPROXIMATE
VERTICAL SCALE: 1" = 6'

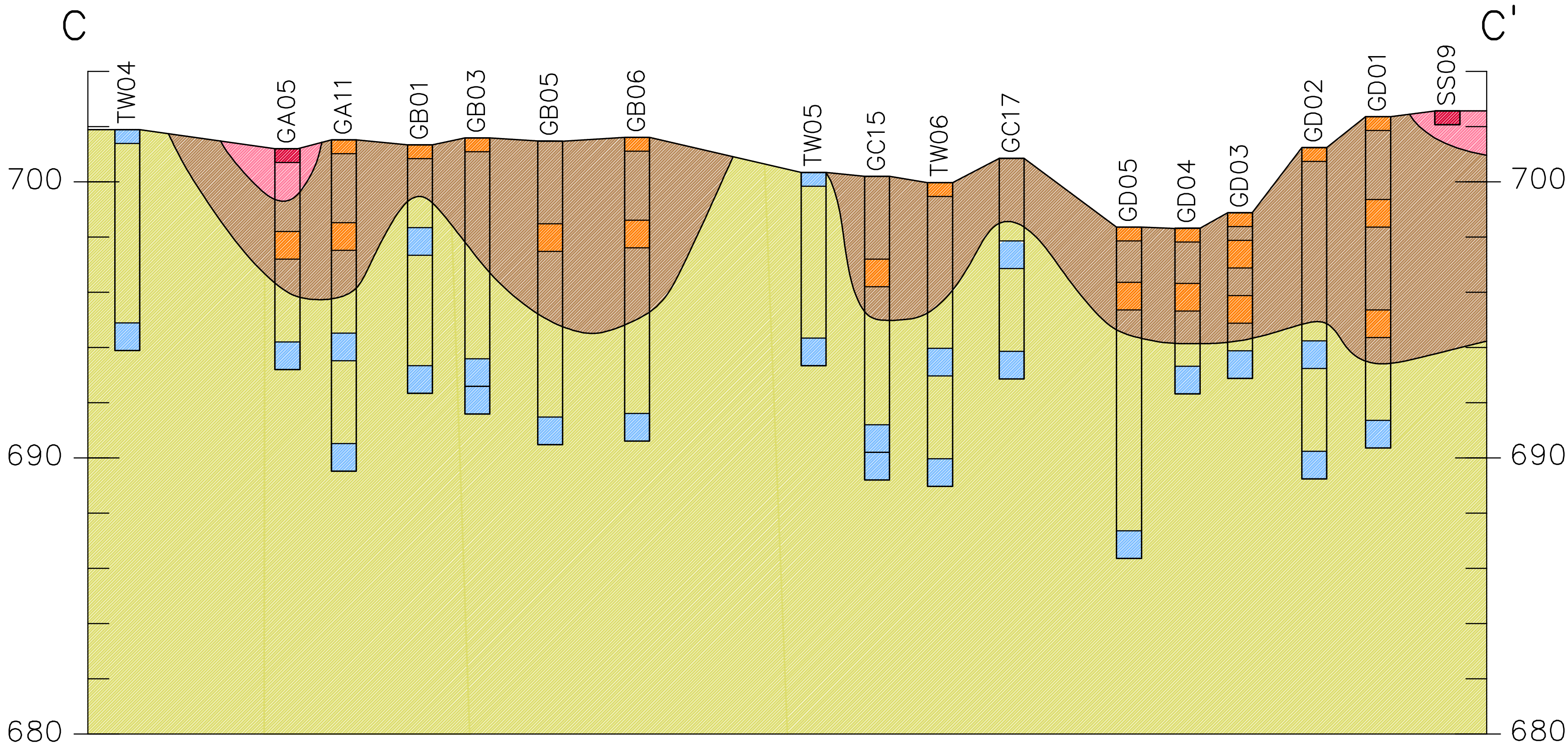
50' 0 50' 100'
APPROXIMATE
HORIZONTAL SCALE: 1" = 100'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-13
IRON CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ C_iron.dwg 04/24/2002 marianne.turonek DN



LEGEND

SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

SOIL SAMPLE CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD

SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR IRON IS 66000 mg/kg
SITE-SPECIFIC STANDARD FOR IRON IS 389944 mg/kg

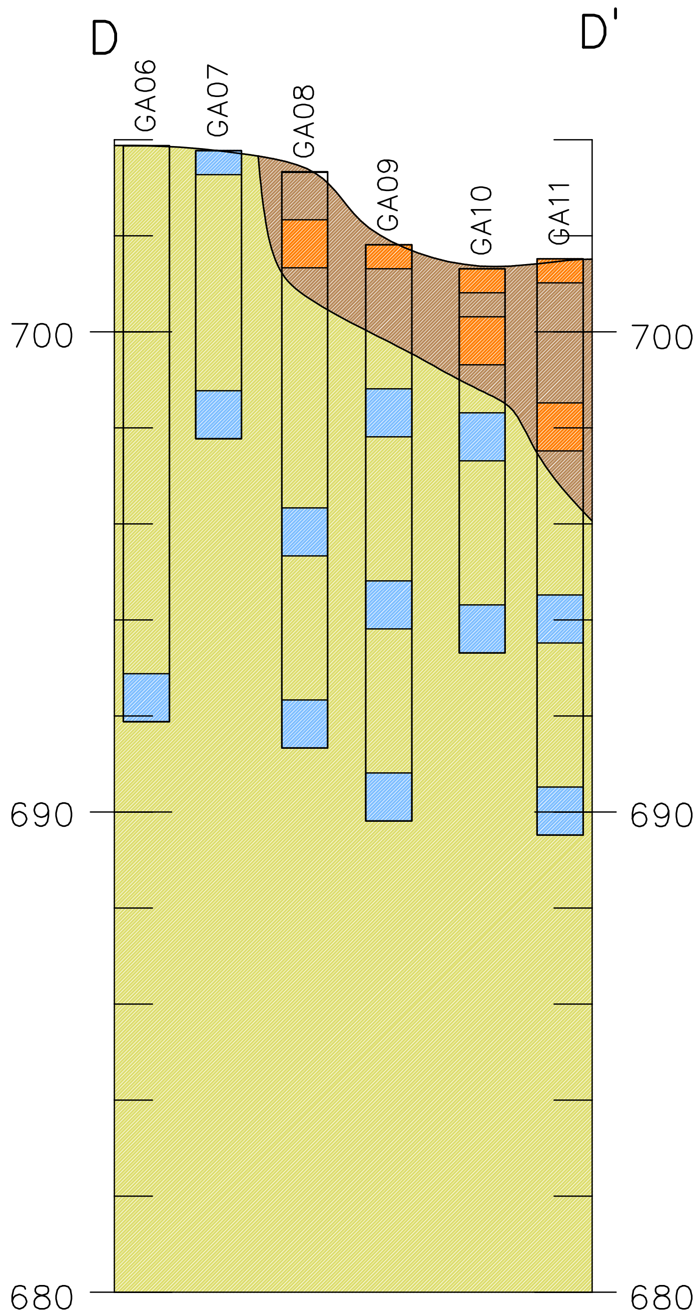
3' 0 3' 6'
APPROXIMATE
VERTICAL SCALE: 1" = 6'

50' 0 50' 100'
APPROXIMATE
HORIZONTAL SCALE: 1" = 100'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-19
IRON CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.



LEGEND

(blue)	SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
(orange)	SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD
(yellow)	SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
(brown)	SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD
MSC	MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR IRON IS 66000 mg/kg
SITE–SPECIFIC STANDARD FOR IRON IS 389944 mg/kg

2' 0 2' 4'
APPROXIMATE
VERTICAL SCALE: 1" = 4'

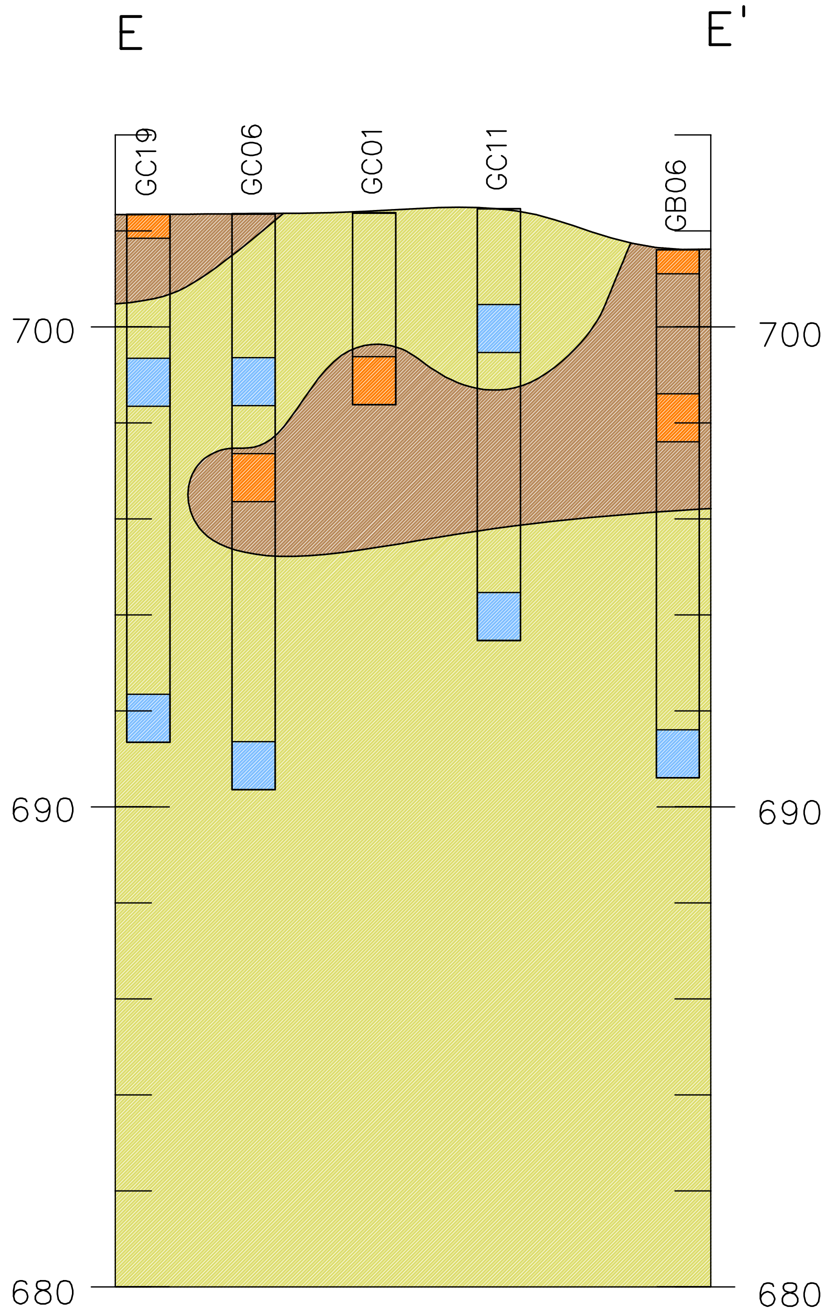
35' 0 35' 70'
APPROXIMATE
HORIZONTAL SCALE: 1" = 70'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-25
IRON CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ D_Iron.dwg 04/24/2002 marianne.turonek DN

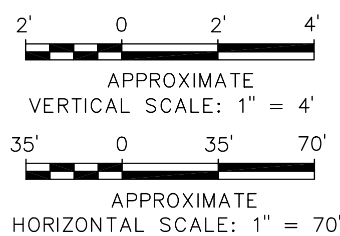


LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR IRON IS 66000 mg/kg
SITE-SPECIFIC STANDARD FOR IRON IS 389944 mg/kg

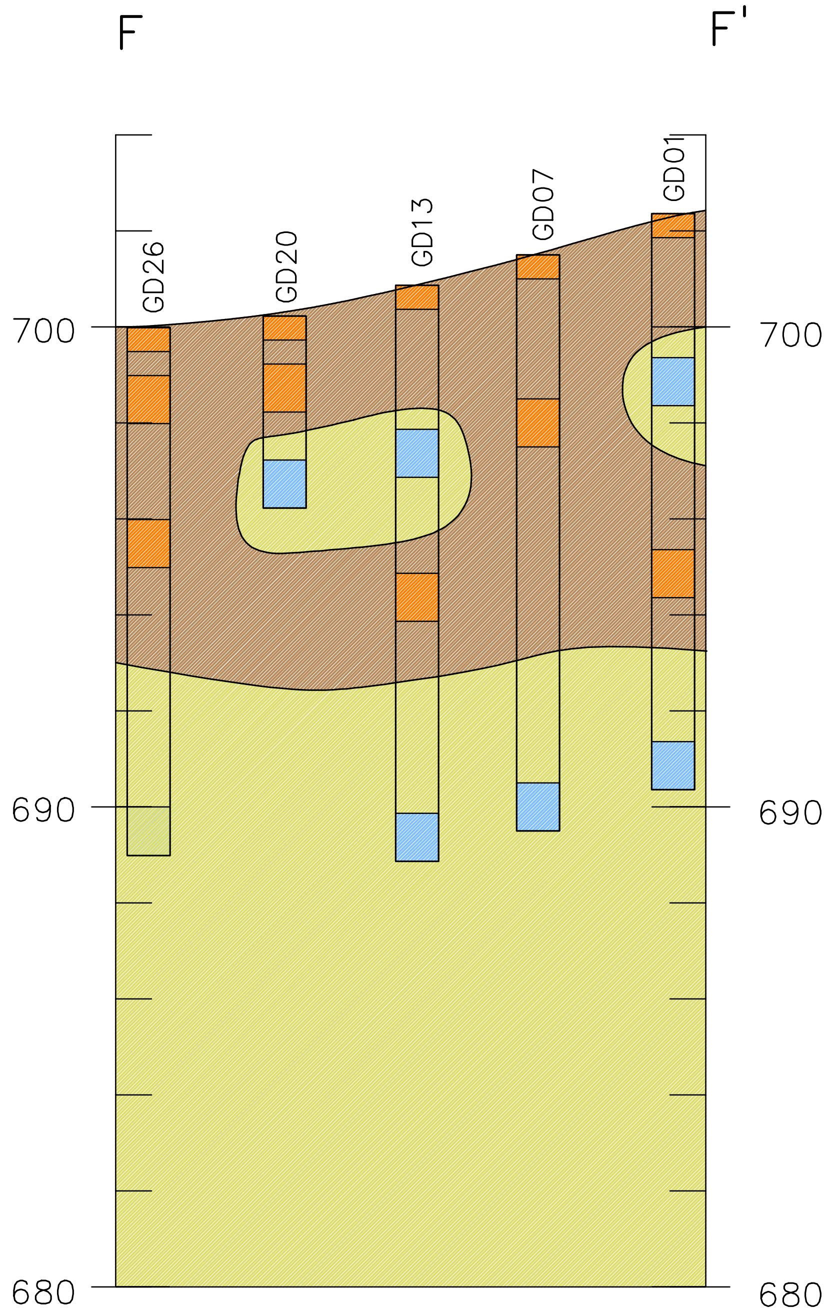


STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-31
IRON CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ E_Iron.dwg 04/24/2002 marianne.turonek DN



LEGEND

- (blue) SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- (orange) SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- (yellow) SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- (brown) SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR IRON IS 66000 mg/kg
SITE-SPECIFIC STANDARD FOR IRON IS 389944 mg/kg

2' 0 2' 4'
APPROXIMATE
VERTICAL SCALE: 1" = 4'

35' 0 35' 70'
APPROXIMATE
HORIZONTAL SCALE: 1" = 70'

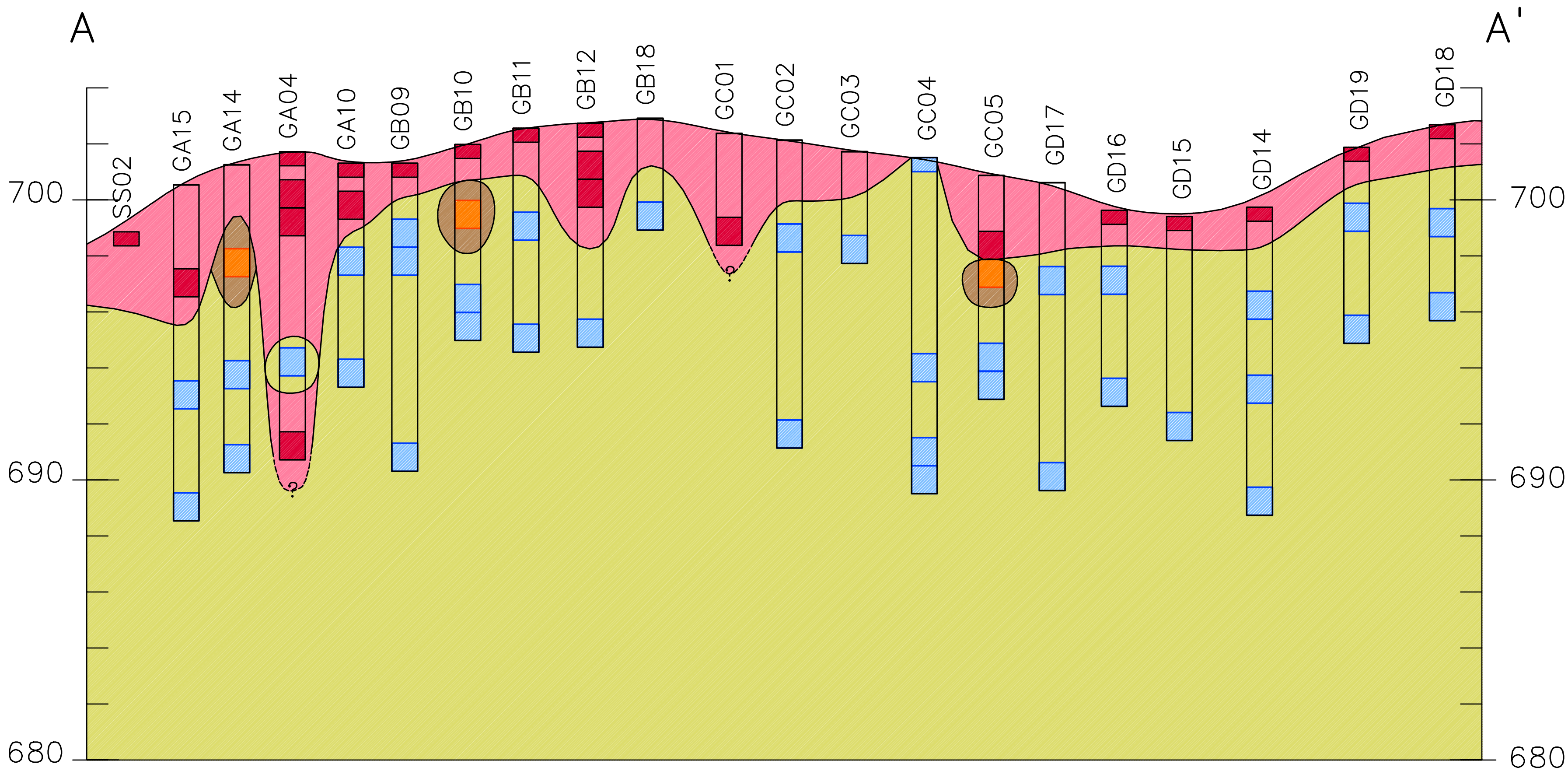
STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-37
IRON CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ F_Iron.dwg 04/24/2002 marianne.turonek DN

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ A_lead.dwg 04/24/2002 marianne.turonek DN



LEGEND

SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

SOIL SAMPLE CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD

SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

3' 0 3' 6'

APPROXIMATE
VERTICAL SCALE: 1" = 6'

50' 0 50' 100'

APPROXIMATE
HORIZONTAL SCALE: 1" = 100'

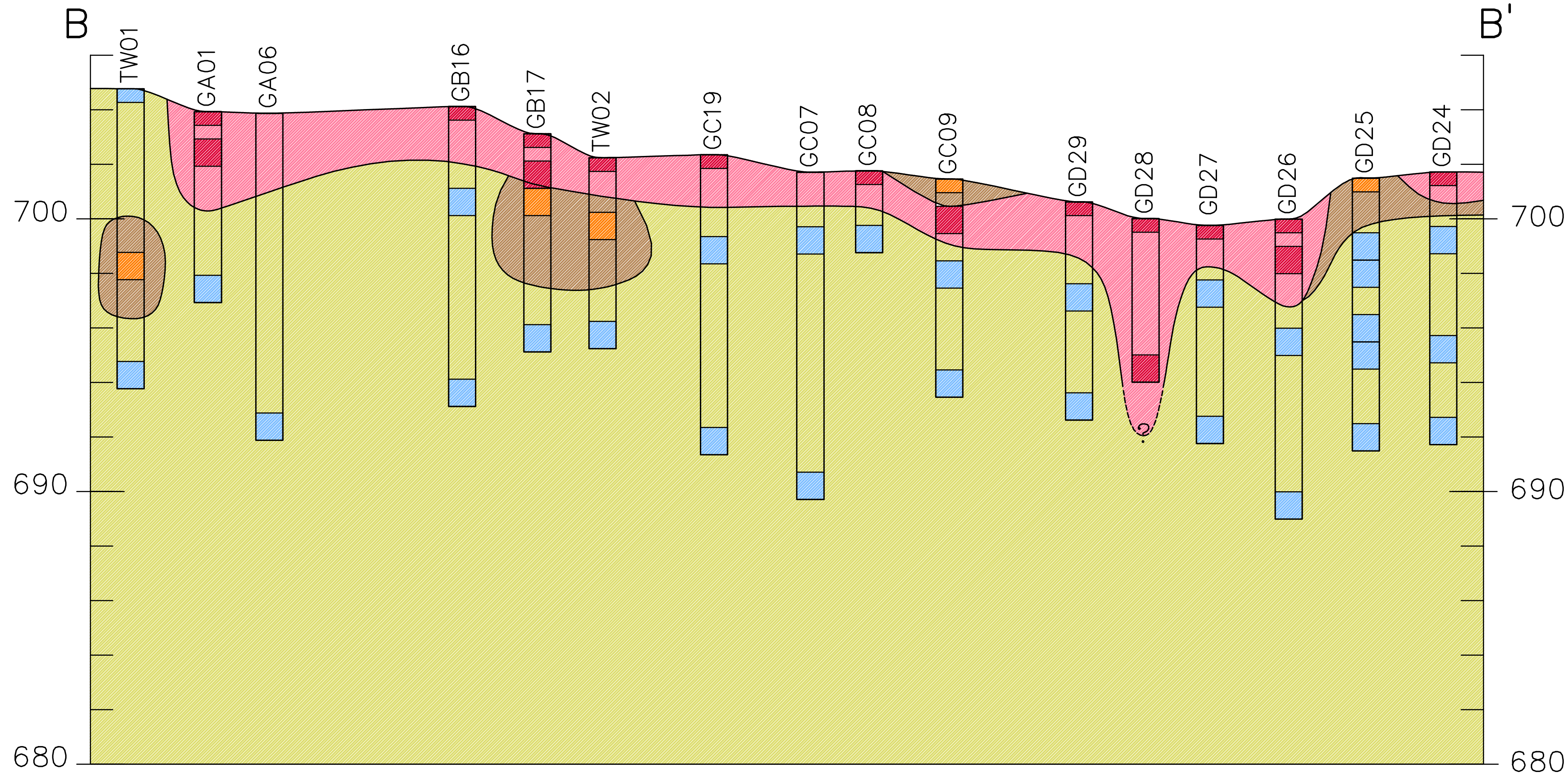
NOTE:
GENERIC MSC FOR LEAD IS 450 mg/kg
SITE-SPECIFIC STANDARD FOR LEAD IS 1300 mg/kg

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-2
LEAD CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ B_lead.dwg 04/24/2002 marianne.turonek DN



LEGEND

SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

SOIL SAMPLE CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD

SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR LEAD IS 450 mg/kg
SITE-SPECIFIC STANDARD FOR LEAD IS 1300 mg/kg

3' 0 3' 6'
APPROXIMATE
VERTICAL SCALE: 1" = 6'

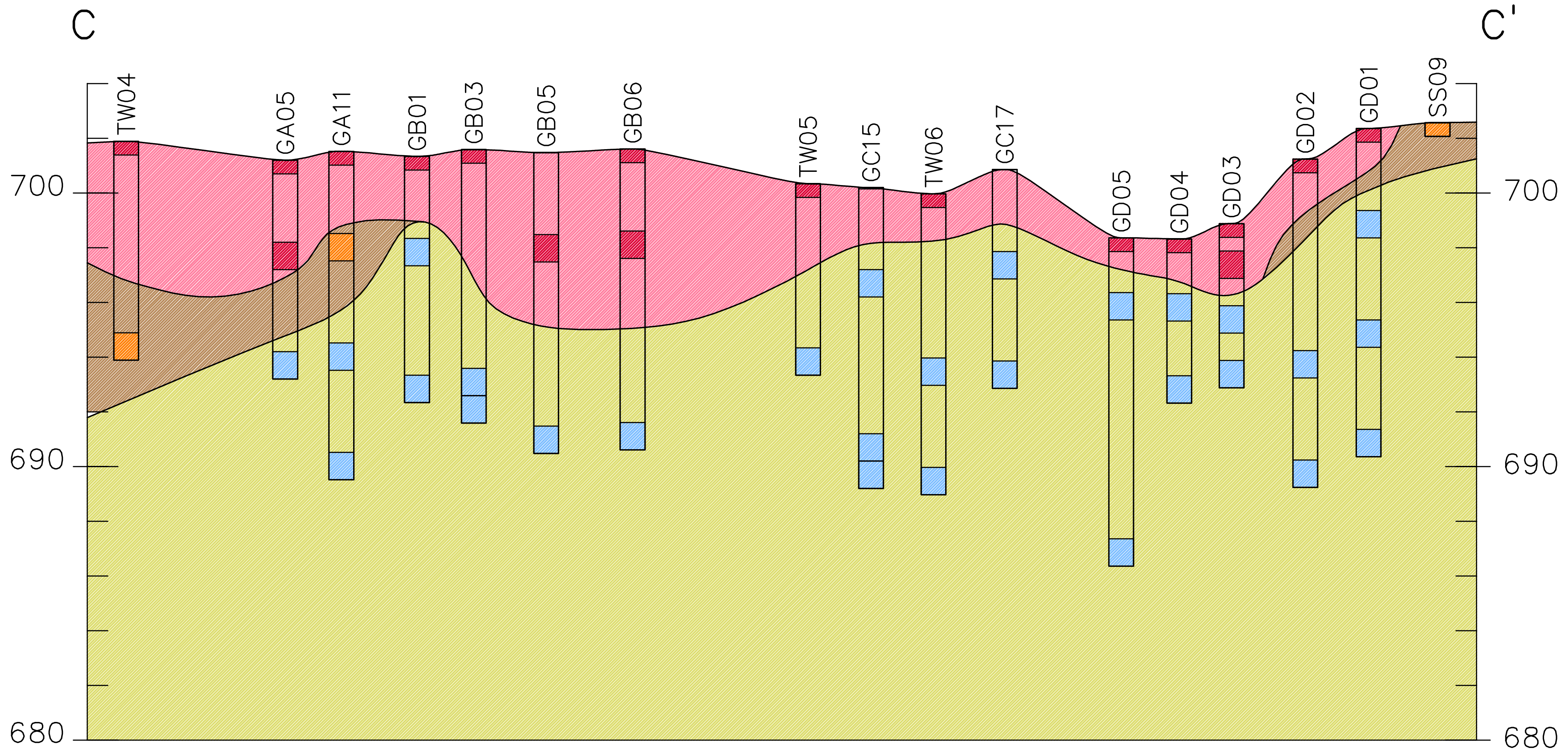
50' 0 50' 100'
APPROXIMATE
HORIZONTAL SCALE: 1" = 100'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-8
LEAD CONCENTRATIONS (mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ C_lead.dwg 04/24/2002 marianne.turonek DN



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL SAMPLE CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

3' 0 3' 6'
APPROXIMATE
VERTICAL SCALE: 1" = 6'

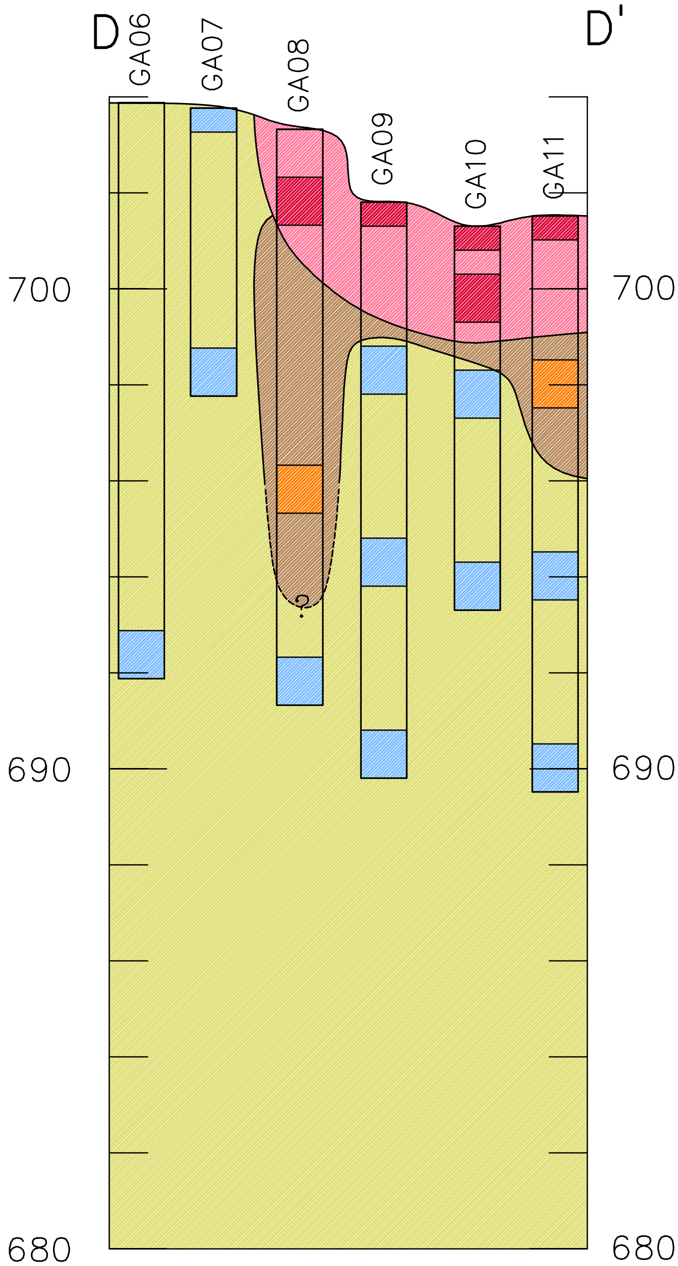
50' 0 50' 100'
APPROXIMATE
HORIZONTAL SCALE: 1" = 100'

NOTE:
GENERIC MSC FOR LEAD IS 450 mg/kg
SITE-SPECIFIC STANDARD FOR LEAD IS 1300 mg/kg

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-14
LEAD CONCENTRATIONS (mg/kg) IN SOIL

Tetra Tech EM Inc.



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD
- SOIL SAMPLE CONCENTRATION EXCEEDS THE SITE–SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE SITE–SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR LEAD IS 450 mg/kg
SITE–SPECIFIC STANDARD FOR LEAD IS 1300 mg/kg

2' 0 2' 4'
APPROXIMATE
VERTICAL SCALE: 1" = 4'

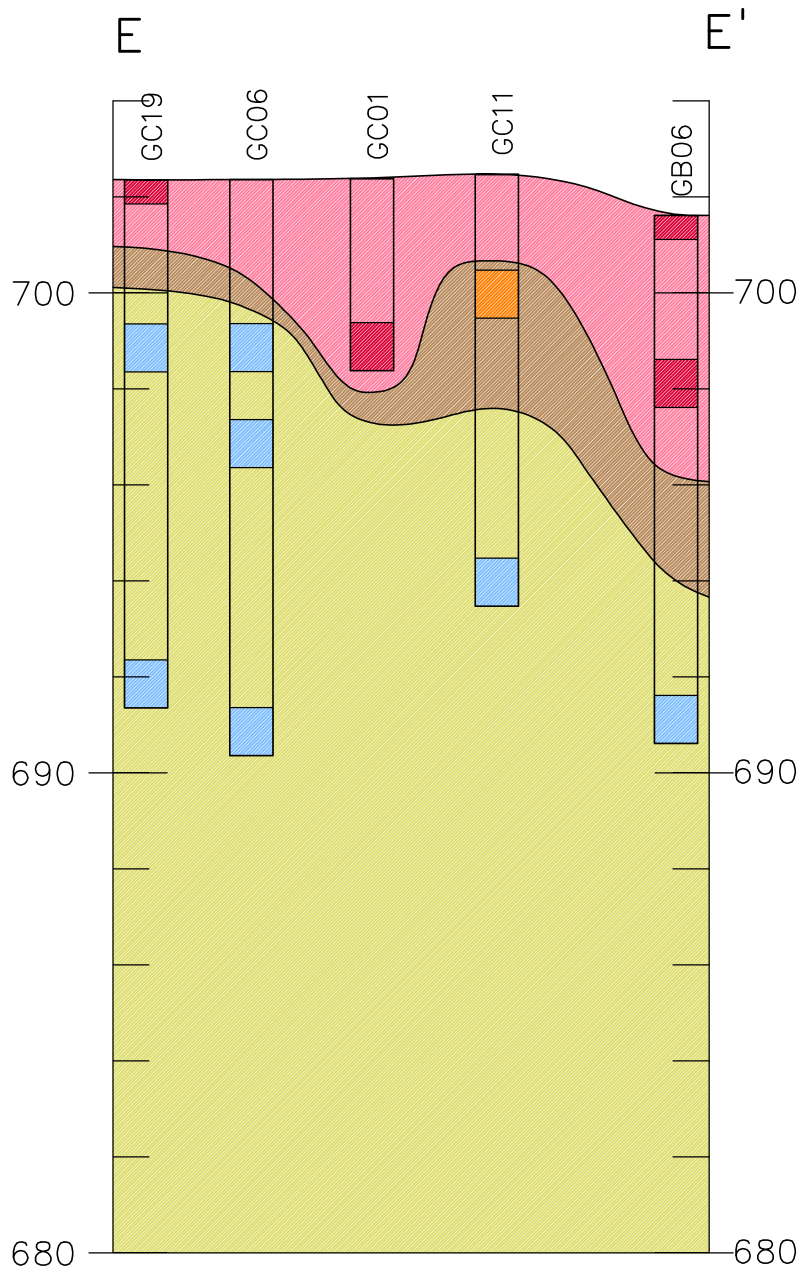
35' 0 35' 70'
APPROXIMATE
HORIZONTAL SCALE: 1" = 70'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A–20
LEAD CONCENTRATIONS (mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino–Bros\Pasternak–Figs\SECTIONS\ D_lead.dwg 04/24/2002 marianne.turonek DN



LEGEND

(blue)	SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
(orange)	SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD
(red)	SOIL SAMPLE CONCENTRATION EXCEEDS THE SITE–SPECIFIC STANDARD
(yellow)	SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
(brown)	SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD
(pink)	SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE SITE–SPECIFIC STANDARD
MSC	MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR LEAD IS 450 mg/kg
SITE–SPECIFIC STANDARD FOR LEAD IS 1300 mg/kg

2' 0 2' 4'

APPROXIMATE
VERTICAL SCALE: 1" = 4'

35' 0 35' 70'

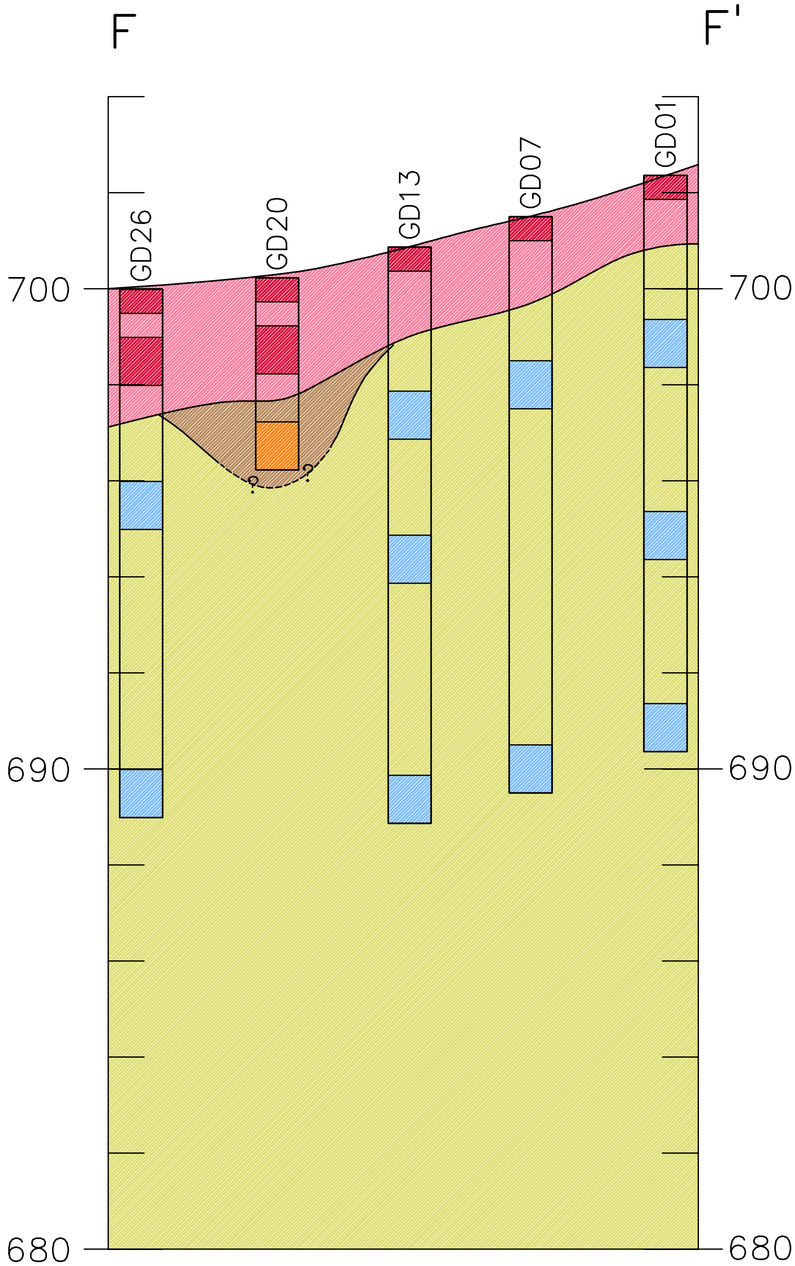
APPROXIMATE
HORIZONTAL SCALE: 1" = 70'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-26
LEAD CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ E_lead.dwg 04/24/2002 marianne.turonek DN



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD
- SOIL SAMPLE CONCENTRATION EXCEEDS THE SITE–SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE–SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE SITE–SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR LEAD IS 450 mg/kg
SITE–SPECIFIC STANDARD FOR LEAD IS 1300 mg/kg

2' 0 2' 4'
APPROXIMATE VERTICAL SCALE: 1" = 4'

35' 0 35' 70'
APPROXIMATE HORIZONTAL SCALE: 1" = 70'

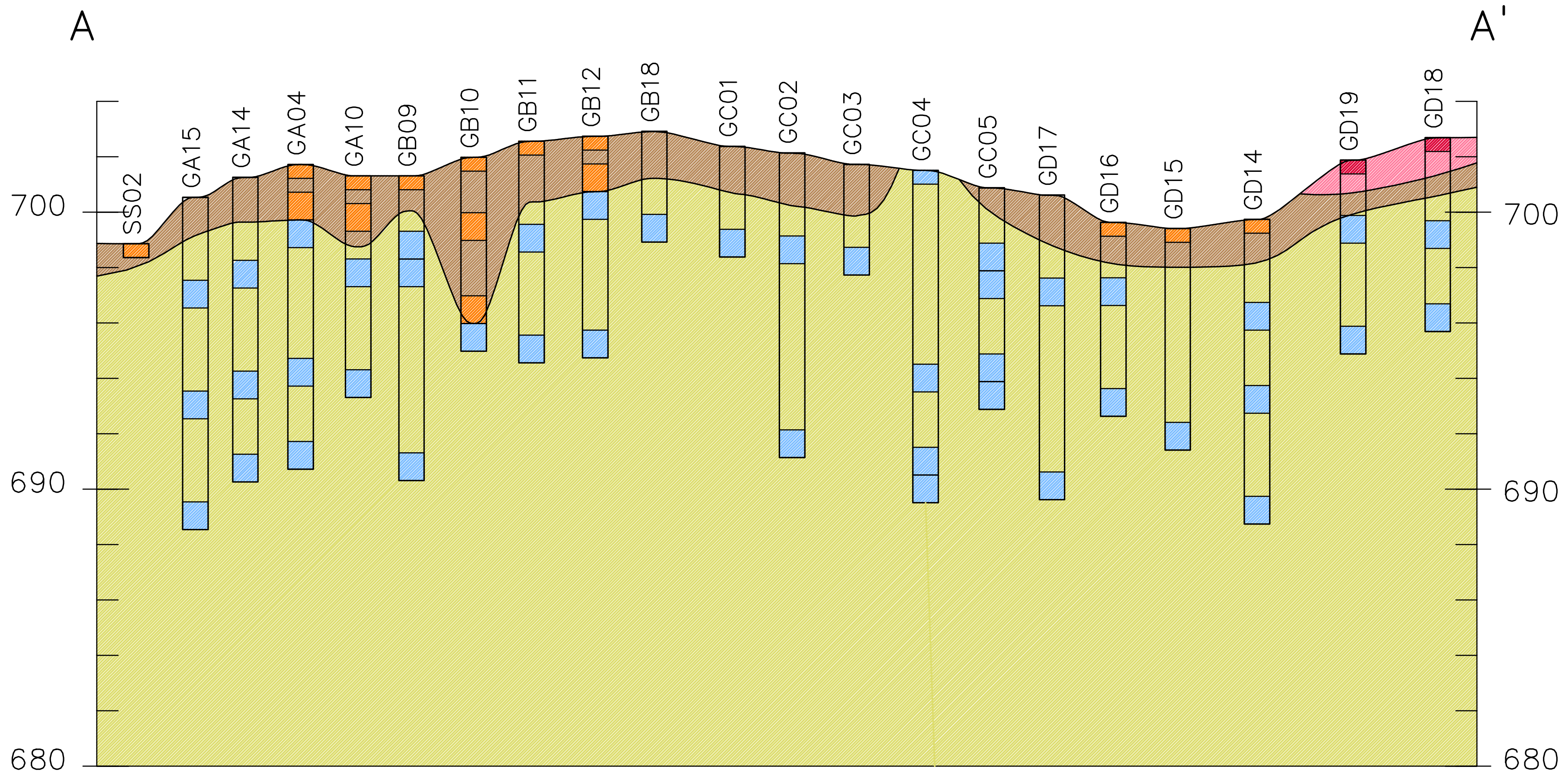
STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-32
LEAD CONCENTRATIONS (mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ F_lead.dwg 04/24/2002 marianne.turonek DN

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ A_mercury.dwg 04/24/2002 marianne.turonek DN



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL SAMPLE CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR MERCURY IS 10 mg/kg
SITE-SPECIFIC STANDARD FOR MERCURY IS 390 mg/kg

3' 0 3' 6'
APPROXIMATE
VERTICAL SCALE: 1" = 6'

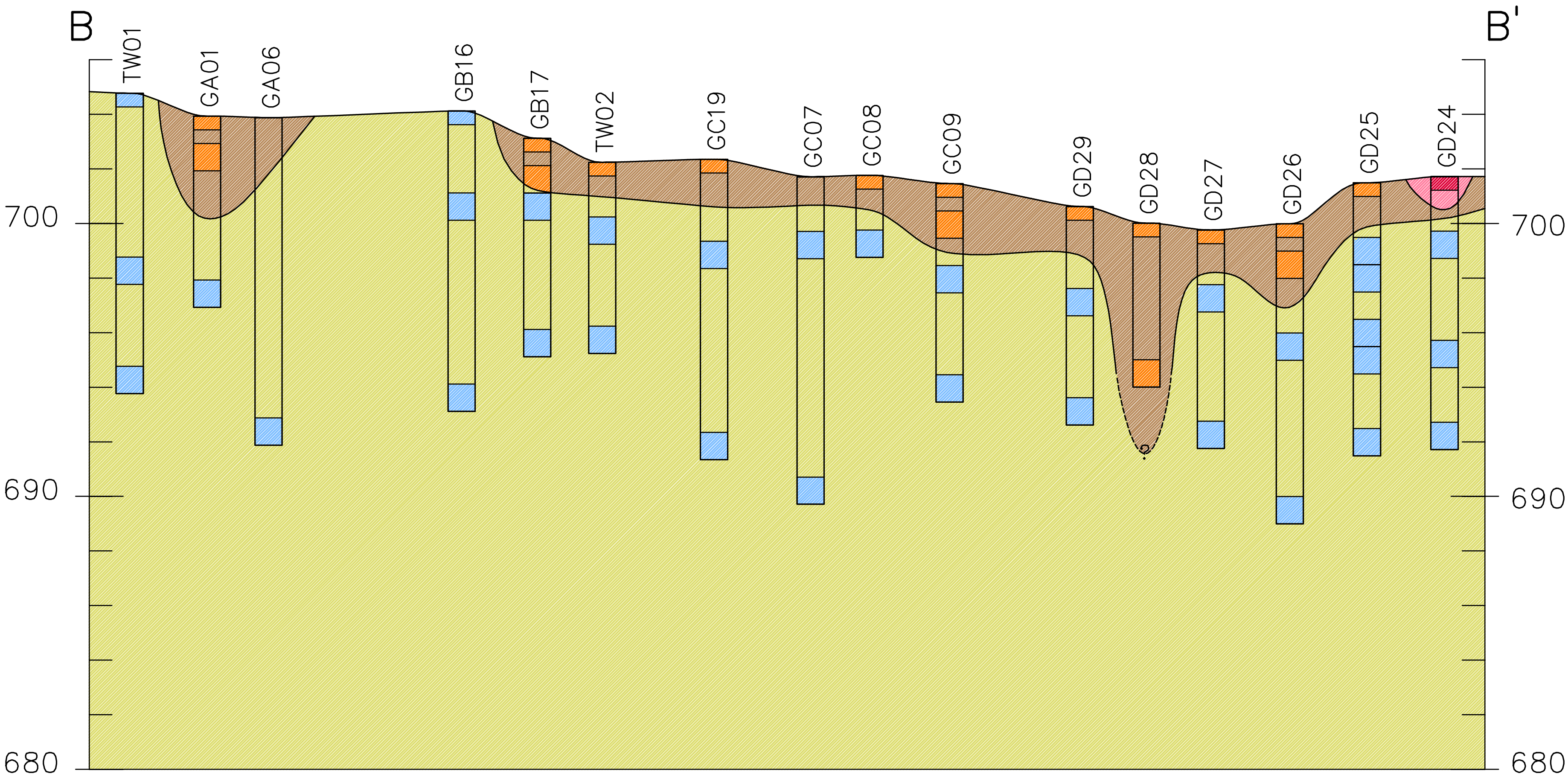
50' 0 50' 100'
APPROXIMATE
HORIZONTAL SCALE: 1" = 100'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-3
MERCURY CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ B_mercury.dwg 04/24/2002 marianne.turonek DN



LEGEND

SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

SOIL SAMPLE CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD

SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR MERCURY IS 10 mg/kg
SITE-SPECIFIC STANDARD FOR MERCURY IS 390 mg/kg

3' 0 3' 6'
APPROXIMATE
VERTICAL SCALE: 1" = 6'

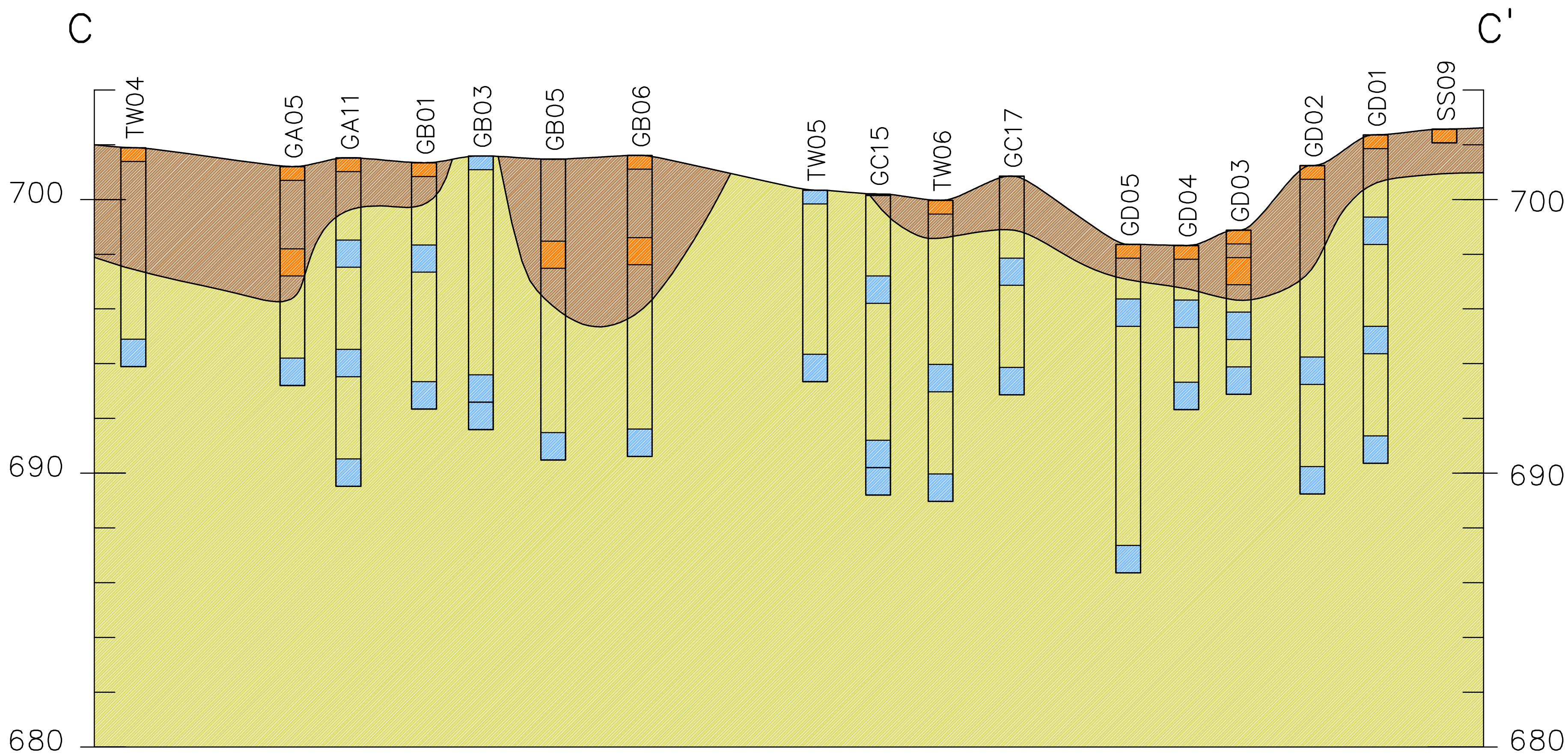
50' 0 50' 100'
APPROXIMATE
HORIZONTAL SCALE: 1" = 100'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-9
MERCURY CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ C_mercury.dwg 04/24/2002 marianne.turonek DN



LEGEND

SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR MERCURY IS 10 mg/kg
SITE-SPECIFIC STANDARD FOR MERCURY IS 390 mg/kg

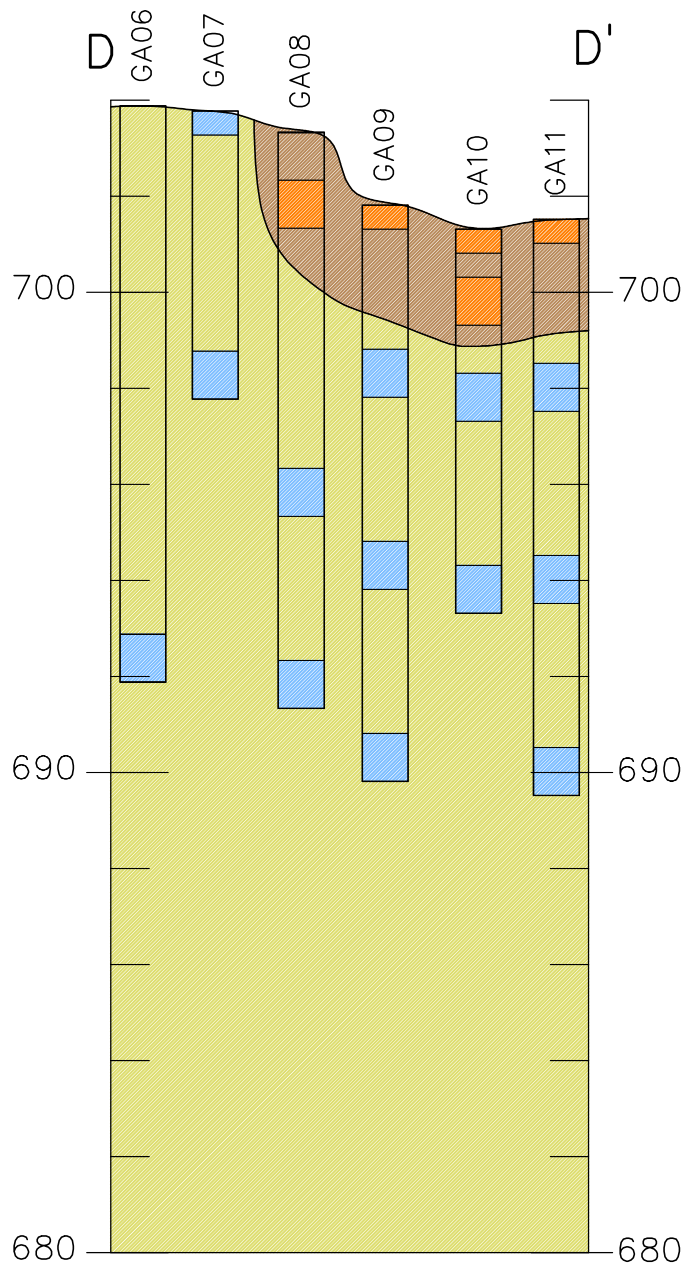
3' 0 3' 6'
APPROXIMATE
VERTICAL SCALE: 1" = 6'

50' 0 50' 100'
APPROXIMATE
HORIZONTAL SCALE: 1" = 100'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-15
MERCURY CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR MERCURY IS 10 mg/kg
SITE-SPECIFIC STANDARD FOR MERCURY IS 390 mg/kg

2' 0 2' 4'
APPROXIMATE
VERTICAL SCALE: 1" = 4'

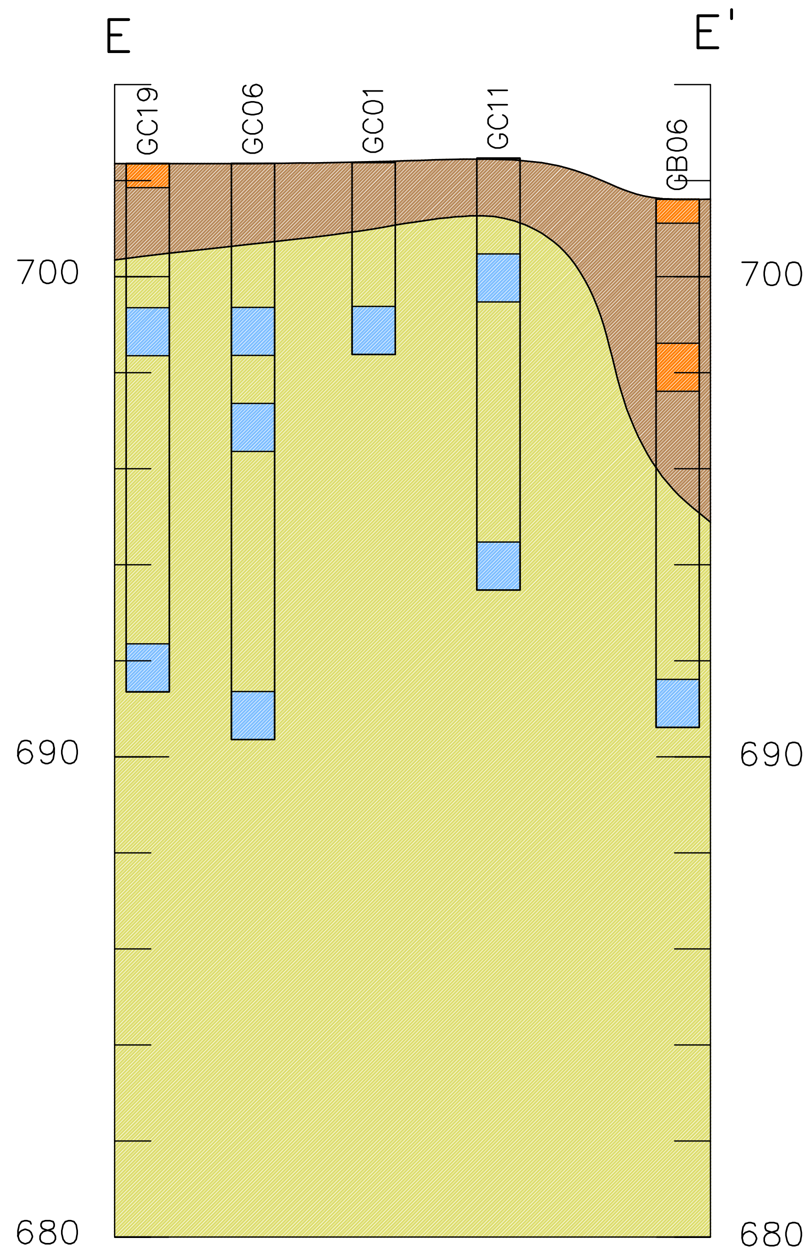
35' 0 35' 70'
APPROXIMATE
HORIZONTAL SCALE: 1" = 70'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-21
MERCURY CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ D_mercury.dwg 04/24/2002 marianne.turonek DN



LEGEND

- SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD
- SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)
- SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR MERCURY IS 10 mg/kg
SITE-SPECIFIC STANDARD FOR MERCURY IS 390 mg/kg

2' 0 2' 4'
APPROXIMATE
VERTICAL SCALE: 1" = 4'

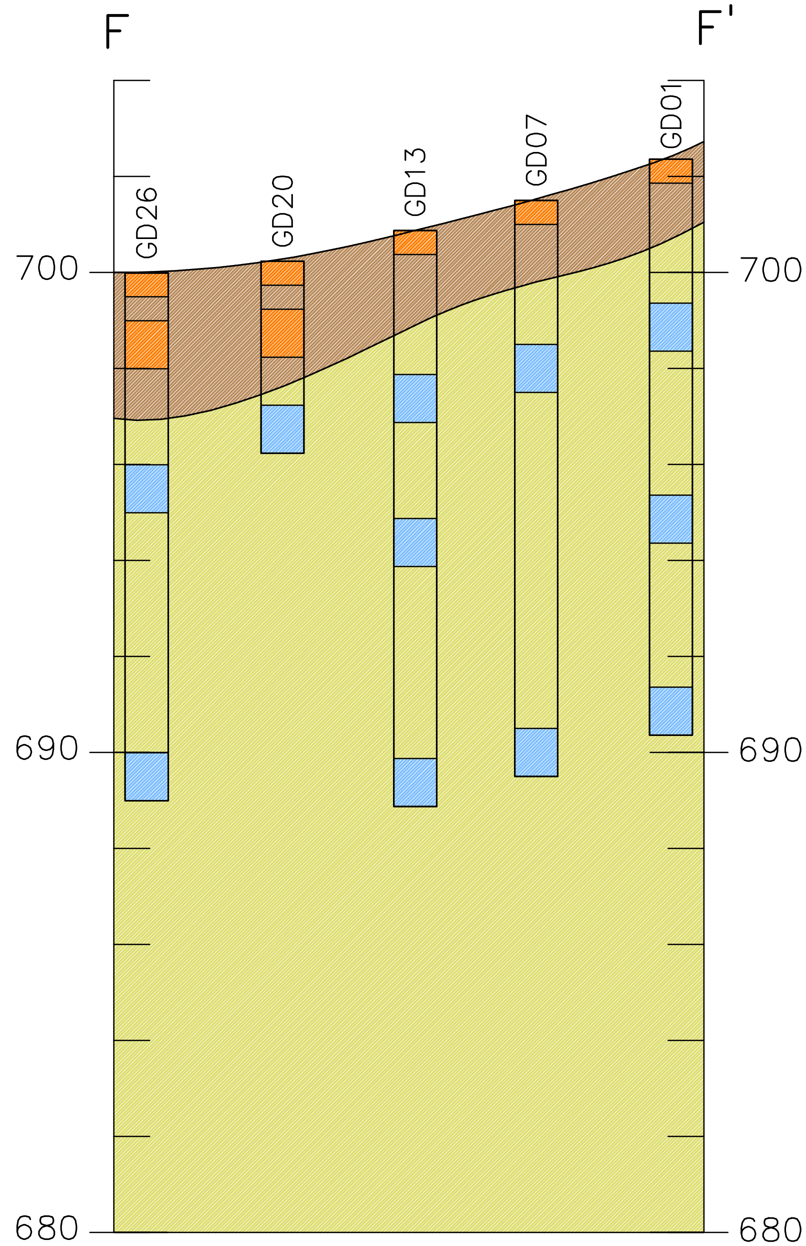
35' 0 35' 70'
APPROXIMATE
HORIZONTAL SCALE: 1" = 70'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-27
MERCURY CONCENTRATIONS (mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ E_mercury.dwg 04/24/2002 marianne.turonek DN



LEGEND

SOIL SAMPLE CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL SAMPLE CONCENTRATION EXCEEDS GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

SOIL ZONE WERE CONTAMINANT CONCENTRATION IS LESS THAN THE GENERIC MSC (CLEAN)

SOIL ZONE WERE CONTAMINANT CONCENTRATION EXCEEDS THE GENERIC MSC AND IS LESS THAN THE SITE-SPECIFIC STANDARD

MSC MEDIA SPECIFIC CRITERIA

NOTE:
GENERIC MSC FOR MERCURY IS 10 mg/kg
SITE-SPECIFIC STANDARD FOR MERCURY IS 390 mg/kg

2' 0 2' 4'
APPROXIMATE
VERTICAL SCALE: 1" = 4'

35' 0 35' 70'
APPROXIMATE
HORIZONTAL SCALE: 1" = 70'

STATEMENT OF WORK
MARINO BROTHERS SCRAPYARD

FIGURE A-34
MERCURY CONCENTRATIONS
(mg/kg) IN SOIL

Tetra Tech EM Inc.

R:\EPA\TIO\BROWNFIELDS\Marino-Bros\Pasternak-Figs\SECTIONS\ F_mercury.dwg 04/24/2002 marianne.turonek DN

ENCLOSURE #4
GROUNDWATER TO SURFACE WATER MODELING RESULTS

Enclosure #4
Part 4-1
Table of Contents

Enclosure #4 Table of Contents

Part

Enclosure #4
Part 4-2
Description of the Approach for Surface Water Modeling Using PENTOX

MARINO BROTHERS SCRAP YARD PENTOX MODELING

The Pennsylvania Single Discharge Wasteload Allocation Computer Program for Toxic Substances (PENTOX) was used to evaluate the water quality-based effluent limits (WQBEL) and maximum daily limit (MDL) of groundwater discharge from the Marino site into the Ohio River. A WQBEL is designed to protect the quality of the receiving water, in this case the Ohio River, by ensuring that state water quality standards are met. PENTOX uses a mass-balance water quality analysis model that includes considerations for mixing and first-order decay to determine WQBELs. The PENTOX model calculated the WQBEL and MDL for a total of 22 chemicals of potential concern (COPC) for the Marino site including: aluminum, antimony, arsenic, barium, cadmium, copper, iron, lead, manganese, mercury, nickel, thallium, zinc, vanadium, Aroclor 1248, Aroclor 1254, Aroclor 1260, Dibenzo (AH) Anthracene, Indeno (1,2,3-CD) Pyrene, Benzo (K) Anthracene, Benzo (A) Anthtracene, and Benzo (A) Pyrene. The calculated WQBELs and MDLs for each COPC are presented in Table 1 provided in Enclosure 4.

The contaminant concentrations in groundwater entering the Ohio River from the Marino site were estimated using the geometric mean for each groundwater COPC provided in Enclosure 1. Water quality data from the Ohio River was not available. Background concentrations for each COPC in the Ohio River were set at zero in order to conservatively calculate the maximum allowable discharge concentration for each COPC. The only background chemical concentration not set at zero was iron. Iron concentrations have been measured at the Sewickley gauging station at levels ranging from 20 to 260 µg/L. The Sewickley gauging station is located approximately 10 miles upstream from the Marino site. An iron concentration of 89.74 µg/L was used as the representative Ohio River concentration, and is the geometric mean of the iron concentrations measured at the Sewickley site. Other required parameters necessary to run PENTOX are presented in Table 2 provided in Enclosure 4.

The flow rate of the Ohio River was set at 33,449.95 cubic feet per second (cfs). This rate is the average annual discharge of the Ohio River measured at the Sewickley gauging station between 1934 and 1999. The discharge rate of groundwater flowing into the Ohio River from the Marino site was estimated using Darcy's Law, an estimate of about 280 cfs.

The PENTOX-calculated WQBELs and MDLs are also presented in the Table 2 provided in Enclosure 4. The WQBELs and MDLs are greater than the contaminant concentrations present in the Marino groundwater discharging into the Ohio River for all of the COPCs. This indicates that groundwater discharge into the Ohio River from the Marino site is not impacting the water quality of the Ohio River.

Enclosure #4
Part 4-3
PENTOX Model Inputs and Outputs

Table 1
Marino and Ohio River COPC Concentrations and PENTOX Model Results

COPC	[1]Marino groundwater discharge concentration (µg/L)	Water quality criteria (µg/L)	WQBEL (µg/L)	MAX daily limit (µg/L)	Marino effluent < WQBEL	Marino effluent < MDL
Aluminum	1163.90	750 [2]	5.41E+09	1859.90	yes	yes
Antimony	4.00	14 [2]	1.01E+08	6.24	yes	yes
Arsenic	7.30	50 [2]	3.60E+08	11.39	yes	yes
Barium	159.57	2400 [2]	1.73E+10	249.00	yes	yes
Cadmium	2.36	2.6609 [2]	1.92E+07	3.68	yes	yes
Copper	15.38	15.367 [2]	1.11E+08	24.00	yes	yes
Iron	6877.90	89.74 [3]	2.16E+09	10731.00	yes	yes
Lead	10.07	3.6086 [2]	2.60E+07	15.71	yes	yes
Manganese	6266.00	1000 [2]	7.21E+09	9776.00	yes	yes
Mercury	0.24	0.05 [2]	3.60E+05	0.37	yes	yes
Nickel	26.00	56.717 [2]	4.09E+08	40.56	yes	yes
Thallium	8.29	1.7 [2]	1.23E+07	12.93	yes	yes
Vanadium	10.36	100 [2]	7.21E+08	16.16	yes	yes
Zinc	53.41	130.29 [2]	9.40E+08	83.33	yes	yes
Aroclor 1248	0.55	0.000044 [2]	3.17E+02	0.86	yes	yes
Aroclor 1260	0.65	0.000044 [2]	3.17E+02	1.01	yes	yes
Aroclor 1254	0.54	0.000044 [2]	3.17E+02	0.84	yes	yes
Dibenzo (AH) Anthracene	0.10	0.0044 [2]	3.17E+04	0.17	yes	yes
Indeno (1,2,3-CD) Pyrene	0.12	0.0044 [2]	3.17E+04	0.19	yes	yes
Benzo (K) Fluoranthene	0.11	0.0044 [2]	3.17E+04	0.17	yes	yes
Benzo (A) Anthracene	0.11	0.0044 [2]	3.17E+04	0.17	yes	yes
Benzo (A) Pyrene	0.10	0.0044 [2]	3.17E+04	0.16	yes	yes

Notes:

1	Geometric mean of groundwater concentrations measured in wells at the Marino site
2	Water quality criteria set according to Title 25 of the Pennsylvania Code
3	An estimate based on measured values from the Sewickley gauging station
COPC	Chemical of potential concern
MDL	Method detection limit
WQBEL	Water quality-based effluent limits
µg/L	Micrograms per Liter

Table 2
PENTOX Model Input Parameters

Parameter	Value	Units
Marino drainage area	83304	ft^2
Marino groundwater discharge rate calculated from Darcy's law	3.24E-03	ft^3/sec
Hydraulic conductivity of groundwater formation at Marino site(1)	1.94E+00	ft/day
Hydraulic gradient at Marino site(1)	3.00E-02	ft/ft
Area of contact between Marino groundwater and Ohio River(2)	4.81E+03	ft^2
Ohio River flow rate (3)	33450	ft^3/sec
Instream hardness of Ohio River (3)	110.4	mg/L
Slope of Ohio River (4)	1.50E-04	ft/ft

Note:
(1) from RI Report, Marino Brothers Scrap Yard Site, Volume 1. Baker Environmental, Inc. June 2001.
(2) assumes a river depth of 9 ft.
(3) from the Sewickley gauging station.
(4) calculated from the elevation change and distance between the Swickluey gauging station and the Marino site.

ENCLOSURE #5
PRELIMINARY
ANALYSIS OF REMEDIAL ALTERNATIVES AND COST ESTIMATES

Enclosure #5
Part 5-1
Table of Contents

Enclosure #5 Table of Contents

Part

Enclosure #5
Part 5-2
Preliminary Remedial Alternatives

MARINO BROTHERS SCRAP YARD SITE
DESCRIPTION OF PRELIMINARY REMEDIAL ALTERNATIVES

Proposed Future Land Use

Rochester Borough is the site owner and has expressed its desire to redevelop the site as a public use area with access to the Ohio River. The borough would prefer to have a park and walkway across the site, similar to other riverside parks being developed around the City of Pittsburgh. Rochester borough wishes to install a boat ramp for the launching of sculling boats or other watercraft. In addition, the Borough wishes to reuse existing buildings at the site for a glass museum. Pennsylvania Department of Environmental Protection (PADEP) has noted that it reserves the right to restrict future uses of the property if remedial costs are determined to be prohibitive. However, if possible, PADEP wishes like to accommodate the desires of Rochester Borough.

Remedial Strategies

Preliminary cost estimates were developed for three remedial alternatives for the Marino Brothers Scrap Yard site. The remedial alternatives are intended to address, as necessary, impacted site media. Some of the impacted site media are addressed similarly in each of the three remedial alternatives. Primarily, the three alternatives address differences in the remedial approach to soil contamination. The cost estimates for each alternative are being provided to PADEP for its use in further discussions with Rochester Borough. Based on the discussions with Rochester Borough and final agreed upon future use of the site, PADEP will select a preferred alternative for site restoration. The remedial alternatives for which preliminary cost estimates have been developed are discussed below.

<u>Base Case</u>

The base case was developed to present those components of a site remedy that would be common to all of the remedial alternatives. It is assumed that uniform measures will be taken to address groundwater, surface water, and sediment issues; the assessment of hazards in existing site buildings; preparing the site for the selected soil remedial alternative; stabilizing the river embankment along the site boundary; controlling surface run-on and runoff; revegetating the site; and implementing necessary site engineering controls. Where appropriate, the non-base case remedial alternatives address additional measures that will be taken specific to that alternative. The base-case remedial measures are described below:

- Groundwater - The base case includes implementing a groundwater monitoring program that will be used to further characterize groundwater contamination and movement at the site. This program will include constructing monitoring wells and performing routine sampling and analysis. In addition, institutional controls will be implemented to limit exposure to contaminated groundwater. This will likely include deed restrictions that limit the use of site groundwater.
- Surface Water – The base case includes implementing a program to assess the impacts of site groundwater to the Ohio River. The program would incorporate the results of the groundwater monitoring program into the surface water assessment.
- Sediment - The base case includes addressing contaminated riverside sediment at the site boundary with the Ohio River. The goal of this component of the remedy is to reduce human exposure to contaminated sediments along the riverbank by removing the exposure pathway. This would be accomplished by constructing a physical barrier using material such as riprap to cover the sediment. Alternatives such as sediment dredging are not considered to be cost effective at the site, given the extensive quantity of debris located in the river shallows and along the riverside and has not been included in the base case cost estimate.

- Existing Buildings – The base case includes assessing the hazards in existing site buildings with building remediation and implementation of engineering controls to be performed by Rochester Borough. The assessment of hazards would include sampling for asbestos-contaminated materials, lead paint, volatile organic campounds in building air space and exposure modeling, if needed.
- Site Preparation – This component of the base case includes clearing and grubbing the site in preparation of implementing the site surface soil remedy. It is anticipated that existing vegetation, concrete surfaces, and surface debris would be stripped to a depth of approximately 6 inches and disposed offsite.
- Riverbank Stabilization - This component of site remediation will include excavating and removing debris along the river embankment with the goal of modifying the slope of the embankment to reduce its grade. Following the reshaping of the river embankment slope a terraced rock wall would be constructed along the site's boundary with the river.
- Run-on/Runoff Controls – Measures would be implemented to control run-on and runoff, and would include constructing drainage ditches, swales, and piping systems.
- Site revegetation – Soil-covered areas of the site would be revegetated with the goal of establishing a vegetative cover to control site surface erosion.
- Engineering Controls – The base case includes constructing site fencing and signs to limit assess and degradation to remediated site features.

<u>Alternative No. 1</u>

The objective of Alternative No. 1 is to reduce human exposure to surface soil by limiting contact with contaminated site soil. This objective will be accomplished by constructing a surface cap that isolates contaminated surface soil. In this alternative, contaminated site soil would be kept in place with the intent of minimizing soil disturbance. The cap will be constructed of imported material with part of the site surface being capped using clay and topsoil and remaining parts of the site being capped with asphalt and used for parking. Under this alternative no site access to the river would be allowed, and only limited access to asphalt-paved areas of the site surface would be allowed. This alternative would also include construction of a system to remediate contaminated groundwater. Consistent with the concept of minimizing soil disturbances, a remedial system would be constructed to address groundwater contaminants using groundwater pump-and-treat methods. The major components of the base case are as follows:

- Construct a surface cap composed of asphalt and clay/soil over the surface of the site.
- Construct a groundwater interceptor trench with the remediation system to address groundwater contamination.

<u>Alternative No. 2</u>

The objective of Alternative No. 2 is to reduce human exposure to contaminated surface soil by reducing the mobility of and contact with surface soil. Additional measures would be implemented to address impacted groundwater and saturated soil through limited source removal. This alternative allows for fewer restrictions on future site use, but would not allow unrestricted site use since surface soil contaminants will still be on site. This alternative would allow for limited access to the river. The major components of this alternative are as follows:

- Contaminated surface soil will be excavated, processed to remove gross metal debris, and solidified/stabilized using on-site ex-situ methods, and placed in on-site waste piles. Surface soil will be excavated, as necessary, based on dynamic work plan concepts and real-time data collection strategies. Stabilizing the surface soil and placing the processed material in an on-site waste pile will address contaminant mobility issues and exposure to surface contaminants. Consolidating stabilized surface soil in waste piles would allow clean surface soil to be imported and those areas of the site to be revegetated. In addition, limited site areas could be paved to allow building and public use parking.

- Contaminated subsurface soil will be surgically excavated and stabilized using the same methods implemented for surface soil. The treated subsurface soil will be consolidated with the surface soil in onsite waste piles.
- Subsurface Light Non-Aqueous Phase Liquid (LNAPL) source areas will also be addressed by excavation of the source areas and aggressive source removal. This action will be taken to reduce source contaminants and diminish their impact on site groundwater. Incorporating source removal into the remedy will eliminate the requirement for a groundwater pump-and-treat system.

Alternative No. 3

The objective of Alternative No. 3 is to reduce human exposure to site contaminants by removing contaminated surface soil and subsurface source material (that is dig and haul). This alternative is the least prohibitive site redevelopment remedy and maximum site reuse. Under this scenario, it would be necessary to excavate surface soil, process it to recover and recycle metal debris, and dispose of the remaining contaminated material offsite at an appropriate landfill. Imported material would be used to re-establish the existing topographic surface of the site and to allow for the surface of the site to be revegetated. Subsurface contaminant source areas would be addressed using LNAPL recovery methods and surgical excavation and removal methods. This alternative will allow for access to the river and the site surface since contaminated surface soils will have been removed. The major components of this alternative are as follows:

- Excavate site soil to meet site-specific action levels, process the excavated material to recover recyclable material and minimize off-site disposal requirements, and dispose of the excavated soil at an appropriate landfill. Surface soil will be excavated as necessary, based on dynamic work plan concepts and real-time data collection strategies. Material will be imported to the site to replace excavated material and to allow for the site to be revegetated. The site surface remedy would include provisions to control surface run-on and runoff.
- Contaminated subsurface soil would be surgically excavated and disposed offsite at an appropriate landfill.
- Subsurface LNAPL source areas will be addressed by excavating the source areas and removing aggressive source. This action would reduce source contaminants and diminish their impact on groundwater. Incorporating source removal into the remedy will eliminate the requirement for a groundwater pump-and-treat system.

Enclosure #5
Part 5-3
Engineering Cost Estimates for the Three Proposed Alternatives

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 1

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
	BASE CASE ACTIVITIES					
1	**PREDESIGN INVESTIGATIONS**					
1.1	**Existing Building Assessment**					
	Work Plan	1.0	LS	$3,500.0	$3,500	Intended to assess contamination in existing buildings.
	Building Sampling	1.0	LS	$2,500.0	$2,500	
	Sample Analysis	1.0	LS	$2,500.0	$2,500	
	Reporting	1.0	LS	$1,500.0	$1,500	
	Task 1.1 Subtotal =				**$10,000**	
1.2	**Soil Separation Treatability Testing**					
	Work Plan	1.0	LS	$5,000.0	$5,000	Intended to assess soil separation requirements.
	Sampling & Analysis	1.0	LS	$2,500.0	$2,500	
	Field Testing	1.0	LS	$7,500.0	$7,500	
	Reporting	1.0	LS	$5,000.0	$5,000	
	Task 1.2 Subtotal =				**$20,000**	
1.3	**Riverbank Sediment Assessment**					
	Work Plan	1.0	LS	$5,000.0	$5,000	Intended to further delineate and address sediment issues.
	Sampling & Analysis	1.0	LS	$7,500.0	$7,500	
	Reporting	1.0	LS	$7,500.0	$7,500	
	Task 1.3 Subtotal =				**$20,000**	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 1

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
2	**CONSTRUCTION PHASE**					Assume six month construction period.
2.1	**Project Construction Setup**					
	Construction Permits: Prep./Meetings/Fees	1.0	LS	$1,500.0	$1,500	
	General Contractor Mob/Demob	1.0	LS	$25,000.0	$25,000	
	Site Office Equipment	1.0	LS	$5,000.0	$5,000	
	Site Construction Trailers	6.0	MO	$750.0	$4,500	
	Construction Utilities Hookup	1.0	LS	$7,500.0	$7,500	
	Temporary Site Security Fence	0.0	LF	$3.5	$0	Assumes existing site boundary fence is adequate.
	Temporary Equipment Decontamination Pad Facilities	1.0	LS	$12,500.0	$12,500	
	Water Storage Tank & Contaminated Water Disposal	6.0	MO	$5,000.0	$30,000	Fresh water for dust suppression & decon water disposal.
	Mob/Demob Soil Separations Equipment	1.0	LS	$10,000.0	$10,000	Power screening equipment setup for soil separation.
	Site Security	6.0	MO	$3,000.0	$18,000	
	Task 2.1 Subtotal =				**$114,000**	
2.2	**Site Preparation**					
	Surveyor & Mapping	1.0	LS	$10,000.0	$10,000	
	Decommission Interfering Site Utilities	1.0	LS	$5,000.0	$5,000	
	Clear & Grub Site	3.5	AC	$2,500.0	$8,750	Clear & grub entire site @ 3.5 acres
	Sort and Separate Spoil Material	2,825	CY	$6.0	$16,948	Spoil material is 3.5 acres by 6 inches deep
	Load, Haul, & Dispose of Recyclable Material	1,130	CY	$8.5	$9,604	40% recyclable with disposal @ $5/ton or $8.5/CY
	Load, Haul, & Dispose of Contaminated Material	1,695	CY	$102.0	$172,867	60% disposed @ haz waste landfill $60/ton or $102/CY
	Task 2.2 Subtotal =				**$223,169**	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 1

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
2.3	**River Embankment Resloping & Stabilization**					
	Excavate & Reslope Embankment	2,363	CY	$14.0	$33,082	Reslope existing embankment from 1:1 to 2:1
	Sort and Separate Excavated Material	2,363	CY	$6.0	$14,178	
	Load, Haul, & Dispose of Recyclable Material	945	CY	$8.5	$8,034	40% recyclable with disposal @ $5/ton or $8.5/CY
	Load, Haul, & Dispose of Contaminated Material	1,418	CY	$102.0	$144,616	60% disposed @ haz waste landfill $60/ton or $102/CY
	Construct Terraced Rock Wall	850	LF	$25.0	$21,250	Block/rock wall terraced to fit with 2:1 slope
	Task 2.3 Subtotal =				**$221,160**	
2.4	**Groundwater Monitoring System Installation**					
	Driller Mob\Demob	1.0	LS	$5,000.0	$5,000	Assumes drilling subcontractor used for sampling wells.
	Well Drilling	15.0	EA	$1,750.0	$26,250	Assumes 15 permanent monitoring wells @ 50 ft deep.
	Well Installation	15.0	EA	$500.0	$7,500	Well casings, etc.
	Oversight during Installation	1.0	LS	$7,500.0	$7,500	Geologist to log wells
	Task 2.4 Subtotal =				**$46,250**	
2.5	**Riverbank Sediment Cap**					
	Sediment Cap/Riprap Bedding Material	629.6	CY	$15.0	$9,444	Sand cap @ 1 ft deep. Site riverbank @ 850 ft L x 20 ft W
	Riprap	850.0	LF	$25.0	$21,250	Riprap @ d50=12 inch & depth 24 inches over sediment cap.
	Task 2.5 Subtotal =				**$30,694**	
2.6	**Run-on/Runoff Controls**					
	Drainage Swales & Area Contouring	1,500.0	LF	$4.0	$6,000	Assumes earthen drainage swales around site.
	Parking Lot Drainage System	1.0	LS	$20,000.0	$20,000	Installed with remedial construction to limit exposure.

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 1

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
	Area Drain Piping	100.0	LF	$50.0	$5,000	Collection pipes and culverts with discharge to river.
	Task 2.6 Subtotal =				**$31,000**	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 1

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
2.7	**Site Engineering Controls**					
	Fencing	2,180.0	LF	$25.0	$54,500	Site perimeter @ 850 ft long x 240 ft wide
	Signs	20.0	EA	$100.0	$2,000	
	Task 2.7 Subtotal =				**$56,500**	
2.8	**Site Revegetation**					
	Topsoil (Imported & Delivered)	2,421	CY	$10.0	$24,211	Topsoil entire site @ 3.0 acres x 6 inches, except parking.
	Place & Grade Topsoil	2,421	CY	$2.5	$6,053	
	Seeding	3.0	Acre	$500.0	$1,500	
	Hydromulching	3.0	Acre	$2,000.0	$6,000	
	Erosion Control					
	- Straw Bale Dikes	180.0	EA	$7.5	$1,350	Used to control erosion in drainage swales.
	- Silt Fence	850.0	LF	$3.5	$2,975	Used to control erosion along riverbank.
	Task 2.8 Subtotal =				**$42,089**	
	ALTERNATIVE NO. 1 ACTIVITIES					
3	**CONSTRUCTION PHASE**					
3.1	**Surface Cap Construction**					
	Clay Cap Material (Import & Deliver)	5,649	CY	$12.5	$70,616	Assume 1 foot deep x 3.5 acres.
	Construct Clay Cap (Grade & Compact)	5,649	CY	$2.5	$14,123	
	Asphalt Cap Material (Import & Deliver)	2,421	SY	$12.0	$29,053	Assume 0.5 acre parking area @ 6 inches deep.
	Construct Asphalt Cap (Grade & Compact)	2,421	SY	$5.0	$12,106	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 1

Tetra Tech EMI

Client: EPA Technology Innovation Office
Project: Marino Brothers Scrap Yard Site
Subject: Site Remediation Design/Build Cost Estimate

Estimated by: DJB
Date: 08/30/04
Checked by: RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
	Task 3.1 Subtotal =				**$125,898**	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 1

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
3.2	**Groundwater Interceptor Trench**					
	Excavate & Construct Interceptor Trench	850.0	LF	$200.0	$170,000	Interceptor trench constructed along site riverbank alignment.
	Sort and Separate Excavated Material	1,417	CY	$6.0	$8,500	Trench @ L=850 ft, D=15ft, W=3ft
	Load, Haul, & Dispose of Recyclable Material	567	CY	$8.5	$4,817	40% recyclable with disposal @ $5/ton or $8.5/CY
	Load, Haul, & Dispose of Contaminated Material	850	CY	$102.0	$86,700	60% disposed @ haz waste landfill $60/ton or $102/CY
	Construct Sump(s) and Pipeline	1.0	LS	$30,000.0	$30,000	
	Electrical Systems	1.0	LS	$20,000.0	$20,000	
	Task 3.2 Subtotal =				**$320,017**	
3.3	**Groundwater Treatment System**					
	Building	1.0	LS	$50,000.0	$50,000	
	Treatment Equipment	1.0	LS	$250,000.0	$250,000	Assumes relatively simple groundwater treatment system.
	Mechanical Installation	1.0	LS	$75,000.0	$75,000	Oil/Water separation, metals removal, & disposal to sewer.
	Electrical/Controls Installation	1.0	LS	$100,000.0	$100,000	
	Task 3.3 Subtotal =				**$475,000**	
3.4	**Commissioning & Startup Activities**					
	System Commissioning	1.0	LS	$20,000.0	$20,000	
	System Startup	1.0	LS	$50,000.0	$50,000	
	Task 3.4 Subtotal =				**$70,000**	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 1

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
CONSTRUCTION COST SUMMARY	**SUBTOTAL =**				**$1,805,776**	
	CONTINGENCY =	**@ 25%**			**$451,444**	
REMEDIAL DESIGN		**@ 10%**			**$180,578**	
ENGINEERING SERVICES DURING CONSTRUCTION		**@ 10%**			**$180,578**	
OVERSIGHT OF REMEDY IMPLEMENTATION		**@ 3%**			**$54,173**	
	TOTAL ESTIMATED DESIGN/BUILD COST =				**$2,672,549**	
	LONG-TERM O&M COSTS					
4	**GROUNDWATER SYSTEM O&M**					
4.1	Groundwater Monitoring Program					Present worth values @ 20 yrs operating life & 5% interest.
	- Sampling	2.0	LS	$62,311.0	$124,622	Semiannual sampling @$5,000 per sampling event.
	- Analysis	30.0	EA	$18,693.3	$560,799	15 wells, sampled semiannually @ $1,500 per sample.
	- Reporting	2.0	LS	$62,311.0	$124,622	Semiannual reporting @ $5,000 per event.
	Task 4.1 Subtotal =				**$810,043**	
4.2	Treatment System Operation					Present worth values @ 20 yrs operating life & 5% interest.
	- O&M Personnel	2.0	FTE	$623,110.0	$1,246,220	Two full-time employees @ $50,000 per FTE.
	- Consumables & Other	1.0	LS	$1,993,952.0	$1,993,952	Consumables, equipment, utilities, etc @ $160,000 annually.
	- O&M Contractor Fixed Fee	1.0	LS	$392,559.3	$392,559	15% of O&M Cost
	Task 4.2 Subtotal =				$3,632,731	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 1

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
	Task 4 Subtotal =				**$4,442,774**	
	TOTAL ESTIMATED PROJECT COST =				**$7,115,323**	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 2

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
	BASE CASE ACTIVITIES					
1	**PREDESIGN INVESTIGATIONS**					
1.1	**Existing Building Assessment**					
	Work Plan	1.0	LS	$3,500.0	$3,500	Intended to assess contamination in existing buildings.
	Building Sampling	1.0	LS	$2,500.0	$2,500	
	Sample Analysis	1.0	LS	$2,500.0	$2,500	
	Reporting	1.0	LS	$1,500.0	$1,500	
	Task 1.1 Subtotal =				**$10,000**	
1.2	**Soil Separation Treatability Testing**					
	Work Plan	1.0	LS	$5,000.0	$5,000	Intended to assess soil separation requirements.
	Sampling & Analysis	1.0	LS	$2,500.0	$2,500	
	Field Testing	1.0	LS	$7,500.0	$7,500	
	Reporting	1.0	LS	$5,000.0	$5,000	
	Task 1.2 Subtotal =				**$20,000**	
1.3	**Riverbank Sediment Assessment**					
	Work Plan	1.0	LS	$5,000.0	$5,000	Intended to further delineate and address sediment issues.
	Sampling & Analysis	1.0	LS	$7,500.0	$7,500	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 2

Tetra Tech EMI

Client: EPA Technology Innovation Office
Project: Marino Brothers Scrap Yard Site
Subject: Site Remediation Design/Build Cost Estimate

Estimated by: DJB
Date: 08/30/04
Checked by: RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
	Reporting	1.0	LS	$7,500.0	$7,500	
	Task 1.3 Subtotal =				**$20,000**	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 2

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
2	**CONSTRUCTION PHASE**					Assume six month construction period.
2.1	**Project Construction Setup**					
	Construction Permits: Prep./Meetings/Fees	1.0	LS	$1,500.0	$1,500	
	General Contractor Mob/Demob	1.0	LS	$25,000.0	$25,000	
	Site Office Equipment	1.0	LS	$5,000.0	$5,000	
	Site Construction Trailers	6.0	MO	$750.0	$4,500	
	Construction Utilities Hookup	1.0	LS	$7,500.0	$7,500	
	Temporary Site Security Fence	0.0	LF	$3.5	$0	Assumes existing site boundary fence is adequate.
	Temporary Equipment Decontamination Pad Facilities	1.0	LS	$12,500.0	$12,500	
	Water Storage Tank & Contaminated Water Disposal	6.0	MO	$5,000.0	$30,000	Fresh water for dust suppression & decon water disposal.
	Mob/Demob Soil Separations Equipment	1.0	LS	$10,000.0	$10,000	Power screening equipment setup for soil separation.
	Site Security	6.0	MO	$3,000.0	$18,000	
	Task 2.1 Subtotal =				**$114,000**	
2.2	**Site Preparation**					
	Surveyor & Mapping	1.0	LS	$10,000.0	$10,000	
	Decommission Interfering Site Utilities	1.0	LS	$5,000.0	$5,000	
	Clear & Grub Site	3.5	AC	$2,500.0	$8,750	Clear & grub entire site @ 3.5 acres
	Sort and Separate Spoil Material	2,825	CY	$6.0	$16,948	Spoil material is 3.5 acres by 6 inches deep
	Load, Haul, & Dispose of Recyclable Material	1,130	CY	$8.5	$9,604	40% recyclable with disposal @ $5/ton or $8.5/CY
	Load, Haul, & Dispose of Contaminated Material	1,695	CY	$102.0	$172,867	60% disposed @ haz waste landfill $60/ton or $102/CY
	Task 2.2 Subtotal =				**$223,169**	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 2

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
2.3	**River Embankment Resloping & Stabilization**					
	Excavate & Reslope Embankment	2,363	CY	$14.0	$33,082	Reslope existing embankment from 1:1 to 2:1
	Sort and Separate Excavated Material	2,363	CY	$6.0	$14,178	
	Load, Haul, & Dispose of Recyclable Material	945	CY	$8.5	$8,034	40% recyclable with disposal @ $5/ton or $8.5/CY
	Load, Haul, & Dispose of Contaminated Material	1,418	CY	$102.0	$144,616	60% disposed @ haz waste landfill $60/ton or $102/CY
	Construct Terraced Rock Wall	850	LF	$25.0	$21,250	Block/rock wall terraced to fit with 2:1 slope
	Task 2.3 Subtotal =				**$221,160**	
2.4	**Groundwater Monitoring System Installation**					
	Driller Mob\Demob	1.0	LS	$5,000.0	$5,000	Assumes drilling subcontractor used for sampling wells.
	Well Drilling	15.0	EA	$1,750.0	$26,250	Assumes 15 permanent monitoring wells @ 50 ft deep.
	Well Installation	15.0	EA	$500.0	$7,500	Well casings, etc.
	Oversight during Installation	1.0	LS	$7,500.0	$7,500	Geologist to log wells
	Task 2.4 Subtotal =				**$46,250**	
2.5	**Riverbank Sediment Cap**					
	Sediment Cap/Riprap Bedding Material	629.6	CY	$15.0	$9,444	Sand cap @ 1 ft deep. Site riverbank @ 850 ft L x 20 ft W
	Riprap	850.0	LF	$25.0	$21,250	Riprap @ d50=12 inch & depth 24 inches over sediment cap.
	Task 2.5 Subtotal =				**$30,694**	
2.6	**Run-on/Runoff Controls**					

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 2

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
	Drainage Swales & Area Contouring	1,500.0	LF	$4.0	$6,000	Assumes earthen drainage swales around site.
	Parking Lot Drainage System	1.0	LS	$20,000.0	$20,000	Installed with remedial construction to limit exposure.
	Area Drain Piping	100.0	LF	$50.0	$5,000	Collection pipes and culverts with discharge to river.
	Task 2.6 Subtotal =				**$31,000**	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 2

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
2.7	**Site Engineering Controls**					
	Fencing	2,180.0	LF	$25.0	$54,500	Site perimeter @ 850 ft long x 240 ft wide
	Signs	20.0	EA	$100.0	$2,000	
	Task 2.7 Subtotal =				**$56,500**	
2.8	**Site Revegetation**					
	Topsoil (Imported & Delivered)	2,421	CY	$10.0	$24,211	Topsoil entire site @ 3.0 acres x 6 inches, except parking.
	Place & Grade Topsoil	2,421	CY	$2.5	$6,053	
	Seeding	3.0	Acre	$500.0	$1,500	
	Hydromulching	3.0	Acre	$2,000.0	$6,000	
	Erosion Control					
	- Straw Bale Dikes	180.0	EA	$7.5	$1,350	Used to control erosion in drainage swales.
	- Silt Fence	850.0	LF	$3.5	$2,975	Used to control erosion along riverbank.
	Task 2.8 Subtotal =				**$42,089**	
	ALTERNATIVE NO. 2 ACTIVITIES					
3	**CONSTRUCTION PHASE**					
3.1	**Solidify/Stabilize Surface Soil**					
	Real Time Sampling/Dynamic Work Plan Implementation	1.0	LS	$100,000.0	$100,000	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 2

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
	Excavate Contaminated Surface Soil	12,653	CY	$14.0	$177,142	Volume per FIELDS for 0 to 2 ft depth
	Sort and Separate Excavated Material	12,653	CY	$6.0	$75,918	
	Load, Haul, & Dispose of Recyclable Material	2,531	CY	$8.5	$21,510	20% recyclable with disposal @ $5/ton or $8.5/CY
	Solify/Stabilize Contaminated Material	10,122	CY	$100.0	$1,012,240	80% solified/stabilized @ $100/CY
	New Fill to Replace Excavated (Imported & Delivered)	7,592	CY	$10.0	$75,918	60% of excavated material replaced
	Place & Grade Fill	7,592	CY	$2.5	$18,980	
	Task 3.1 Subtotal =				**$1,481,708**	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 2

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
3.2	**Solidify/Stabilize Subsurface Soil**					
	Real Time Sampling/Dynamic Work Plan Implementation	1.0	LS	$20,000.0	$20,000	
	Excavate Contaminated Subsurface Soil	4,192	CY	$14.0	$58,688	Volume per FIELDS for 2 to 4 ft depths
	Sort and Separate Excavated Material	4,192	CY	$6.0	$25,152	
	Load, Haul, & Dispose of Recyclable Material	419	CY	$8.5	$3,563	10% recyclable with disposal @ $5/ton or $8.5/CY
	Solify/Stabilize Contaminated Material	3,773	CY	$100.0	$377,280	90% solified/stabilized @ $100/CY
	New Fill to Replace Excavated (Imported & Delivered)	2,515	CY	$10.0	$25,152	60% of excavated material replaced
	Place & Grade Fill	2,515	CY	$2.5	$6,288	
	Task 3.2 Subtotal =				**$516,123**	
3.3	**Subsurface LNAPL Contaminants Removed**					Construct contaminant removal trenches
	Real Time Sampling/Dynamic Work Plan Implementation	1.0	LS	$50,000.0	$50,000	
	Excavate Subsurface/Remove LNAPL Contaminants	400.0	LF	$200.0	$80,000	Trench @ L=400 ft, D=15ft, W=3ft
	Sort and Separate Excavated Material	667	CY	$6.0	$4,000	Trench @ L=400 ft, D=15ft, W=3ft
	Load, Haul, & Dispose of Recyclable Material	267	CY	$8.5	$2,267	40% recyclable with disposal @ $5/ton or $8.5/CY
	Load, Haul, & Dispose of Contaminated Material	400	CY	$100.0	$40,000	60% solified/stabilized @ $100/CY
	New Fill to Replace Excavated (Imported & Delivered)	240	CY	$10.0	$2,400	60% of excavated material replaced
	Place & Grade Fill	240	CY	$2.5	$600	
	Task 3.3 Subtotal =				**$179,267**	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 2

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
CONSTRUCTION COST SUMMARY	**SUBTOTAL =**				**$2,991,959**	
	CONTINGENCY =	**@ 25%**			**$747,990**	
REMEDIAL DESIGN		**@ 10%**			**$299,196**	
ENGINEERING SERVICES DURING CONSTRUCTION		**@ 10%**			**$299,196**	
OVERSIGHT OF REMEDY IMPLEMENTATION		**@ 3%**			**$89,759**	
	TOTAL ESTIMATED DESIGN/BUILD COST =				**$4,428,100**	
	LONG-TERM O&M COSTS					
4	**GROUNDWATER SYSTEM O&M**					
4.1	Groundwater Monitoring Program					Present worth values @ 20 yrs operating life & 5% interest.
	- Sampling	1.0	LS	$62,311.0	$62,311	Annual sampling @$5,000 per sampling event.
	- Analysis	15.0	EA	$18,693.3	$280,400	15 wells, sampled annually @ $1,500 per sample.
	- Reporting	1.0	LS	$62,311.0	$62,311	Annual reporting @ $5,000.
	Task 4.1 Subtotal =				**$405,022**	
	Task 4 Subtotal =				**$405,022**	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 2

Tetra Tech EMI

Client: EPA Technology Innovation Office
Project: Marino Brothers Scrap Yard Site
Subject: Site Remediation Design/Build Cost Estimate

Estimated by: DJB
Date: 08/30/04
Checked by: RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
	TOTAL ESTIMATED PROJECT COST =				**$4,833,121**	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 3

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
	BASE CASE ACTIVITIES					
1	**PREDESIGN INVESTIGATIONS**					
1.1	**Existing Building Assessment**					
	Work Plan	1.0	LS	$3,500.0	$3,500	Intended to assess contamination in existing buildings.
	Building Sampling	1.0	LS	$2,500.0	$2,500	
	Sample Analysis	1.0	LS	$2,500.0	$2,500	
	Reporting	1.0	LS	$1,500.0	$1,500	
	Task 1.1 Subtotal =				**$10,000**	
1.2	**Soil Separation Treatability Testing**					
	Work Plan	1.0	LS	$5,000.0	$5,000	Intended to assess soil separation requirements.
	Sampling & Analysis	1.0	LS	$2,500.0	$2,500	
	Field Testing	1.0	LS	$7,500.0	$7,500	
	Reporting	1.0	LS	$5,000.0	$5,000	
	Task 1.2 Subtotal =				**$20,000**	
1.3	**Riverbank Sediment Assessment**					
	Work Plan	1.0	LS	$5,000.0	$5,000	Intended to further delineate and address sediment issues.
	Sampling & Analysis	1.0	LS	$7,500.0	$7,500	
	Reporting	1.0	LS	$7,500.0	$7,500	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 3

Tetra Tech EMI

Client: EPA Technology Innovation Office — Estimated by: DJB
Project: Marino Brothers Scrap Yard Site — Date: 08/30/04
Subject: Site Remediation Design/Build Cost Estimate — Checked by: RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
	Task 1.3 Subtotal =				**$20,000**	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 3

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
2	**CONSTRUCTION PHASE**					Assume six month construction period.
2.1	**Project Construction Setup**					
	Construction Permits: Prep./Meetings/Fees	1.0	LS	$1,500.0	$1,500	
	General Contractor Mob/Demob	1.0	LS	$25,000.0	$25,000	
	Site Office Equipment	1.0	LS	$5,000.0	$5,000	
	Site Construction Trailers	6.0	MO	$750.0	$4,500	
	Construction Utilities Hookup	1.0	LS	$7,500.0	$7,500	
	Temporary Site Security Fence	0.0	LF	$3.5	$0	Assumes existing site boundary fence is adequate.
	Temporary Equipment Decontamination Pad Facilities	1.0	LS	$12,500.0	$12,500	
	Water Storage Tank & Contaminated Water Disposal	6.0	MO	$5,000.0	$30,000	Fresh water for dust suppression & decon water disposal.
	Mob/Demob Soil Separations Equipment	1.0	LS	$10,000.0	$10,000	Power screening equipment setup for soil separation.
	Site Security	6.0	MO	$3,000.0	$18,000	
	Task 2.1 Subtotal =				**$114,000**	
2.2	**Site Preparation**					
	Surveyor & Mapping	1.0	LS	$10,000.0	$10,000	
	Decommission Interfering Site Utilities	1.0	LS	$5,000.0	$5,000	
	Clear & Grub Site	3.5	AC	$2,500.0	$8,750	Clear & grub entire site @ 3.5 acres
	Sort and Separate Spoil Material	2,825	CY	$6.0	$16,948	Spoil material is 3.5 acres by 6 inches deep
	Load, Haul, & Dispose of Recyclable Material	1,130	CY	$8.5	$9,604	40% recyclable with disposal @ $5/ton or $8.5/CY
	Load, Haul, & Dispose of Contaminated Material	1,695	CY	$102.0	$172,867	60% disposed @ haz waste landfill $60/ton or $102/CY
	Task 2.2 Subtotal =				**$223,169**	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 3

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
2.3	**River Embankment Resloping & Stabilization**					
	Excavate & Reslope Embankment	2,363	CY	$14.0	$33,082	Reslope existing embankment from 1:1 to 2:1
	Sort and Separate Excavated Material	2,363	CY	$6.0	$14,178	
	Load, Haul, & Dispose of Recyclable Material	945	CY	$8.5	$8,034	40% recyclable with disposal @ $5/ton or $8.5/CY
	Load, Haul, & Dispose of Contaminated Material	1,418	CY	$102.0	$144,616	60% disposed @ haz waste landfill $60/ton or $102/CY
	Construct Terraced Rock Wall	850	LF	$25.0	$21,250	Block/rock wall terraced to fit with 2:1 slope
	Task 2.3 Subtotal =				**$221,160**	
2.4	**Groundwater Monitoring System Installation**					
	Driller Mob\Demob	1.0	LS	$5,000.0	$5,000	Assumes drilling subcontractor used for sampling wells.
	Well Drilling	15.0	EA	$1,750.0	$26,250	Assumes 15 permanent monitoring wells @ 50 ft deep.
	Well Installation	15.0	EA	$500.0	$7,500	Well casings, etc.
	Oversight during Installation	1.0	LS	$7,500.0	$7,500	Geologist to log wells
	Task 2.4 Subtotal =				**$46,250**	
2.5	**Riverbank Sediment Cap**					
	Sediment Cap/Riprap Bedding Material	629.6	CY	$15.0	$9,444	Sand cap @ 1 ft deep. Site riverbank @ 850 ft L x 20 ft W
	Riprap	850.0	LF	$25.0	$21,250	Riprap @ d50=12 inch & depth 24 inches over sediment cap.
	Task 2.5 Subtotal =				**$30,694**	
2.6	**Run-on/Runoff Controls**					

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 3

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
	Drainage Swales & Area Contouring	1,500.0	LF	$4.0	$6,000	Assumes earthen drainage swales around site.
	Parking Lot Drainage System	1.0	LS	$20,000.0	$20,000	Installed with remedial construction to limit exposure.
	Area Drain Piping	100.0	LF	$50.0	$5,000	Collection pipes and culverts with discharge to river.
	Task 2.6 Subtotal =				**$31,000**	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 3

Tetra Tech EMI

Client: EPA Technology Innovation Office
Project: Marino Brothers Scrap Yard Site
Subject: Site Remediation Design/Build Cost Estimate

Estimated by: DJB
Date: 08/30/04
Checked by: RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
2.7	**Site Engineering Controls**					
	Fencing	2,180.0	LF	$25.0	$54,500	Site perimeter @ 850 ft long x 240 ft wide
	Signs	20.0	EA	$100.0	$2,000	
	Task 2.7 Subtotal =				**$56,500**	
2.8	**Site Revegetation**					
	Topsoil (Imported & Delivered)	2,421	CY	$10.0	$24,211	Topsoil entire site @ 3.0 acres x 6 inches, except parking.
	Place & Grade Topsoil	2,421	CY	$2.5	$6,053	
	Seeding	3.0	Acre	$500.0	$1,500	
	Hydromulching	3.0	Acre	$2,000.0	$6,000	
	Erosion Control					
	- Straw Bale Dikes	180.0	EA	$7.5	$1,350	Used to control erosion in drainage swales.
	- Silt Fence	850.0	LF	$3.5	$2,975	Used to control erosion along riverbank.
	Task 2.8 Subtotal =				**$42,089**	
	ALTERNATIVE NO. 3 ACTIVITIES					
3	**CONSTRUCTION PHASE**					
3.1	**Excavate & Dispose Surface Soil**					
	Real Time Sampling/Dynamic Work Plan Implementation	1.0	LS	$100,000.0	$100,000	
	Excavate Contaminated Surface Soil	12,653	CY	$14.0	$177,142	Volume per FIELDS for 0 to 2 ft depth

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 3

Tetra Tech EMI

Client: EPA Technology Innovation Office
Project: Marino Brothers Scrap Yard Site
Subject: Site Remediation Design/Build Cost Estimate

Estimated by: DJB
Date: 08/30/04
Checked by: RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
	Sort and Separate Excavated Material	12,653	CY	$6.0	$75,918	
	Load, Haul, & Dispose of Recyclable Material	2,531	CY	$8.5	$21,510	20% recyclable with disposal @ $5/ton or $8.5/CY
	Load, Haul, & Dispose of Contaminated Material	10,122	CY	$85.0	$860,404	80% disposed @ haz waste landfill $50/ton or $85/CY
	New Fill to Replace Excavated (Imported & Delivered)	10,122	CY	$10.0	$101,224	80% of excavated material
	Place & Grade Topsoil	10,122	CY	$2.5	$25,306	
	Task 3.1 Subtotal =				**$1,361,504**	

Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 3

Tetra Tech EMI

Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
3.2	**Excavate & Dispose Subsurface Soil**					
	Real Time Sampling/Dynamic Work Plan Implementation	1.0	LS	$20,000.0	$20,000	
	Excavate Contaminated Subsurface Soil	4,192	CY	$14.0	$58,688	Volume per FIELDS for 2 to 4 ft depths
	Sort and Separate Excavated Material	4,192	CY	$6.0	$25,152	
	Load, Haul, & Dispose of Recyclable Material	419	CY	$8.5	$3,563	10% recyclable with disposal @ $5/ton or $8.5/CY
	Load, Haul, & Dispose of Contaminated Material	3,773	CY	$85.0	$320,688	90% disposed @ haz waste landfill $50/ton or $85/CY
	New Fill to Replace Excavated (Imported & Delivered)	3,354	CY	$10.0	$33,536	80% of excavated material
	Place & Grade Topsoil	3,354	CY	$2.5	$8,384	
	Task 3.2 Subtotal =				**$470,011**	
3.3	**Subsurface LNAPL Contaminants Removed**					Construct contaminant removal trenches
	Real Time Sampling/Dynamic Work Plan Implementation	1.0	LS	$50,000.0	$50,000	
	Excavate Subsurface/Remove LNAPL Contaminants	400.0	LF	$200.0	$80,000	Trench @ L=400 ft, D=15ft, W=3ft
	Sort and Separate Excavated Material	667	CY	$6.0	$4,000	Trench @ L=400 ft, D=15ft, W=3ft
	Load, Haul, & Dispose of Recyclable Material	267	CY	$8.5	$2,267	40% recyclable with disposal @ $5/ton or $8.5/CY
	Load, Haul, & Dispose of Contaminated Material	400	CY	$85.0	$34,000	60% disposed @ haz waste landfill $50/ton or $85/CY
	New Fill to Replace Excavated (Imported & Delivered)	320	CY	$10.0	$3,200	80% of excavated material
	Place & Grade Topsoil	320	CY	$2.5	$800	
	Task 3.3 Subtotal =				**$174,267**	

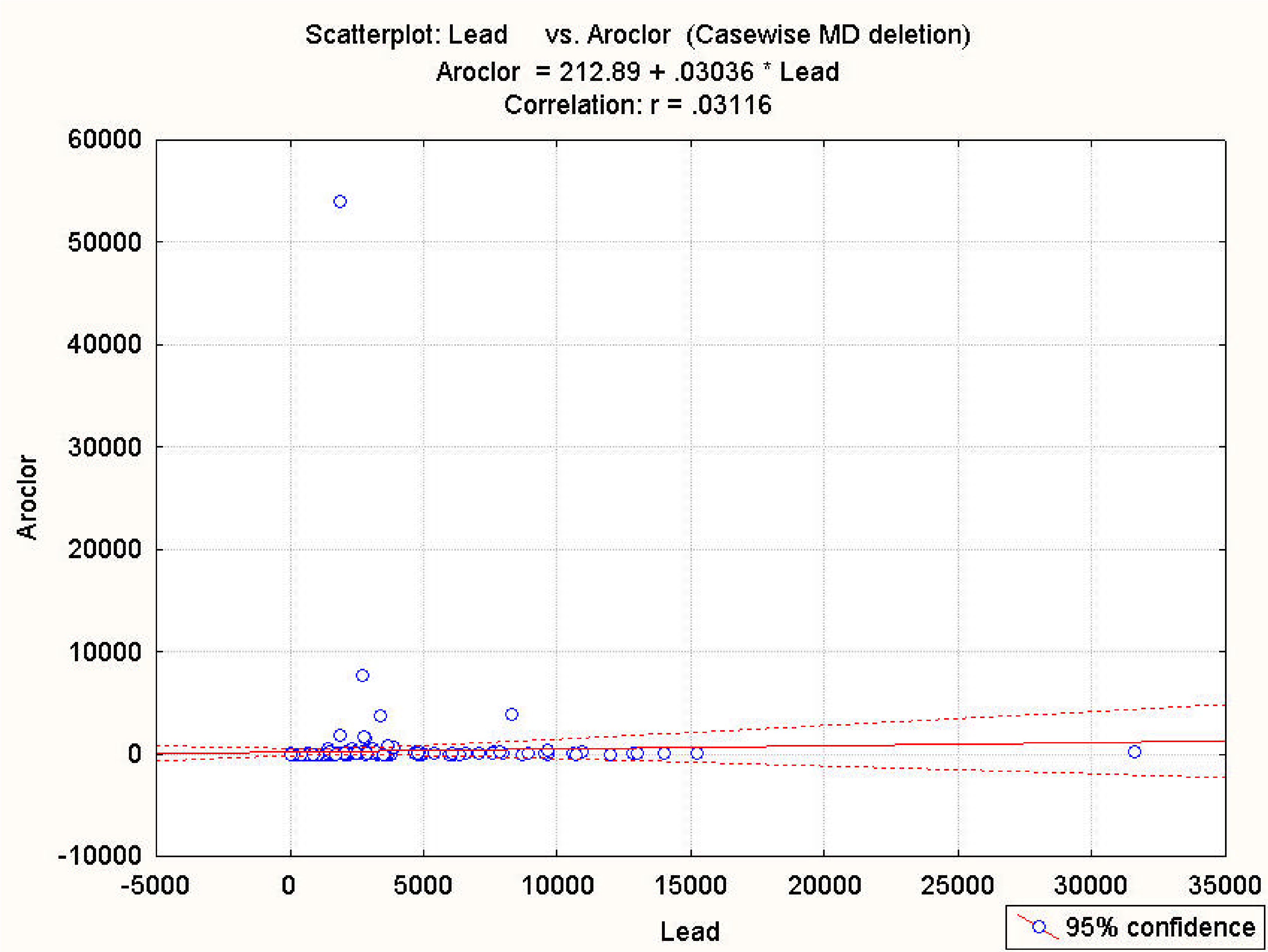
Marino Brothers Scrap Yard Site - Remedial Costing Alternatives
Alternative No. 3

Tetra Tech EMI

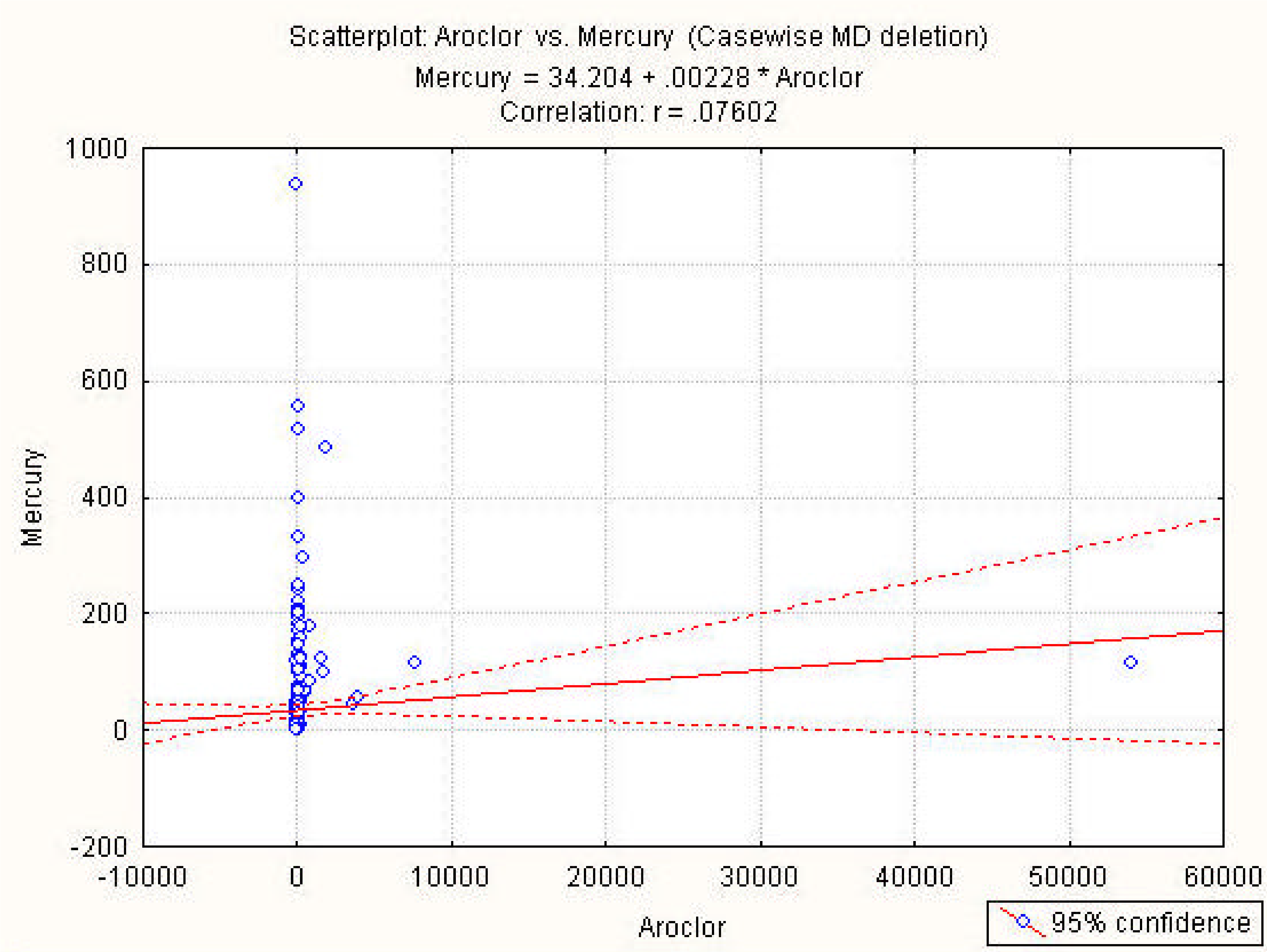
Client:	EPA Technology Innovation Office	Estimated by:	DJB
Project:	Marino Brothers Scrap Yard Site	Date:	08/30/04
Subject:	Site Remediation Design/Build Cost Estimate	Checked by:	RAH

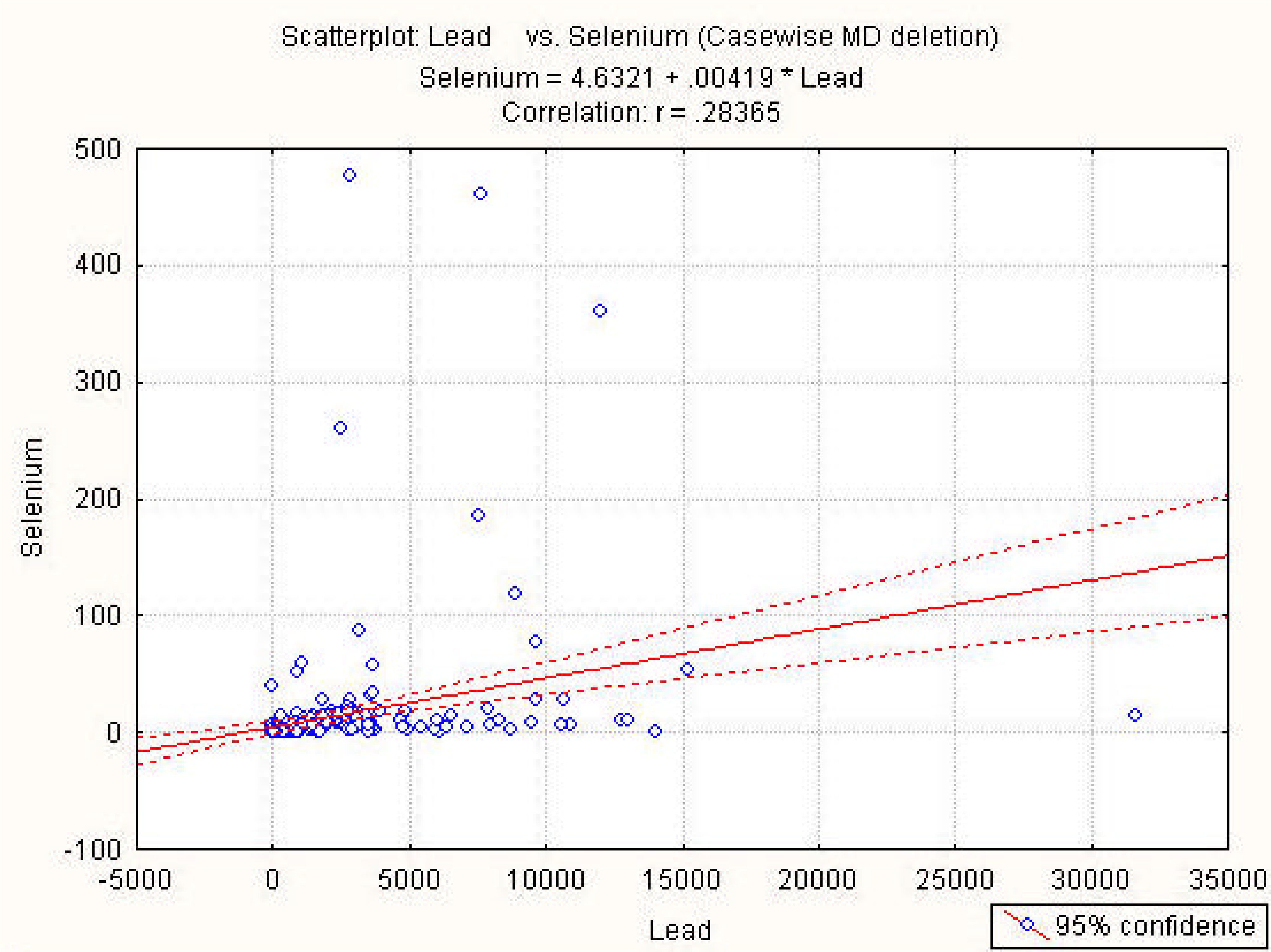
TASK	DESCRIPTION	QTY	UNIT	UNIT RATE	TOTAL	COSTING ASSUMPTIONS
CONSTRUCTION COST SUMMARY	**SUBTOTAL =**				**$2,820,644**	
	CONTINGENCY =	**@ 25%**			**$705,161**	
REMEDIAL DESIGN		**@ 10%**			**$282,064**	
ENGINEERING SERVICES DURING CONSTRUCTION		**@ 10%**			**$282,064**	
OVERSIGHT OF REMEDY IMPLEMENTATION		**@ 3%**			**$84,619**	
	TOTAL ESTIMATED DESIGN/BUILD COST =				**$4,174,553**	
	LONG-TERM O&M COSTS					
4	**GROUNDWATER SYSTEM O&M**					
4.1	Groundwater Monitoring Program					Present worth values @ 20 yrs operating life & 5% interest.
	- Sampling	1.0	LS	$62,311.0	$62,311	Annual sampling @$5,000 per sampling event.
	- Analysis	15.0	EA	$18,693.3	$280,400	15 wells, sampled annually @ $1,500 per sample.
	- Reporting	1.0	LS	$62,311.0	$62,311	Annual reporting @ $5,000.
	Task 4.1 Subtotal =				**$405,022**	
	Task 4 Subtotal =				**$405,022**	
	TOTAL ESTIMATED PROJECT COST =				**$4,579,575**	

ATTTACHMENT 2
CONSTITUENT OF CONCERN CORRELATION PLOTS

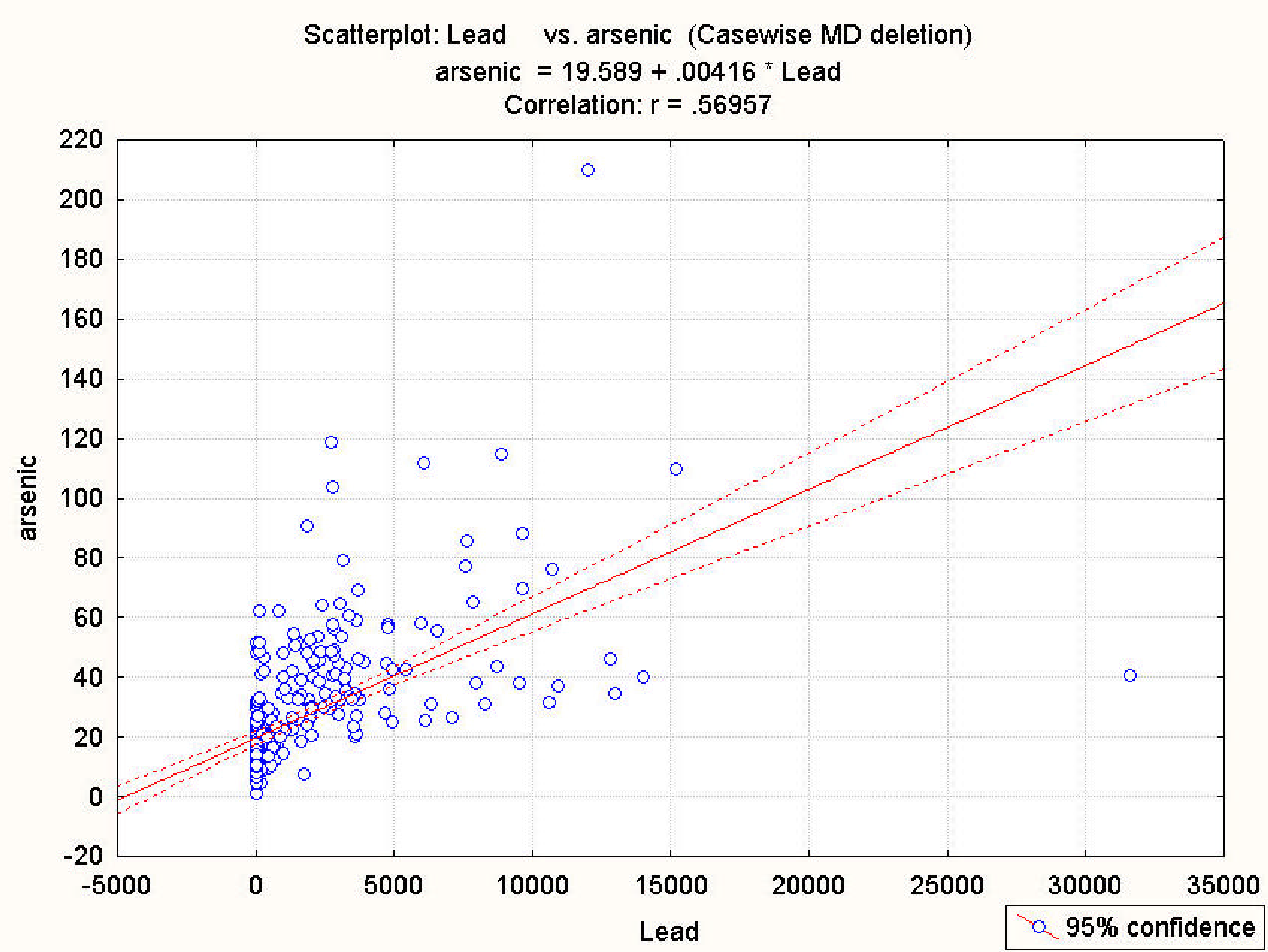


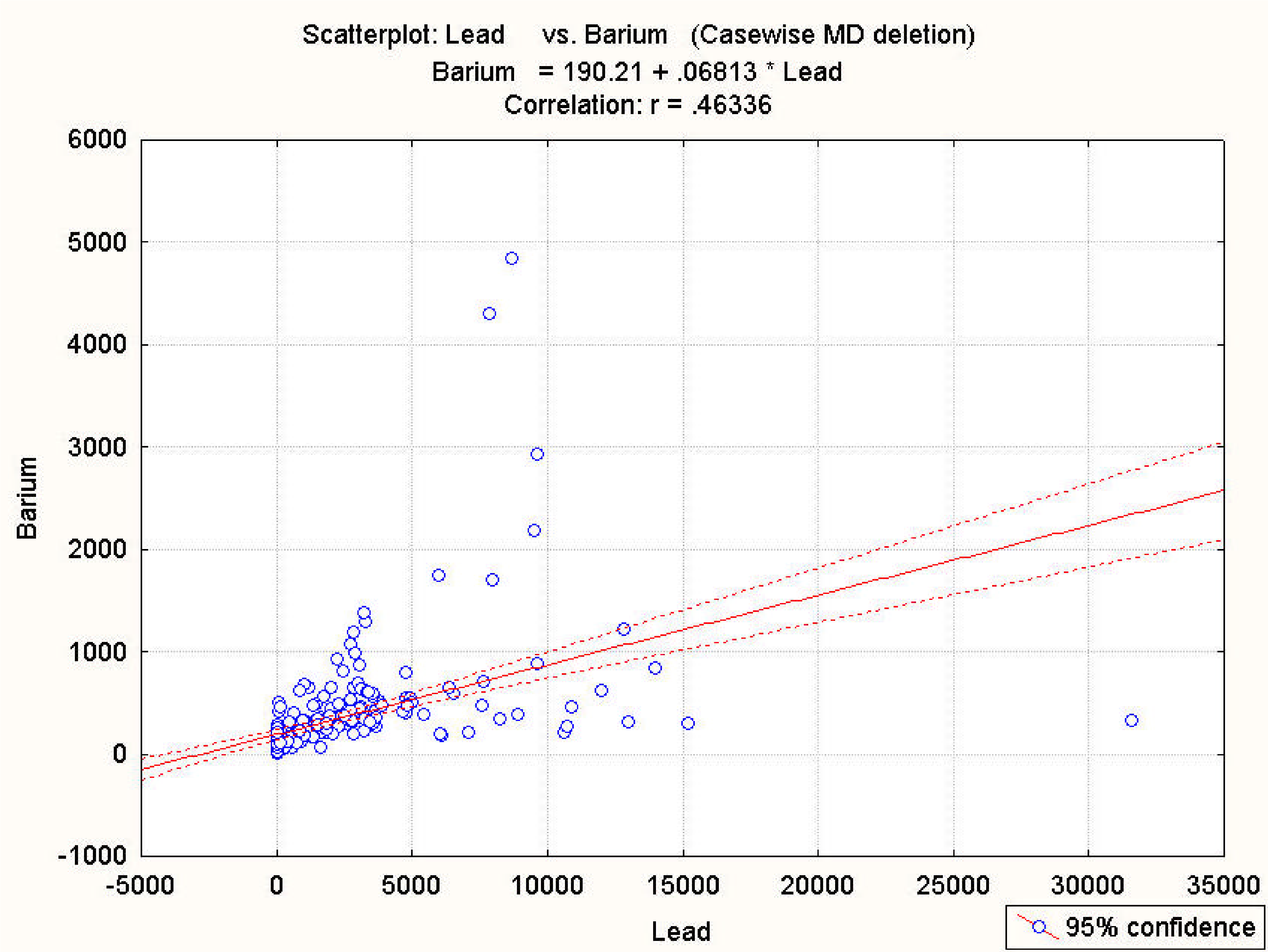
Scatterplot: Lead vs. Aroclor (Casewise MD deletion)
Aroclor = 212.89 + .03036 * Lead
Correlation: r = .03116
60000
50000
40000
30000
20000
10000
0
-10000
Aroclor
-5000
0
5000
10000
15000
20000
25000
30000
35000
Lead
95% confidence

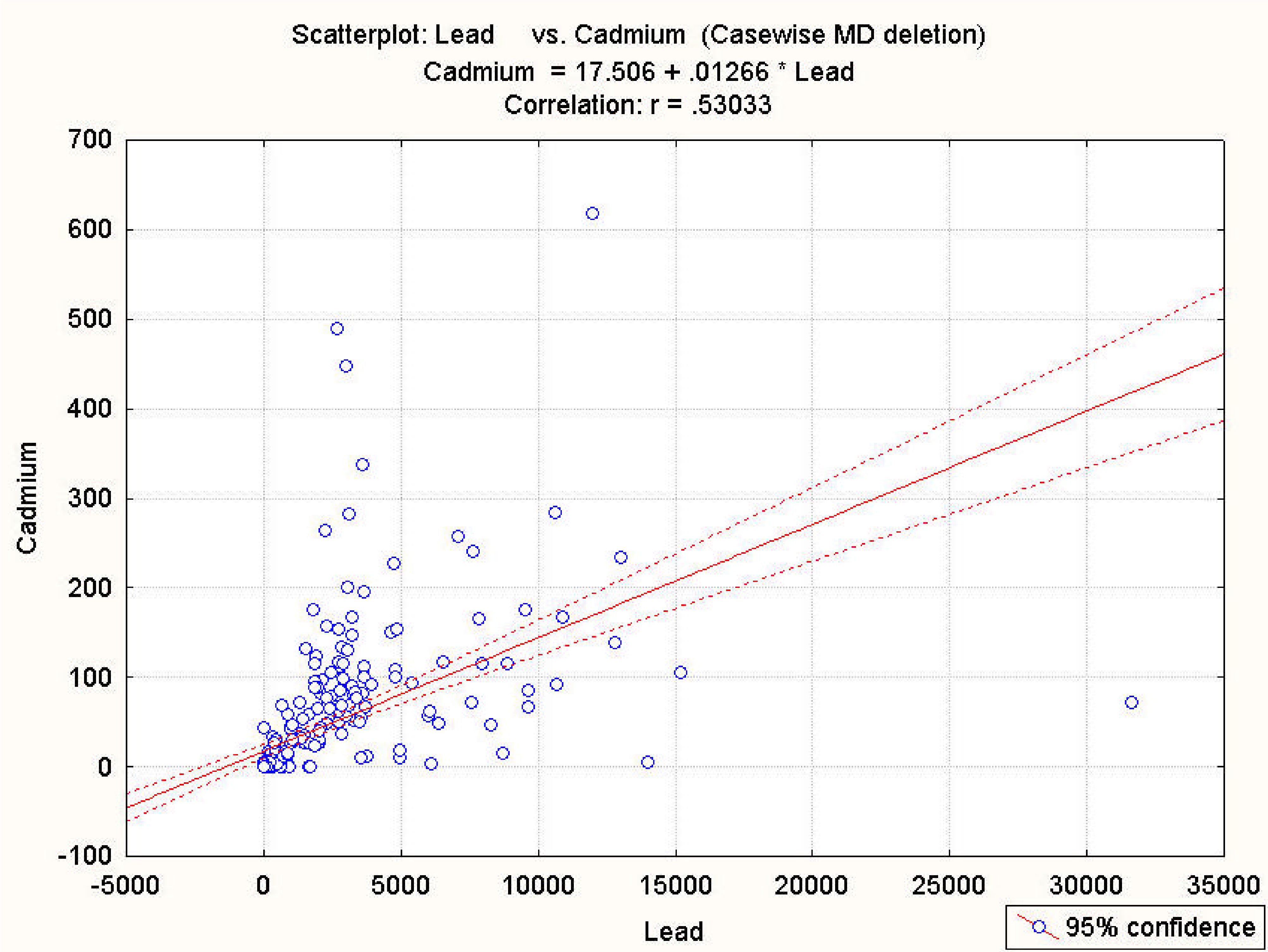

Scatterplot: Aroclor vs. Mercury (Casewise MD deletion)
Mercury = 34.204 + .00228 * Aroclor
Correlation: r = .07602
1000
800
600
400
200
0
-200
-10000
0
10000
20000
30000
40000
50000
60000
Mercury
Aroclor
95% confidence



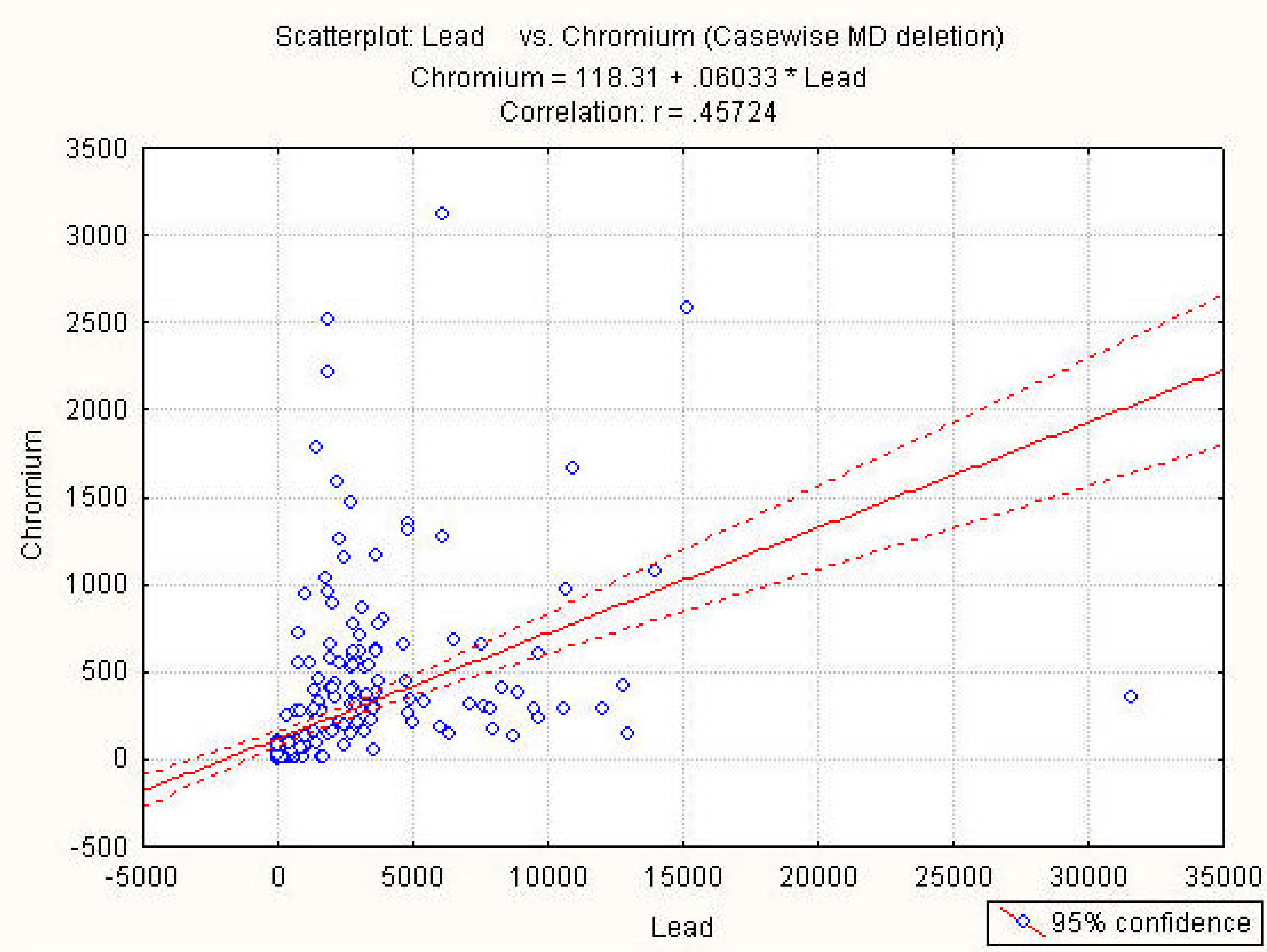
Scatterplot: Lead vs. Selenium (Casewise MD deletion)
Selenium = 4.6321 + .00419 * Lead
Correlation: r = .28365
Selenium
500
400
300
200
100
0
-100
-5000
0
5000
10000
15000
20000
25000
30000
35000
Lead
95% confidence


Scatterplot: Lead vs. arsenic (Casewise MD deletion)
arsenic = 19.589 + .00416 * Lead
Correlation: r = .56957
arsenic
220
200
180
160
140
120
100
80
60
40
20
0
-20
-5000
0
5000
10000
15000
20000
25000
30000
35000
Lead
95% confidence

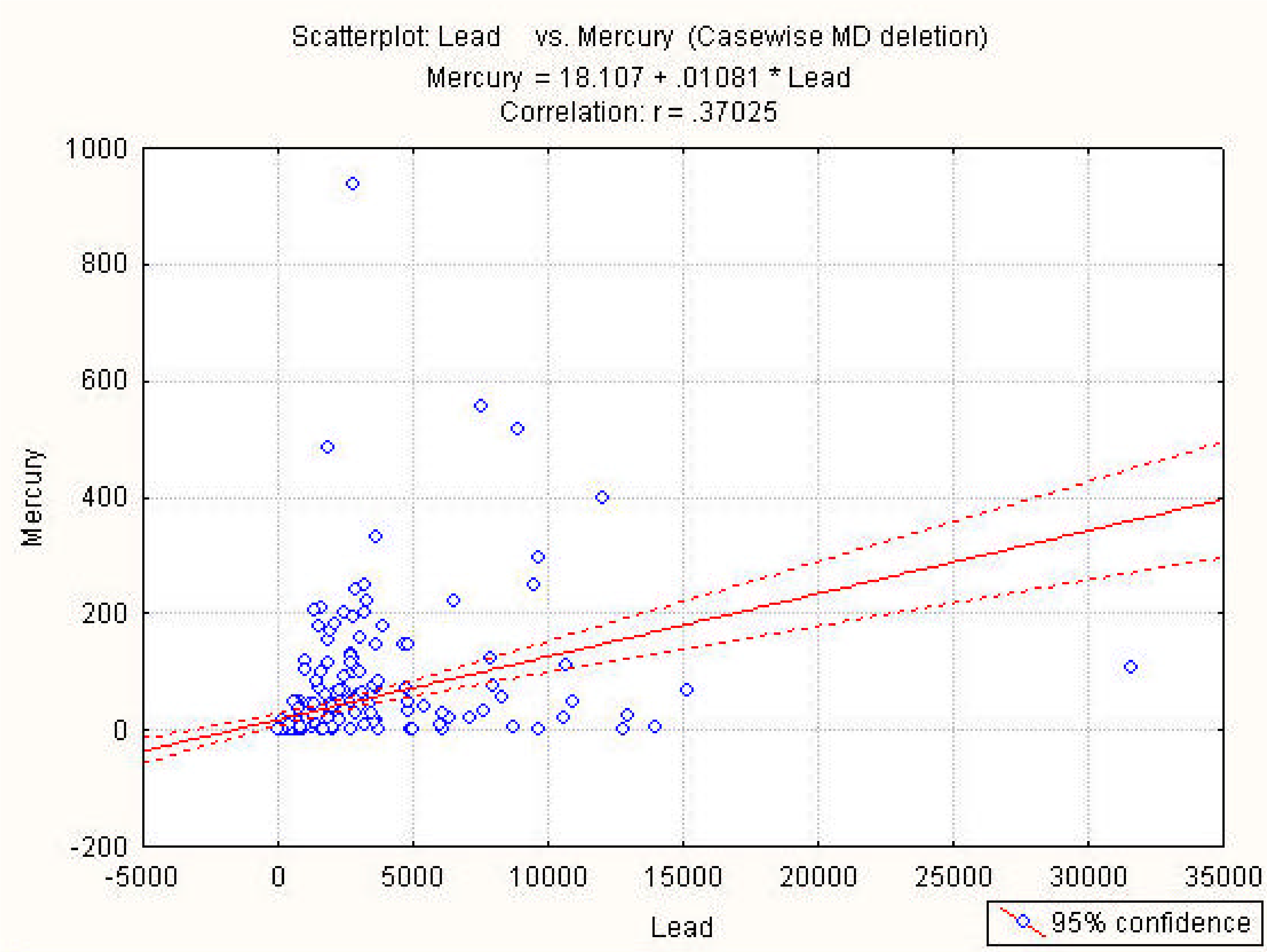

Scatterplot: Lead vs. Barium (Casewise MD deletion)
Barium = 190.21 + .06813 * Lead
Correlation: r = .46336
Barium
Lead
6000
5000
4000
3000
2000
1000
0
-1000
-5000
0
5000
10000
15000
20000
25000
30000
35000
95% confidence

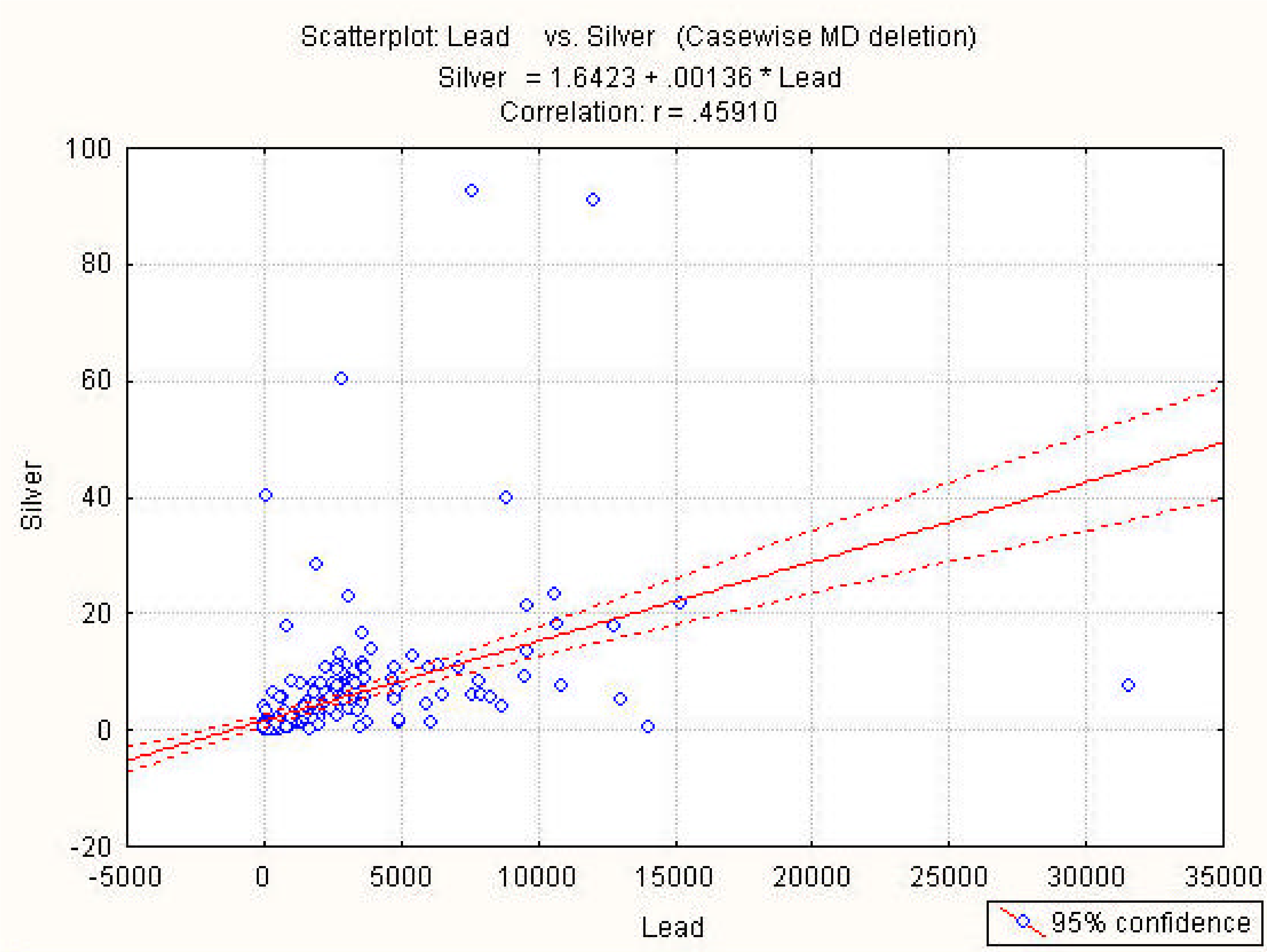


Scatterplot: Lead vs. Cadmium (Casewise MD deletion)
Cadmium = 17.506 + .01266 * Lead
Correlation: r = .53033
700
600
500
400
300
200
100
0
-100
Cadmium
-5000
0
5000
10000
15000
20000
25000
30000
35000
Lead
95% confidence



Scatterplot: Lead vs. Chromium (Casewise MD deletion)
Chromium = 118.31 + .06033 * Lead
Correlation: r = .45724
3500
3000
2500
2000
1500
1000
500
0
-500
Chromium
-5000
0
5000
10000
15000
20000
25000
30000
35000
Lead
95% confidence


Scatterplot: Lead vs. Mercury (Casewise MD deletion)
Mercury = 18.107 + .01081 * Lead
Correlation: r = .37025
Mercury
1000
800
600
400
200
0
-200
-5000
0
5000
10000
15000
20000
25000
30000
35000
Lead
95% confidence


Scatterplot: Lead vs. Silver (Casewise MD deletion)
Silver = 1.6423 + .00136 * Lead
Correlation: r = .45910
Silver
Lead
100
80
60
40
20
0
-20
-5000
0
5000
10000
15000
20000
25000
30000
35000
95% confidence

PART B

SPECIFICATIONS

ATTACHMENT B

Specification Sections
Table of Contents

SCHEDULE

Item Number	Description	Estimated Quantity	Unit	Unit Price	Amount
	BASE ITEMS				
0001	All Work for EGDY Trenching/Drum Removal except Items 0002 through 0007	100	Day	$______	$______
0002	Mobilization and Demobilization	1	Job	L.S.	$______
0003	Site Preparation	1	Job	L.S.	$______
0004	Plans/Reports/Data Review				
	a) Management Plan	1	EA	$______	$______
	b) Final Report	1	EA	$______	$______
	c) Data Review per Sample Delivery Group	50	EA	$______	$______
0005	Analytical Sampling				
	a) Volatile Organics: TCL+TIC's SW-846/8260	50	EA	$______	$______
	b) Total PCBs SW-846 8082	50	EA	$______	$______
	c) Total Metals RCRA Regulated SW-846 6010 or 6020/7000	50	EA	$______	$______
	d) Semivolatile Organics: TCL+TIC's SW-846 8270	50	EA	$______	$______
	e) TCLP Metals SW-846 1311/6010/7000	10	EA	$______	$______
	f) NW-TPHD, WAC	10	EA	$______	$______
	g) NW-TPHG, WAC	10	EA	$______	$______
	h) RCRA Regulated Pesticides SW-846 8081	10	EA	$______	$______
	i) Haz-Cat, SW-846 (200 Samples)	1	Job	L.S.	$______
	J) Reactive Cyanide SW846 Ch. 7.3.3.2	30	EA	$______	$______
	k) Reactive Sulfide SW846 Ch. 7.3.4.1	30	EA	$______	$______
	l) Corrosivity pH Test SW846 9045	30	EA	$______	$______
	m) Ignitability Flash Point SW846 1010	30	EA	$______	$______
	n) Moisture Content, Carl/Fischer Titration Method SW846	30	EA	$______	$______
	o) Sediment Content, SW846 Centrifuge	30	EA	$______	$______
	p) RCRA Regulated Herbicides SW-846 8150	10	EA	$______	$______
	q) BTU Content, ASTM D240	30	EA	$______	$______
	r) Total Halogen Content, SW-846	30	EA	$______	$______
	s) TCLP VOCs, SVOCs, Pesticides, Herbicides, and Metals SW-846 1311/ 8260/8081/8082/8270/6010 or 6020/8150	10	EA	$______	$______
	t) Paint Filter Test, SW-846	30	EA	$______	$______

EGDY = East Gate Disposal Yard

SCHEDULE (Cont'd)

Item Number	Description	Estimated Quantity	Unit	Unit Price	Amount
0006	Vacuum Truck	20	Day	$______	$______
0007	Chemical/Environmental Technician	25	Day	$______	$______
		TOTAL BASE ITEMS			$______
	OPTIONAL ITEMS				
0008	All Work for EDGY Trenching/Drum Removal except for Items 0012 through 0016	100	Day	$______	$______
0009	All Work for EGDY Trenching/Drum Removal except for Items 0012 through 0016	100	Day	$______	$______
0010	All Work for EGDY Trenching/Drum Removal except for Items 0012 through 0016	50	Day	$______	$______
0011	All Work for EGDY Trenching/Drum Removal except for Items 0012 through 0016	50	Day	$______	$______
0012	Mobilization and Demobilization	1	Job	L.S.	$______
0013	Standby Time	15	Day	$______	$______
0014	Analytical Sampling				
	a) Volatile Organics: TCL+TIC's SW-846/8260	50	EA	$______	$______
	b) Total PCBs SW-846 8082	50	EA	$______	$______
	c) Total Metals RCRA Regulated SW-846 6010/7000	50	EA	$______	$______
	d) Semivolatile Organics: TCL+TIC's SW-846 8270	50	EA	$______	$______
	e) TCLP Metals SW-846 1311/6010/7000	10	EA	$______	$______
	f) NW-TPHD, WAC	10	EA	$______	$______
	g) NW-TPHG, WAC	10	EA	$______	$______
	h) RCRA Regulated Pesticides SW-846 8081	10	EA	$______	$______
	i) Haz-Cat, SW-846 (200 Samples)	1	Job	L.S.	$______
	J) Reactive Cyanide SW846 Ch. 7.3.3.2	30	EA	$______	$______
	k) Reactive Sulfide SW846 Ch. 7.3.4.1	30	EA	$______	$______
	l) Corrosivity pH Test SW846 9045	30	EA	$______	$______
	m) Ignitability Flash Point SW846 1010	30	EA	$______	$______

Item Number	Description	Estimated Quantity	Unit	Unit Price	Amount
	n) Moisture Content, Carl/Fischer Titration Method SW846	30	EA	$______	$______
	o) Sediment Content, SW846 Centifuge	30	EA	$______	$______
	p) RCRA Regulated Herbicides SW-846 8150	10	EA	$______	$______
	q) BTU Content, ASTM D240	30	EA	$______	$______
	r) Total Halogen Content, SW-846	30	EA	$______	$______
	s) TCLP VOCs, SVOCs, Pesticides, Herbicides, and Metals SW-846 1311/ 8260/8081/8082/8270/6010 or 6020/8150	10	EA	$______	$______
	t) Paint Filter Test, SW-846	30	EA	$______	$______
0015	First Additional Chemical/Environmental Technician	25	Day	$______	$______
0016	Second Additional Chemical/Environmental Technician	25	Day	$______	$______
	TOTAL OPTIONAL ITEMS				$______
	TOTAL BASE AND OPTIONAL ITEMS				$______

Quantities: All quantities shown other than an item with unit of "Job" are estimated for use in evaluating offers only. Payment will be made for actual quantities.