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VOLUME 1
SECTIONS 1 THROUGH 13

RCRA FACILITY INVESTIGATION
REVISED PHASE I INTERIM REPORT
FOR
COLUMBIA MANUFACTURING COMPANY
WESTFIELD, MASSACHUSETTS

SEPTEMBER, 1994

Tighe&Bond
Consulting Engineers
Environmental Specialists

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Tighe&Bond
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Environmental Specialists

MEMORANDUM

TO: Recepient
FROM: Tighe & Bond, Inc.
SUBJECT: **REVISED PHASE I INTERIM REPORT-COLUMBIA MANUFACTURING**
DATE: August 8, 1994

Please confirm the contents of this package upon receipt. In case of any discrepencies, please call Evan T. Johnson at 413-562-1600.

- [x] Volume I: Chapter 1 to Chapter 13
- [x] Volume II: Chapter 14 to Chapter 25
- [x] Volume III: Appendix A to Appendix D
- [x] Volume IV: Appendix E to Appendix J
- [x] Volume V: Appendix K to Appendix N
- [x] Appendix O: Section 1
- [x] Appendix O: Section 2 and 3
- [x] Appendix O: Section 4, Part 1
- [x] Appendix O: Section 4, Part 2
- [x] Appendix O: Section 4, Part 3
- [x] Appendix O: Section 4, Part 4 and 5

Westfield Executive Park 53 Southampton Road Westfield, MA 01085 Tel. 413-562-1600 Fax. 413-562-5317

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Tighe&Bond
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Environmental Specialists

W-517-2-10
September 8, 1994

United States Environmental Protection Agency
Waste Management Division - Region 1
90 Canal Street
Boston, MA 02114

Attn: Mr. Frank Battaglia
Mail Code HRRCAN3

Re: **Phase I Interim Progress Report - Revised**
Columbia Manufacturing Company
Westfield, Massachusetts

Dear Mr. Battaglia:

Enclosed please find the revised Phase I Interim Progress Report and the Phase II Scope of Work for the RCRA Facility Investigation (RFI) at the Columbia Manufacturing Company (CMC) located on Cycle Street in Westfield, Massachusetts (the Site). This document represents revisions to our initial submittal of these documents on February 11, 1994 in response to EPA review comments received on July 8, 1994. Should you have any questions feel free to call.

Very truly yours,

TIGHE & BOND, INC.

Evan T. Johnson

Evan T. Johnson, P.E.
Project Manager

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Evan T. Johnson

Evan T. Johnson, P.E.

Attachments

cc: Dan Dooher, United States Department of Justice
Joanna Hall, TRC Environmental Corporation
Rich Green, Massachusetts DEP, Western Regional Office
Steven DeGabriele and Jeff Corman, Massachusetts DEP, Boston Office
Ken Howard, Columbia Manufacturing Company
Dave Williams, Columbia Manufacturing Company
Dick Estes, Columbia Manufacturing Company
David Herrington, Wegman, Hessler, Vanderburg & O'Toole
David Martel, Doherty, Wallace, Pilsbury & Murphy

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Tighe&Bond
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W517-2-10
September 7, 1994

Attorney David W. Herrington
Wegman, Hessler, Vanderberg & O'Toole
6100 Rockside Woods Blvd., Suite 345
Cleveland, OH 44131

Re: Columbia Manufacturing Site
Westfield, MA

Dear Attorney Herrington:

We forward herewith a copy of Sections 20 thru 23 of our revised RCRA Facility Investigation Report and Proposal.

These Sections represent the Phase II Proposal and should serve as a good overview of our proposals for additional investigative work in Phase II. These sections have been reviewed by Bill Norman of GZA GeoEnvironmental and finalized subsequent to his review.

Tomorrow we will hand deliver copies of the complete RCRA Facility Investigation Report and Proposal to EPA in Boston and TRC in Lowell. Copies will also be forwarded to you (via overnight mail) and Ken Howard tomorrow, as well as the other appropriate parties.

You may wish to review these sections and, if you have comments on the Phase II Proposal, please get them to us promptly early tomorrow morning.

Very truly yours,

TIGHE & BOND, INC.

John W. Powers, P.E.
President

hp\W517\LTR\JWP.B
Enclosure

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ACRONYMS FOR THE PHASE I INTERIM REPORT

AFB . . . Air Force Base
AOC . . . Area of Concern
CMC . . . Columbia Manufacturing Company, Inc.
DCA . . . Dichloroethane
DCE . . . Dichloroethene
DEP . . . Massachusetts Department of Environmental Protection
DEQE . . Massachusetts Department of Environmental Quality Engineering
EPA . . . United States Environmental Protection Agency
eV . . . . electronvolt
GC . . . . Gas Chromatograph
gpm . . . gallons per minute
HERA . . Health and Environmental Risk Assessment
ID . . . . Inside Diameter
mg/L . . . milligrams per liter
mg/kg . . milligrams per kilogram
mL . . . . milliliter
mV . . . . millivolts
MSDS . . Material Safety Data Sheet
MTD . . . MTD Products, inc.
MW . . . Monitoring Well
NCDC . . National Climatic Data Center
ng/L . . . nanograms per liter
NGVD . . National Geodetic Vertical Datum
OD . . . . Outside diameter
PAH . . . Polycyclic Aromatic Hydrocarbon
PCE . . . Tetrachloroethene
PID . . . . Photoionization detector
POTW . . Publicly Owned Treatment Works
ppb . . . . parts per billion
ppm . . . parts per million
ppt . . . . parts per trillion
PVC . . . Polyvinyl chloride
RCRA . . Resource Conservation Recovery Act
RFA . . . RCRA Facility Assessment
RFI . . . . RCRA Facility Investigation
SWMU . Solid Waste Management Unit
TCE . . . Trichloroethene
TEF . . . Toxicity Equivalency Factor
TEGD . . Technical Enforcement Guidance Document
TOC . . . Total Organic Carbon
TPH . . . Total Petroleum Hydrocarbons
TDS . . . Treatment, Storage & Disposal
µg/L . . . micrograms per liter
µg/kg . . micrograms per kilogram
µmhos/cm micromhos per centimeter
USDA . . United States Department of Agriculture
USGS . . United States Geologic Survey
UST . . . Underground Storage Tank
VOC . . . Volatile Organic Compound
WWTP . Wastewater Treatment Plant

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EXECUTIVE SUMMARY

A Phase I RCRA Facility Investigation and a Phase II Scope of Work have been completed for the Columbia Manufacturing Company (CMC) property in Westfield, Massachusetts. This investigation included an evaluation of releases from Areas of Concern (AOC) which are located on the Site. The investigation also included an evaluation of the physical characteristics of the Site and surrounding areas, and release characterizations of AOC groupings at the property. The Phase I data was evaluated and a series of data gaps were determined to exist at the Site.

A Phase II Scope of Work has been developed which is designed to fill the data gaps identified during Phase I. The primary data gaps to be addressed in the first portion of Phase II (Phase IIA) will be the development of background characteristics for evaluating the releases at the site. A copy of the findings will be forwarded to USEPA for review and approval. Upon approval, the second portion of Phase II (Phase IIB) will be performed to fill the release characterization data gaps at the AOC groupings which were identified during Phase I. Again, our interim report will be submitted to USEPA for review and approval. In the third section of Phase II (Phase IIC), any additional data gaps from the first two portions of Phase II will be addressed and any off-site data gaps will be filled. A series of Health and Environmental Risk Assessment (HERA) interim reports will be submitted with the Phase II reports.

A Consent Order was signed on August 11, 1993 initiating the commencement of the Phase I activities. Field work and data evaluation was performed during the Fall and Winter of 1993-1994 and the Phase I RFI Report and the Phase II Scope of Work was submitted to the EPA on February 11, 1994. EPA review comments were received on July 8, 1994 and this document represents revisions to the February 11, 1994 submission in response to those comments. As part of the revision process, a QA Oversight Contractor was engaged to review and comment on the revisions to the Phase I Report and the Phase II Scope of Work. GZA GeoEnvironmental of Newton, MA performed these oversight services.

This revised Phase I and Phase II Scope of Work has been designed to characterize the releases at the Site such that contaminants of concern may be identified and ultimately a Corrective Measure Study (CMS) prepared to address those releases which require a remediation.

The document has been presented in a manner designed for ease of review. The first six (6) sections of the report address the physical characteristics which were evaluated at the Site. Section 7 breaks the Areas of Concern into a series of groupings which are subsequently evaluated in Sections 8 through 15 for release characterization. Section 16 evaluates the release characterization for the off-site locations. A summary of the release characterizations is then presented in Section 17. Section 18 is the first interim deliverable for the Health and Environmental Risk Assessment (HERA). This section is the first of four steps in evaluating the risk associated with the releases which have been identified at this Site. The subsequent three (3) HERA deliverables will be submitted as part of Phases IIA, IIB and IIC which are described in the Phase II Scope of Work. Finally, the Phase I RFI concludes with Section 19 that summarizes the physical and release characteristics which have been identified at the Site.

Section 20 is the Introduction to the Phase II Scope of Work and lays out the frame work for conducting Phases IIA, IIB and IIC. In Phase IIA (Section 21) the background release characteristics will be more clearly defined. This data gap was evident at the completion of Phase I and must be addressed early in Phase II in order to develop those contaminants of concern. Once the contaminants of concern have been

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addressed the more detailed release characterization (Section 22) will be addressed at the AOC grouping which were previously identified. Finally, in Section 23, residual data gaps from Phases IIA and IIB will be addressed.

Section 24 provides a preliminary evaluation of the release characterization identified in Sections 7 through 19 and conducts a screening of the possible remedial alternatives to be performed as part of the Corrective Measures Study. The report concludes in Section 25 with a new approach to project management to address those problems encountered during Phase I.

This document has been designed in a manner that carefully and clearly explains what the sources of the problem are at the Site, how additional investigations will better refine and clarify those problems and, ultimately, what remedial alternatives may be selected in order to remediate release which have occurred.

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1 INTRODUCTION

1.1 OVERVIEW

This Phase I Interim Report and Phase II Proposal presents the results of a Phase I RCRA Facility Investigation (RFI) of the Columbia Manufacturing Company (CMC) facility in Westfield, Massachusetts (the Site) and proposes a work scope for a Phase II Investigation at that facility. This section reviews the history of the facility and this project (Section 1.2), provides an overview of the Areas of Concern (AOCs) on the Site and the wastes associated with those AOCs (Section 1.3), provides an overview of the Phase I investigation (Section 1.4), and summarizes the organization and contents of each volume in this document (Section 1.5). A summary is found at the conclusion of this Section (Section 1.6).

1.2 SITE LOCATION AND HISTORY

This section describes:

- the location of the Site
- the developmental history of the facility and the Site;
- the history of production activities at the Site;
- the history of manufacturing operations employed in production activities;
- the history of wastes generated and disposed of at the Site;
- the findings of previous investigations at the Site.
- the regulatory milestones leading up to the submittal of this document;

Various documents providing supporting information for this section may be found in Appendix A, Plates, and in Appendix B, Historical Documentation. Appendix B is divided into three (3) parts, containing historical Sanborn Fire Insurance Maps, selected regulatory correspondence and summaries of analytical data from previous investigations.

1.2.1 Site Location

The Site consists of a 23.7-acre parcel located at One Cycle Street at the southeast limit of a heavily developed portion of the City of Westfield, Massachusetts. The location of the Site is shown on the Site Plan in Appendix A, and on Figure 1-1, Site Locus Map. The Site Locus Map covers a radius of two (2) miles around the Site as specified in the RFI Proposal. The Site is bounded to the north by residential properties on Cleveland, Lozier and Toledo Avenues, to the west by a railroad embankment, and to the south and east by agricultural land currently used primarily for the cultivation of shade tobacco. South Meadow Road parallels the eastern Site property line.

The Little River flows along the edge of these agricultural fields. The direction of flow in the Little River is generally to the east, however the river bed meanders to the west, south and east of the site, prior to its confluence with the Westfield River approximately one-half mile to the northeast of the Site.

1.2.2 Developmental History of the Site

The buildings constructed on the Site date back to the late 1800s and early 1900s. The Warehouse building, constructed in 1969, is the only relatively recent building on the Site. Sanborn Fire

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Insurance Maps for 1924, 1947 and 1963 confirm the configuration of Site buildings during that time period. Those maps are provided in Appendix B-1.

A canal formerly crossed the property along its southwestern border, in the vicinity of the former lagoons and the current location of the Fire Pond. According to information available for examination in the historical collection at the Westfield Public Library, the Hampshire & Hampden Canal was constructed sometime around 1825 for the purpose of transporting cargo. The project extended from Northampton, Massachusetts to Southwick, Massachusetts and included 18 locks in Westfield and two (2) aqueducts.

In the late 1840's, the development of the canal was abandoned as railroads became a more favorable means of transporting cargo. In many areas the canal was filled and railroad beds were built upon it. The majority of the portion of the canal was on the Site backfilled during the late 1800's, with the exception of the existing Fire Pond. Sanborn Fire Insurance Maps of the site dating back to 1924 indicate that the Fire Pond in essentially its present configuration (See Appendix B).

1.2.3 Production History

The products manufactured at the Site have consisted of a variety metal tube items including: bicycles, mopeds, lawnmowers; motorcycles, munitions (shells only), school furniture and other tubing-based products (eg. exercise equipment and strollers). The primary manufacturing item over the history of the Site was bicycles, until production was discontinued in 1991. Currently, the only manufacturing item is school furniture. With the exception of bicycles, the other items listed above were produced for short periods of time and then discontinued.

The production of bicycles at the Site began when the original manufacturing buildings were constructed around 1897 by the American Bicycle Company. Between 1902 and 1932 the company operated as the Westfield Manufacturing Company, a subsidiary of the Torrington Company. In 1905, the Pope Manufacturing Company purchased the Site from the American Bicycle Company and continued the manufacture of bicycles. Pope Manufacturing subsequently moved all bicycle manufacturing from their Hartford, Connecticut location to the Site in 1906. Pope Manufacturing also diversified the production items to include the Pope Motorcycle, United States Army bicycles, and munitions shells for the Russian Government. The manufacture of children's bicycles began in 1919. During World War II, wartime products, including motorcycles and high explosive shells, were produced for the United States Government. School furniture production began around the mid-1950s.

In 1960, the company incorporated and became the Columbia Manufacturing Company. A merger, in 1967, with MTD Products of Cleveland, Ohio, transformed Columbia Manufacturing into a division of MTD. In 1987, executives of Columbia purchased the division from MTD, restoring the Columbia Manufacturing Company name.

1.2.4 History of Manufacturing Operations

The four (4) primary operations at the Site have included:

- machining of tube metal;
- metal cleaning;

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- electroplating;
- painting.

These basic operations have not changed significantly throughout the history of the Site. Different methods may have been used, however, for different workpieces to maintain production. The history of operations is shown in Table 1-1. The locations of the buildings are indicated on the Site Plan in Appendix A. The locations of the various manufacturing operations in 1968 are indicated on a Site Plan dated September, 1968 also located in Appendix A.

Machining has included bending, welding, cutting, heat treatment, and annealing of tube metal. Tumbling and annealing of cranks and other small metal parts has also been conducted.

Metal cleaning was undertaken to remove residual oil by degreasing with either a methylene chloride or trichloroethene vapor degreaser. Excess flux from welding was removed by immersing the parts in a phosphoric acid pickling solution. Currently, cleaning of school furniture workpieces is accomplished by immersion in an alkaline solution in the plating area.

Electroplating of metals (cadmium, copper, zinc, nickel and chromium) to manufactured items has been an operation at the Site since manufacturing began. Different forms of plating have been used during different periods. Chromium, for example, was apparently added in 1929. Currently, chromium is plated over nickel in the production of school furniture.

Non-plated metal items, primarily bicycle frames, were coated with a phosphate solution prior to painting. This process is known as bonderizing and increases the chipping resistance of the finish. Frames and other items which required paint were then moved to the third floor of Building 1 to be painted. School furniture painting, primarily desk bodies, is completed in the southwest corner of the warehouse. Inadvertently painted items and equipment were stripped with a sodium carbonate solution.

1.2.5 Waste Generation and Disposal History

There is little factual data regarding waste disposal prior to 1967. Two (2) plans illustrating the historical wastewater drainage pipes in use on the Site prior to the construction of the facility wastewater treatment plant (WWTP) are provided in Appendix A. A plan entitled Drainage Detail, dated December, 1967 shows the locations of grated surface drains, covered manholes, sanitary drains, and the locations of the receiving pipelines at that time. The liquid waste from the main office building (Building 14) and portions of Buildings 9, 10 and 15 in the northwest portion of the Site was discharged to a municipal sewer manhole on Cleveland Avenue at that time. Limited portions of Buildings 1 and 2 in the northern portion of the Site discharged liquid waste to a sanitary manhole on Lozier Avenue. Grated surface drains near Buildings 6 and 11 in the southwestern portion of the Site discharged runoff to the Fire Pond.

The remainder of the liquid waste from the Site was discharged to the Little River after passing through a discharge structure located near the southeastern property line. The liquid wastes created by the plating operations were discharged, without treatment, to the Little River outfall (See Figure 1-2). Waste paints, paint solids, and solvents were apparently drummed and transported off-site for disposal. Solid wastes, waste packaging and office paper, was either disposed of off-site or burned in an incinerator formerly located west of the southwest portion of the warehouse.

Table 1-1
HISTORY OF MANUFACTURING OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Operation	Current	Former	Location	Period of Operation
MACHINING				
Bending/Cutting/Heat treatment	X		Building 9	Pre-1919 to Present
Welding/Brazing	X		Building 2 Building 2A	~1900 to Present
Heat treating/Annealing	X		Building 2B Building 2C	1899 to Present
Tumbling/Annealing	X		Building 6	1899 to Present
Machining Rim Steel		X	Building 4	1897 to 1991
CLEANING				
Degreasing (with Trichloroethene)		X	Building 1A	1956 to ~1970
(with Methylene chloride)		X	Building 1A	1980 to 1990
Degreasing (with Methylene chloride)		X	Warehouse	1971 to 1986
Cleaning School Furniture	X		Building 3	1955 to Present
Paint Stripping		X	Building 4 (Former Wash Room)	~1955 to ~1985
Paint Stripping	X		Building 17	~1985 to Present
Pickling	X[1]		Building 7A	1955 to Present
ELECTROPLATING				
Nickel/Chromium (School Furniture)	X		Building 3 (East end)	1955 to Present
Nickel/Chromium (Bicycle Components)		X	Building 3 (West end)	Nickel: 1897 to 1955 Chrome: 1929 to 1955
Zinc		X	Building 3 (West end)	~1900 to 1987
Cadmium, Copper		X	Building 3 (West end)	~1900 to unknown (early 1900s)
PAINTING/COATING				
Bonderizing	X		Building 2 Building 2B	~1900 to Present
Painting (School Furniture)	X		Warehouse	1969 to Present
Painting (Bicycle Frames)		X	Building 1 (3rd Floor)	1896 to 1991

1 Unit is inactive, but operable.

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A subsequent Site Plan dated September, 1968 (See Appendix A) was prepared prior to construction of the WWTP. This site plan illustrates details of the diversion structure and the proposed piping to route wastewater from the site to the municipal sewer on Lozier Avenue. The plan indicated that an 18" stormwater line to be constructed would continue to discharge to the Little River. The NPDES permit currently held by the facility (Permit #MAR00A173) governs discharges from the two pipes discharging from the diversion structure. These pipes now convey only stormwater runoff on a periodic basis.

In 1970, the WWTP was constructed. Liquid plating wastes discharged to the WWTP received either pH adjustment or metal hydroxide sludge precipitation, depending on the source of the wastewater. Cleaning and rinse water was pH adjusted and discharged to the NPDES outfall on the Little River. Contaminant monitoring of the rinse waters was performed prior to discharge. During winter months, the water was discharged directly to the Diversion Structure, where it flowed in two 16-inch pipes to the Little River. During warmer weather, a portion of the discharge was pumped to a pipe which ran in a northeasterly direction to the northern end of the Former Reflecting Pond (AOC 16). At the northern end of the pond the pipe was connected to a perforated T-connection pipe. From this perforated pipe, the wastewater was discharged to the pond. The water in the pond was directed to a sump at the southern end of the pond which directed the water into the Diversion Structure for discharge to the Little River. Columbia Manufacturing personnel (David Williams) indicate that the Former Reflecting Pond existed for aesthetic purposes.

Wastewater generated in the plant which contained or may have contained heavy metals was piped to the WWTP where treatment vessels precipitated metal hydroxide sludges. The clarified liquid was discharged to the Little River outfall and the bottom slurry of metal hydroxide sludge was pumped to two (2) lagoons (AOC 29) constructed for the purpose of dewatering this sludge (See Site Plan, Appendix A).

The remaining precipitate was recycled to the plating baths. The discharge of the clarified liquid and pH adjusted cleaning and rinse water solutions was redirected to the sanitary sewer system in the late-1980s. After the addition of a filter press in 1983, metal hydroxide sludges were generated and transported off-site as hazardous waste. Metal hydroxide sludge from nickel filters was transported to the local landfill for disposal prior to 1988. Since that time the sludge has been transported off-site as hazardous waste.

The former lagoons have been the focal point of a great deal of investigative activities at the Site. According to a Tighe & Bond report prepared in May, 1986 (discussed in Section 1.2.6), the lagoons were used from late in 1971 until May, 1983. Each lagoon had an area of approximately 5,000 square feet and a depth of four (4) feet. The base of the lagoons were lined with drainage sand to facilitate drying of the sludge.

The lagoons were initially deemed an inappropriate method of waste disposal in 1981 by the Massachusetts Department of Environmental Quality Engineering (DEQE), now the Department of Environmental Protection (DEP). They were subsequently classified as regulated units under RCRA and required either a Part B permit or closure. In addition, groundwater monitoring was required by the DEQE. Initially, four (4) monitoring wells were installed (MW-1I, MW-2I, MW-3I, and MW-4I) in 1983. Columbia elected, in May 1983, to close the lagoons and excavate sludge which had built up over the 13-year operating period. This excavation was completed in the fall of 1983.

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Two (2) additional monitoring wells (MW-5 and MW-6S) were installed in 1984 to ensure that three (3) downgradient monitoring wells were located near the lagoons. Subsequent analysis of groundwater samples detected contamination by metals (chromium and nickel) and cyanide, and total volatile organic compounds (VOCs). The DEP required, under a Consent Order, the completion of additional hydrogeologic investigations. As part of those investigations, soil borings were completed in the former location of the lagoons and additional monitoring wells were installed in 1985 and 1986 (MW-7S, MW-7I, MW-8S, MW-8I, MW-9S, MW-9I, MW-9D, MW-10S, MW-10I, and MW-11I). Monitoring well MW-11I, which is located in the northeast corner of the Site, was installed primarily to provide an additional location for triangulation of water table measurements.

Prior to the passage of RCRA, waste paints, paint solids, solvents and oils were transported off-site for disposal. Wastes which were later characterized as hazardous by RCRA were transported off-site to Treatment, Storage and Disposal (TSD) facilities. Waste oil which was not considered hazardous was shipped as a Massachusetts regulated waste. Spent alkaline cleaners and pickling acids were pH adjusted and discharged to the sanitary sewer system.

Wastes have been generated primarily by the painting and electroplating operations at the Site. Effluent from the on-site wastewater treatment plant WWTP and cleaning and rinse waters from the plating operations comprise the majority of liquid wastes generated at the Site. Waste paint, paint solids, and waste solvents have historically been generated from bicycle painting operations on the third floor of Building 1 and, more recently, from the school furniture painting operation in the southwest corner of the warehouse. Metal hydroxide sludges have been generated by the filter press and the nickel filters associated with the WWTP and the nickel plating baths, respectively.

Wastes from other operations include waste oils from threading and machining and the distillation of degreasing solutions in stills. Spent alkaline cleaners have been generated from metal cleaning operations and paint stripping, and spent acids have been generated from pickling operations. Waste solvents, mainly methylene chloride and trichloroethene, have been generated from degreasing activities.

1.2.6 Previous Investigations and Reports

This section summarizes the findings of five (5) major investigations that preceded this Phase I RFI.

1

Preliminary Investigative Report Findings on Solid Waste Activity (2/82) - This report was prepared for CMC by Water Management, Inc. The investigation included sampling and analysis of one (1) composite sample of sludge representing four (4) locations in the sludge drying beds (lagoons) for RCRA metals using the EP Toxicity Procedure. Complete laboratory QA/QC documentation was not provided. Therefore, the data were not considered suitable for inclusion in the findings of this Phase I Investigation. Those results are summarized in Table 1-2 below for reference purposes along with the maximum allowable leachate concentration for a waste to be classified as non-hazardous. The data for the CMC sludge leachate were below the hazardous waste criteria for all eight (8) analytes. The report recommended closure of the two (2) lagoons, installation of sludge dewatering equipment, and off-site disposal of the filter cake.

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Table 1-2
1982 SLUDGE ANALYSIS RESULTS
Columbia Manufacturing Company, Westfield, MA

Analyte	E.P. Toxicity Allowable Concentration (mg/l)	CMC Sludge Sample, E.P. Toxicity Leachate (mg/l)
Arsenic	5.0	<0.10
Barium	100.0	<0.10
Cadmium	1.0	<0.02
Chromium	5.0	0.24
Lead	5.0	0.20
Mercury	0.2	<0.001
Selenium	1.0	<0.10
Silver	5.0	<0.01

(2)

Interim Progress Report on Remedial Investigation (5/86) - This report was prepared by Tighe & Bond on behalf of CMC in compliance with a condition of a Consent Order negotiated between CMC and Massachusetts DEQE (now DEP). The work scope included analysis of soil samples collected from locations within and around the lagoon area, installation of additional monitoring wells downgradient of the lagoon area and collection of groundwater samples and one (1) surface water sample from the Little River for analysis.

The report included data from a subsurface investigation performed in the former lagoon area. Split-spoon samples collected at depths from 0-25 feet in the lagoon area in December, 1985 were analyzed for total and amenable cyanide. Soil samples were logged in to the laboratory in April, 1986. Those results are summarized in Table 1-3. The soils investigation delineated a volume of approximately 180 cubic yards of subsurface soils with cyanide concentrations greater than 1,000 mg/kg, and approximately 1,000 cubic yards with cyanide concentrations between 100 and 500 mg/kg. Plans, cross-sections and summary tables of analytical results from that investigation are included in Appendix B.

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Table 1-3
SUMMARY OF PREVIOUS ANALYSES - CYANIDE IN SOIL, 1985
Columbia Manufacturing Company, Westfield, MA.

Depth Interval (ft)	Total Cyanide			Amenable Cyanide		
	Detects[2]/ Analyzed	Detected Range (mg/kg)	Detected Average (mg/kg)	Detects/ Analyzed	Detected Range (mg/kg)	Detected Average (mg/kg)
2.0-3.5	7/12	2-59	19.2	0/12	---	0
3.5-5.0	6/12	7-1945	301.6	3/12	45-1466	130.8
5.0-6.5	5/12	2-2811	344.8	2/12	359-2705	255.3
6.5-8.0	7/12	1.1-732	72.1	2/12	24-106	10.8
8.0-9.5	8/12	4-517	70.4	2/12	6.1-274	23.3
9.5-11.0	8/12	1.6-529	90.2	3/12	6.4-154	15.7
11.0-12.5	12/12	3.7-604	126.1	5/12	4.4-23	3.9
12.5-14.0	12/12	1.1-495	123.1	6/12	0.3-171	21.8
14.0-15.5	10/12	6.4-499	135.2	5/12	4.2-133	21.3
15.5-17.0	8/11	4-264	87.7	4/11	12-96	17.2
23.5-25.0[1]	4/9	8.3-85	14.6	0/9	---	0

1 Includes one (1) sample from 24.0-25.5 and 1 sample from 24.0-25.5.
2 Detection limits ranged from 1 mg/kg to 10 mg/kg. Results are reported on a dry weight basis.

The overview of the hydrogeologic investigation presented in that report stated that previous analysis of groundwater samples from the four (4) initially installed wells (MW-1I, 2I, 3I and 4I) had revealed the presence of elevated concentrations of chromium at MW-3I and cyanide at MW-2I. The investigation summarized in the report included the installation of three (3) two-point wells (MW-7S/I, MW-8S/I, and MW-10S/I) one (1) three-point well (MW-9S/I/D), and MW-11I.

Hydraulic conductivity tests (bail tests) were performed on MW-2I, 3I, 4I, 8I, 9I, 9D, and 10I as part of this investigation. The calculated hydraulic conductivity values are summarized below.

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Table 1-4
PREVIOUS HYDRAULIC CONDUCTIVITY DATA
Columbia Manufacturing Company, Westfield, MA

Monitoring Well ID	Hydraulic Conductivity (ft/d)
MW-2I	0.36
MW-3I	0.09
MW-4I	0.44
MW-8I	3.45
MW-9I	13.95
MW-9D	1.09
MW-10I	1.55

Groundwater samples were collected in December, 1985 and April, 1986. Hexavalent chromium was detected in eight (8) wells during the December monitoring round (MW-3I, 10I, 9S, 8I, 9I, 8S, 10S, 7S, in order of decreasing concentration) at concentrations between 28 mg/L and 0.1 mg/L. Hexavalent chromium was detected only in MW-10I (6.55 mg/L) and MW-9I (4.3 mg/L) during analysis of the April 1986 groundwater samples. The text of the May 1986 report noted that amenable cyanide was detected during the December 1985 sampling event in MW-2I at a concentration of 1.33 mg/L. However, the analytical data sheets for this sample were not appended to the report. Amenable cyanide was also reported at lower concentrations in monitoring wells MW-3I, MW-4I, MW-6S, MW-7S, MW-7I, MW-8S, MW-8I, and MW-9S, during analysis of the December 1985 samples. None of the groundwater samples collected during the April 1986 groundwater sampling event exhibited detectable concentrations of amenable cyanide, although considerable negative sample interference was noted. A water sample collected from the Little River was analyzed for total chromium, and none was detected at a detection limit of 0.05 mg/L.

Various VOCs were detected in all wells except for upgradient well MW-1I. The most prevalent organic contaminants were trichloroethylene, trans-1,2-dichloroethylene, and tetrachloroethylene. The highest total VOC concentrations were reported in samples from MW-9S/I. Summary Tables of analytical data and total VOC isopleths presented in that report are reproduced in Appendix B.

(3)

Phase I - Limited Site Investigation (5/8/89) - This investigation was conducted for DEP by a contractor (HMM Associates of Concord, Massachusetts) between March 30 and May 5, 1989. The objectives of the investigation were to determine whether the Site is a disposal site and, if so, to classify the disposal site as Priority or Non-Priority, as defined in DEP Regulations. At the request of the DEP, the investigation included no sampling, and was based exclusively upon information provided by others. The report included a description of the Site, site history, a summary of previously reported analytical data, completion of Massachusetts and EPA Preliminary Assessment forms, completion of a Massachusetts Interim Site Classification form and completion of an EPA Site Inspection report.

Analytical data summarized in the report included groundwater monitoring data submitted to the

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DEP by Tighe & Bond on behalf of CMC from sampling events conducted between June 22, 1983 and October 29, 1986 (including those reported above), and data collected by DEP between April 24, 1986 and November 19, 1987.

Data validation was not performed at the time of submittal to the DEP or by HMM as part their report. Due to the advances in sampling, analytical and reporting procedures since these samples were collected and analyzed, the data presented in that report were not considered to be comparable to data collected during this RFI. Therefore, it was not used during this RFI to evaluate the quality of soil and groundwater at the Site. Data summaries are presented below.

Aqueous samples were collected from the Fire Pond and the Little River. Analyses performed on groundwater samples included metals, inorganic non-metals, and organics (including volatiles). Tables of all analytical results for each analyte are presented in that report, and are also reproduced in Appendix B.

The report also summarized data from soil samples collected by Tighe & Bond in and around the former lagoon area. A total of 13 shallow soil samples collected from the 0-2 foot depth interval were analyzed for metals. Soil samples included six (6) samples collected at two (2) locations (at depths of 0-6", 6-12" and 12-18" at each location) on October 20, 1983 that were analyzed for RCRA metals by the EP Toxicity method, and seven (7) soil samples collected on January 5, 1984 at depths between 0-2 feet that were analyzed for total cyanide and for various metals using the EP Toxicity method. Tables of all analytical results are presented in Appendix B. Table 1-5 below summarizes the analytical data.

Table 1-5
SUMMARY OF PREVIOUS E.P. TOXICITY ANALYSES
METALS IN SHALLOW SOILS, 1983/1984
Columbia Manufacturing Company, Westfield, MA.

Analyte	Detected/ Analyzed	E.P. Toxicity Leachate Detected Range (mg/l)	E.P. Toxicity Leachate Detected Average (mg/l)	E.P. Toxicity Allowable Concentration (mg/l)
Arsenic	3/13	0.008-0.008	0.008	5.0
Barium	7/13	0.2-0.6	0.4	100.0
Cadmium	12/13	0.016-0.715	0.053	1.0
Chromium	2/13	0.09-0.10	0.10	5.0
Lead	2/13	0.1-0.2	0.150	5.0
Mercury	2/6	0.0001-0.0003	0.0002	0.2
Selenium	0/6	---	---	1.0
Silver	2/6	0.002-0.003	0.003	5.0
Nickel	7/7	1.9-45.0	16.2	NA

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Analyte	Detected/ Analyzed	E.P. Toxicity Leachate Detected Range (mg/l)	E.P. Toxicity Leachate Detected Average (mg/l)	E.P. Toxicity Allowable Concentration (mg/l)
Zinc	7/7	0.73-241.5	36.95	NA
Total Cyanide	7/7	12.35-46.6	22.19	NA

NA - Not applicable, no regulatory limit established for this analyte.

The Massachusetts Interim Site Classification form was completed by HMM with a recommendation for a Non-Priority designation. In the conclusion section of the EPA Preliminary Assessment, HMM disagreed with the outcome of the previous EPA Preliminary Assessment completed in December 1987. HMM recommended continued CERCLA involvement with a low priority designation.

The report recommended further investigative work. This recommendation cited evidence from previously collected data of groundwater contamination with VOCs, chromium and cyanide that was thought to be migrating from the lagoons, and soil contamination with metals and cyanide in the area of the lagoons. A detailed assessment of the spatial distribution of contamination of the site was not possible due to the limited areal coverage provided by the wells in place at the time, however, evidence was noted of off-site migration of contaminants to the south based upon contaminant distribution and groundwater flow direction.

4

RCRA Facility Assessment (RFA) Report (5/89) - This report was prepared for the U.S. EPA (addressed to Ms. Camille Connick) by A.T. Kearney. The report documented the findings of a Preliminary Review and Visual Site Inspection (PR/VSI). A third aspect sometimes included in RFA, the Sampling Visit, was not included since there was already documented evidence of releases from the site.

The report included a description of the facility and processes, a description of the Site environmental setting, a discussion of release pathways and potential exposures. The report identified and described a total of 46 Solid Waste Management Units (SWMUs) at the site. One additional area, an underground gasoline tank, was identified as an Area of Concern (AOC). No rationale was provided for identifying this area as an AOC rather than a SWMU. The AOCs currently being investigated at the site during this RFI are a subset of the list compiled for this document. The report recommended further sampling and analyses to provide additional information.

The report provided a detailed summary of SWMUs, listing the unit type, release potential, media potentially affected, reasons for suspecting releases, need for further investigation, and media to be included in these further investigations. Three (3) areas were identified as having particularly high potential for releases. Those areas were:

- the Former Lagoons (SWMU 29);
- the Storage Yard Runoff Area (SWMU 21);
- the Rim Room (SWMU 44).

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In the Summary and Conclusions, the following observations were made regarding the potential for releases from the Site to various media:

- high potential for release to groundwater in the event of releases to the soil due to shallow depth to groundwater and high permeability of soils;
- moderate to high potential for releases to surface water from some units;
- low potential for releases to air and generation of subsurface gas due to low concentrations of VOC and inorganic nature of most wastes

5

EPA Investigation - 1991 - Samples of groundwater, soil and residual oil were collected by EPA in November, 1991. The results of that sampling program are summarized below. Tables summarizing the data are presented in Appendix B.

Groundwater samples were collected from MW-1I, 2I, 4I, 7I, 8I, and 11I for analysis of total cyanide, total and dissolved metals (cadmium, chromium, copper, nickel and zinc) and VOCs using EPA Method 8240. Duplicate samples were collected from MW-2. Amenable cyanide was determined for the samples from MW-2 only.

Cyanide was detected in samples from MW-2 and MW-8B. Amenable cyanide was not detected. The following VOCs were detected along with the number of well locations in which each analyte was detected indicated in parentheses: acetone (1), 1,2-dichloroethlene isomers (6), trichloroethlene (3), tetrachloroethlene (1).

Soil and sediment samples were collected at 14 locations. Samples from eight (8) locations in and near the Former Lagoons were analyzed for cyanide. Cyanide was detected in all samples. Amenable cyanide was analyzed for in samples from six (6) of those eight (8) locations, was not detected. Samples from 10 locations were analyzed for total metals (cadmium, chromium, copper, nickel and zinc). Detectable concentrations of all metals except for cadmium were found at each location. Cadmium was not detected (<0.54 $\mu g/g$) at a location at the end of a former pipe to the lagoons. Samples from 14 locations were analyzed for VOCs using EPA Method 8240. The following VOCs were detected with the number of sample locations in which each analyte was detected indicated in parentheses: 1,2-dichloroethlene isomers (1), trichloroethlene (8), tetrachloroethlene (2). Naphthalene was also reported in three (3) locations. Other compounds were tentatively identified. These data are discussed in greater detail in Section 10.

Samples from three (3) locations in the former lagoon area and a residual oil sample that was collected from within the diked area of a fuel oil tank were subjected to qualitative analysis of fuels and oils. Fuels and oils were not detected in the samples from the lagoon area. The sample from the diked tank area contained hydrocarbons, but the product did not resemble any of the laboratory standards available at EPA's Lexington, Massachusetts Laboratory.

1.2.7 Regulatory History

The history of regulatory activities at the Site is lengthy and complex. Certain milestones in the regulatory history of the project are briefly summarized in this section for the purpose of providing a context for this document. The reader should refer to the RFA for the facility (May, 1989) and the RFI Proposal Appendices (June, 1993) for additional regulatory history. Correspondence referenced herein is included in Appendix B.

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MTD Products, Inc, the former parent company of CMC, submitted filings to the EPA regarding hazardous waste handling in 1980. These filings included a Notification of Hazardous Waste Activity (8/5/80), General Information form (11/19/80) and Hazardous Waste Permit Application (11/19/80). These documents may be found in Appendix B.

A Notice of Violation (NOV) was issued to CMC on October 22, 1981 due to disposal of metal hydroxide sludges in the lagoons at the site. Following the issuance of this Notice of Violation, a report titled *Preliminary Investigative Report Findings on Solid Waste Activity* was prepared for CMC by Water Management, Inc. in February, 1982. The report recommended closure of the two (2) lagoons, installation of sludge dewatering equipment, and off-site disposal of the filter cake. Analytical data summarized in the report indicated that the sludge could be classified as non-hazardous. Those data are discussed in Section 1.2.6. An effort to have the sludge de-listed was subsequently pursued, but was ultimately abandoned when it became evident that this would be infeasible.

On April 12, 1983, Stephen F. Joyce of the DEP sent a NOV to Mr. Ken Howard of CMC following a DEP inspection of the facility. The facility was found in violation of the groundwater monitoring requirements of state and federal regulations. A meeting was held at the DEP offices in Springfield, Massachusetts on June 1, 1983 and attended by representatives of CMC, DEP and EPA. In follow-up correspondence dated June 17, 1983 from Mr. Joyce to Mr. Howard, a required sampling and analysis schedule was outlined. Follow-up correspondence from Mr. Dennis Huebner of EPA to Mr. Howard of MTD Products outlined additional groundwater monitoring and closure plan requirements.

CMC filed a closure plan with the Massachusetts DEP and proceeded to close the lagoons. The sludge was removed in 1983, samples were collected in the excavated area, and groundwater monitoring wells were installed. A report on an inspection trip conducted by representatives of EPA and Massachusetts DEQE (now DEP) on February 10, 1984 stated that the required closure plan and hydrogeologic study had been received, all sludge had been removed from the lagoons, soil samples had been collected from the underlying soils, and five (5) groundwater monitoring wells had been installed.

In correspondence dated May 9, 1985 from Mr. Merrill S. Hohman of EPA to Mr. Howard of MTD, EPA requested submittal of a RCRA Part B permit application, a certification of compliance with the groundwater monitoring and financial assurance requirements of RCRA, and corrective action information. Requested corrective action information included a drawing of the facility showing each SWMU, descriptions of each SWMU, information regarding releases from the SWMUs, and corrective actions already undertaken at any SWMU. This letter referenced amendments to Section 3004 and 3008 of RCRA. These amendments give the EPA the authority to require corrective action at SWMUs. The information was requested in order to evaluate the need for corrective action at the Site. A copy of this letter is included in Appendix B.

CMC originally identified four (4) SWMUs: the sludge roll-off box (currently AOC 9), the former lagoons (AOC 29), the former hazardous waste drum storage area (currently AOC 14b), and satellite storage of hazardous waste in the degreasing room in Building 1A (currently SWMU 13).

A Consent Order was filed against MTD Products Inc. on June 5, 1985 as a result of the detection of contamination in soils underlying the former lagoons. The Consent Order outlined requirements for soil and groundwater quality assessment. A detailed description of regulatory activity prior to

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that date may be found in this document, which is included in Appendix B.

An EPA Preliminary Assessment of the site conducted by Mr. Kevin Sheehan of the DEP was completed on December 28, 1987. This assessment noted that the facility was being overseen by the RCRA section, and recommended no further action under CERCLA.

On September 13 and 14, 1988, representatives of the EPA and A.T. Kearney, an EPA subcontractor, inspected the Site to further document SWMUs. A listing of SWMUs, prepared from file reviews completed by A.T. Kearney, was revised by EPA based on visual observations at the Site. The inspection led to the preparation of a RCRA Facility Assessment (RFA) for the Site. The RFA, dated May 1989, documents forty-seven (47) SWMUs, identifies the potential for a release from each SWMU, and makes recommendations for further action. This report is discussed in more detail in Section 1.2.6.

On May 8, 1989, A report entitled *Phase I - Limited Site Investigation, Columbia Manufacturing Company* was issued by HMM Associates as a contractor to DEP under the Site Assessment and Remediation Support Services (SARSS) contract program. The findings of this report are discussed in Section 1.2.6.

The Consent Decree guiding this RFI, Civil Action No. 91-30044-F, issued against both CMC and MTD was originally filed by the EPA on February 22, 1991. The Decree references the RFI Proposal, prepared by Tighe & Bond in June, 1993, as Attachment 1. In the RFI Proposal, the SWMUs which are considered Areas of Concern (AOCs) were identified for assessment during the RFI and potential future corrective action.

In addition to pursuing corrective action, the EPA collected soil, groundwater, sediment, and residual oil samples at the Site on November 18 and 19, 1991. That data is summarized above in Section 1.2.6 and is utilized in this Report to supplement Phase I sampling as agreed upon by the EPA during the development of the Phase I RFI Proposal.

The Consent Decree was signed on August 11, 1993, thereby starting the Phase I process. The schedule set forth in Section 6.0 of the RFI Proposal indicates that the Phase I Interim Progress Report for the RFI would be completed six (6) months from entry of the decree. The original submittal of this Report, dated February 11, 1994, was intended to fulfill that requirement.

In correspondence dated June 6, 1994 the EPA determined that the February 11, 1994 RFI Phase I Interim Report was unacceptable. A written review of the February 11, 1994 submittal was issued by the EPA on July 8, 1994. The cover letter to that review document affirmed that a 60 day deadline agreed upon during a prior meeting held at the EPA offices in Boston, Massachusetts was in effect as of that date. The submittal of this Revised Report, dated September 8, 1994 meets that deadline.

1.3 OVERVIEW OF AOCs AND SITE WASTES

This Section discusses the AOCs identified at the site and the wastes associated with the AOCs.

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1.3.1 AOCs Identified at the Site

A total of 47 SWMUs were identified at the Site (including a gasoline tank initially identified as an AOC) prior to the development of the RFI Proposal as a result of the RFA report. Two (2) additional SWMUs were identified during the development of the RFI Proposal. From the 49 SWMUs (shown in Table 1-6), 27 AOCs were identified for further investigation (boldfaced units in the table). Two (2) of those AOCs were further subdivided during Phase I of the RFI to account for differences in location or use. Two (2) separate areas were identified for the storage of hazardous waste drums, the current area (AOC 14a) and the former area (AOC 14b). Additional information regarding the former incinerator (AOC 33b) indicated that the unit was not located at the former scrap metal fill area (AOC 33b). The locations of all SWMUs and AOCs are indicated on the Site Plan in Appendix A.

Table 1-6
LIST OF SWMUs AND AOCs
Columbia Manufacturing Company, Westfield, MA

SWMU Number[1]	Unit Name/Description	General Location
1	Nickel WWT Tank (3000 gal AFT)	Building 8 (WWTP)
2	Chrome WWT Tank #1 (1600 gal AFT)	Building 8 (WWTP)
3	Chrome WWT Tank #2 (3000 gal AFT)	Building 8 (WWTP)
4	WWTP Floor Spills Tank (2800 gal AFT)	Building 8 (WWTP)
5	Zinc WWT Tank (2800 gal AFT)	Building 8 (WWTP)
6	Mixing Tank (3000 gal AFT)	Building 8 (WWTP)
7	WWTP Filter Press	Building 8 (WWTP)
8	WWTP Filter Press Hoppers	Building 8 (WWTP)
9	**Sludge Roll-off Box**	**South of Building 4**
10	**Nickel Filter**	**South of Building 3**
11	**pH Adjustment Tank (old)**	**South of Building 3**
12	**Storage Tank 11**	**Building 3**
13	Drum Storage Room	Building 1
14	**Hazardous Waste Drum Storage**	**South of Building 4**
15	Scrap Metal Roll-off	South of Building 4
16	**Reflecting Pond**	**East of Warehouse (Building 13)**
17	**Storm Sewer**	**Site**
18	**Sanitary Sewer**	**Site**

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SWMU Number[1]	Unit Name/Description	General Location
19	Paint Waste Accumulation Area	Building 1 (third floor)
20	Paint Waste Accumulation Area	Warehouse (Building 13)
21	Storage Yard Runoff Area	South of Building 3
22	Distillation Tanks	Building 1
23	Stripping Area Floor Drains	Building 17
24	Nickel Transfer Tank	Building 3
25	Chrome 1 Transfer Tank No. 1	Building 3
26	Chrome 1 Transfer Tank No. 2	Building 3
27	Chrome 2 Transfer Tank No. 1	Building 3
28	Nickel Reclamation Tank	Building 3
29	Former Lagoons	South of Building 4/West of Warehouse
30	Underground Discharge Pipe	East of Former Lagoons/West Side of Warehouse
31	Polishing Baghouse	South of Building 4
32	Furniture Polishing Baghouse	Between Building 6 and Building 11
33	Former Incinerator/Scrap Metal Fill Area	West of Warehouse (Building 13)
34	Fire Pond	South of Building 5, Building 6, and Building 11
35	Removed UST	West of Building 11
36	Abandoned UST	Building 1
37	Fuel Storage Area	South of Building 5 and Building 6
38	Old Degreaser	Warehouse (Building 13)
39	Old Trenches and Sumps	Building 3 (Western Portion)
40	Pickling Room Drain and Sump	Building 7A
41	Zinc Plating Line Trench and Sump	Building 3 (Western Portion)
42	Nickel & Chrome Plating Line Sump	Building 3 (Eastern Portion)
43	Decanting Tanks	Variable
44	Rim Room	Building 4
45	Wastewater Treatment Pipes	Building 3 to Building 8 (WWTP)
46	Wastewater Treatment Room Sump	Building 8 (WWTP)

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SWMU Number[1]	Unit Name/Description	General Location
47	Gasoline UST	South of Building 15
ADDITIONAL SWMUs IDENTIFIED DURING RFIP DEVELOPMENT		
48	Abandoned UST	Building 2
49	Rack Maintenance Area	Building 2A

(1) AOCs are shown in boldface type

1.3.2 Wastes Associated with AOCs

Wastes or products containing contaminants which are associated with the AOCs are listed in Table 1-7. Waste designations are general groupings or descriptions of the type of waste which may be present in the AOC. The waste designations are further detailed in Table 1-8 which lists the waste designation, the associated AOCs, and the chemical constituents or trade names of chemicals in the virgin product used on the Site. MSD sheets for these products/chemicals are included in Appendix C. The MSDSs are for chemical products used or previously used at the Site, and may be present in wastes released from the AOC.

Table 1-7
AREAS OF CONCERN AND ASSOCIATED WASTES
Columbia Manufacturing Company, Westfield, MA

AOC #	Unit Name/Description	Associated Wastes/Products
9	Sludge Roll-off Box	Metal Hydroxide Sludges
10	Nickel Filter	Metal Hydroxide Sludges
11	pH Adjustment Tank (old)	Plating Liquids
12	Storage Tank 11	Plating Liquids Pickling Liquids
14a	Hazardous Waste Drum Storage (current)	Waste Oils Waste Paints
14b	Hazardous Waste Drum Storage (former)	Waste Oils Waste Paints Waste Solvents
16	Reflecting Pond	Plating Liquids
17	Storm Sewer Lines	Plating Liquids
18	Sanitary Sewer Lines	Plating Liquids Paint Strip Liquids Paint Waste Liquids Printing Shop Liquids

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AOC #	Unit Name/Description	Associated Wastes/Products
21	Storage Yard Runoff Area	Waste Oils Waste Paints Waste Solvents Metal Hydroxide Sludges
23	Stripping Area Floor Drains	Paint Strip Liquids
29	Former Lagoons	Metal Hydroxide Sludges
30	Underground Discharge Pipe	Metal Hydroxide Sludges Waste Solvents
33a	Scrap Metal Fill Area	Scrap Metal Incinerator Wastes
33b	Former Incinerators	Incinerator Wastes Waste Solvents
34	Fire Pond	Plating Liquids Tumbling and Annealing Wastewaters
35	Removed UST	Fuel Oil
36	Abandoned UST	Cutting Oil
37	Fuel Storage Area	Fuel Oil
39	Old Trenches and Sumps	Plating Liquids
40	Pickling Room Drain and Sump	Pickling Liquids
41	Zinc Plating Line Trench and Sump	Plating Liquids
42	Nickel Chrome Plating Line Trench & Sump	Plating Liquids
44	Rim Room	Cutting Oil
45	Wastewater Treatment Pipes	Plating Liquids
46	Wastewater Treatment Room Sump	Plating Liquids
47	Gasoline UST	Unleaded Gasoline
48	Abandoned UST	Cooling Oil
49	Rack Maintenance Area	PVC Resin

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Table 1-8
CONSTITUENTS OF WASTES
Columbia Manufacturing Company, Westfield, MA

Waste Designation	Associated AOCs	Related MSDSs[1]
Metal Hydroxide Sludges	9, 10, 21, 29, 30	- none -
Plating Liquids	11, 12, 16, 17, 18, 34, 39, 41, 42, 45, 46	Ammonia Ammonium Acid Fluoride Boric Acid Hydrazine Hydrochloric Acid Nickel Chloride Nickel Sulfate Nitric Acid Potassium Chloride Potassium Permanganate Potassium Hydroxide Sodium Hydroxide Sodium Hydrosulfite Sodium Bisulfite Sulfuric Acid Zinc Chloride
Pickling Liquids	12, 40	Phosphoric Acid Sodium Carbonate
Waste Oils	14a, 14b, 21	Hydraulic Oil
Waste Paints	14a, 14b, 21	Light Hot Pink Cocoa Brown Hitech Clear Aquamarine Special Blue Industrial Lacquer Chrome Primer
Waste Solvents	14a, 14b, 21	Acetone Methylene Chloride Trichloroethane Trichloroethylene
Paint Strip Liquid	23	Sodium Carbonate
Print Shop Liquids	18	- NONE -
Incinerator Wastes	33b	- NONE -
Tumbling and Annealing Wastewater	34	Sodium bisulfate Sodium hydroxide
Fuel Oils	35, 37	No. 4 Fuel Oil No. 6 Fuel Oil

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Waste Designation	Associated AOCs	Related MSDSs[1]
Metal Hydroxide Sludges	9, 10, 21, 29, 30	- none -
Cutting Oil	36, 44	Dromus Oil Garia Oil LUS-CO-CUT
Gasoline	47	Regular Unleaded Gasoline
Cooling Oil	48	- NONE -
PVC Resin	49	MOCAP

1 MSD sheets included in Appendix C.

In Section 23.B(2) of the Consent Decree there is a requirement that documentation of specific characteristics be provided for each waste which may have collected in the AOCs. This has been done on a preliminary basis for a select list of contaminants which may be present in the waste designations above. Table 1-9 lists the metals and organic compounds characterized in Appendix D. Portions of the characterizations have not been fully completed or no information could be located in the sources referenced. The characterizations of contaminants identified by release characterization as contaminants of concern will be fully documented in subsequent submittals.

Table 1-9
CONTAMINANTS CHARACTERIZED
Columbia Manufacturing Company, Westfield, MA

Metals	Organic Compounds
Barium	Acenaphthene
Cadmium	Acenaphthylene
Calcium	Acetone
Chromium	Ammonia
Cobalt	Ammonium Acid Fluoride
Copper	Anthracene
Iron	Benzene
Lead	Bis(2-ethylhexyl)phthalate
Nickel	Boric Acid
Selenium	Dioxins
Sodium	Ethylbenzene
Vanadium	Hydrazine
Zinc	Hydrochloric Acid

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Metals	Organic Compounds
	Isobutyl Alcohol
	Methylene Chloride
	Methyl Ethyl Ketone
	Methyl Isobutyl Ketone
	2-Methylnapthalene
	Mineral Spirits(Stoddard Solvent)
	Napthalene
	Nickel Chloride
	Nickel Sulfate
	Nitric Acid
	Phenanthrene
	Phosphoric Acid
	Potassium Chloride
	Potassium Hydroxide
	Potassium Permanganate
	Sodium Bisulfite
	Sodium Carbonate
	Sodium Hydrosulfite
	Sodium Hydroxide
	Sulfuric Acid
	Toluene
	1,1,1-Trichloroethane
	Trichloroethylene
	Xylenes
	Zinc Chloride

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1.4 OVERVIEW OF THE PHASE I INVESTIGATION

This section provides an overview of the goals, implementation and results of each of the main components of the Phase I RCRA Facility Investigation. Those three (3) components are: characterization of the physical conditions on the Site, characterization of the releases that have occurred at the Site, and characterization of off-site releases.

1.4.1 Physical Characterization

The physical characterization of the Site was conducted to provide information about the physical environment to provide a context for evaluating releases at the Site. The physical characterization examined Site geology, hydrogeology, hydrology and climate.

Goals: The goals of the Phase I physical characterization were to provide the necessary information about the physical environment of the facility and surrounding area to develop a conceptual model of the study area, and to identify data gaps remaining at the end of the Phase I investigation to be incorporated into the Phase II Investigation Scope of Work.

Implementation: Field and research activities for the Physical Characterization under Phase I began in September, 1993 and were completed by December, 1993. The methods used are summarized in Section 2 of this Phase I Interim Report, and were detailed more fully in the Phase I RFI Proposal.

Results: The results of the Physical Characterization are presented in Sections 3 through 6 of this Phase I Interim Report. Each of these sections includes a preliminary conceptual model and identification of data gaps.

1.4.2 On-Site Release Characterization

The Phase I on-site release characterization was conducted to provide information needed to gain a preliminary understanding of the nature and extent of releases at the Site from the AOCs.

Goals: The goals of the Phase I on-site release characterization were to provide information about known or suspected releases at the Site, and to identify data gaps remaining at the end of the Phase I investigation to be incorporated into the Phase II Investigation Scope of Work.

Implementation: The Phase I on-site release characterization began in September, 1993 and was completed by December, 1993. The methods used are summarized in Section 2 of this Phase I Interim Report, and were detailed more fully in the Phase I RFI Proposal.

Results: The results of the Phase I on-site release characterization are presented in Sections 7 through 15 of this Phase I Interim Report.

1.4.3 Off-site Release Characterization

The Phase I off-site release characterization was conducted to provide information needed to gain a preliminary understanding of the extent of off-site migration of releases from the Site.

Goals: The goals of the Phase I off-site release characterization were to provide information about

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known or suspected migration of releases from the Site, and to identify data gaps remaining at the end of the Phase I investigation to be incorporated into the Phase II Investigation Scope of Work.

Implementation: The Phase I off-site release characterization began in September, 1993 and was completed by December, 1993. The methods used are summarized in Section 2 of this Phase I Interim Report, and were detailed more fully in the Phase I RFI Proposal.

Results: The results of the off-site investigation are presented in Section 16 of this Phase I Interim Report.

1.5 SUMMARY OF PHASE I INTERIM REPORT VOLUMES

This section summarizes the contents of each of the five (5) volumes included in this Phase I Interim Report. The title of each Section found in each volume of this document is listed along with a description of the information provided in each Section.

1.5.1 General

This report is divided into five (5) volumes. The Phase I Interim Report is found in Volumes I and II. Volume I contains the Phase I Interim Report, Sections 1 through 13, Volume II contains the Phase I Interim Report, Sections 14 through 19. These volumes describe the Phase I physical characterization, release characterization, and off-site investigation. The Phase II Proposal is found in Volume II (Sections 20 through 25). This volume proposes additional on-site and off-site physical and release characterization activities and provides a preliminary evaluation of corrective measures alternatives.

Each chapter begins with an overview and concludes with a summary. Data gaps are identified within each Section. Summary tables are incorporated within the text. Supplementary tables with more comprehensive data presentation are provided in Appendix L. Figures are included at the end of the Section in which they are cited. Volumes III through V and Books 1 through 5 (Appendix O) contain the Appendices cited in the preceding volumes.

1.5.2 Description of Report Sections

Section 2: Sampling and Analysis Methods This Section describes the field and analytical methods used in the Phase I Investigation.

Section 3: Phase I Geological Investigation This Section describes the objectives, methods and analyses, and results of the Phase I geological investigation and presents a preliminary conceptual geological model of the Site.

Section 4: Phase I Hydrogeological Investigation This Section describes the objectives, methods and analyses, and results of the Phase I hydrogeological (groundwater) investigation and presents a preliminary conceptual hydrogeological model of the Site.

Section 5: Phase I Hydrological Investigation This Section describes the objectives, methods and analyses, and results of the Phase I hydrological (surface water) investigation and presents a preliminary conceptual hydrological model of the Site.

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Section 6: Phase I Climatological Investigation This Section describes the objectives, methods and analyses, and results of the Phase I climatological investigation and presents a preliminary conceptual climatological model of the Site.

Section 7: Phase I Release Characterization This Section provides an overview of the release characterization at SWMUs which are considered to be AOCs.

Sections 8 through 15: Phase I Release Characterization These Sections describes the objectives, methods and analyses, and results of the Phase I release characterization of the following areas:

- Plating Operations (3 AOCs)
- Wastewater Treatment (5 AOCs)
- On-Site Sludge Disposal (3 AOCs)
- Waste Storage Yard (3 AOCs)
- On-Site Surface Water Bodies (2 AOCs)
- Utility Lines (2 AOCs)
- Storage Tanks (5 AOCs)
- Other Operations (4 AOCs)

Sampling locations targeting those AOCs are identified, and analytical results for those sampling locations are summarized and discussed.

Section 16: Off-Site Release Monitoring This Section describes the objectives, methods and analyses, and results of the Phase I off-site release monitoring. Sampling locations and analytical results for those sampling locations are summarized and discussed.

Section 17: Summary of Release Characterization This Section provides a summary of the data discussed in detail in Sections 8 through 16. In addition to summarizing the data, Section 17 summarizes the data gaps that will be addressed as part of Phase II activities.

Section 18: Health and Environmental Risk Assessment This Section will serve as the first of four (4) Risk Assessment deliverables required in the RFI. As part of this first submittal, a preliminary risk assessment data set, a human health hazard identification and exposure assessment, and the development of baseline risk assessment parameters has been performed.

Section 19: Conclusion and Data Gaps This Section will conclude the Phase I RFI. The primary conclusions and data gaps developed in Sections 1 through 18 will be summarized in this Section.

Section 20: Introduction to the Phase II Proposal This Section will provide an introductory frame work for the primary components of the Phase I Proposal which are included in Section 21 through 23. The discussion will include the physical characterization as well as the on-site/off-site release characterization. This section will also include an introduction to the three (3) phase (Phase IIA, IIB, and IIC) approach to be utilized.

Section 21: Phase IIA Proposal This Section will describe the tasks required to fill the Phase I data gaps in the physical, geological and hydrogeological components of the investigation. A key aspect of Phase IIA, the development of background concentrations, will also be presented in this Section. This Section will also include the proposal for the second HERA deliverable.

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Section 22: Phase II Release Characterization Proposal This Section covers the Phase IIB proposal for filling data gaps identified during the Phase I release characterization. A series of borings, monitoring wells and other data collection will be proposed to address those data gaps. The third HERA interim report will also be proposed in this section.

Section 23: Phase II Off-Site Investigation Proposal This Section will address those data gaps still evident after completion of the Phase IIB investigation. The Phase II RFI will be completed at the end of this phase of work and the final HERA will also be submitted.

Section 24: Preliminary Evaluation of Corrective Measures This Section summarizes the key releases which have been detected on-site during Phase I and provides a preliminary screening of remedial alternatives which might be considered as part of the Corrective Measures Study.

Section 25: Project Management Plan This Section provides an outline of the project management structure, identifies goals and approaches to achieve those foals, and describes changes in the project management which have occurred since submittal of the RFI Proposal. This section concludes with a time line for completing the tasks described in the Phase II Scope of Work.

References: References cited throughout the entire document are listed alphabetically in the References section following Section 25.

1.5.3 Report Text

The Phase I RCRA Facility Investigation report is provided in two (2) volumes. Volume I includes Sections 1 through 13. Volume II includes Sections 14 through 25 References.

1.5.4 Appendices

Appendices: Appendices cited throughout the entire document are provided in Volumes 3, 4 and 5. Appendix O, the final Appendix in the document, contains a significant volume of information. Therefore, Appendix O is divided into a series of five (5) Books.

The Appendices include:

Volume III	Appendix A	Plates
	Appendix B	Historical References
	Appendix C	Material Safety Data Sheets
	Appendix D	Contaminant Characteristics Summary Sheets
Volume IV	Appendix E	Boring Logs
	Appendix F	Field Data Sheets
	Appendix G	Geological Documentation
	Appendix H	Geologic Cross Sections
	Appendix I	Hydrogeological Documentation
	Appendix J	Climatological Documentation
Volume V	Appendix K	Analytical Data Summary Tables
	Appendix L	Releases Characterization Summary Tables
	Appendix M	HERA Documentation
	Appendix N	Phase II Scope of Work Summary Tables

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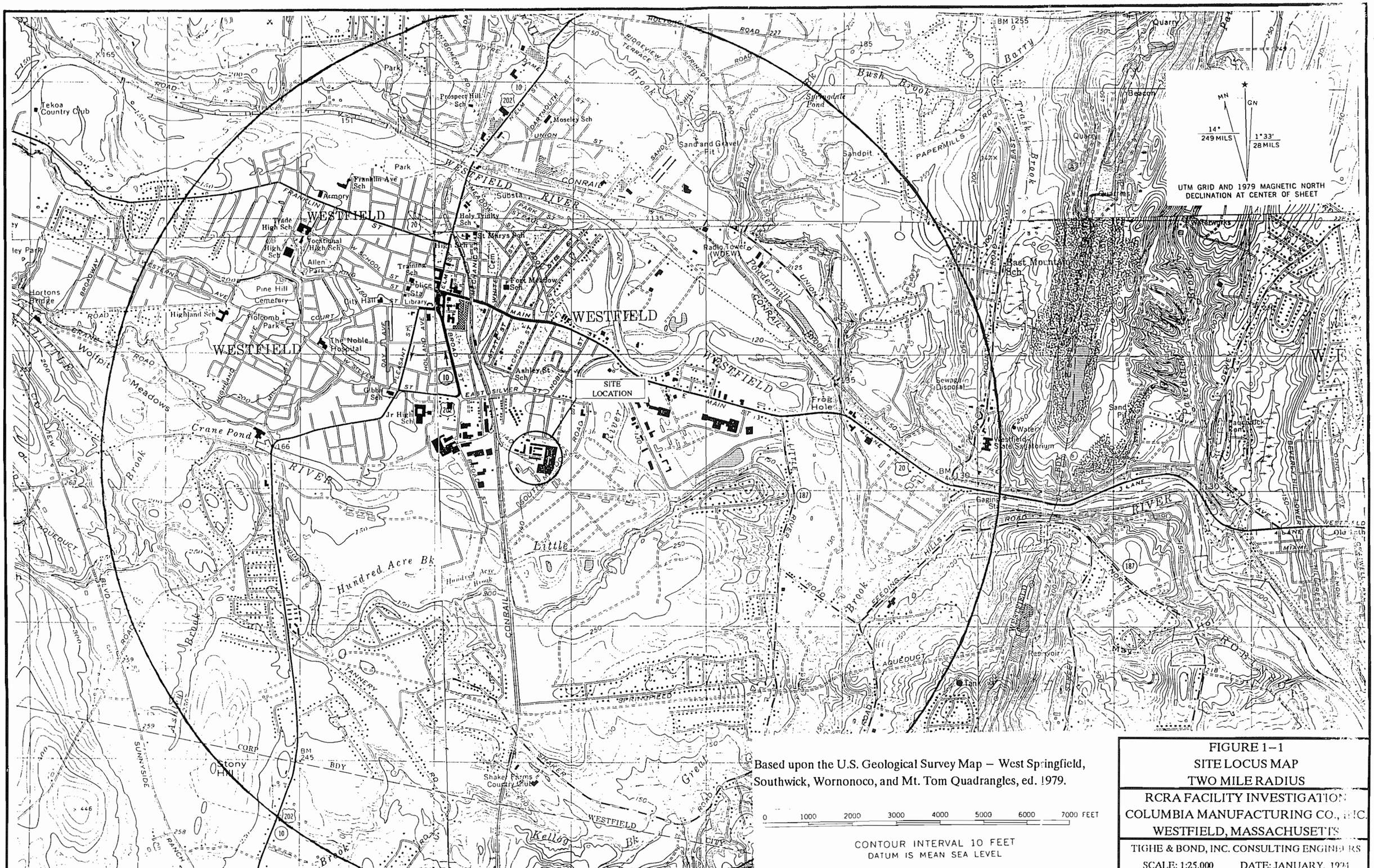
Book 1 through 5	Appendix O	Laboratory Submittals • Analytical Data Sheets and Errata • Response to 2/94 EPA Comments • August 1994 Data Validation Sheets • April 1994 Data Validation Sheets • Data Validation from Gradient Corp.

1.6 SUMMARY

This Section presented an overview of the Phase I RFI, presented a history of the facility and the project, outlined the AOCs that were investigated in Phase I, provided an overview of the Phase I investigation, and presented a summary of the organization of this document.

The next section describes the sampling and analysis methods used in this Phase I RCRA Facility Investigation.



Based upon the U.S. Geological Survey Map – West Springfield, Southwick, Wornonoco, and Mt. Tom Quadrangles, ed. 1979.

FIGURE 1–1
SITE LOCUS MAP
TWO MILE RADIUS

RCRA FACILITY INVESTIGATION
COLUMBIA MANUFACTURING CO., INC.
WESTFIELD, MASSACHUSETTS

TIGHE & BOND, INC. CONSULTING ENGINEERS
SCALE: 1:25,000 DATE: JANUARY, 1994

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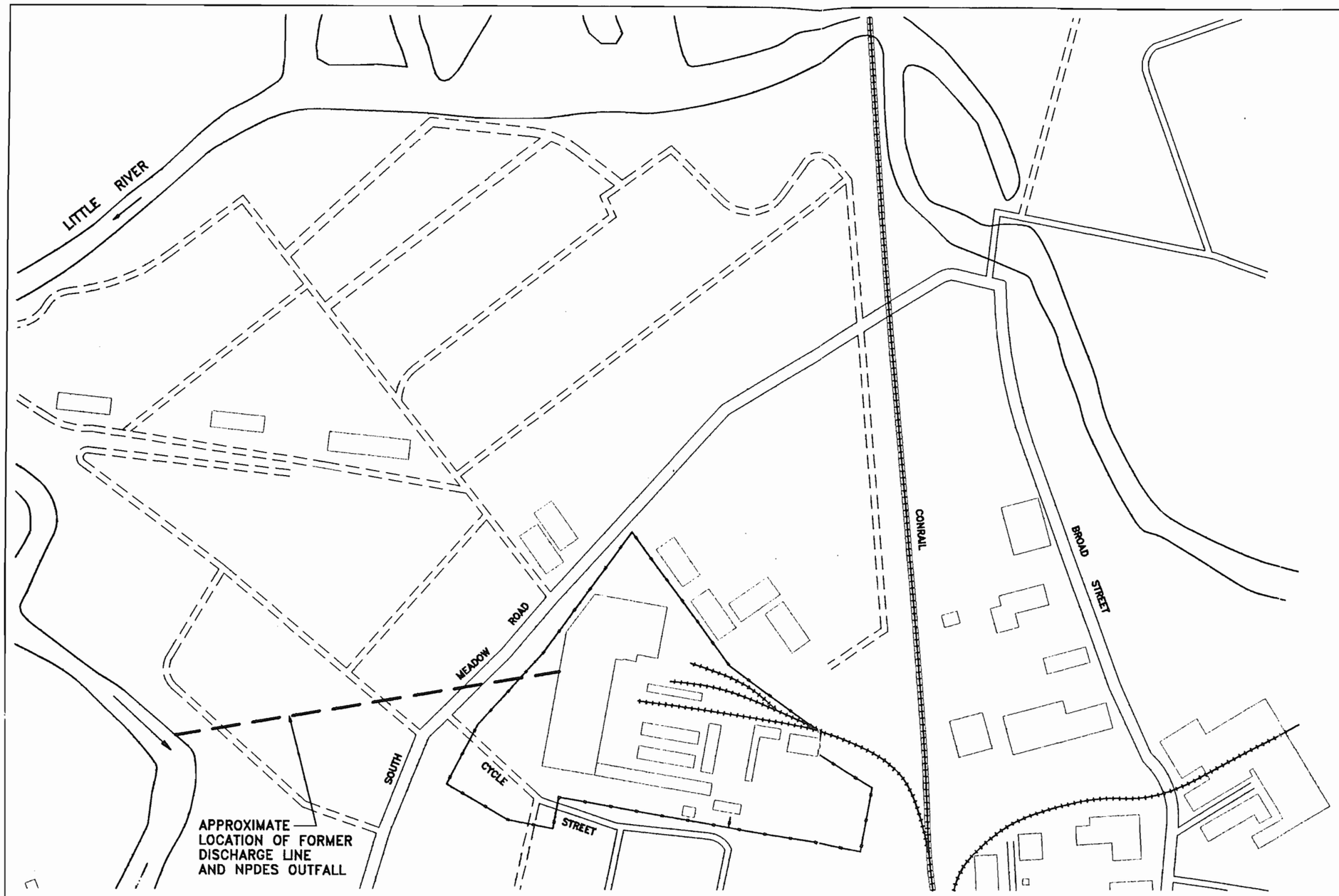

FIGURE 1–2

LOCATION OF FORMER WASTEWATER DISCHARGE LINE

COLUMBIA MANUFACTURING COMPANY, INC
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=400' DATE: SEPTEMBER 1994

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2
SAMPLING AND ANALYSIS METHODS

2.1 OVERVIEW

This Section details the field sampling and analysis methods used during Phase I of the RFI. Additional detail is provided in the Phase I RFI Proposal. Deviations from approved field procedures are also noted.

The subsections which follow are organized by media that were investigated, namely: soil (Section 2.2), groundwater (Section 2.3), surface water (Section 2.4), sediment (Section 2.5) air (Section 2.6), and subsurface gas (Section 2.7). A summary of sample collection and transport procedures is presented in Section 2.8. Variations from approved field procedures are presented in Section 2.9. Finally, a summary is provided in Section 2.10.

2.2 SOIL SAMPLING AND ANALYSIS METHODS

Soil borings were advanced at the Site to supplement data obtained during the installation and sampling of monitoring wells and to allow characterization of subsurface conditions. Samples were collected for field and laboratory analysis of physical and chemical parameters, and examined in the field to determine their lithology. Subsurface soil sampling and analysis methods are described in the following Sections. Sampling and analysis was completed in accordance with the procedures specified in the Phase I RFI proposal. Any variations from those methods are noted in Section 2.9.

2.2.1 Boring Advancement

Twelve borings were advanced at nine (9) locations on the site (BH-1 through BH-9) during the Phase I RFI. Four (4) separate borings were advanced at location BH-6, which were designated as BH-6A through BH-6D. Two (2) borings (BH-2 and BH-9) were completed as monitoring wells (MW-18S and MW-13S, respectively) after detection of elevated levels of TPH by on-site analysis. Locations of borings and wells are indicated on the Site Plan in Appendix A.

The boring for each monitoring well was advanced by rotating a single section of hollow-stem auger (4¼-inch ID, 7⅝-inch OD) into the soil to the limit of the auger section. To continue advancing the borehole, additional auger flights were added one at a time, repeating this sequence until the required depth was reached.

When an obstruction was met, the driller attempted to penetrate the obstruction by the use of a roller bit. If attempts to penetrate the obstruction were unsuccessful, the boring was abandoned and a new boring was started a short distance from the original boring location. Hollow-stem auger techniques were normally employed without the use of drilling water. If water was deemed necessary by the driller, its use was approved by the drilling inspector. Water used to advance the augers was drawn from a potable water source, and was not recirculated back into the boring. Drilling muds were not used at this Site. An auger plug was utilized to prevent soil from entering the auger head while the boring was being advanced. All drilling equipment was steam cleaned between borings to prevent cross contamination.

A description of each boring was recorded on boring logs, which are included in Appendix E. Logs prepared by both the Tighe & Bond drilling inspector and the drilling contractor are provided in that Appendix. Drillers' logs indicate offset borings which were required to collect sufficient

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samples for analysis. Numerous offset borings were required, for example, at locations where Appendix IX samples were being split with the EPA oversight subcontractor. The secondary borings are shown on the Site Plan in Appendix A with letter designations indicating the subsequent boring attempts. Borings BH-6A, BH-6B, BH-6C, BH-6D are actually separate borings, as outlined in the RFI Proposal, and not subsequent attempts at one boring.

2.2.2 Subsurface Soil Sample Collection

After drilling to the desired sampling depth, a split-spoon sampler and attached drilling rod was lowered to the bottom of the boring. With the split-spoon sampler set at the bottom of the hole, the drill rod was marked at four (4) consecutive six-inch (6″) intervals for measuring the blows per six-inches (6″) of driving. The sampler was driven by a 140-pound weight falling 30 inches. The sampler was driven 24 inches unless the blow count exceeded 100 blows per six inches (6″) indicating sampler refusal at that depth. The number of blows and the inches of penetration were recorded.

Split-spoon samplers were driven with a pneumatic hammer at interior borings (BH-2/MW-18S, BH-9/MW-13S, BH-6A through D, and MW-19S); therefore, blow counts could not be recorded. The use of the pneumatic hammer was mandated by physical constraints on drilling methods within the building.

When the sampler was brought to the ground surface, the length of recovery was measured and recorded. Any loose wash at the top of the sample was not counted as part of the recovery. If recovery was insufficient to fill sample jars, a new sampler was driven. All surface samples (0 to 2-foot interval) were collected using a split-spoon sampler, except from boring BH-8 which was hand angered. The split-spoon sampler (and hand auger at BH-8) was decontaminated after collection of each sample by washing with a low phosphate detergent (Alconox) and a series of rinses: tap water, nitric acid, tap water, methanol, hexane, and deionized water. The sampler was then allowed to air dry on clean plastic. Decontaminated stainless steel laboratory spoons and scoopulas were used to transfer soil samples from the split spoons to the appropriate sample containers.

Selected samples were split in the field with a representative of EPA's oversight contractor, TRC Environmental, in accordance with the work scope detailed in the RFI proposal.

2.2.3 Field Analysis of Soil

Split-spoon soil samples were screened for the presence of VOCs with an HNu Systems Model PI 101 PID with a 10.2 eV lamp. The PID was first zeroed and calibrated against a known standard of isobutylene gas and the battery voltage was checked. Calibration data was recorded on the field PID log sheets, which are provided in Appendix F.

To perform the field screening, a sample of soil from the split-spoon sampler was placed in a clean eight-ounce (8 oz) jar covered with aluminum foil and agitated. The foil was punctured approximately 10 minutes after the sample was agitated and the probe of the PID was placed in close proximity to the soil. The lowest possible scale range (0-20 ppm) was selected during screening and then changed to a higher scale as required. The probe intake was not allowed to directly contact the soil sample. Readings were recorded on the field log sheet presented in the RFI Proposal. A record of the most recent calibration is included on each log sheet.

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Field TPH analysis was performed at the Site by Tetra-K Testing, Westfield, Massachusetts. The procedures of the analysis are appended to the RFI Proposal. On-site TPH analysis was conducted for samples from interior borings BH-2, 6A, 6B, 6C, and 9.

2.2.4 Laboratory Analysis of Soil

Laboratory analysis of soil samples collected during Phase I of the RFI were analyzed at the Tighe & Bond Environmental Laboratory of Westfield, Massachusetts with the exception of dioxin. Dioxin samples were analyzed by Triangle Laboratories of Sugarland, Texas. All samples were validated using internal validation procedures as outlined in the June, 1993 RFI proposal. In addition, validation of the results from the Tighe & Bond laboratory soil sample analysis for samples MW-9I/D S-1, MW-9I/D S-2, MW-12I S-1, MW-12I S-1 dup, MW-14I S11-1, MW-14I S5-2, MW-20S dup-1, and MW-20S S-4-4, was completed by Gradient Corporation of Cambridge, Massachusetts. Gradient Corporation also provided validation for the following dioxin analyses; MW-14I S4-1, MW-14I S5-2, MW-15I S2-3, MW-16S S2-2, MW-16S S3-3, MW-16S S4-4, MW-16S DUP-1, MW-17S S2-2, MW-17S S4-3, MW-20S S2-2, MW-20S S3-3, MW-20S S4-4, MW-20S DUP-1. The full laboratory analysis reports and validation reports are included in Appendix O. Samples that were split in the field with the EPA's oversight contractor were logged in by the oversight contractor to the Contract Laboratory Program (CLP) for analysis. Split sample data are provided in Appendix K.

The parameters included in the analysis of subsurface soil samples are listed, with units reported, in Table 2-1. Parameters for any particular soil sample were either outlined in the RFI Proposal or developed as a result of field observations during sample collection. Analysis for Appendix IX parameters, including all parameters in Table 2-1 except for TPH, was performed on all soil samples from borings for monitoring wells with PID screening results greater than 10 ppm.

Table 2-1
SOIL ANALYSIS PARAMETERS
Columbia Manufacturing Company, Westfield, MA

Parameter	Units Reported
TOTAL METALS Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Magnesium, Mercury, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Tin, Vanadium, and Zinc	mg/kg, dry weight
INORGANICS	
Ammonia	as Nitrogen, mg/kg, dry weight
Cyanide (Total)	ug/kg, dry weight
Nitrate	as Nitrogen, mg/kg, dry weight
Oil and Grease	mg/kg, dry weight

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Parameter	Units Reported
Phosphate	mg/kg, dry weight
Sulfate	mg/L, 10% slurry
pH	pH units
Percent Solids	percent
Volatile Organic Compounds (VOCs) (EPA Method 8240)	ug/kg, dry weight
Semivolatile Organic Compounds (EPA Method 8270)	ug/kg, dry weight
Organochlorinated Pesticides and Polychlorinated Biphenyls (PCBs) (EPA Method 8080)	ug/kg, dry weight
Organophosphorus Pesticides (EPA Method 8140)	ug/kg, dry weight
Chlorinated Herbicides (EPA Method 8150)	ug/kg, dry weight
Dioxin (DFL M01.0)	ug/kg, dry weight
Total Petroleum Hydrocarbons (TPH) (EPA Method 418.1)	mg/kg, dry weight
Total Organic Carbon (TOC) (Lloyd Kahn Method)	mg/kg

Borings BH-1, 5, and 7 were sampled at the 0 to 1-foot, 1 to 2-foot, and 5 to 6-foot intervals. Samples were analyzed for metals, inorganics, VOCs, semivolatile organic compounds and TOC. Samples from BH-7 were also analyzed for chlorinated herbicides and organophosphorus pesticides, (EPA Methods 8140 and 8150, respectively). Dioxin analysis was not included at BH-7 because the location of the former incinerator(s) (AOC 33) was not adequately known prior to Phase I. Analysis for chlorinated herbicides, organophosphorus pesticides, and dioxin was proposed for the soil sample with the highest PID reading from BH-1; however, this analysis was not completed.

Borings BH-3 and BH-4 were advanced as continuous borings with sample collection at two-foot (2′) intervals to a depth of eight-feet (8′) below ground surface. Samples were analyzed for metals, inorganics, VOCs, semivolatile organic compounds, chlorinated pesticides, organophosphorus herbicides, and TOC. Dioxin analysis was proposed for the upper two (2) samples, but was performed on all four (4) samples from each boring due to the high PID readings detected.

Background conditions were partially characterized by analysis of a soil sample collected from a depth of 1 to 2 feet in BH-8, a shallow boring located immediately north of the office building (Building 14). This soil sample was analyzed for metals, inorganics, and VOCs. Pesticide and herbicide analysis was not performed on this sample. It was collected in an area where decorative plantings are maintained. Therefore, analytical results for those parameters may not be representative of background conditions at the Site and additional background data collection is proposed for Phase II.

Interior borings BH-2, 6A, 6B, 6C, 6D, and 9 were sampled at continuous two-foot (2′) intervals. Soil samples from all of these borings, except BH-6D, were analyzed on-site for TPH due to suspected underground fuel storage and/or release of petroleum in the vicinity of these borings. Soil samples from borings BH-2 and BH-9 with detected TPH concentrations greater than 50 mg/kg

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were submitted to the Tighe & Bond laboratory analysis for metals, VOCs, and TPH; samples from BH-6A, 6B, and 6C were submitted for TPH analysis only. Boring BH-6D was completed to collect samples for metals and VOC analysis from a location near BH-6A, 6B, and 6C.

Soil samples collected from borings advanced for the majority of the monitoring wells were sampled at the 0 to 2-foot and 5 to 7-foot intervals for metals, inorganics, VOCs, semivolatile organic compounds and PCBs. This sampling includes monitoring wells MW-6S, 9I/D, 12S, 12I, 14I, 15I, 16S, 17S, 20S, 21S, 22S, 23S, 24S, 25D and 26S. Appendix IX sampling was conducted at one or both of these intervals in MW-15I, 16S, 17S, 20S, and 24S (See Table 2-2). Background soil samples for chlorinated pesticides, PCBs, organochlorinated pesticides, and chlorinated herbicides were also collected at MW-25D. Soil samples from the boring for monitoring well MW-15I were also analyzed for dioxins. Samples from the 0 to 2-foot and 5 to 7-foot intervals in MW-24S and 12S were also analyzed for organochlorinated pesticides, PCBs, organophosphorus pesticides, and chlorinated herbicides.

Samples were collected to be analyzed for the full list of Appendix IX parameters when headspace PID readings of greater than ten (10) ppm VOCs were detected in soil samples collected from borings advanced for the installation of monitoring wells. Table 2-2 lists the locations where samples were collected for full Appendix IX analysis.

Table 2-2
APPENDIX IX SAMPLING LOCATIONS
SOIL FROM BORINGS FOR MONITORING WELLS
Columbia Manufacturing Company, Westfield, MA

Interval (Feet below ground surface)	Monitoring Well							
	MW-26I	MW-14I	MW-15I	MW-16S	MW-17S	MW-20S	MW-24S	MW-25D
0-2			X					
5-7			X	X	X	X		
10-12				X		X		
15-17		X		X	X	X	X	
20-22	X	X					X[1]	
25-27								
35-37								X

1 Two soil samples with PID responses of 38 and 52 ppm were grouped into this interval.
Note: Blank cells in table indicate that Appendix IX sampling was not completed at that location.

Samples were collected in continuous two-foot (2') intervals to a depth of 12 feet below the floor surface at monitoring well MW-19S, which was installed after contamination was detected in soil samples from the BH-6 boring series. These samples were analyzed for metals and VOCs. The 10 to 12-foot sampling interval was divided into two (2) parts based upon the observation of a visual line of contamination. The upper portion is reported as S-6a; the lower, S-6b. Monitoring

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wells MW-13S and MW-18S were completed in borings BH-9 and BH-2, respectively. Samples were also collected in continuous two-foot increments in those borings.

Soil samples were split with EPA's oversight contractor at the following well and boring locations: borings BH-3 (6 to 8 foot interval), BH-4 (6 to 8-foot interval), and BH-7 (1 to 2-foot interval); and monitoring wells MW-9I/D (5 to 7-foot interval), MW-26 (0 to 2-foot and 5 to 7-foot intervals), and MW-15I (0 to 2-foot interval). In addition, a duplicate soil sample was collected from BH-3 (6 to 8-foot interval). These soil samples were analyzed for metals, VOCs, semivolatile organic compounds, and pesticides/PCBs. EPA's oversight contractor also collected a field rinsate blank to be analyzed for these parameters.

Soil cuttings brought to the surface while advancing augers were collected in DOT approved drums and stored on the Site pending proper disposal.

2.3 GROUNDWATER SAMPLING AND ANALYSIS METHODS

Field methods employed for sampling and analysis of groundwater are described below. Sampling and analysis was completed in accordance with the procedures specified in the Phase I RFI proposal. Any variations from those methods are noted in Section 2.9.

2.3.1 Monitoring Well Installation

Fifteen (15) on-site monitoring wells (MW-6S and MW-12S through 26S) were installed during the Phase I investigation. Three (3) of these wells (MW-13S, 18S and 19S) were installed inside buildings after contamination was confirmed by on-site TPH analysis. Three (3) additional monitoring wells (MW-21S, 22S and 23S) were installed off-site in the tobacco fields to the south and downgradient of the Site. Specific details of the installation methods are outlined below. Including all previously installed monitoring wells, there are now 29 monitoring wells on-site and three (3) monitoring wells off-site. Locations of all wells are indicated on the Site Plan in Appendix A.

Monitoring wells were installed in borings advanced using the methods and procedures described in the preceding section. Soil sampling during monitoring well installation was completed with split-spoon samplers at five-foot (5') intervals. The method of collection, logging and screening of soil samples is identical to those used for borings where no monitoring well was constructed. A discussion of soil sampling methods is included in Section 2.2.2.

Monitoring wells were constructed of two-inch (2") ID PVC pipe (2¼-inch outside diameter). The screened sections of most wells consist of ten-foot (10') lengths of 0.010-inch (10 slot) slotted PVC well screen. Exceptions include two (2) of the three (3) interior monitoring wells, (MW-18S and MW-19S), which have 20 slot (0.020-inch) screens to allow for the detection of separate-phase petroleum hydrocarbons which may be present at those locations. In addition, MW-13S (another interior well) and MW-19S have eight-foot (8') screens due to shallow auger refusal.

All PVC sections were connected by flush threaded joints without the use of glues, solvents or lubricants. The ten-foot (10') screen length was deemed sufficient to accurately characterize specific zones of the aquifer without diluting groundwater samples. Two-foot (2') blind sumps were installed below screen sections to collect any fines that may enter the well. At locations where the use of a sump was infeasible due to refusal conditions or depth limitations, the sump was shortened

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or replaced by a point. The depth at which well screens were set was determined by examining flow nets, groundwater surface maps, and geologic cross sections developed during prior investigations. Additionally, PID screening of soil samples and field observations indicating changes in permeability in the subsurface were used to select the depths at which well screens were placed.

Backfill around the screened portion of the exterior, on-site wells consisted of clean sand (0.01-inch nominal diameter) which extended 1-2 feet above the top of the screen. Wells that were installed inside the buildings as well as the three (3) off-site wells were backfilled with 0.02-inch clean sand. Above the sand, a two-foot (2') bentonite clay seal was installed. A bentonite/cement grout (10%/90%) was then installed to within four feet (4') of the ground surface. Another two-foot (2') bentonite clay seal and a two-foot (2') concrete collar were then installed to complete the well at ground surface. In cases where shallow wells were installed, a thicker seal of bentonite clay was installed rather than a three-tiered seal using the grout mixture. A flush-mounted road box (5¼-inch x 16-inch) or a protective stand pipe (4-inch diameter x 6-foot long with slide-on locking cap) were installed in the concrete collar. Concrete near the wells was mounded to shed water and minimize the potential for runoff to enter the well. Construction details for each well are included on the boring logs in Appendix E.

2.3.2 Monitoring Well Development

Monitoring wells were developed following completion by over pumping. During well development, the discharge water was monitored for pH, conductivity and temperature. Development was deemed complete after the pH, conductivity, and temperature were within ten percent (10%) of the average reading. Development was also suspended once five (5) well volumes were removed from the well, whether or not the discharge stabilized. Water samples were also screened with a PID during the development process. Water produced by development was temporarily stored on-site pending analysis for disposal. A suction pump was used for development at each well. Air lift development was not required at the Site. Wells were allowed to stabilize for at least one (1) week prior to sample collection.

2.3.3 Groundwater Sampling

Immediately prior to sampling, three (3) well volumes were purged from the wells using disposable teflon bailers that were exclusively dedicated to each well. Pumps were not used to collect groundwater samples at the Site. The volume of water removal was equivalent to three (3) times the standing water in the well casing as required by the RCRA Groundwater Monitoring Technical Enforcement Guidance Document (TEGD). Clean, calibrated buckets were utilized to measure the amount of groundwater purged from the well. When a well was completely evacuated prior to purging three (3) well volumes, the well was allowed to recharge prior to further purging. After three (3) volumes were removed, sufficient time was allowed for the well to recharge before initiating sampling.

Samples were withdrawn from the wells using the dedicated teflon bailer for the well. Groundwater samples were transferred directly from the bailer to sample containers selected and prepared for the parameters to be analyzed at each location. Samples were carefully transferred into sample containers to minimize turbulence and avoid aerating the sample. After use, dedicated bailers were dried and stored in a plastic bag separate from all clean bailers. All bailers were returned to the Tighe & Bond Laboratory at the end of each day.

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All sampling information was recorded in a field log book. This information includes the well number and location, observations regarding well response while purging, the total volume of water purged, the purging method used, the date and time of sample collection, the type of container, the number of containers, and preservative for each fraction of the sample from the well. Field measurements (i.e. pH, specific conductance, temperature, dissolved oxygen and Eh) were also recorded on field data record sheets (Appendix F).

Purge water was stored at the Site in 55-gallon DOT approved barrels. After receipt of analytical results from the well water samples, a determination was made as to its disposition. Non-hazardous purge water was discharged to the CMC, WWTP subject to discharge guidelines and approvals from the Westfield publicly owned treatment works (POTW). Hazardous purge water was stored on site pending appropriate disposal.

On-site monitoring wells were sampled between October 19 and 22, 1993; off-site wells were sampled on November 18, 1993. The exact date of sampling at each well is shown in Table 2-3. One (1) duplicate sample was collected on each day of groundwater sampling, as well as a field equipment blank. These samples were collected as a quality assurance measure. Trip blanks accompanied volatile samples on each day of sampling.

Table 2-3
PHASE I GROUNDWATER SAMPLING DATES
Columbia Manufacturing Company, Westfield, MA

Date	Monitoring Wells[1]
October 19, 1993	9B, 10A, 10B[2]
October 20, 1993	2, 3[2], 4, 9C
October 21, 1993	6[2], 7A, 8A, 9A, 9D, 12, 12A, 12B, 14
October 22, 1993	13, 15[2], 16, 17, 18, 19, 20, 24, 25
November 18, 1993	21, 22[2], 23

1 MW-1I, MW-7I, MW-8I, and MW-11I were not sampled; November 1991 EPA analysis results will be used in accordance with the RFI Proposal.
2 Location of duplicate sample collection.
Note: MW-5S was destroyed prior to Phase I and could not be located or sampled.

2.3.4 Monitoring of Groundwater Levels

Monitoring of groundwater levels was performed on various occasions in September through December of 1993 during the Phase I RFI. During Phase I, groundwater levels were monitored at on-site wells prior to well development (October 7 through 14, 1993), prior to sampling (October 19 through 22, 1993), and prior to hydraulic conductivity testing (October 25 through November 3, 1993). The groundwater elevations in off-site wells were monitored on November 11 and 18, 1993. Since these monitoring and water level measurement events spanned a significant time period, a single water level measurement event was completed on December 20, 1993.

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To gauge the depth to groundwater, a fiberglass tape weighted with a "plunker" was lowered into the well. The length of the weight attached to the tape was measured and recorded in field notes. Using the weighted tape, the depth of the well and the depth to groundwater were recorded to the nearest 0.01 feet from the top of the PVC riser pipe. Any observations, such as well obstructions, absence of groundwater, or unusual odors were indicated in field notes.
Depths were measured from the highest point of unevenly cut PVC riser pipes. In MW-22S, the riser pipe was below the protective steel casing and hidden from sight. Therefore, the inside lip of the steel casing was used as a reference point. The distance from the top of the PVC pipe to the inside lip of the steel casing, or top of flush mounted casing, was also measured to the nearest 0.01 foot and recorded in field notes. Measurements recorded in field notes included the depth measured directly from the tape and the length of the weight, which was added to the direct reading from the tape.

2.3.5 Field Analysis of Groundwater

The specific conductance, temperature, pH and Eh of groundwater samples were measured with a YSI Model 33 meter. The meter was properly calibrated and zeroed according to the manufacturer's specifications. Samples were analyzed using calibrated scales only. The sample was placed in a wide-mouth glass jar immediately following removal from the monitoring well. Measurements of specific conductance, pH and Eh were automatically temperature corrected by the instrument. The instrument was recalibrated every 2 or 3 hours, or as required. All field readings were recorded in the groundwater sample collection field log book. Specific conductance was recorded in μmhos/cm at 25°C; Eh in mV; and temperature in °C.

A YSI Dissolved Oxygen meter was utilized to analyze for dissolved oxygen in the field. Prior to calibrating the instrument, the probe was allowed to stabilize for 15 minutes in moist air. The instrument was then calibrated according to the manufacturers specifications. Sufficient time was allowed for the probe readings to stabilize. The dissolved oxygen reading was recorded on the field record sheet in mg/L.

The results of all field analyses are shown in Appendix K under the heading Field Tests.

2.3.6 Laboratory Analysis of Groundwater

Groundwater samples collected during Phase I of the RFI were analyzed at the Tighe & Bond Environmental Laboratory of Westfield, Massachusetts with the exception of dioxin. Dioxin was analyzed by Triangle Laboratories of Sugarland, Texas. All samples were validated using internal validation procedures as outlined in the June, 1993 RFI proposal. In addition, the analytical data for groundwater samples from the following locations were validated by Gradient Corporation of Cambridge Massachusetts: MW-1I, MW-6S, MW-6S duplicate, MW-9S, MW-14I, MW-17S, MW-18S, MW-19S, MW-24S, MW-25D, and MW-26I. The full laboratory analysis results and data validation reports are included in Appendix O. Samples that were split in the field with the EPA's oversight contractor were logged in by the oversight contractor to the Contract Laboratory Program (CLP) for analysis. Split sample data are provided in Appendix K.

Analysis for all parameters included in Appendix IX was performed on groundwater samples except where data from previous investigations clearly identified the contaminants anticipated. The RFI Proposal lists the analyses proposed for each monitoring well. Groundwater from the majority of the monitoring wells was analyzed for metals, inorganic parameters, volatile organic compounds

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(VOCs), and total organic carbon (TOC). The parameters included in the analyses are listed in Table 2-4.

Table 2-4
GROUNDWATER ANALYSIS PARAMETERS
Columbia Manufacturing Company, Westfield, MA

Parameter	Units Reported
TOTAL METALS Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Magnesium, Mercury, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Tin, Vanadium, Zinc	µg/L
INORGANICS Ammonia	as Nitrogen, mg/L
Chlorine	mg/L
Cyanide	µg/L
Nitrate	as Nitrogen, mg/L
Oil & Grease	mg/L
Phosphate	as Phosphorous, mg/L
Sulfate	mg/L
pH[1]	pH units
Alkalinity	mg/L
Total Dissolved Solids (TDS)	mg/L
Total Suspended Solids (TSS)	mg/L
Biological Oxygen Demand (BOD)	mg/L
Chemical Oxygen Demand (COD)	mg/L
Volatile Organic Compounds (VOCs)(EPA Method 8240)	µg/L
Total Organic Carbon (TOC)(EPA Method 9060)	mg/L
Semivolatile Organic Compounds (EPA Method 8270)[2]	µg/L
Organophosphorus Pesticides (EPA Method 8140)[2]	µg/L
Chlorinated Herbicides (EPA Method 8150)[2]	µg/L
Dioxins (CLP Method DFLM01)[2]	ng/L
organochlorinated Pesticides/PCBs (EPA Method 8080)[3]	µg/L

1 Measured in the laboratory in addition to field measurement.
2 Appendix IX Analyses performed on selected samples only.
3 Performed in exceedance of RFI requirements.

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Analysis for the full list of Appendix IX analytes was performed on groundwater samples collected from MW-3I, 6S, 10S, 10I, and 15I. These wells were identified in the RFI Proposal as being associated with the Incinerator Pit (AOC 33b) and Scrap Metal Fill Area (AOC 33a). The parameters included: metals, inorganic parameters, VOCs, TOC, semivolatile organic compounds, organophosphorus pesticides, chlorinated herbicides, and dioxin. Analysis for organochlorinated pesticides and PCBs was conducted in exceedance of the analyses included in the RFI Proposal. Duplicate samples at monitoring wells MW-3I, 6S, 10I, and 15I were also analyzed for these Appendix IX parameters.

Groundwater samples from monitoring wells MW-13S, 18S, and 19S were analyzed for: metals, inorganic compounds, VOCs, semivolatile organic compounds and TOC. These wells were installed during Phase I contingent upon the results of on-site analyses of soil samples for TPH from interior borings. Groundwater analysis for VOCs by EPA Method 8240 was substituted for Method 8020 in the sample from monitoring well MW-13S for consistency. Groundwater samples from monitoring wells MW-16S and MW-17S were analyzed for semivolatile organic compounds in addition to metals, inorganic compounds, VOCs, and TOC. Groundwater samples from off-site monitoring wells MW-21S, 22S, and 23S were analyzed for PCBs in addition to metals, inorganic compounds, VOCs, and TOC.

2.3.7 Hydraulic Conductivity Testing

Hydraulic conductivity tests (rising and falling head) were conducted in all on- and off-site monitoring wells following development. Testing in wells installed prior to Phase I of the RFI was conducted on October 25, 27, 28, and 29, 1993; Phase I on-site monitoring wells were tested on November 1, 2, and 3, 1993; off-site wells were tested on November 18, 1993. Drawdown and time data from the tests were recorded using a downhole pressure transducer connected to an electronic data logging system. Thirty readings were recorded for each time segment. Time intervals between each reading in a segment increased as the testing progressed (in seconds): 1, 2, 5, 10, 20, 30, and 60. In several of the monitoring wells, the one-second (1s) interval of the first segment was not rapid enough to record the changing water level. In those cases, a "turbo" function was utilized to take five (5) readings per second for the first 30 readings.

Water level displacement was accomplished by lowering a 1-inch (1") or 1½-inch diameter PVC solid rod ("slug") into the monitoring wells, and then removing it. The 1-inch (1") PVC slug was typically used to avoid damage to the transducer when the depth of water in the well was not adequate to safely isolate the transducer below the water table. The slugs were decontaminated prior to use to prevent the introduction any foreign material or fluids into the monitoring wells. The depth to the groundwater table, depth to the bottom of the well and the static water level above the pressure transducer were recorded prior to commencing tests at a monitoring well. Drawdown recording was discontinued when the water level returned to the static level measured prior to the test, or when the groundwater level changed at a rate indicative of a nonlinear relationship between the log of the displacement and time.

Time and drawdown measurements from the data logger were transferred to computer text files which were manipulated to change water level data to drawdown data. The resulting data was transferred into the AQTESOLV™ analysis program by Geraghty & Miller for graphing and hydraulic conductivity calculation.

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2.4 SURFACE WATER SAMPLING AND ANALYSIS METHODS

Samples of surface water were collected from locations at and in the vicinity of the Site as specified in the RFI Proposal. All field methods and analyses were carried out in accordance with the methods specified in the Phase I RFI Proposal. Any variations from approved methods are noted in Section 2.9.

2.4.1 Surface Water Sampling

Four (4) Surface water samples (SW-1, SW-2, SW-2 duplicate and SW-3) were collected on September 24, 1993 from three (3) locations in the Fire Pond (AOC 34). Samples were collected from an area near the outlet of a discharge pipe in the central portion of the north shore, and from the east and west ends of the pond. Sampling locations are illustrated on the Site Plan in Appendix A.

Samples were collected from 6 to 12 inches below the water surface to avoid the influence of wind eddy currents. A background "surface water" sample was also collected from tap water used for boiler make up water which eventually discharges to the Fire Pond. Additional samples were collected from the SW-1 and SW-3 locations on September 30, 1993 because insufficient sample volume was originally obtained. Sampling data was recorded in the surface water sampling field log book. Copies of the field logs are provided in Appendix F. Sample containers were handled in accordance with the procedures outlined in Section 2.8.

2.4.2 Surface Water Analysis

Surface water samples were analyzed for metals, inorganics, and TOC, as listed in Table 2-5. Samples were also field screened for specific conductance, pH, oxidation reduction potential, dissolved oxygen, and temperature.

A tap water sample collected from the boiler make up water was not screened for specific conductance, pH, oxidation reduction potential, or temperature at the time of collection. The two (2) additional samples collected on September 30, 1993 from the Fire Pond (SW-1 and SW-2) were analyzed for pH, alkalinity, specific conductance, sulfate, nitrate, total dissolved solids, total suspended solids, biological oxygen demand, and chlorine.

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Table 2-5
SURFACE WATER ANALYSIS PARAMETERS
Columbia Manufacturing Company, Westfield, MA

Parameter	Units Reported
TOTAL METALS Calcium, Iron, Magnesium, Manganese, Potassium, Sodium	µg/L
INORGANICS	
Ammonia	as Nitrogen, mg/L
Chlorine	mg/L
Cyanide (Total)	µg/L
Nitrate	as Nitrogen, mg/L
Oil and Grease	mg/L
Phosphate	as Phosphorous, mg/L
Specific Conductance[1]	µmho/cm @ 25°C
Sulfate	mg/L
pH	pH units
Alkalinity	mg/L
Total Dissolved Solids	mg/L
Total Suspended Solids	mg/L
Biological Oxygen Demand	mg/L
Chemical Oxygen Demand	mg/L
Total Organic Carbon (EPA Method 9060)	mg/L

1 Specific conductance was screened in the field at the time of collection and was subsequently analyzed in the laboratory.

2.5 SEDIMENT SAMPLING AND ANALYSIS

Samples of sediment were collected from locations on and around the Site as specified in the RFI Proposal. Sampling and analysis was completed in accordance with the procedures specified in that proposal. Any variations from those methods are noted in Section 2.9.

2.5.1 Sediment Sampling

Sediment samples were collected on September 24, 1993 from the Fire Pond, two (2) manholes, the diversion structure, and the Little River. On-site sediment sampling locations are illustrated on the Site Plan in Appendix A. The collection location of the Little River sediment samples (SS-5 and SS-6) is indicated on Figure 2-1. Sediment samples from the Fire Pond (SS-1, SS-2, and SS-3) were collected from 0 to 6 inches below the top of the sediment, at the surface water sampling locations, following collection of surface water samples.

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Little River sediment samples (SS-5 and SS-6) were collected from alluvial deposits upstream and downstream of the Little River NPDES outfall. The outfall discharges via two 16-inch pipes into a small intermittent stream (Figure 2-1). Interviews with CMC personnel (David Williams) indicate that these two pipes originate in the Diversion Structure. Originally, these pipes discharged directly to the Little River. Subsequent river reconfiguration, reportedly performed by the U.S. Army Corps of Engineers, rerouted the Little River northward to its current location. Therefore, pipe discharge flows easterly in the intermittent stream toward a new discharge point in the Little River. Following discussions with EPA, it was determined that sediment samples would be collected immediately downstream of this discharge point (SS-6) in the Little River and at a point upstream of that location that was not influenced by the discharge (SS-5).

A third pipe identified on Figure 2-1 (12" C.I.) is believed to be a former suction line used for supplying water to the Columbia Manufacturing Facility. Following the diversion of the Little River, this line was abandoned.

Manhole sediments were collected by mounting sample containers on an extension pole. Sediments were sampled in the outlet manhole of the storm drain system in the northern portion of the Site (SS-8). This manhole ultimately flows to the storm drain system located on Cleveland Avenue. Sewer sediments were to be sampled from the outlet manhole to the sanitary sewer system on Lozier Avenue (SS-7); however, sediments were not present in that manhole during sampling. The manhole contained a shallow trough with rapidly flowing effluent, thus sediment does not collect in this manhole. A sediment sample (SS-4) from the diversion structure located at the south end of the Reflecting Pond (AOC 16) was sampled to characterize the sediments produced by combined process wastewater and storm water. Sampling data was recorded in a sediment sample collection field log book. Copies of those logs are provided in Appendix F.

2.5.2 Sediment Analysis

Phase I sediment samples were analyzed for metals, inorganic parameters, VOCs, semivolatile organic compounds, and TOC. The analysis parameters for sediments are listed in Table 2-6. Fire Pond sediment samples were analyzed for cyanide, pH, and metals (except calcium, iron, magnesium, manganese, potassium, and sodium). Additionally, grain-size analysis, porosity, and bulk density were determined for the Fire Pond samples. Analytical data from November 1991 EPA sampling also included sediments from the Fire Pond. The EPA samples were analyzed for VOCs (EPA Method 8240) and chromatograms of the samples were compared to known petroleum standards.

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Table 2-6
SEDIMENT ANALYSIS PARAMETERS
Columbia Manufacturing Company, Westfield, MA

Parameter	Units Reported
TOTAL METALS	
Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Mercury, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Tin, Vanadium, and Zinc	ug/kg, dry weight
INORGANICS	
Ammonia	as Nitrogen, mg/kg, dry weight
Cyanide (Total)	ug/kg, dry weight
Nitrate	as Nitrogen, mg/kg, dry weight
Oil and Grease	mg/kg, dry weight
Phosphate	mg/kg, dry weight
Sulfate	mg/L, 10% slurry
pH	pH units
Percent Solids	percent
Volatile Organic Compounds (VOCs) (EPA Method 8240)	ug/kg, dry weight
Semivolatile Organic Compounds (EPA Method 8270)	ug/kg, dry weight
Total Organic Carbon (TOC) (Lloyd Kahn Method)	mg/kg

2.6 AIR SAMPLING AND ANALYSIS METHODS

Air screening was performed on September 13 and 17, 1993 at five (5) air monitoring stations (See Appendix A, Site Plan). Screening was conducted at a shallow 6-inch deep boring at AS-1 and near the surface of the Fire Pond (AOC 34) at AS-2. The remaining background air quality samples were screened at stations AS-3, 4, and 5, which are located along northern border of the Site. These three samples were collected with the monitoring equipment in the personal breathing space of the personnel conducting the evaluation. Air was also screened during a walk-through of Buildings 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, and 17 on September 17, 1993.

Ambient air was screened for the presence of VOCs with an HNu Systems Model Pl 101 PID with a 10.2 eV lamp. The PID was first zeroed and calibrated against a known standard of isobutylene gas and the battery voltage was checked. For air screening near soil or surface water, the probe of the PID was placed in close proximity to the media. Surface water was disturbed prior to screening near the surface. The lowest possible scale range (0-20 ppm) was selected during screening and then changed to a higher scale, as required. Readings were recorded in field notes.

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General weather conditions were recorded on both sampling dates. On September 13, 1993, the winds varied from 5 to 15 MPH out of the south/southeast. The skies were clear, with the temperatures near 80°F. On September 17, 1993, there was no perceptible wind. The skies were cloudy with temperatures near 65°F.

2.7 SUBSURFACE GAS SAMPLING AND ANALYSIS METHODS

Subsurface gas samples were collected from beneath a concrete pad to the south of Building 14 at 10 discrete locations as specified in the Phase I RFI Proposal. (See Site Plan in Appendix A). Sampling and analysis was completed in accordance with the procedures specified in the RFIP. Any variations from those methods are noted in Section 2.9.

Holes were drilled through the concrete pad prior to beginning the soil gas evaluation to provide access to underlying soil. The soil gas probes used for collection of soil vapor samples were driven to the desired depth (3.5 to 5.0 feet below grade) using a manual slide hammer and modeling clay was used to seal the soil gas tube to the surrounding ground surface. Tubing protruding from the rod was attached to the soil gas sampling system. A vacuum pump was started and the time was noted on the field data sheet. The flow and the vacuum were also recorded. The flow was adjusted to maintain a rate of approximately 2-liters-per-minute. The system was allowed to pump for either 2 minutes at 2 liters per minute or, if necessary, for a longer period at a lower flow rate. While purging, the air discharged from the system was monitored using a PID for a preliminary characterization of VOC contamination.

After purging, a 5.0-mL gas-tight syringe was inserted through the septum sampling port and a 0.2 to 5 mL sample was collected based on expected concentrations of contamination. Duplicate samples were collected simultaneously and all samples were transported to the mobile laboratory for immediate injection into a gas chromatograph (GC). Sample analysis was conducted on-site by Tetra-K Testing of Westfield, Massachusetts.

2.8 SAMPLE CONTAINERS, TRANSPORT AND HANDLING

Sample containers were prepared in the laboratory according to the list of required analyses. Containers were selected using the table titled "Required Preservation and Holding Times" included with the Standard Procedures appended to the RFI Proposal. For samples which required a chemical preservative, the measured amount of preservative appropriate for the sample volume was added to the sample container during preparation at the laboratory. The container was labelled to identify the preservative added and the sample to be collected in that container. The pH of all preserved samples was checked in the field with pH paper to verify that the proper pH had been obtained. A field preservation kit was utilized to adjust the pH as necessary.

All sample containers were filled to the appropriate level and sealed. The outside of the container was wiped with a clean paper towel. During storage on-site and during transport, the containers were maintained at temperatures specified in the Table "Required Preservation and Holding Times" appended to the RFI Proposal. Sample containers were labeled using black indelible ink and adhesive sample identification labels. Labels detailed the sample identification, date and time collected, collector, preservative, client, job number, and analyses required. Time and date of sample collection, collector's name, sample location, and other pertinent information was also recorded in the field log book.

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Containers for aqueous volatile organic samples were sealed so that no air remained inside the container. When air bubbles remained upon first sealing the container, the container was carefully opened and additional sample added to the container. Volatile organic samples were stored and transported in an inverted position.

Samples were packed in coolers and arranged to prevent breakage. A protected thermometer was placed in a representative area in the cooler. Ice or ice packs were then added to preserve the samples. Samples collected at different sampling locations were not transported together in the same cooler. Custody tape, signed and dated across the overlap, was used to seal each cooler. The custody tape remained in place until the samples were logged in at the laboratory.

Sample labels, chain-of-custody forms and field data records were completed at the time of sampling. The original chain-of-custody form accompanied the samples at all times after collection. When samples were transferred in possession, the individuals who relinquished and received the samples signed and dated the chain-of-custody form and noted the time on the form. The chain-of-custody forms include the project name, media sampled, sampling date and time, sampling location, preservation, and the signature of the person performing the sampling.

2.9 VARIATIONS FROM APPROVED PROCEDURES

The following sections describe variations from the approved field procedures as outlined in the Phase I RFI Proposal and as summarized above. A discussion of the impact of each variation on data obtained is provided where applicable.

Variations in Soil Sampling & Analysis Procedures

The Phase I RFI Proposal states that a sledge hammer will be used to drive split-spoon samplers in locations that are inaccessible to a drill rig. Soil sample collection at BH-8 was not accomplished using a split-spoon sampler. Only a shallow soil sample (0-1.5') was collected at this location. The boring was advanced using a decontaminated post hole digger. The samples were collected using a stainless steel laboratory spoon. As discussed in Section 3, the sample collected at this location was intended as a background sample, but was subsequently rejected for that purpose due to the potential that fertilizers, pesticides and soil amendments may have been used in that area. Therefore, no corrective measures are proposed.

Split-spoon samplers were not driven in the approved manner during the advancement of borings at the following locations: BH-9/MW-13S, BH-2/MW-18S, MW-19S, and BH-6A through BH-6D. A pneumatic ram was used to advance the split-spoon samples at these locations. These borings were advanced inside buildings, in areas inaccessible to a conventional drill rig. Due to the number of samples to be obtained, and the depths of the boreholes from which the samples were obtained, manual sample collection using a sledge hammer was not considered feasible. The method used was effective and did not compromise sample integrity.

Augers used in the advancement of MW-12S, 18S, 19S, 24S, 25D, 26I, and BH-1, 3, 4, 5, 6A through D, and 7 were decontaminated over the ground surface at the former lagoons (AOC 29). The location of the decontamination is illustrated on Figure 2-2.

The sample with the highest PID reading from boring BH-1 was supposed to have been analyzed for organophosphorus pesticides by EPA Method 8140, chlorinated herbicides by EPA Method

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8150, and dioxin by EPA Method 8280. A representative soil sample will be collected near BH-1 in Phase II for organochlorinated pesticides, chlorinated herbicides, organophosphorus pesticides, and dioxin.

2.9.1 Variations in Groundwater Sampling & Analysis Procedures

Groundwater level measurements were performed using a fiberglass tape rather than a steel tape as specified in the Phase I RFI Proposal. For future phases of the RFI, water level monitoring will be performed with a steel tape.

Water was used in the installation of five (5) groundwater monitoring wells (MW-9I/D, MW-26I, MW-16S, MW-22S, and MW-23S) at the Site. At three (3) of these locations (MW-26I, MW-16S, and MW-22S), an equal volume of water was not removed in addition to the amount required to develop and purge the well. Seven (7) days elapsed between well installation and the collection of groundwater samples at these locations. Based upon the groundwater flow velocities calculated in Section 4.4.2, the volume of water introduced into the well would have dispersed into the formation and as a result, concentrations of contaminants collected at two (2) of the locations (MW-26I and 16S) are likely to be impacted by the use of water during well installation. Based on these same velocities, contaminant concentrations at monitoring well MW-22S are unlikely to be impacted by the use of water during drilling. Additional evacuation of water in an amount at least equal to water added during drilling will be completed for monitoring wells installed during Phase II.

Monitoring wells installed at the Site were constructed with Schedule 40 PVC pipe rather than Schedule 50, as specified in the RFI Proposal. The reference to Schedule 50 PVC in the RFI Proposal was inadvertent, and should have been listed as Schedule 40. For consistency in monitoring, Schedule 40 PVC pipe will be used for construction of additional wells at the site.

The Phase I RFI Proposal specifies that well protective casings are to be painted, and the well number painted on the casing in one-inch numerals of a contrasting color. This was not completed. The proposed corrective action is to paint the protective casings.

2.9.2 Variations in Surface Water Sampling & Analysis Procedures

No variations from approved surface water sampling and analysis procedures were noted during Phase I of the RFI.

2.9.3 Variations in Sediment Sampling & Analysis Procedures

A sediment sample was not collected from proposed sampling location SS-7 since no sediment was found in the manhole at that location. Since sediment was not present at that location, no corrective action is proposed.

2.9.4 Variations in Air Sampling & Analysis Procedures

No variations from approved air sampling and analysis procedures were noted during Phase I of the RFI.

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2.9.5 Variations in Subsurface Gas Sampling & Analysis Procedures

A modified EPA Method 8010/8020 from SW-846 was used during the subsurface gas analysis. This method is a waste method normally used for liquids, solids or other "non-gaseous" matrices. However, the first step in most of the volatile organic methods is a preparation method, EPA Method 5030, purge and trap concentration, which puts all the VOCs into gaseous form. Because samples were already in the gaseous form, the gas sample was introduced into the purge and trap concentrator and subsequent analysis followed both the conditions and requirements for these two (2) methods. Reported values also involved two (2) modifications. Gas concentrations were reported in mg/m^3 (of air) rather than liquid or solid units, and a shortened list of analytes was reported that included those compounds that were tentatively identified as contaminants of concern at the Site. This methodology will be used as part of Phase II subsurface gas investigations.

2.10 SUMMARY

This section has presented an overview of the field procedures and laboratory analysis methods used in the collection and analysis of environmental samples during Phase I of the RFI. Variations from the approved procedures outlined in the June, 1993 Phase I Proposal were also noted. Data resulting from the activities described in this Section will be used in the following Sections to develop a conceptual model of the Site and characterize releases at the Site.

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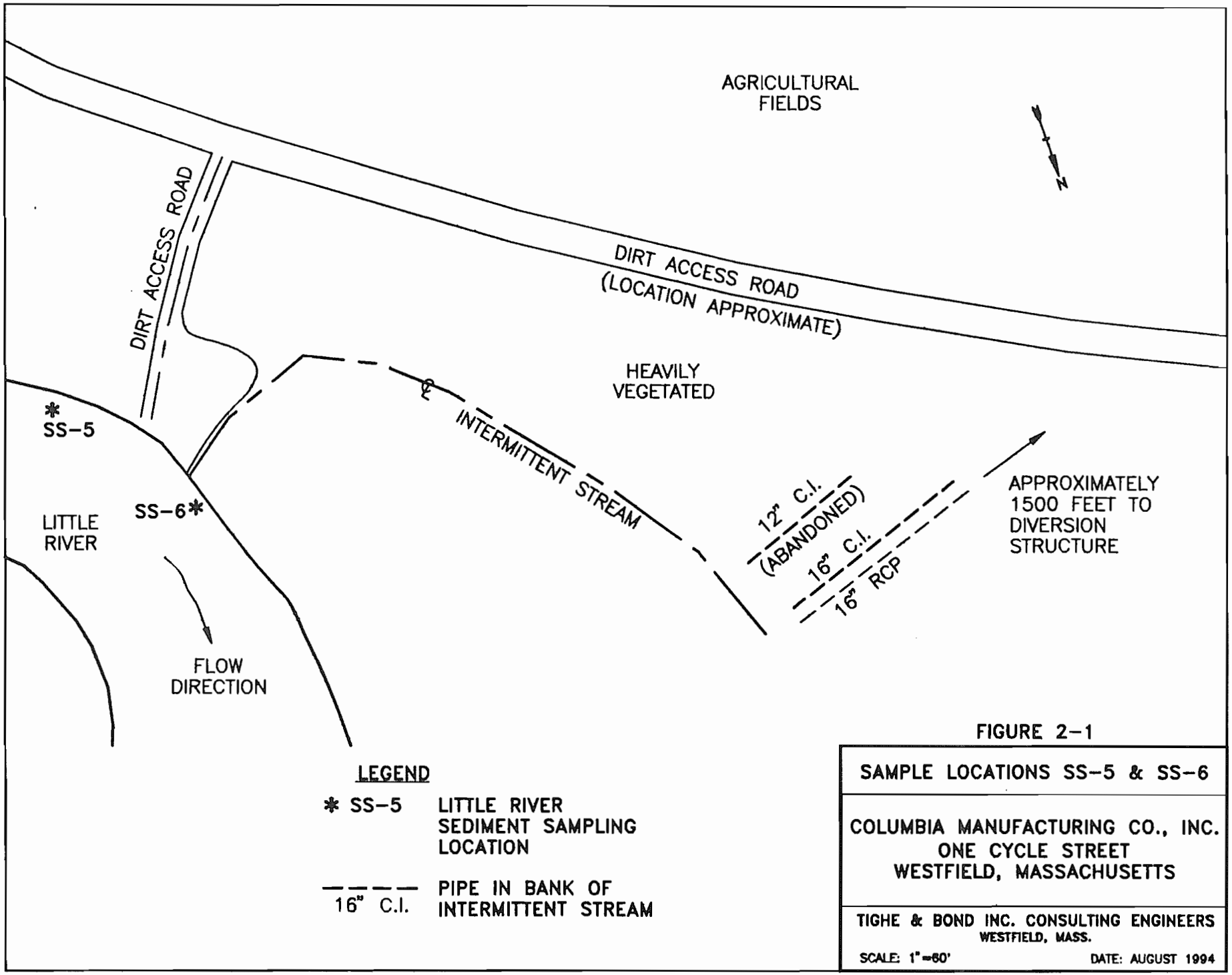

FIGURE 2-1

SAMPLE LOCATIONS SS-5 & SS-6

COLUMBIA MANUFACTURING CO., INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=60' DATE: AUGUST 1994

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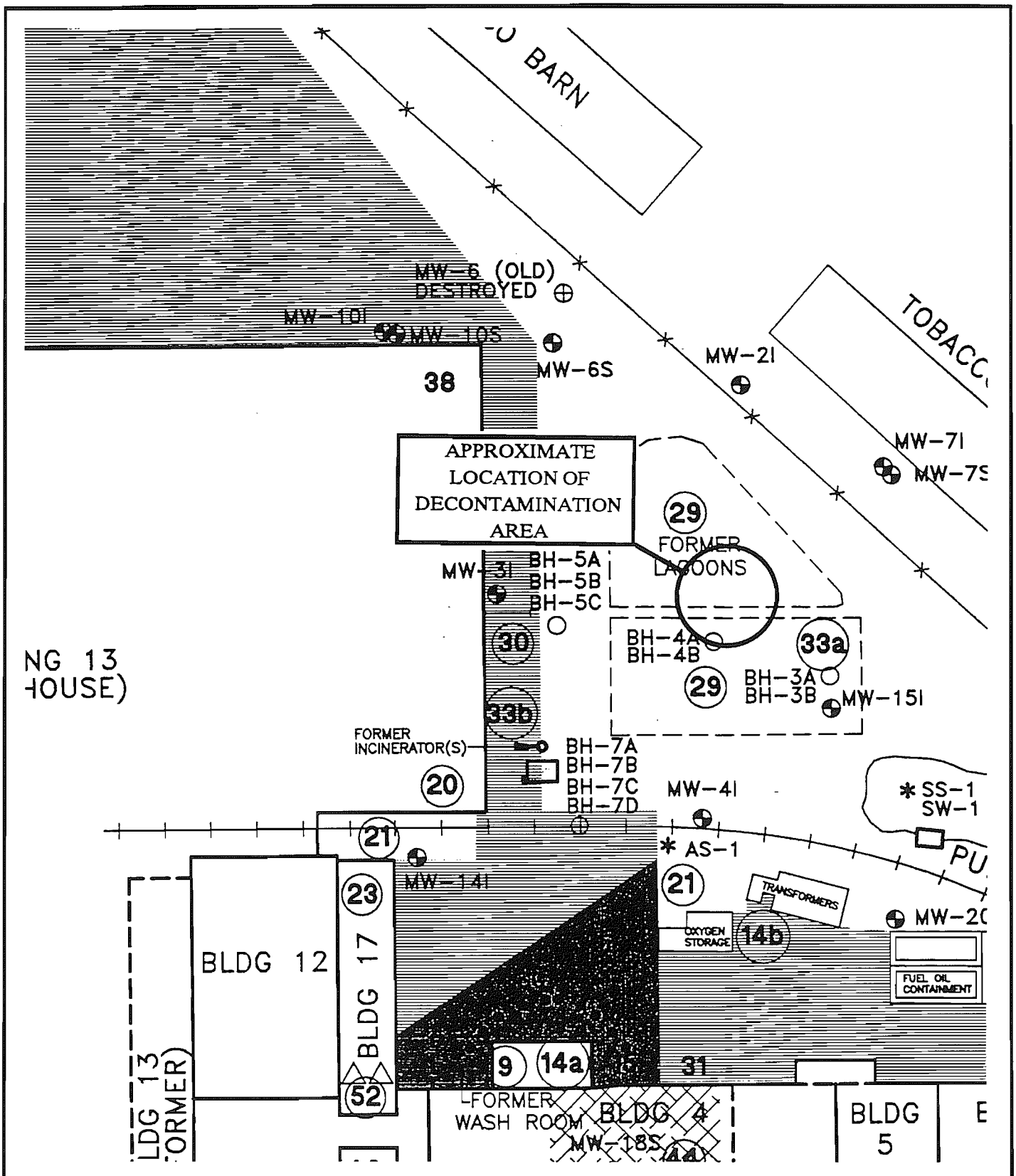

FIGURE 2-2
LOCATION OF DECONTAMINATION
RCRA FACILITY INVESTIGATION
COLUMBIA MANUFACTURING CO., INC.
WESTFIELD, MASSACHUSETTS
TIGHE & BOND, INC. CONSULTING ENGINEERS
SCALE: 1" = 60 DATE: SEP. 1994

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3
PHASE I GEOLOGICAL INVESTIGATION

3.1 OVERVIEW

This Section describes the Phase I geological investigation of the Site. The investigation included a literature survey, advancement of soil borings at the Site, and collection of soil samples for chemical and physical analysis.

Section 3.2 presents the objectives of the Phase I geological investigation, Section 3.3 describes the methods and analyses used, and Section 3.4 discusses the results obtained. Section 3.5 presents a preliminary geological model of the Site and identifies data gaps determined during the Phase I investigation. A summary is included in Section 3.6.

3.2 OBJECTIVES

The overall goal of the Phase I preliminary geological investigation was to obtain regional and site-specific geological data in order to develop a preliminary conceptual geologic model of the Site. This model provides a framework for interpreting the results from the Phase I hydrogeological and hydrological investigations (Discussed in Sections 4 and 5).

Objectives of the Phase I geological investigation that were outlined in the Consent Decree were to:

- define regional and site specific stratigraphy including soil and unconsolidated sediment cover, bedrock, strike and dip, and formation origins;
- define regional and local structural features including folding, faulting, tilting, jointing, etc;
- determine the depositional history of unconsolidated and consolidated units;
- classify each of the geologic units underlying the Site;
- determine the lithology, grain size distribution, texture and uniformity of specific geologic units;
- determine the properties of surface and subsurface soil that may cause or influence the migration, transformation, or attenuation of contaminants including the following for each stratigraphic unit identified: Soil Conservation Service (SCS) class, surface soil distribution, soil profile, hydraulic conductivity (saturated and unsaturated), bulk density, particle size distribution, soil pH, infiltration rate, storage capacity and flow rate.

The results from the geological investigation were used to develop a preliminary conceptual geological model of the Site.

3.3 METHODS AND ANALYSES

This Section describes the methods and analyses used in the literature survey and the on-site geological investigation, which included advancement of soil borings and collection of soil samples for classification and grain-size analysis.

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3.3.1 Literature Survey

The regional geology for Site and the area surrounding the Site was researched through review of the following published information and other literature sources:

- topographic, surficial and bedrock mapping prepared by the USGS;
- soil mapping prepared by the USDA Soil Conservation Service;
- a report on regional soils prepared by the Massachusetts Agricultural Experiment Station;
- a regional environmental impact study conducted by the Army Corps of Engineers;
- geophysical studies conducted by Weston Geophysical, Inc.
- review of boring logs from monitoring wells and borings completed prior to Phase I;

3.3.2 On-site Geological Study

The on-site geological study involved:

- advancement of soil borings at the Site;
- collection of soil samples for analysis of physical and chemical parameters;

The methods and analyses used for these activities are described herein. A more detailed discussion of field methods may be found in Section 2 and in the Phase I RFI proposal dated June, 1993.

Advancement of Soil Borings

Soil borings were advanced during the Phase I geological investigation at 27 locations on the Site and in surrounding areas. This work included borings for the installation of 14 new on-site wells and three (3) new off-site wells, and ten (10) boreholes that were not completed as monitoring wells.

Drilling Methods

Soil borings for this Phase I investigation were completed between September 24, and November 11, 1993. All drilling was performed by Seaboard Environmental Drilling Service of Springfield, Massachusetts. Drilling activities were supervised by Tighe & Bond personnel to ensure that protocols outlined in the RFI Proposal were followed. TRC Environmental (TRC), an EPA subcontractor, was also present during most of the Site activities.

Borings were advanced with hollow-stem auger drilling equipment, using 4¼-inch ID, 7⅝-inch OD augers with the exception of borehole BH-8, which was advanced using a post-hole digger. Drilling procedures are detailed in the Phase I RFI Proposal and summarized in Section 2.

Sampling Methods

During the advancement of the boreholes, split-spoon soil samples were collected in two-foot (2') increments, at five-foot (5') intervals (or as deemed appropriate given soil conditions), using a 3-inch ID (3") stainless steel, split-spoon sampler and a 140-pound hammer. Density blow counts were recorded on the boring logs for every six inches (6") of split spoon advancement. Soil sampling equipment was decontaminated between sampling events according to procedures described

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in Appendix F. All samples were classified in the field (as described below) and subjected to headspace analysis in the field.

As noted, the sample collected at BH-8 was not collected with a spilt-spoon sampler. Sampling at this location included only a shallow (1-2 feet) sample for the purpose of characterizing background conditions. The boring was advanced manually using a decontaminated post hole digger and the sample was collected using a previously decontaminated stainless steel laboratory spoon.

Classification of Soil Samples

The lithology of each borehole was recorded on drilling logs by both Tighe & Bond and the drilling contractor. Each sample collected was classified in the field using the Burmeister method. The descriptive classification of each sample is indicated on the drilling log for each boring. Similar samples were then grouped together into generalized stratigraphic units.

Review of Boring Logs

Information gathered by previous on-site geological investigations was also included in this Phase I investigation. This was accomplished by review of drilling logs from monitoring wells and borings installed on the Site between 1983 and 1986. The review included the logs for the following previously installed wells: MW-1, 2, 3, 4, 5, 6, 7A, 7B, 8A, 8B, 9A, 9B, 9C, 10A, 10B, 11. Logs from geotechnical borings advanced prior to construction of the Columbia warehouse addition in 1969 were also reviewed. One of those logs, for structural boring T3, was used to develop a geologic cross-section. A copy of this boring log is included in Appendix E.

Physical Analysis of Soil Samples

Split-spoon soil samples from each major stratigraphic unit identified during the Phase I investigation were submitted for laboratory grain-size analysis. A total of 17 samples were analyzed for grain-size distribution. Since the stratigraphic units defined exhibit varying degrees of sorting, the task of choosing representative samples proved to be difficult. Furthermore, due to the volume of soil required for the chemical analyses performed for release characterization (See Section 7) a limited volume of soil was available from split-spoon samples for grain-size analysis from some stratigraphic units. This is discussed further in Section 3.5.2.

Chemical Analysis of Soil Samples

Soil samples collected from the Site were subjected to chemical analysis for total organic carbon (TOC), soil moisture content and pH in order to further define on-site soil characteristics. Section 3.4.3 of this report describes the physical and chemical characteristics of soils on and around the Site. Additional chemical analyses performed on soil samples are discussed in the sections describing the release characterization in each area of the Site.

3.4 RESULTS OBTAINED

This Section describes the results of the geological investigation. The results are first discussed for the regional and local area (within 2 miles of the Site) and then discussed for the Site.

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3.4.1 Regional and Local Geology

The Site is located on the flood plain of the Little River, in the Westfield River Basin of Southwestern Massachusetts. According to USGS topographic mapping (Figure 3-1), the study Site is situated at an elevation of approximately 140 feet above mean sea level and exhibits minimal topographic relief of ten (10) feet across the Site. The Little River, which flows in a generally easterly direction, meanders within 0.5 miles of the Site to the west, south, and east of the facility at an elevation of approximately 130 feet above mean sea level. The confluence of the Westfield and Little Rivers lies approximately 2600 feet to the northeast of the property.

Agricultural lands lie between the Site and the Little River to the south and east, and industrial properties are present to the west. The center of the City of Westfield is located to the north of the Site in a relatively flat, urban area. The topographic surface gradually slopes across the agricultural land, from the Site to the Little River. Figure 3-1, Topographic Map, taken from USGS mapping of the West Springfield and Southwick quadrangles, shows the location of the study Site relative to these features.

Surficial Geology

The surficial geology of the area was mapped for the West Springfield quadrangle in 1971 by Colton and Hartshorn (GQ-892), and for the Southwick quadrangle by Schnabel (GQ-891) that same year (Figure 3-2). Surficial deposits underlying the Site consist of alluvium deposited in the flood plains of the Westfield and Little Rivers, comprised of varying proportions of clay, silt, sand and gravel. Cross-sections of surficial deposits on those maps have been reproduced as Figure 3-3, Regional Surficial Cross-Sections.

According to the geologic map of the West Springfield quadrangle, this alluvial deposit is generally less than 20 feet thick, and is present everywhere within the confines of the Little River Bend, and beyond to the north and east. Eolian sand and silt deposits reportedly cover the alluvium in most areas in thicknesses of less than six (6') feet.

Stratified drift underlies the alluvium in many areas of the West Springfield quadrangle. Based on the type and thickness of unconsolidated materials encountered during drilling, this drift is believed to underlie the study Site. The stratified drift is also composed of clay, silt, sand and gravel, and according to the surficial geologic map, can be very difficult to distinguish from the alluvial deposits above. The drift is of glacial origin, deposited during the retreat of the glaciers from this area.

The Army Corp of Engineers conducted an Environmental Impact Study of the area in 1978 entitled "Draft EIS, Westfield River Local Protection Project". As part of that study, soil borings were drilled along the Little River to the southeast of the Site, and also further to the northeast, between the Little and Westfield Rivers. The report concluded that overburden thicknesses in this area generally range from 10 to 60 feet. Overburden deposits on the study Site were found to be as much as 132 feet thick in borings advanced during this investigation. Site stratigraphy as characterized from borings advanced at the Site are discussed in Section 3.4.2, Site-Specific Geology.

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Bedrock Geology

Bedrock geology for the West Springfield quadrangle was mapped in 1966 by Colton and Hartshorn (GQ-537), and for the Southwick quadrangle in 1974 by Schnabel (GQ-1170). Both references were used to create Figure 3-4, Bedrock Geologic Map. According to those sources, bedrock underlying the study area consists of New Haven Arkose of Upper Triassic age, which is primarily a coarse-grained, reddish-brown arkosic siltstone and conglomerate formation, with a minimum thickness of 5,000 feet.

The New Haven formation dips at an angle of approximately 20° to the east in the vicinity of the Site. This is illustrated in Figure 3-5, Bedrock Geologic Cross-Section. The location of cross-section A-A' is indicated on Figure 3-4. Three (3) normal faults are illustrated on the eastern end of cross-section A-A in the vicinity of East Mountain, on the opposite side of the Westfield River from the Site. There are no mapped outcrops of this formation in the vicinity of the Site, therefore, strike is not indicated on the map and was not determined during this investigation.

East Mountain and Provin Mountain are located approximately 2 miles to the east of the Site. These mountains trend NNE/SSW with a maximum elevation of 640 feet, and are separated by the Westfield River as it flows through a gap between the mountains. The Holyoke Basalt is exposed on these mountains in frequent outcrops along their extent. These mountains are the highest topographic features in the vicinity of the Site.

In 1967, Weston Geophysical published a "Compilation of Geophysical Studies Conducted by Weston Geophysical Engineers, Inc. Throughout Massachusetts", in which depths to bedrock for selected study areas were described. The closest of these selected sections mapped during their investigation is approximately 2.5 miles to the north of the study Site, near Barnes Municipal Airport in Westfield. According to the published data, depths to bedrock in this area are between 115 and 215 feet. Other sections within the West Springfield and Southwick quadrangles were either on the other side of Provin Mountain or at greater distances from the study area. In either case, the sections were not considered to be of any relevance to the Site.

3.4.2 Site-Specific Geology

The stratigraphy of the Site was determined by review of boring logs prepared during the Phase I Investigation and other previous drilling activities at this Site.

Overburden Thickness

The thickness of unconsolidated materials over portions of the Site is believed to be between 97 and 132 feet, based on the depths at which auger refusal was encountered during installation of two (2) wells on the Site. Hollow-stem auger refusal was encountered in the borings for MW-1I and MW-9D at depths of 97 feet and 132 feet, respectively. A third boring, drilled for the installation of monitoring well MW-3I, encountered "hard pan" at depths of 128 to 129 feet. The boring was terminated at that depth. The "hard pan" may represent a basal till, and may have been close to the bedrock surface. The log for MW-1I indicates nine (9) feet of "hard pan" was penetrated before refusal was encountered. These depths roughly correspond to data obtained during the Weston Geophysical study published in 1967 (Section 3.4.1). During the Weston Geophysical investigation,

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depths to bedrock in a selected area approximately 2.5 miles to the north of the Site ranged from 115 to 215 feet.

Identification of Stratigraphic Units

Bedrock was tentatively encountered by auger refusal in borings MW-1I and MW-9D advanced on the Site, as described above. Bedrock cores were not advanced as part of this Phase I geological investigation.

Six (6) major stratigraphic units were identified beneath the Site based upon drilling logs and field classification of split-spoon soil samples. These units are:

- fill;
- eolian sands;
- alluvium/stratified drift;
- glaciolacustrine deposits;
- till;
- bedrock.

The stratigraphic position of and identifying features of each of these units is described below:

Fill - Isolated units of fill occur in areas near buildings and other man-made features throughout the site. The fill is generally poorly sorted, and consists of dark brown fine sand or fine to medium sand. This unit is sometime identified by the presence of pieces of brick or other debris, including coal ash, nails, concrete, metal scraps and other waste materials. Where present, the fill unit generally ranges from two (2) feet to nine (9) feet in thickness.

Eolian Sand - This unit was encountered near the surface in areas of the site where surficial deposits have not been re-worked by human activities. It is well sorted, and is typically logged as tan fine sand. This unit extends to depths of up to seven (7) feet, but is more typically encountered in thicknesses ranging from three (3) feet to five (5) feet.

Alluvium/Stratified Drift - These deposits are widespread throughout the site, and vary significantly in grain size. They are typically logged as fine to coarse sands, and are most often encountered beneath the fill or the eolian sand deposits. Separate units identified as coarse alluvium were encountered in various portions of the Site. Coarse alluvium includes higher proportions of gravel or coarse sand than other materials in these units. These units may represent relatively recent (in geologic time) fluvial deposits of meanders of the Little River or tributaries previously crossing the Site. They do not appear to be continuous. The units include both recent (alluvial) and glacial (stratified drift) deposits of Wisconsin age. The alluvium/stratified drift unit ranges from approximately 15 feet to 30 feet thick.

Glaciolacustrine Deposits - Fine-grained glacial lake bed deposits were identified in most of the deeper borings on the Site. This unit is identified by the presence of high proportions of silt or by the presence of varved clay. Although these deposits are relatively well sorted, lenses of medium to coarse sand were sometimes encountered in the borings. The coarse sand layers represent periodic increases in the energy level of the depositional environment. One of these medium to

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coarse sand layers was encountered apparently below the finer grained lake bed deposits in MW-9D (from 125' to 132'). It is unclear whether this unit is part of the glaciolacustrine sediments or if it is a separate unit. The thickness of the glaciolacustrine deposits is not as well documented as the thicknesses of shallower units at the Site. Based on boring logs for which refusal or till were encountered at depths ranging from 97 feet to 132 feet (MW-1I, MW-3I, and MW-9D), glaciolacustrine sediment thicknesses may range from 70 to 100 feet thick.

Till - This unit is tentatively identified based upon the notations of the presence of hard pan in drillers logs for MW-1I and MW-3I. Blow counts were not recorded. Till was not recorded in any split-spoon samples collected during the boring program for the Phase I Investigation. The thickness of the till layer is unknown.

Bedrock - Bedrock is tentatively identified by the notations of refusal in driller's logs prepared for MW-9D and MW-1I. The bedrock unit was not confirmed by coring. Bedrock was not identified in any of the borings advanced during the Phase I Investigation of this RFI.

3.4.3 Chemical and Physical Properties of Soils

The descriptions of the chemical and physical properties of soils at the Site in the following paragraphs are derived from the literature and from laboratory analysis of soil samples collected during the on-site geological investigation.

Soils underlying the Site were mapped by the USDA Soil Conservation Service as Urban land Hadley Winooski association (UH), and Hadley very fine sandy loam (HbA). These soils are described in general terms as deep soils that have a medium textured, friable surface layer and subsoil. They are nearly level to gently sloping flood plain soils formed in alluvium. A diagram illustrating the general topographic setting of these soils is provided as Figure 3-6, Soils, Relief and Underlying Materials.

The majority of the Site is classified as UH, with only the pond along the eastern border and a small area to the west of the buildings being classified as HbA. The agricultural lands to the south of the Site are also classified as HbA, with portions classified as HbB. HbB also signifies the Hadley very fine sandy loam, however HbB soils generally exhibit steeper slopes than HbA soils. Figure 3-7, USDA Soil Classification Map, is taken from the USDA Soil Survey of Hampden County, Massachusetts, Central Part, and depicts the location and classification of the study Site soils and surrounding area.

Soils classified as UH include urban land and shallow sloping Hadley and Winooski soils found on flood plains. Approximately 55 percent of map unit UH consists of urban land, 30 percent consists of Hadley and Winooski soils, and included soil units comprise the remaining 15 percent. Urban land consists of soils that have been altered or reworked by urban construction and defy further identification. The Hadley soils are deep and well drained, whereas the Winooski soils are deep and only moderately well drained. Slopes typically range from 0 to 8 percent in UH soils. Soil permeabilities are described as moderate to moderately rapid and the available water capacity is high. The parent material for each of these soils is recent alluvium from surrounding rivers (Veneman, 1985).

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HbA soils are very fine sandy loams with slopes ranging from 0 to 3 percent. These soils, which are found on the flood plains of large rivers, are deep and very well drained. Permeability is moderate or moderately rapid, and the available water capacity is high. These soils are ideal for farming and are used as such in the vicinity of the study Site. HbB soils are very similar to HbA soils, except that they exhibit slightly steeper slopes from 3 to 6 percent.

Chemical Properties

General chemical characteristics of the Hadley and Winooski soils have been examined by the USDA Soil Conservation Service and the Massachusetts Agricultural Experiment Station. Although the soils analyzed in each unit were not collected from the vicinity of the Site, the values presented are broadly applicable to each soil classification. These data are presented for the Hadley and Winooski soil units only and may not be representative of the chemical properties of the urban land unit also present at the Site. The chemical characteristics of the Hadley and Winooski soils, including pH, TOC, cation exchange capacity, soluble salt content, and base saturation, are shown in Table 3-1.

Table 3-1
SOIL CHEMICAL CHARACTERISTICS - HADLEY AND WINOOSKI SOILS
Columbia Manufacturing Company, Westfield, MA

Chemical Characteristics	Soil Classification				
	Hadley Soils, HbA & HbB			Winooski Soils	
	0-12"	12-55"	55-66"	0-12"	12-66"
Soil Reaction (pH)[1]	4.5-7.3	4.5-7.8	5.6-7.8	5.1-6.5	5.1-7.0
Organic Carbon Content[2]	1.15%	0.24-0.94	0.24	0.51-1.41%	0.16-0.51
Cation Exchange Capacity (CEC)[2] in meq/100g	10.1	5.2-9.8	5.2	8.6-14.0	2.6-8.6
Soluble Salts[2] (meq/100g)	0.35	0.24-0.42	0.24	0.05-0.28	0.02-0.06
Base Saturation[2]	28%	20-35%	35%	27-53%	27-31%

1 USDA Soil Conservation Service, 1978.
2 Veneman, 1985.

Measured chemical values gathered during Phase I investigative activities for five (5) the six (6) overburden units identified during Phase I activities at the study Site are summarized in Table 3-2 below. Soil samples were analyzed for total organic carbon and pH. Analysis for soil moisture content was also performed and is discussed herein. In order to account for localized variations in soil properties, ranges for each chemical characteristic have been presented. Stratigraphic units at the Site which exist entirely below the water table are assumed to be saturated.

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Table 3-2
CHEMICAL CHARACTERISTICS OF SITE STRATIGRAPHIC UNITS - MEASURED VALUES[1]
Columbia Manufacturing Company, Westfield, MA

Stratigraphic Unit	Chemical Characteristic		
	Soil Moisture Content (%)	Total Organic Carbon (mg/kg)	pH (s.u.)
Fill	15.4	15,462	6.99
Eolian Sands	16.1	4,300	6.80
Alluvium	13.4	12,005	6.13
Glaciolacustrine Deposits	23.2	20,200	6.00
Till	NA	NA	NA

(1) Values taken from averages of data for samples considered representative for each unit.
NA Not Analyzed

Concentration ranges for five (5) naturally occurring elements in soils in the eastern United States were analyzed by the Massachusetts Agricultural Experiment Station for both the Hadley and Winooski soils (Veneman, 1985). These data are summarized in Table 3-3. Additional chemical data for soil samples collected at the Site are discussed in sections describing release characterization in various parts of the Site.

Table 3-3
PUBLISHED METALS CONCENTRATIONS IN SOILS
Columbia Manufacturing Company, Westfield, MA

Analyte	Hadley Soils[1]	Winooski Soils[1]
	Range (ppm)	
Chromium	78-98	80-100
Copper	26-43	24-31
Lead	13-35	13-32
Nickel	28-35	29-30
Zinc	76-90	74-105

1 USDA Soil Conservation Service, 1978.

Close File

Physical Properties

The physical characteristics of each of the soil units described above, including permeability (infiltration rate), available water capacity (storage capacity), erosion factors, and bulk density, have been investigated by the USDA and the Massachusetts Agricultural Experiment Station. Table 3-4 summarizes published values for those physical parameters included in the USDA survey of area soils and presents each characteristic according to soil depth. Urban land is not listed as a separate unit, as it has no specific physical description and is highly variable. Instead, the associated soil types are summarized. In the case of the study Site, this includes the Hadley and Winooski soils.

Permeability is an estimate of the rate at which water moves vertically through the soils (measured in inches of water per hour), assuming saturated soil conditions. Available water capacity is the ability of the soils to hold water (measured in inches of water per inch of soil). Erosion factors are a prediction of both erodability and tolerance to erosion by various mechanisms. Erosion factor K measures soil susceptibility to erosion by water, and T is a measure of soil erosion by precipitation or wind. Bulk density is the mass of dry soil per unit volume, measured as grams per cubic centimeter (g/cc).

Table 3-4
SOIL PHYSICAL CHARACTERISTICS - HADLEY AND WINOOSKI SOILS
Columbia Manufacturing Company, Westfield, MA

Physical Properties	Soil Classification				
	Hadley Soils, HbA & HbB			Winooski Soils	
	0-12"	12-55"	55-66"	0-12"	12-66"
Permeability[1] (inches/hour)	0.6-2.0	0.6-2.0	0.6-6.0	0.6-2.0	0.6-2.0
Available Water Capacity[1] (inches/inch)	0.15-0.25	0.17-0.26	0.10-0.20	0.17-0.25	0.13-0.26
Erosion Factors[1] (K,T)	0.49	0.49	0.49	---	---
Bulk Density[2] (g/cc)	1.43	1.40-1.43	1.43	1.29	1.20-1.31

1 USDA Soil Conservation Service, 1978.
2 Veneman, 1985.
--- No data available

Sieve analyses were performed on 17 soil samples collected during Phase I drilling. These soil were selected to represent three (3) of the five (5) major overburden stratigraphic units identified during this phase of investigation, as described above. Table 3-5 is a summary of the sieve analysis data received for the Site samples. Laboratory reports and grain-size distribution curves are included in Appendix G. The stratigraphic unit that the sample was chosen to represent is listed at the bottom of the table. These data are used in the development of a preliminary conceptual geological model in Section 3.5.1. The need for additional sieve analyses is identified in Section 3.5.2.

Close File

Table 3-5
SUMMARY OF SIEVE ANALYSIS DATA
Columbia Manufacturing-Company, Westfield, MA

Sieve Number (U.S. Std.)	Opening size (inches)	Grain Size Range	Cumulative Percent Retained								
			BH-5 1-2′ (S-2)	MW-6 10-12′	MW-6 20-22′	MW-9D 15-17′	MW-9D 40-42′	MW-12A 5-7′ (S-2)	MW-12B 30-32′	MW-14 5-7′	MW-14 10-12′
3/8″	0.375	Fine Gravel		29.3		43.2					32.6
#5	0.1570			47.1		56.1		15.4		16.0	45.9
#6	0.132	Very Fine Gravel		48.8		57.9		16.3		18.7	49.0
#8	0.0931			51.1		61.7		17.8		24.3	54.3
#10	0.0787	Very Coarse Sand		52.3		64.6		18.9		26.5	57.1
#16	0.0469			57.0	41.1	70.5		21.2		32.6	62.7
#20	0.0331	Coarse Sand		63.3	48.8	75.4		24.2		38.4	68.0
#30	0.0232	Medium Sand		72.1	54.4	79.2		29.0		45.5	74.2
#50	0.0117		5.3	84.6	62.9	85.6	2.1	43.0		60.3	84.7
#60	0.0098	Fine Sand	10.1	86.6	64.3	87.6	2.3	46.8	10.6	63.5	86.8
#70	0.0083		17.0				2.9		14.1		
#100	0.0059		39.6	90.4	68.4	92.0	5.8	58.2	20.7	73.4	90.4
#200	0.0029	Clay & Silt	88.9		72.9		49.0		28.1		
#325	0.0017				88.1				71.3		
Stratigraphic Unit			Fill	Coarse Alluvium	Glacio-lacustrine	Coarse Alluvium	Glacio-lacustrine	Fill	Glacio-lacustrine	Fill	Coarse Alluvium

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Table 3-5 cont.
SUMMARY OF SIEVE ANALYSIS DATA
Columbia Manufacturing Company, Westfield, MA

Sieve Number (U.S. Std.)	Opening size (inches)	Grain Size Range	Cumulative Percent Retained							
			MW-14 25-27′	MW-15 5-7′ (S-2)	MW-17 0-2′	MW-17 12-14′	MW-21 0-2′	MW-22 5-7′	MW-22 10-12′	MW-22 20-22′
3/8″	0.375	Fine Gravel				31.7			28.7	
#5	0.1570					47.3			36.7	
#6	0.132	Very Fine Gravel				49.5			38.1	
#8	0.0931					52.5			40.4	
#10	0.0787	Very Coarse Sand				54.8			42.8	
#16	0.0469					59.4			49.2	15.8
#20	0.0331	Coarse Sand			9.2	63.8	60.6		56.5	19.4
#30	0.0232	Medium Sand			10.7	69.5	63.2		65.1	24.0
#50	0.0117			0.1	17.7	79.4	72.1	22.1	77.5	33.8
#60	0.0098	Fine Sand	26.2	0.5	21.3	82.0	74.4	26.9	80.2	35.1
#70	0.0083		26.9	1.0				29.7		
#100	0.0059		31.0	7.2	43.1	88.0	80.5	34.8	86.1	37.4
#200	0.0029	Clay & Silt	34.4	61.6	85.3		89.0	59.8		44.6
#325	0.0017		54.8							
Stratigraphic Unit			Glacio-lacustrine	Alluvium	Fill	Coarse Alluvium	Alluvium	Alluvium	Coarse Alluvium	Alluvium

Close File

Hydraulic Conductivity

Soil grain-size distribution may be used for estimating saturated hydraulic conductivities of soils. Hydraulic conductivities of saturated materials may be determined by slug and bail tests, as described in Section 4. Hydraulic conductivities of unsaturated soils cannot be evaluated in this manner, and grain-size data provide a useful means of estimating this parameter. Unsaturated hydraulic conductivity is transient, as it is a function of the hydraulic pressure head (which varies with time since wetting and depth in the soil column) in addition to soil grain size. The greatest hydraulic conductivities are found in soils under saturated condition, and values decrease with decreasing degree of saturation (Freeze & Cherry, 1979). Therefore, unsaturated hydraulic conductivity values were not estimated. Further references to hydraulic conductivity in this report refer to saturated hydraulic conductivities, unless otherwise noted.

Hydraulic conductivity can be determined for uniformly graded soils (where $d_{60}/d_{10} \leq 5$) from grain-size distribution by using the Hazen Approximation. Rough estimates of hydraulic conductivity can also be generated by using this method for soils exhibiting characteristics in the fine sand to gravel range (Freeze and Cherry, 1979).

Due to the poor degree of sorting in many zones within each formation, and the presence of varying percentages of silt and clay in most units, the application of the Hazen Approximation to soil samples from this Site was considered inappropriate. An alternative approach to estimating hydraulic conductivity is the Kozeny-Carmen equation. However, this equation requires porosity data, which were not acquired as part of the Phase I investigation at the Site. The need for additional data for determining hydraulic conductivities of soils is identified in Section 3.5.2.

In-situ measurements of hydraulic conductivity collected in the field by conducting slug tests in wells throughout the Site will be used in subsequent Sections of this Report as the primary source of data for evaluating the hydraulic properties of the various stratigraphic units beneath the Site. Those data are described in Section 4.3.5.

The grain-size distribution data will be useful in future investigative phases for assessing the sorptive capacity of soils impacted by contaminants, and also in determining potential migration patterns of contaminants at the Site.

3.4.4 Determination of Background Soil Characteristics

The Phase I RFI Proposal included collection of one (1) background soil sample for chemical analysis at BH-8. Subsequently, additional potential background samples were identified by EPA, including samples collected from the borings advanced for upgradient well MW-25D and well MW-23S, advanced in the tobacco field to the west of the Site. The designated background sample locations are described below:

- **BH-8** - This boring was identified in the Phase I RFI proposal as a background sampling location for soils. The sample was collected from 0-2'.
- **MW-23** - This boring was advanced approximately 300 feet west of the western property boundary. Soil samples were collected for laboratory analysis at the 0-2' and the 5-7' depth increments.

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- **MW-25** - This boring was advanced for installation of a monitoring well in a location selected to provide background data for groundwater quality at the site. The boring was advanced in the northwestern corner of the site. Soil samples were collected for laboratory analysis at the 0-2', 5-7' and 35-37' depth increments.

Although these locations were initially considered to be representative of background conditions as indicated below, observations and analytical data indicate that the locations of BH-8 and MW-23S are not suitable to represent background conditions for all parameters analyzed during Phase I of the RFI.

- **BH-8** - This sample was collected in a location where decorative plantings are maintained, therefore, analysis was not performed for pesticides or herbicides. Therefore, background data for those analytes are not provided by this sample. Concentrations of various metals may be impacted by the use of fertilizers. In addition, this location is near a roadway, presenting another potential source of metals from vehicle emissions.
- **MW-23S** - This boring was advanced in a tobacco field adjacent to the Site. The site is currently used for cultivation of tobacco, and has historically been used for a variety of agricultural activities. These activities may contribute a variety of contaminants to the soil, such as metals, pesticides and herbicides.

Background values of some potential site-related contaminants such as VOCs and cyanide may be expected to be nondetectable. Various compounds analyzed for in samples from the Site are often found at detectable concentrations in relatively unaltered areas. Metals found in site-related wastes as well as other metals occur in varying concentrations as natural constituents of soils, and various organic compounds that are widely used or highly recalcitrant may be present at detectable levels in background soils.

Dioxins and certain semi-volatiles in the polycyclic aromatic hydrocarbon (PAH) family are widespread in the environment as a result of the combustion of fossil fuels. Various PAHs are also present in asphalt, oils, and preservatives used for building materials (such as creosote). When released to the environment, many of these compounds are persistent in the environment. Therefore, the detection of dioxins and semivolatiles in media from the Site does not necessarily indicate that these constituents were generated and released from prior or current Site activities. Additionally, agricultural activities in the vicinity of the Site may have impacted soil chemistry.

Since metals are natural constituents of soils, it is critical to determine typical levels of metals in soils that are not impacted by Site activities. Based upon historical data regarding materials used and disposed of at the site, five (5) metals may be identified as potential Site related contaminants: cadmium, chromium, copper, nickel and zinc. In discussions that follow regarding releases from the AOCs, these metals are considered to be attributable to the Site. For other metals, PAHs, dioxins, pesticides and herbicides, it is unclear (because of the lack of background samples) which of these constituents are related to prior or current Site activities.

Further evaluation of background soil chemistry will be completed during the Phase II RFI. Plans for this evaluation are presented in Sections 20 and 21.

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3.5 GENERAL DISCUSSION OF GEOLOGY

This Section presents a discussion of the results obtained from the Phase I geological investigation of the Site. A preliminary conceptual geological model is presented based upon these results. The data are also compared to results obtained from the hydrogeological investigation.

The data generated by the geological investigation reveal that data from the Site are in general agreement with information presented in published literature. The overburden deposits consist of identifiable stratigraphic units. Fill occurs locally throughout the Site. In areas that have not been reworked by human activities, eolian sands are found. Materials deposited by moving water are found beneath all areas of the Site and consist of alluvial and glacial outwash materials which frequently occur beneath fill or eolian sand deposits. Occasionally, alluvial/glacial outwash deposits occur at the ground surface. This deposit is underlain by more fine-grained glaciolacustrine deposits consisting of fine sands, silts and varved clays. Till may occur above the bedrock surface, as documented in previous studies, but the unit was not confirmed by the Phase I investigation.

3.5.1 Preliminary Conceptual Geological Model

This section presents a preliminary conceptual geological model of the Site and adjacent areas based on the results of the Phase I geological investigation. The conceptual model is presented using geologic cross-sections based upon results of the on-site geological investigation. This model is then compared to the results of the literature survey.

Geologic cross-sections were developed on six (6) section lines in a variety of orientations. The cross-sections are presented on two (2) plates in Appendix H. Cross-section locations were chosen based on availability of adequate stratigraphic information for accurate cross-section development and the relative interest of the section in terms of proximity to AOCs. A plan view of the Site identifying the locations of the cross-sections is included on the first plate. Cross-section locations are also indicated on the plan entitled Geologic Cross-Section Locations in Appendix H. This plate is prepared at the same horizontal scale as the cross-sections. The proximity of each AOC to the cross-sections is also illustrated on that plate.

Fill was identified in many areas of the Site in close proximity to buildings and other areas altered by human activities. Locations where fill was encountered are depicted on all cross-sections except for cross-section B-B'. Fill material may be highly variable in terms of grain size and composition, and may be composed of re-worked soils from the Site.

A layer of eolian sands identified in the literature was encountered on the Site in areas that have not been reworked by human activities. Cross-section B-B' illustrates the location of a deposit of eolian sand in the southern portion of the Site. These deposits are well sorted, and had a maximum depth of seven (7) feet in borings on the Site.

Alluvium and stratified drift is found beneath the fill and eolian sand deposits, and is sometimes found at the surface. In this area of the Site, alluvium may have been deposited by flooding of the Little River as discussed in Section 5.4. This deposit generally overlies stratified drift, and often

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is not readily distinguishable from the coarser stratified drift materials. These units have been grouped together as a single unit.

Alluvium and coarser stratified drift materials are both deposited by moving water. The degree of sorting varies as water velocities vary due to changes in hydrology. In the case of stratified drift deposits, the grain size characteristics may reflect the proximity of that deposit to a stream or river delta, or shoaling of a water body.

The coarse deposits found within the alluvium/stratified drift unit may represent fluvial deposits from glacial or more modern streams. These deposits are identified on all cross-sections, however, they do not form a continuous stratigraphic unit. They are identified primarily because of the variability of grain size, hydraulic conductivity and other soil properties within the alluvium/stratified drift unit. This variability is in part a reflection of the presence of these deposits.

The alluvium/stratified drift deposits consist of multimineralic particles in the coarser grain size fractions as well as sand size particles composed primarily of quartz. The high proportion of silica in these deposits makes them less chemically reactive than soils composed predominantly of silt and clay sized particles.

Glaciolacustrine deposits were identified throughout the Site. These deposits represent a deep water, low energy depositional environment and are predominantly composed of fine sand, silt and clay carried from streams of glacial runoff. The mineralogy of these deposits includes a much smaller proportion of silica than the alluvium/stratified drift deposits due to the low stability of silica when it is reduced to silt sized particles. The layered clay minerals typically found in these deposits are more chemically reactive than silica and have significant concentrations of various metals.

Till was tentatively identified in two locations beneath the site (MW-1I, MW-3I) during previous on-site investigations. The borings were backfilled to within 40 feet of the ground surface before installation of monitoring wells in those locations. In a third location (MW-9C), refusal was reported at a depth of 132 feet without notation of any till unit. Till was not encountered during Phase I activities.

The depth of overburden deposits beneath the site correlates well with published geophysical data. Limited Site-specific information was available in the literature for determining the depth to bedrock beneath the Site. Bedrock mapping of the area indicates that the bedrock unit beneath the area is the New Haven Arkose. The type and depth of the bedrock unit was not confirmed in Phase I.

In general, the surficial materials encountered beneath the Site during the Phase I geological investigation correspond well to the materials described in published information from sources noted in Section 3.4.1. Unconsolidated materials at the study Site are comparable to the alluvium underlain by stratified drift of similar composition, as described by the USGS.

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3.5.2 Data Gaps Identified in the Phase I Geological Investigation

The Phase I geological investigation identified the data gaps discussed below. Strategies for addressing these data gaps are discussed and specific tasks for filling these data gaps are proposed for the Phase II geological investigation discussed in the Phase II Scope of Work.

Hydraulic conductivities and porosities of unsaturated units not determined. These values were not estimated due to non-uniform grain size and lack of porosity data. Samples should be collected for determination of the porosity of all unsaturated units at the Site.

Vertical hydraulic conductivities of overburden units not determined. Vertical hydraulic conductivities were not determined during the Phase I investigation. Undisturbed samples should be collected from saturated overburden units for laboratory permeability testing.

Chemical characteristics of geological units not fully characterized. Samples from all four (4) overburden units encountered during the Phase I investigation were analyzed for pH, total organic carbon (TOC) and percent moisture content. However, a minimal number of samples were collected from the eolian sand and glaciolacustrine units. Additional samples from these two (2) units should be collected during Phase II and analyzed for these parameters.

Till unit requires additional characterization. The till unit tentatively identified beneath the glaciolacustrine deposits requires further investigation to characterize the depth, continuity, chemical quality, physical properties and hydraulic conductivity of that unit.

Bedrock unit not characterized. The Phase I Scope of Work did not include advancement of bedrock cores. The depth to bedrock, degree of fracturing of the bedrock surface, and the chemical quality of the groundwater in the bedrock is unknown.

More data is needed to determine background values for soils. The Phase I sampling program did not provide adequate data to develop background values for certain metals, PAHs, dioxins, pesticides and herbicides for soils. Background values are needed for soils at various depths.

3.6 SUMMARY

This Section presented the objectives of the Phase I geological investigation, the methods and analyses used to accomplish those objectives, and the results of the literature survey and field activities. A preliminary conceptual geological model was presented, and data gaps were identified. Following is a summary of the major conclusions of the Phase I geological investigation:

- Five (5) major stratigraphic units were identified in the overburden deposits beneath the Site. These units include: fill, eolian sands, alluvium/stratified drift, glaciolacustrine deposits, and till (tentatively identified). This interpretation is in good agreement with data presented in the literature.

- The thickness of overburden deposits beneath the Site was estimated between 97 and 132 feet based upon previous boring logs. This estimate agrees with published information.

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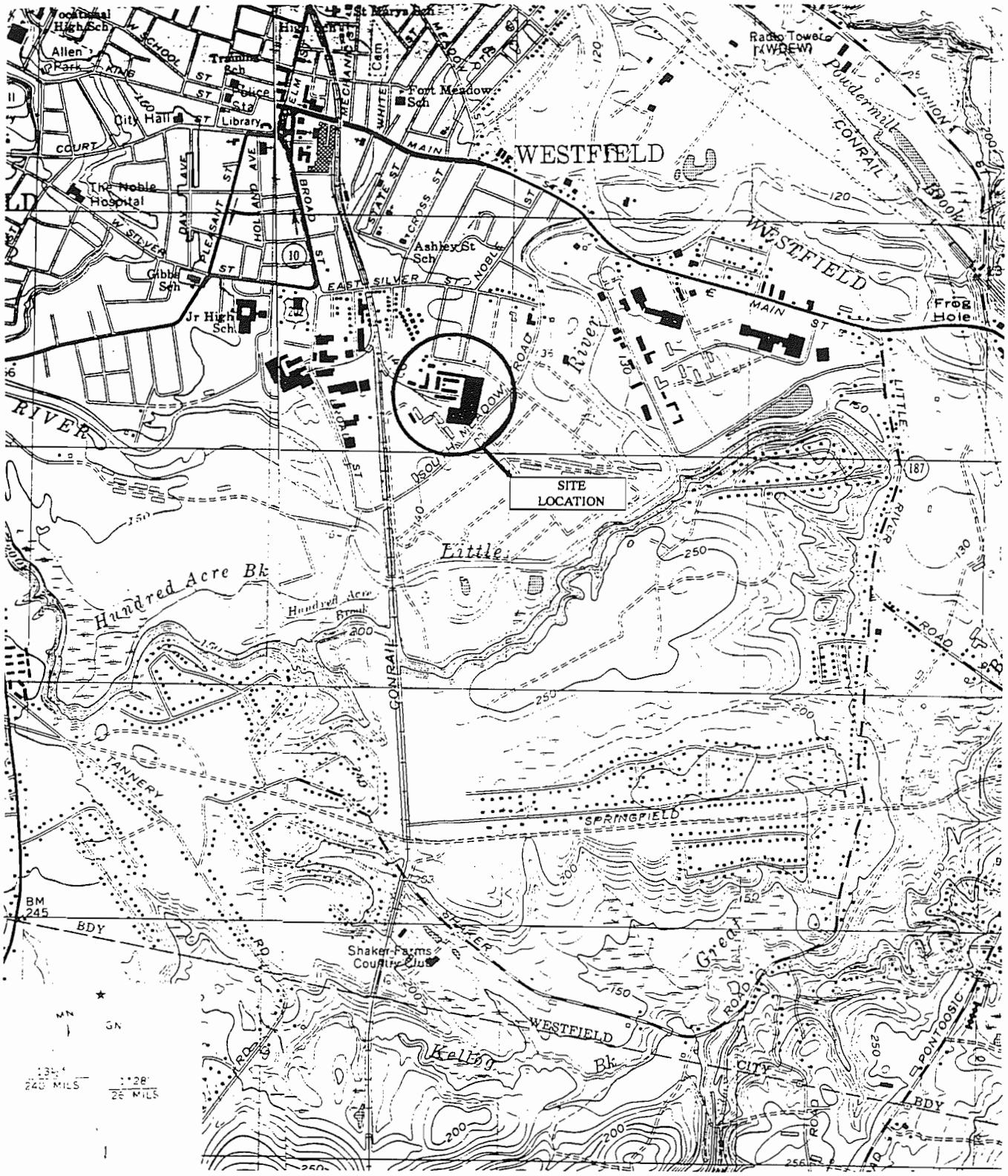
- The bedrock unit beneath the Site was determined by the literature survey to be the New Haven Arkose formation. This was not confirmed by Phase I field investigations.

- Sieve analysis data revealed variations in grain sizes that were correlated with different stratigraphic units on the Site. The differences in grain sizes correlate to differences in physical and chemical properties that may influence migration of contaminants in the subsurface.



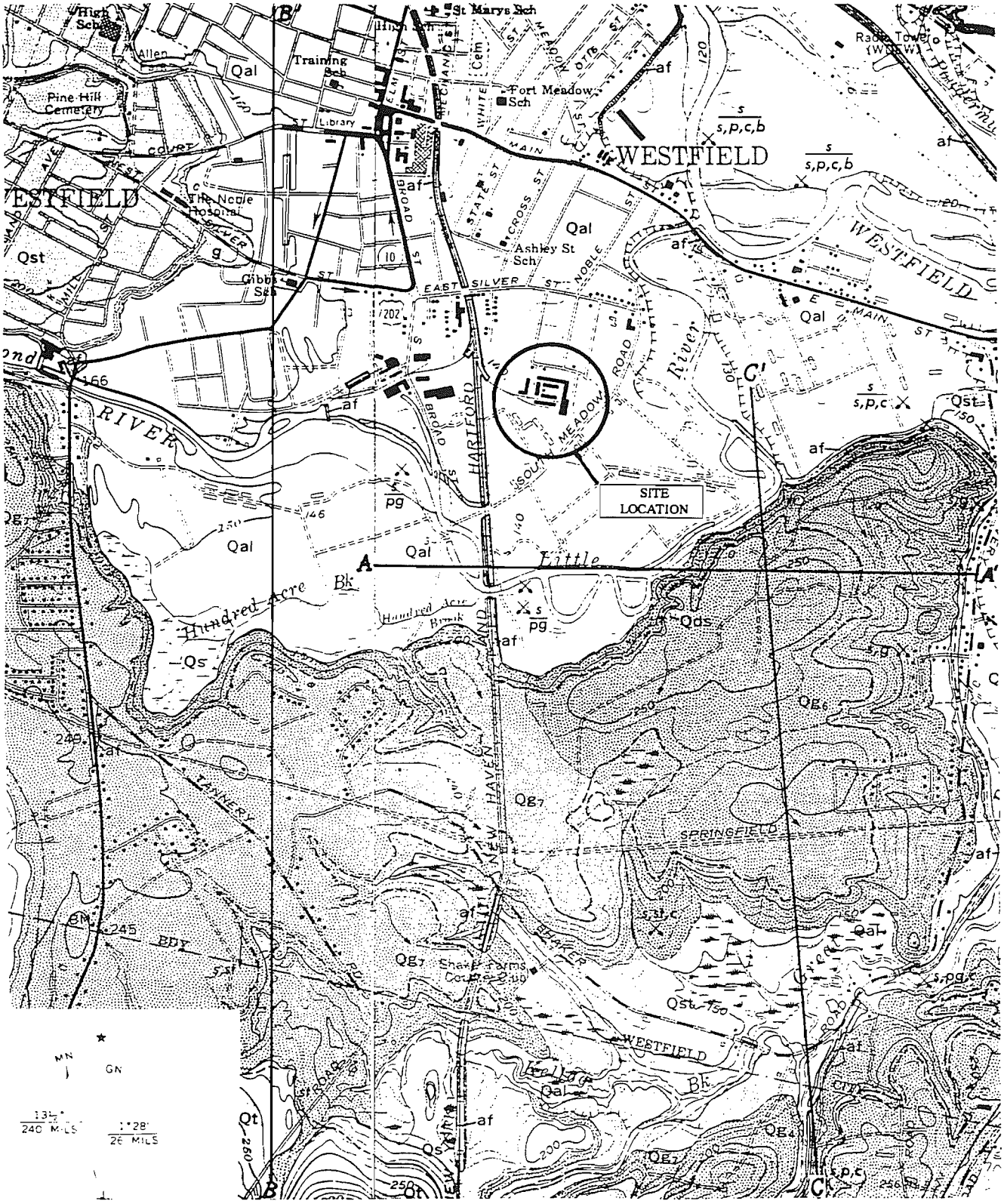
Based upon the U.S. Geological Survey Map – West Springfield, and Southwick Quadrangles, ed. 1979.

FIGURE 3–1
TOPOGRAPHIC MAP

RCRA FACILITY INVESTIGATION
COLUMBIA MANUFACTURING CO., INC.
WESTFIELD, MASSACHUSETTS

TIGHE & BOND, INC. CONSULTING ENGINEERS

SCALE: 1:24,000 DATE: JANUARY, 1994



Based upon Surficial Geology Maps – West Springfield Quadrangle, Colton and Hartshorn, 1971, and Southwick Quadrangle, Robert Schnabel, 1971.

FIGURE 3–2
SURFICIAL GEOLOGIC MAP
RCRA FACILITY INVESTIGATION
COLUMBIA MANUFACTURING CO., INC.
WESTFIELD, MASSACHUSETTS
TIGHE & BOND, INC. CONSULTING ENGINEERS
SCALE: 1:24,000 DATE: JANUARY, 1994

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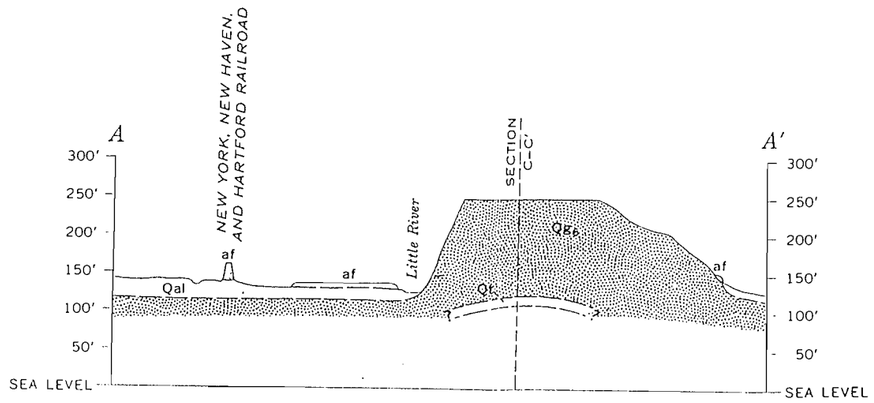

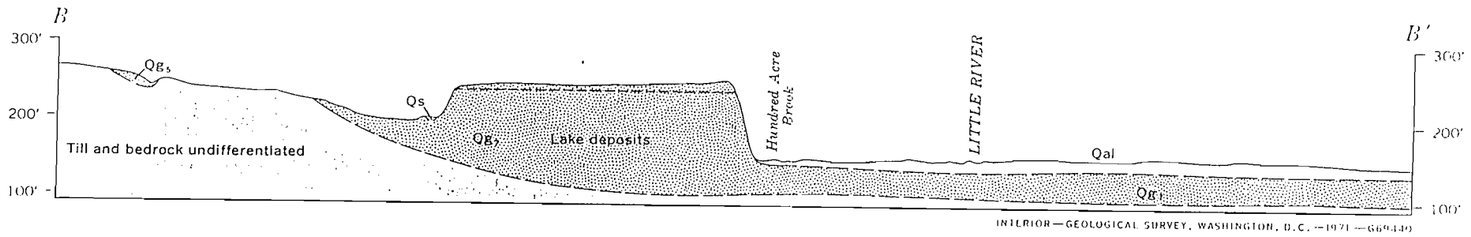

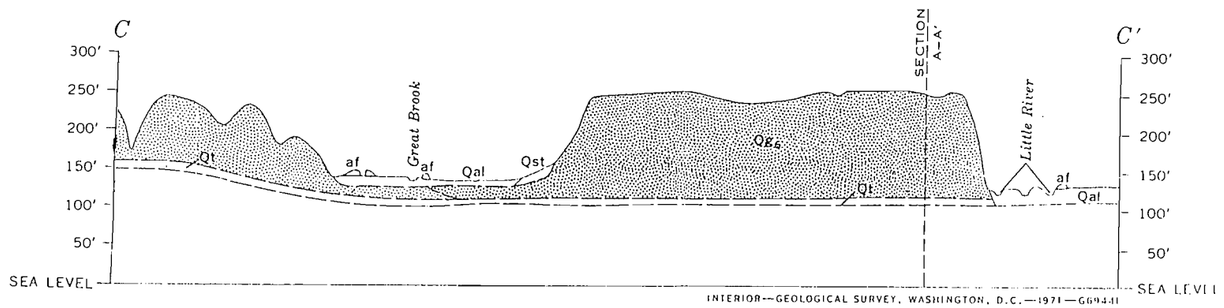

LEGEND

Qal – Alluvium
af – Artifical fill
Qt – Till
Qg5 – Stratified drift deposits
Qg6 – Stratified drift deposits
Qg7 – Stratified drift deposits
Qs – Swamp deposits
Qst – River or stream terrace deposits

SCALE 1:24 000

1 ½ 0 1 MILE

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

Based upon Surficial Geology Maps -- West Springfield Quadrangle, Colton and Hartshorn, 1971, and Southwick Quadrangle, Robert Schnabel, 1971.

FIGURE 3–3
REGIONAL SURFICIAL CROSS–SECTIONS
RCRA FACILITY INVESTIGATION
COLUMBIA MANUFACTURING CO., INC.
WESTFIELD, MASSACHUSETTS
TIGHE & BOND, INC. CONSULTING ENGINEERS
SCALE: 1:24,000 DATE: JANUARY, 1994

Close File

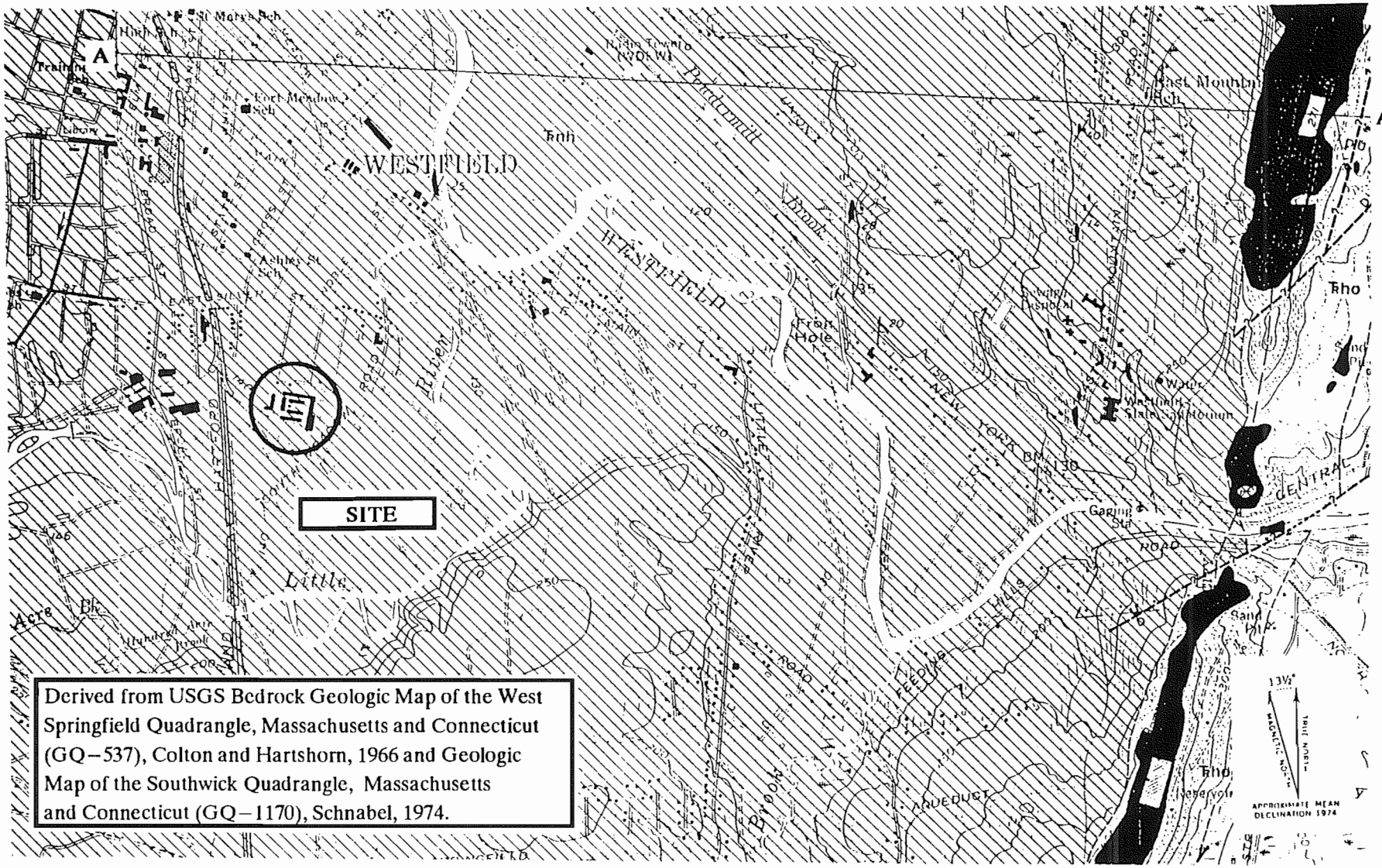

FIGURE 3–4
BEDROCK GEOLOGIC MAP
RCRA FACILITY INVESTIGATION
COLUMBIA MANUFACTURING CO., INC.
WESTFIELD, MA

TIGHE & BOND, INC. CONSULTING ENGINEERS
SCALE: 1:24000 DATE: SEP, 1994

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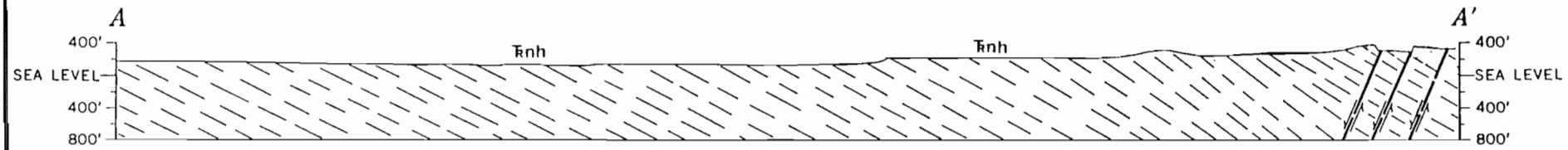
EXPLANATION

Solid red denotes areas of outcrop or areas of bedrock veneered with as much as 5 feet of surficial deposits
Small t indicates temporary exposure

New Haven Arkose

Light to dark reddish brown arkosic siltstone and arkosic conglomerate, mostly coarse-grained arkose; formation at least 5000 feet thick



Based upon the Bedrock Geology Map – West Springfield Quadrangle, Colton and Hartshorn, 1966.

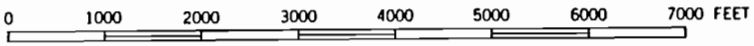
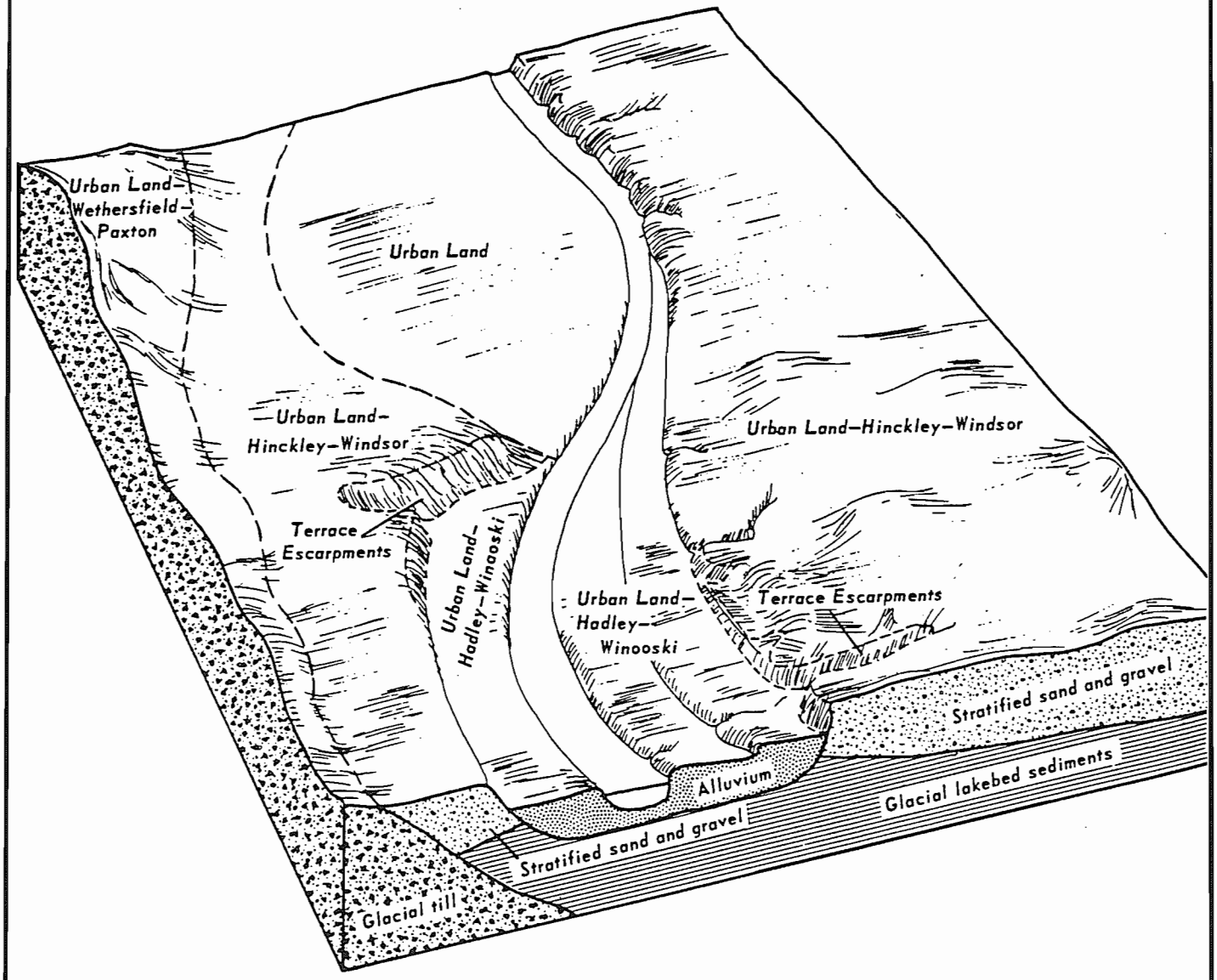


FIGURE 3–5
BEDROCK GEOLOGIC CROSS–SECTION
RCRA FACILITY INVESTIGATION
COLUMBIA MANUFACTURING CO., INC.
WESTFIELD, MASSACHUSETTS
TIGHE & BOND, INC. CONSULTING ENGINEERS
SCALE: 1:24,000 DATE: JANUARY, 1994



Typical pattern of soils, relief, and underlying material in an area of the Urban land-Hadley-Winooski unit and the Urban land-Hinckley-Windsor unit.

Based upon the U.S.D.A. "Soil Survey of Hampden County Massachusetts, Central Part", 1978

FIGURE 3–6
SOILS, RELIEF, AND UNDERLYING MATERIALS

RCRA FACILITY INVESTIGATION
COLUMBIA MANUFACTURING CO., INC.
WESTFIELD, MASSACHUSETTS

TIGHE & BOND, INC. CONSULTING ENGINEERS
SCALE: NONE DATE: JANUARY, 1994

Based upon the U.S.D.A. "Soil Survey of Hampden County Massachusetts, Central Part", 1978.

FIGURE 3–7
U.S.D.A. SOIL CLASSIFICATION MAP
RCRA FACILITY INVESTIGATION
COLUMBIA MANUFACTURING CO., INC.
WESTFIELD, MASSACHUSETTS
TIGHE & BOND, INC. CONSULTING ENGINEERS
SCALE: 1:15,8400 DATE: JANUARY, 1994

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4
PHASE I HYDROGEOLOGICAL INVESTIGATION

4.1 OVERVIEW

This Section describes the Phase I hydrogeological investigation of the Site.

Section 4.2 reviews the objectives of the Phase I hydrogeological investigation, Section 4.3 describes the methods and analyses used, and Section 4.4 discusses the results obtained. Section 4.5 presents a preliminary conceptual hydrogeological model of the Site and identifies data gaps remaining after the Phase I investigation. A summary is included in Section 4.6.

4.2 OBJECTIVES

The objectives of the Phase I hydrogeological investigation were to:

- describe the regional and Site-specific hydrogeologic characteristics affecting groundwater flow beneath the Site, including hydrogeologic flow patterns, analysis of the interrelationship between the bedrock and surficial aquifers, and analysis of the potential influence(s) of geologic, topographic, and geomorphic features on the groundwater flow system;
- classify and describe the hydrogeologic properties of Site-specific geologic units including determining hydraulic conductivity and porosity (total and effective), and interpreting hydraulic interconnections between saturated zones and consolidated and unconsolidated geologic units;
- describe groundwater quality and flow beneath the Site through the review of soil borings, groundwater monitoring data, and the development of groundwater contour and gradient maps; and
- identify man-made structures or influences that may affect the hydrogeology of the Site.

The results from the hydrogeological investigation were used to develop a preliminary conceptual hydrogeological model of the Site, as described in Section 4.5.1.

4.3 METHODS AND ANALYSES

This Section describes the methods and analyses used in the literature survey, the hydrogeological field investigation, and the analysis of Phase I hydrogeological data, including monitoring well installation, groundwater sample collection, and hydraulic conductivity testing.

4.3.1 Literature Survey

The regional hydrogeology for Site and the area surrounding the Site was researched through review of the following published information and other literature sources:

- Aquifer Characteristics mapping for the City of Westfield prepared by the Pioneer Valley Planning Commission;
- Groundwater Favorability mapping prepared by the Massachusetts Water Resources Commission, prepared in cooperation with the United States Department of the Interior, Geological Survey;

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- The Water Supply Protection Atlas Handbook prepared by the Massachusetts Department of Environmental Quality Engineering;
- Review of boring logs from monitoring wells and borings completed prior to Phase I;
- Current Water Resource Conditions in Central New England, prepared by the USGS;

4.3.2 Monitoring Well Installation

Eighteen (18) monitoring wells were installed between September 24, and November 11, 1993, as part of the Phase I RFI investigation. Three (3) of these additional wells were installed off-site, to allow access to groundwater downgradient of the property. The Site is currently monitored by a total of 32 monitoring wells. Tighe & Bond boring logs are provided in Appendix E. Monitoring well installation details are contained in Section 2.3.1

Table 4-1 summarizes the construction details of monitoring wells installed during the Phase I investigation.

Table 4-1
SUMMARY OF RFI PHASE I WELL CONSTRUCTION
Columbia Manufacturing Company, Westfield, MA.

Monitoring Well Number	Well Depth[1] (feet)	Screen Length (feet)	Sump Length (feet)	Elevation (feet)[2]			
				Ground Surface	Top of PVC	Top of Screen	Bottom of Screen
MW-6S	22	10	2	87.7	87.5	77.7	67.7
MW-9I/D	72	10	2	87.5	89.6	25.5	15.5
MW-12S	22	10	2	88.8	91.4	78.8	68.8
MW-12I	42	10	2	88.8	91.1	58.8	48.8
MW-13S	11	8	PO	88.7	88.3	86.0	78.0
MW-14I	24	10	2	85.8	88.2	73.8	63.8
MW-15I	27	10	2	93.2	95.9	78.2	68.2
MW-16S	15	10	2	88.3	87.9	85.3	75.3
MW-17S	15	10	2	88.6	88.0	85.6	75.6
MW-18S	15	10	1	88.3	87.9	84.3	74.3
MW-19S	11	8	PO	88.6	88.2	85.6	77.6
MW-20S	18	10	2	90.4	93.4	87.4	77.4
MW-21S	21	10	1	85.7	85.5	75.5	65.5
MW-22S	24	10	2.5	86.9	89.8[3]	74.9	64.9
MW-23S	26	10	2	87.9	89.8	76.8	66.8

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Monitoring Well Number	Well Depth[1] (feet)	Screen Length (feet)	Sump Length (feet)	Elevation (feet)[2]			
				Ground Surface	Top of PVC	Top of Screen	Bottom of Screen
MW-6S	22	10	2	87.7	87.5	77.7	67.7
MW-24S	27	10	2	87.8	90.3	75.3	65.3
MW-25D	72	10	2	92.2	94.3	34.3	24.3
MW-26I	27	10	2	87.3	89.7	72.3	62.8

1 Depth of well is in reference to ground surface.

2 Elevations are relative to the Westfield City Datum (52.72 feet NGVD) referenced at a stone boundary marker on the southwest corner of Lozier Street and East Silver Street at an elevation of 86.42 feet Westfield City Datum.

3 The top of the PVC riser is not visible in MW-22. The reference point is the top of the metal stand pipe without the locking slide cap.

PO Well point only, no additional sump present.

4.3.3 Monitoring Groundwater Levels

Depths to groundwater were measured in each of the 32 monitoring wells on several occasions throughout this investigation. A detailed description of groundwater monitoring procedures is included in Section 2.3.4. Gauging data were collected prior to well development, groundwater sample collection and hydraulic conductivity testing, and again on December 20, 1993 (no data other than water level measurements were collected during this latter event). The December 20, 1993 gauging event was necessary because the previously collected data were gathered over a period of days or weeks while conducting sampling or performing other field measurement activities. Groundwater contours for the Site were developed using the December 1993 data since the measurements were taken in one day. A review of historical USGS water level gauging data for central New England indicates that seasonal high and low groundwater levels occur in the spring (March/April), and late summer (August/September), respectively. Based on this information, as well as a comparison of the December data to previously collected data for this Site, the December 20, 1993 data represents an intermediate groundwater elevation period. Both high and low water table measurements will be collected during the Phase II investigation. The results of the December 1993 groundwater monitoring event are further discussed in Section 4.4.2.

4.3.4 Groundwater Sample Collection

Groundwater samples were collected from on-site monitoring wells from October 19 to October 22, 1993, and from off-site wells on November 18, 1993. Section 2.3.3 contains a description of the groundwater sampling techniques utilized. Groundwater chemistry is discussed in Section 4.3.6 and in Section 7.

4.3.5 Estimating Hydraulic Conductivity

Hydraulic conductivity tests (slug tests) were conducted on all 32 monitoring wells at the Site in October and November of 1993, a minimum of seven (7) days after well development. The

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tests were conducted using a five-foot (5') long, solid PVC rod of known volume (a "slug") to displace water in the well. Water level measurements were recorded at predetermined time intervals throughout the tests using a downhole pressure transducer connected to an electronic data logging system.

The field data were downloaded directly from the datalogger to a personal computer, and formatted for use by AQTESOLV™, a software package developed by Geraghty & Miller, Inc. The AQTESOLV™ program was used to calculate hydraulic conductivity (K) values using the Bower and Rice Method for unconfined aquifers, with partially or fully penetrating wells. AQTESOLV™ plots a graph of the data, and performs repetitive line matching iterations and least squares analysis of each result to find the line which best matches the slope of the plotted data. The hydraulic conductivity (K) is then calculated from the field data and other input values.

For the Bouwer and Rice method of analysis used for these tests, the value of hydraulic conductivity is affected by the geometry of the monitoring well and the surrounding soil strata. The geometry at each well is represented by five (5) variables; aquifer thickness (b), height of the water column (H), length of the screened interval (L), radius of the borehole (r_w), and radius of the well casing (r_c). These variables are defined as follows:

- b: Aquifer thickness. Distance from an assumed impermeable layer below the strata in the screened interval and the groundwater table.
- H: Height of water column. Distance from the bottom of the screened interval to the groundwater table.
- L: Length of the screened interval (for wells where the static groundwater table is located within the screened interval, L represents the saturated length of screen).
- r_w: Radius of the well including the gravel pack surrounding the PVC well casing (4.125 inches for the hollow stem augers used).
- r_c: Radius of the well casing. The r_c value is the inside radius of the casing if the water level is above the top of the screen. However, if the water level rises within the screened section during the test, allowances for the porosity of the gravel pack are necessary (Bouwer and Rice, 1976). As a result, r_c becomes $[r_c^2 + n (r_w^2 - r_c^2)]^{1/2}$, where n = porosity.

Values for each of these variables were derived from boring logs and measurements of depth to groundwater, and depth to well bottom taken prior to commencement of each test. Using these parameters, along with displacement values collected in the field, the value of hydraulic conductivity was determined for each monitoring well. A summary of the variables used in calculating hydraulic conductivity values is provided in Table 4-2.

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Table 4-2
HYDRAULIC CONDUCTIVITY CALCULATION VALUES
Columbia Manufacturing Company, Westfield, MA

Well ID	Initial Drawdown Falling (feet)	Initial Water Level Rising (feet)	Radius of Well Casing r_c (feet)	Radius of Well r_w (feet)	Saturated Thickness b (feet)	Screen Length L (feet)	Static Height of Water in Well H (feet)
MW-1I	2.71	2.29	0.083	0.344	75.05	10	22.32
MW-2I	2.55	2.27	0.083	0.344	16.20	10	11.16
MW-3I	2.73	2.69	0.083	0.344	17.65	10	14.94
MW-4I	2.77	1.99	0.083	0.344	18.6	10	18.14
MW-6S	*1.70	1.80	0.214	0.344	7.36	6.86	6.86
MW-7S	1.26	2.07	0.083	0.344	9.61	9.61	9.61
MW-7I	2.73	1.17	0.083	0.344	85	2	14.30
MW-8S	*1.08	1.16	0.214	0.344	10.29	3.34	3.34
MW-8I	2.55	1.45	0.083	0.344	113	2	13.88
MW-9S	*0.27	0.31	0.214	0.344	81	1.09	1.09
MW-9I	1.53	1.93	0.083	0.344	83.69	10	13.72
MW-9D	1.95	2.07	0.083	0.344	114.52	5	114.52
MW-9I/D	2.745	2.095	0.083	0.344	115.84	10	53.84
MW-10S	*2.63	1.74	0.214	0.344	16.27	5.96	5.96
MW-10I	3.14	2.34	0.083	0.344	22.77	10	14.38
MW-11I	2.68	2.47	0.083	0.344	59	10	15.94
MW-12S	*1.38	2.12	0.214	0.344	8.31	5.31	5.31
MW-12I	2.37	2.35	0.083	0.344	82.56	10	22.56
MW-13S	*0.33	1.02	0.214	0.344	14.81	5.48	5.48
MW-14I	2.27	1.92	0.083	0.344	7.59	7.59	7.59
MW-15I	3.08	2.07	0.083	0.344	6.63	6.63	6.63
MW-16S	*1.85	2.63	0.214	0.344	12.41	6.41	6.41
MW-17S	*0.82	1.82	0.214	0.344	12.74	7.74	7.74
MW-18S	*1.08	2.46	0.214	0.344	12.89	6.89	6.89
MW-19S	*0.49	1.33	0.214	0.344	12.91	4.91	4.91
MW-20S	*1.83	2.23	0.214	0.344	11.71	8.71	8.71
MW-21S	*--	1.79	0.214	0.344	19.14	7.14	7.14
MW-22S	*0.22	1.56	0.214	0.344	18.27	8.27	8.27
MW-23S	*0.92	1.38	0.214	0.344	8.91	8.91	8.91
MW-24S	*1.49	2.00	0.214	0.344	17.09	10	17.09
MW-25D	2.61	2.32	0.083	0.344	64.72	10	47.72
MW-26I	1.60	1.84	0.083	0.344	57.88	7.88	7.88

* Falling head test subject to rewetting effect.

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For those monitoring wells in which the screened interval was not completely submerged, only data from the rising head tests were used to calculate K values in order to avoid inaccuracies caused by entrapment of air during the rewetting of previously unsaturated soils. As such, rising head test data were used for the calculation of hydraulic conductivity for the following monitoring wells: MW-6S, MW-8S, MW-9S, MW-10S, MW-12S, MW-13S, MW-16S, MW-17S, MW-18S, MW-19S, MW-20S, MW-21S, MW-22S, MW-23S, and MW-24S.

Conversely, falling head test data alone were used for the calculation of K in three (3) monitoring wells (MW-7S, MW-13S, and MW-26I), where the initial drawdown from the removal of the PVC solid lowered the water table below the top of the screen. As a result, the effective value of r_c changed over the course of these three (3) tests, making calculation of K more difficult.

4.3.6 Determining Groundwater Chemistry

Natural groundwater chemistry can be evaluated through an analysis of cation and anion species present, specifically, calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium and potassium (Na^{+} + K^{+}), sulfates (SO_4^{2-}), chlorides (Cl^{-}), and carbonate and bicarbonate (CO_3^{2-} + HCO_3^{-}). Each of the major geologic units or aquifers is expected to have a distinct inorganic chemistry defined by these cationic and anionic parameters. Groundwater analyses conducted during the Phase I investigation at the Site yielded data for each of these parameters, with the exception of carbonate and bicarbonate concentrations. Instead, total alkalinity analyses were conducted on the Phase I groundwater samples. Although total alkalinity consists of the sum (in equivalents) of all bases titratable with strong acid, the carbonate species (CO_3^{2-} + HCO_3^{-}) tend to predominate, making total alkalinity approximately equal to carbonate alkalinity in most natural waters (Drever, 1988). Therefore, in place of carbonate and bicarbonate concentrations, alkalinity was used in the preliminary determination of groundwater chemical properties. This model will be refined during Phase II with the analysis of samples for carbonate and bicarbonate concentrations specifically. The data obtained will be used to compare the chemical signatures of each of the major geological units to assist in determining the level of interaction between units/aquifers. Summary Table I-1 presents the data obtained.

Groundwater analyses from three (3) wells were initially considered to be indicative of background conditions during the Phase I investigation. Monitoring wells MW-1I and MW-25D are hydrologically upgradient of the facility building, and monitoring well MW-23S is located on an adjacent property, apparently cross-gradient from the Site (shallow groundwater flow). As discussed in Section 3.4.4, monitoring well MW-23S is not being considered as a location indicative of background soil conditions due to the potential for impact of surficial soils by past or present agricultural activities. This location is also being excluded as a background monitoring point for groundwater for the same reason. As a result, only two (2) groundwater monitoring wells are considered to be located in areas that can reasonably be considered representative of background. As with soils, additional background data is necessary to differentiate contaminants attributable to the Site from naturally occurring concentrations of metals and other constituents.

Further evaluation of background groundwater chemistry will be completed during the Phase II RFI. Plans for this evaluation are presented in Section 20 and 21.

4.4 RESULTS OBTAINED

This Section describes the results of the hydrogeological investigation. The results are first discussed for the regional and local area (within 2 miles of the Site) and then discussed in relation to the Site.

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4.4.1 Regional and Local Hydrogeology

Review of the USGS Hydrologic Investigations Atlas for the Westfield and Farmington River Basins (HA-716) indicates that the Site is underlain by thin layers of well-sorted sand and gravel, with areas of well-sorted to poorly-sorted sand and gravel present within these layers. Additionally, the Atlas provides generalized transmissivities for this material, although no distinction is made regarding relative sorting, ranging from 100 to 1,400 square feet per day (ft^2/d), and potential well yields of less than 100 gpm (Maevsky and Johnson, 1990). In unconfined aquifers, the transmissivity is defined as the hydraulic conductivity K, in units of distance over time (L/T) multiplied by the saturated thickness of the aquifer b, in units of distance (L). The resulting unit, L^2/T, may be expressed as m^2/s, ft^2/d, gal/d/ft, or other equivalent units. Aquifers having transmissivities of greater than 13,000 ft^2/d are considered favorable for water supply exploration (Freeze & Cherry).

Figure 4-1, Groundwater Availability Map, shows transmissivity and well yield values for unconsolidated materials beneath the site and surrounding area. Also shown on this figure is a north/south trending band of sediments located to the east of the Site (between the Site and Provin and East Mountains) which exhibit transmissivities greater than 4000 ft^2/day. These sediments are remnants of the preglacial Connecticut River channel. Sand and gravel deposits within this ancient channel range in thickness from approximately 35 feet to 600 feet.

Further evaluation of the review of the Aquifer Information Overlay at the DEP revealed that aquifer materials in the vicinity of the Site have an M9 classification. According to the Water Supply Protection Atlas Handbook (DEQE, 1982), materials classified as M9 are described as follows:

> "Fine-grained stratified drift. Deposits include lake-bottom sediments of clay, silt, and fine-to-very-fine sand and a wide-spread near surface sand layer covering flood plains and low river terraces. Lake-bottom sediments yield little or no water to wells, whereas wells tapping near surface sand beds yield less than 25 gpm. Sand and gravel is found beneath the lake-bottom deposits in many places. Wells tapping these deposits may yield as much as 1,000 gpm. Hydrologic data is not adequate to map the extent of these buried coarse-grained materials. Some water saturated areas are finer-grained or thinner, sand and gravel does not underlie the lake-bottom sediments, and individual wells yield less than 25 gpm".

This data is based on information gathered from the USGS Hydrologic Atlas Series and thus, generally agrees with information gathered from the USGS and other sources for Section 3.4.1, Regional and Local Geology.

4.4.2 Site-Specific Hydrogeology

<u>Groundwater Contours and Flow Directions</u> - Groundwater contours were developed for both shallow and intermediate stratigraphic units, using water level measurements collected on December 20, 1993. Well depths are classified as follows:

- Shallow wells are wells in which the screen straddles the water table and which are generally screened in the fill/alluvium units. Exceptions include monitoring wells MW-6S, MW-7S, MW-21S, and MW-24S, which were installed with a sump or small portion of screen which intercepts the top of the glaciolacustrine silts and clays. These wells are designated with an "S" on Figures accompanying this report.
- Intermediate wells are wells in which the screen is completely below the water table and generally screened in the glaciolacustrine deposits. Exceptions to this include monitoring wells MW-26I, MW-14I, and MW-15I, which are screened across the

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deep alluvial/stratified drift sediment/glaciolacustrine interface. These wells are designated with an "I" on Figures which accompany this report.

- Deep wells are also screened below the water table and are screened within the lower portion of the glaciolacustrine deposits, apparently on top of the glacial till unit. These wells are designated with a "D" on the Figures which accompany this report.
- Intermediate/Deep wells are screened below the water table, at depths between the intermediate and deep designations within the glaciolacustrine sediments. These wells are identified on the Figures as "I/D".

Monitoring well depth classifications are listed in Table 4-2 in addition to the pertinent monitoring and survey information for each well at the site.

Table 4-3
MONITORING WELL AND GROUNDWATER ELEVATION DATA
DECEMBER 20, 1993 GAUGING EVENT
Columbia Manufacturing Company, Westfield, MA

Monitoring Well Identification	Monitoring Well Classification	Stratigraphic Unit Screened by Well	PVC Elevation[2]	Depth to Groundwater	Groundwater Elevation	Top of Screen Elevation
MW-1I	Intermediate	glaciolacustrine	94.03	11.30	82.73	66.74
MW-2I	Intermediate	glaciolacustrine	87.89	12.23	75.66	63.04
MW-3I	Intermediate	glaciolacustrine	87.97	11.71	76.26	68.21
MW-4I/D	Inter/Deep	glaciolacustrine	89.20	12.55	76.65	64.89
MW-6S	Shallow	alluvium	87.47	10.42	77.05	77.71
MW-7S	Shallow	alluvium	88.88	8.56	80.32	78.95
MW-7I	Intermediate	glaciolacustrine	88.94	14.09	74.85	61.09
MW-8S	Shallow	alluvium	88.56	12.37	76.19	78.93
MW-8I	Intermediate	glaciolacustrine	88.81	14.71	74.10	60.20
MW-9S	Shallow	alluvium	91.71	15.97	75.74	81.86
MW-9I	Intermediate	glaciolacustrine	89.03	16.10	72.93	61.43
MW-9D	Deep	till	90.25	18.25	72.00	-41.64
MW-9I	Inter/Deep	glaciolacustrine	89.57	16.44	73.13	25.46
MW-10S	Shallow	alluvium	88.46	11.41	77.05	76.66
MW-10I	Intermediate	glaciolacustrine	88.01	12.35	75.66	58.51
MW-11I	Intermediate	glaciolacustrine	87.48	12.72	74.76	66.31
MW-12S	Shallow	alluvium	91.42	14.95	76.47	78.78
MW-12I	Inter/Deep	glaciolacustrine	91.10	17.93	73.17	58.78
MW-13S	Shallow	alluvium	88.34	4.43	83.91	86.00
MW-14I	Intermediate	glaciolacustrine	88.20	9.22	78.98	73.84
MW-15I	Intermediate	glaciolacustrine	95.93	14.62	81.31	78.16
MW-16S	Shallow	alluvium	87.88	5.56	82.32	85.31
MW-17S	Shallow	alluvium	87.96	4.06	83.90	85.57
MW-18S	Shallow	alluvium	87.92	6.23	81.69	84.30
MW-19S	Shallow	alluvium	88.19	5.05	83.14	85.55
MW-20S	Shallow	alluvium	93.43	9.75	83.68	87.43
MW-21S	Shallow	alluvium	85.52	10.13	75.39	75.52

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Monitoring Well Identification	Monitoring Well Classification	Stratigraphic Unit Screened by Well	PVC Elevation[2]	Depth to Groundwater	Groundwater Elevation	Top of Screen Elevation
MW-22S	Shallow	alluvium	89.83[1]	14.11	*75.72	74.85
MW-23S	Shallow	alluvium	89.78	13.39	76.39	76.78
MW-24S	Shallow	alluvium	90.26	9.76	80.50	75.26
MW-25D	Deep	glaciolacustrine	94.30	22.20	72.10	34.30
MW-26I	Intermediate	glaciolacustrine	89.68	13.76	75.92	72.34

1 depth to groundwater in MW-22 was measured from the top of casing (not top of PVC)
2 Elevations are relative to the Westfield City Datum (52.72 feet NGVD) referenced at a stone boundary marker on the southwest corner of Lozier Street and East Silver Street at an elevation of 86.42 feet Westfield City Datum.

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Sixteen (16) monitoring wells at the Site are classified as shallow wells based on the above-described criteria. Shallow wells are generally screened in the alluvium, and have total depths ranging from 11 to 27 feet. Groundwater contours based on measurements in these wells are depicted in Figure 4-2, Shallow Groundwater Contour Map.

The shallow groundwater contours generally depict a southeasterly flow, toward the Little River which is approximately 2500 feet from the Site. An easterly component to flow is exhibited between monitoring wells MW-13S, MW-16S, MW-17S, and MW-24S. The contours form a ripple pattern which may be due to local changes in stratigraphy, or the presence of building foundations, drains or other man-made structures. As discussed in Section 1.2.2, a canal formerly crossed the Site along its southwestern border, apparently in the vicinity of the former lagoons. The location of this abandoned canal roughly corresponds to the area exhibiting the ripple effect. This type of contour pattern appears to locally affect the direction of groundwater flow at any given point on the Site, but does not alter the overall flow direction to the southeast.

Eleven (11) intermediate wells are located at the Site, which are generally screened in the stratified glaciolacustrine deposits, and have total depths ranging from 24 to 36 feet. Monitoring wells MW-4I and MW-12I were also installed in the glaciolacustrine unit, however were not used in the development of the intermediate groundwater flow directions because of their total depths. Each of these wells was installed to a depth of 41.5 feet, and are screened approximately ten (10) feet deeper within the clay layer than the other intermediate wells. These two (2) wells have, therefore, been given a classification of intermediate/deep.

The contours of groundwater levels in wells screened at intermediate depths are illustrated in Figure 4-3, Intermediate Groundwater Contour Map. Groundwater in this zone flows in a semi-radial pattern, from the west to east in the northern portion of the Site, and from northwest to southeast in the southern portion of the Site. An abrupt change in flow direction occurs in the vicinity of the former lagoons. This abrupt change in flow direction may be the result of residual effects of mounding from the lagoons. Lagoon effluent may have altered soil porosity in this localized area.

Monitoring wells MW-9D, MW-9I/D and MW-25D were installed as deep wells, with depths ranging from 72 to 132 feet. Although three (3) data points are available for deep groundwater at the Site, groundwater contours were not developed using these deep wells. Triangulation was considered inadvisable due to both the vertical and horizontal spacing of the monitoring wells. As discussed in Section 4.5.2, deep groundwater flow will be evaluated during Phase II.

Groundwater Gradients - Horizontal groundwater flow gradients were calculated in both shallow and intermediate zones for flow paths in various areas of the Site. Shallow groundwater beneath most of the Site flows under a generally consistent horizontal groundwater gradient of approximately 0.014. The gradient is considerably steeper in the vicinity of the former canal, where it increases to 0.029. Similarly, intermediate horizontal flow appears to exhibit a fairly shallow gradient, ranging from 0.005 to 0.013 across most of the Site. However, the gradient increases substantially in the vicinity of the former lagoons, to a maximum of 0.063.

As described above, groundwater flow in both the shallow alluvium and in the intermediate glaciolacustrine sediments appear to be affected in the vicinity of the former canal and lagoons. Backfill material used to abandon these features may be locally affecting groundwater flow at the Site. Although it is likely that these areas were filled with native material (no apparent anomalies are present in the boring logs), reworking of this material for filling may have caused zones of

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preferential flow along the southeastern property border. In addition, changes in porosity of soils beneath the lagoons may have resulted from infiltration of liquids during past use of the lagoons. The pore spaces in the soils may have become clogged, resulting in the soil having lower hydraulic conductivity, and possibly explaining the steeper hydraulic gradients observed in the vicinity of the former lagoons.

Vertical groundwater flow gradients were determined from water table elevations observed in well couplets MW-7S/7I, MW-8S/8I, MW-10S/10I, and MW-12S/12I. In each case, a downward vertical component to groundwater flow is apparent, as evidenced by higher groundwater elevations in the shallow wells associated with each couplet. Downward gradients are reasonable given the distance from the Site to the Little River. Since much of the Site and surrounding area is unpaved, infiltration and groundwater recharge takes place. Gradients are expected to be reversed closer to the river, as groundwater approaches the apparent discharge point. Vertical gradients are summarized in Table 4-4.

Table 4-4
VERTICAL GROUNDWATER FLOW GRADIENTS
Columbia Manufacturing Company, Westfield, MA

Well Cluster	Elevation Difference[1] (ft)	Vertical Separation[2] (ft)	Vertical Gradients (ft/ft)
MW-7S/7I	5.47	13.5	0.405
MW-8S/8I	2.09	12	0.174
MW-10S/10I	1.39	15	0.093
MW-12S/12I/D	3.30	20	0.165

1 Difference in feet between water-level measurements on December 20, 1993.
2 Vertical distance in feet between the midpoints of the well screens.

The well cluster where the steepest vertical gradient was observed was MW-7S/7I. The vertical groundwater flow gradient in that cluster was 0.405 ft/ft. The shallowest gradient, 0.093 ft/ft, was found in MW-10S/10I. That value is similar to the vertical gradients in the other two (2) remaining clusters MW-8S/8I and MW-12S/12I, which were nearly identical at 0.174 ft/ft and 0.165 ft/ft, respectively.

Hydraulic Conductivities - Table 4-5 summarizes the resulting hydraulic conductivity values developed using the AQTESOLV™ program. Graphs of drawdown versus time produced to arrive at the solutions are included in Appendix I. Further discussion of the methods employed during slug testing is included in Section 2.3.7 of this report.

The values of hydraulic conductivity obtained from the Site are generally within ranges of published data presented below in Table 4-6, Reference Values of Hydraulic Conductivity. From Table 4-6, the large range of values that can be obtained from each type of unconsolidated deposit is evident. The hydraulic conductivity data obtained from monitoring wells screened within the alluvium deposits at the Site range from 0.26 feet/day to 80.35 feet/day, and from wells screened within the glaciolacustrine sediments they range from 0.03 feet/day to 1.83 feet/day. These ranges correspond with the silt-loess, and silty sand and clean sand soil categories listed in Table 4-6. Given that the accuracy of hydraulic conductivity values is

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usually measured in terms of orders of magnitude, the values determined from field tests at the Site are generally considered acceptable.

Table 4-5
RESULTS OF HYDRAULIC CONDUCTIVITY TESTS
Columbia Manufacturing Company, Westfield, MA

Well ID	K {falling} (ft/min)	K {falling} (ft/day)	K {rising} (ft/min)	K {rising} (ft/day)	K {average} (ft/day)	Soil Description
MW-1I	1.44E-05	0.02	6.28E-04	0.9	0.46	glaciolacustrine deposits
MW-2I	2.30E-05	0.03	1.86E-05	0.03	0.03	glaciolacustrine deposits
MW-3I	4.90E-05	0.07	5.89E-05	0.08	0.08	glaciolacustrine deposits
MW-4I	2.59E-05	0.04	3.37E-05	0.05	0.05	glaciolacustrine deposits
MW-6S			3.22E-03	4.64	4.64	alluvium/stratified drift
MW-7S	7.07E-03	10.18			10.18	alluvium/stratified drift
MW-7I	2.14E-05	0.03	1.82E-05	0.03	0.03	glaciolacustrine deposits
MW-8S			1.32E-02	19.01	19.01	alluvium/stratified drift
MW-8I	1.31E-03	1.89	4.51E-04	0.65	1.27	glaciolacustrine deposits
MW-9S			5.58E-02	80.35	80.35	alluvium/stratified drift
MW-9I	2.25E-04	0.32	2.84E-04	0.41	0.37	glaciolacustrine deposits
MW-9D	3.82E-04	0.55	1.54E-04	0.22	0.39	glaciolacustrine deposits
MW-9I/D	6.94E-04	1.00	1.85E-03	2.66	1.83	glaciolacustrine deposits
MW-10S			5.38E-04	0.77	0.77	alluvium/stratified drift
MW-10I	2.72E-05	0.04	1.49E-04	0.21	0.13	glaciolacustrine deposits
MW-11I	3.18E-05	0.05	1.82E-05	0.03	0.04	glaciolacustrine deposits
MW-12S			7.13E-03	10.27	10.27	alluvium/stratified drift
MW-12I	6.29E-05	0.09	3.76E-05	0.05	0.07	glaciolacustrine deposits
MW-13S			4.36E-04	0.63	0.63	alluvium/stratified drift
MW-14I	3.80E-04	0.55	3.70E-04	0.53	0.54	alluvium/stratified drift
MW-15I	1.22E-03	1.76			1.76	alluvium/stratified drift
MW-16S			1.15E-03	1.66	1.66	alluvium/stratified drift
MW-17S			3.09E-04	0.44	0.44	alluvium/stratified drift
MW-18S			4.27E-02	61.49	61.49	alluvium/stratified drift
MW-19S			1.38E-03	1.99	1.99	alluvium/stratified drift
MW-20S			2.41E-03	3.47	3.47	alluvium/stratified drift

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Well ID	K {falling} (ft/min)	K {falling} (ft/day)	K {rising} (ft/min)	K {rising} (ft/day)	K {average} (ft/day)	Soil Description
MW-21S			1.70E-03	2.45	2.45	alluvium/stratified drift
MW-22S			2.04E-02	29.38	29.38	alluvium/stratified drift
MW-23S			3.49E-03	5.03	5.03	alluvium/stratified drift
MW-24S			1.20E-02	17.28	17.28	alluvium/stratified drift
MW-25D	5.75E-05	0.08	5.27E-05	0.08	0.08	glaciolacustrine deposits
MW-26I	1.78E-04	0.26			0.26	alluvium/stratified drift

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Table 4-6
REFERENCE VALUES OF HYDRAULIC CONDUCTIVITY
Columbia Manufacturing Company, Westfield, MA.

Soil Type	Hydraulic Conductivity Low end		Hydraulic Conductivity High end	
	feet/second	feet/day	feet/second	feet/day
Glacial Till	3.28×10^{-12}	2.8×10^{-7}	3.28×10^{-6}	2.8×10^{-1}
Silt, loess	3.28×10^{-9}	2.8×10^{-4}	3.28×10^{-5}	2.83
Silty Sand	3.28×10^{-7}	2.8×10^{-2}	3.28×10^{-3}	283
Clean Sand	3.28×10^{-6}	2.83	3.28×10^{-2}	2.8×10^{3}
Gravel	3.28×10^{-3}	283	3.28	2.8×10^{5}

Adapted from: Freeze and Cherry, 1979.

The highest hydraulic conductivities measured are the values obtained for monitoring wells MW-9S and MW-18S, which are 80.35 ft/day and 61.49 ft/day, respectively. These values are much higher than any of the other measurements obtained from the Site, although they are not out of reasonable range for alluvial deposits. As expected, the lowest hydraulic conductivity values were obtained for wells screened within the glaciolacustrine sediments, the lowest of which occurred in monitoring wells MW-2I and MW-7I (0.03 ft/day at each location).

Groundwater Velocities - Groundwater velocities were calculated for both shallow and intermediate groundwater flow at the Site. Velocities were calculated over five (5) flow paths in the shallow flow regime, and over four (4) flow paths in the intermediate flow regime, using the formula $V = Ki/n$, where V is the groundwater velocity, K is a representative hydraulic conductivity, i is the hydraulic gradient, and n is the effective porosity of the soil. The locations of the flow path segments used for calculating hydraulic gradients in various parts of the Site are illustrated on the groundwater contour plans, Figures 4-2 and 4-3, Shallow and Intermediate Contour Maps.

Values for hydraulic conductivity were obtained from slug tests performed on monitoring wells in October and November of 1993 (refer to Sections 2.3.7 and 4.3.5). Groundwater gradients specific to each flow path were calculated from the groundwater contours perpendicular to the chosen flow segment. Hydraulic conductivity values were selected from monitoring wells completed in the same flow regime (i.e. shallow or intermediate, and in general proximity to the flow path segment). In those cases where more than one (1) hydraulic conductivity value was available from wells in close proximity to the flow paths, the maximum value was used for the velocity calculation. Two (2) flow path segments (Shallow C-C', and Intermediate A-A') had only one (1) monitoring well in their respective vicinities, so only one (1) hydraulic conductivity value was available. Groundwater velocity calculation data and the resultant velocities are summarized in Table 4-7.

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Table 4-7
GROUNDWATER VELOCITY CALCULATION DATA
Columbia Manufacturing Company, Westfield, MA

Location of Measurement	Difference in Groundwater Elevation (ft)	Distance (ft)	Horizontal Gradient (*i*) (ft/ft)	Hydraulic Conductivity (K) (ft/day)	Source of Hydraulic Conductivity Value	Effective Porosity (Freeze & Cherry)	Groundwater Velocity (ft/day)
Shallow A-A'	2	105	0.019	10.27	MW-12S	30%	0.65
Shallow B-B'	2	180	0.011	19.01	MW-8S	30%	0.70
Shallow C-C'	2	82.5	0.024	10.18	MW-7S	30%	0.81
Shallow D-D'	3	203	0.015	3.47	MW-20S	30%	0.17
Shallow E-E'	2	135	0.015	17.28	MW-24S	30%	0.86
Intermediate A-A'	2	120	0.017	0.37	MW-9I	50%	0.01
Intermediate B-B'	2	159	0.013	0.13	MW-10I	50%	3.4E-3
Intermediate C-C'	4	120	0.033	1.76	MW-15I	50%	0.12
Intermediate D-D'	3	53	0.057	0.03	MW-2I	50%	3.4E-3

Based on the data in Table 4-7 groundwater velocities in the shallow alluvial deposits for those sections chosen range from 0.17 feet/day to 0.86 feet/day, with an average value of 0.64 feet/day. Groundwater flow velocities within the glaciolacustrine sediments range from 3.4E-3 feet/day to 0.12 feet/day, with an average value of 0.03 feet/day. The highest of the glaciolacustrine groundwater velocity values is exhibited by intermediate flow path segment C-C' (0.12 ft/day). This value is from the segment located closest to the former lagoons. This is primarily due to the steep groundwater gradients present in this area.

4.5 GENERAL DISCUSSION OF HYDROGEOLOGY

This section presents a discussion of the results obtained from the Phase I hydrogeological investigation of the Site. A conceptual hydrogeological model is presented based upon these results.

Water table elevations across the site range from 4.06 feet to 15.97, with horizontal gradients ranging from 0.011 ft/ft to 0.024 ft/ft. Groundwater levels in intermediate wells range from 9.22 feet to 16.10 feet, with horizontal flow gradients ranging from 0.013 ft/ft to 0.057 ft/ft. The steepest gradients measured in both shallow and intermediate groundwater occurred in the vicinity of the former lagoons.

Although groundwater at the Site generally flows toward the south/southeast, flow patterns differ between shallow and intermediate groundwater. Shallow groundwater generally flows toward the

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southeast, with an easterly component to flow in the north central portion of the site, near monitoring well MW-24S. The contours form a ripple pattern which may be due to localized changes in stratigraphy, the presence of building foundations, or other man-made structures. Intermediate groundwater flows in a semi-radial pattern from the west to east in the northern portion of the Site, and from northwest to southeast in the southern portion of the Site. The somewhat radial flow component is probably controlled by the position of the Little River which wraps around the Site.

Hydraulic conductivities at the Site are highly variable between geologic units, and range from 0.26 ft/d to 80.35 ft/d for flow through the alluvial deposits, and 0.03 ft/d to 1.83 ft/d for flow through the glaciolacustrine sediments. These data correspond well with published ranges for silty sand/clean sand, and silt/loess respectively. As expected, groundwater velocities also vary between units, with consistently higher velocities calculated for the alluvial deposits than for the glaciolacustrine silts and clays.

Vertical gradients measured from the four (4) well clusters monitoring the alluvial and glaciolacustrine groundwater flow zones indicate the presence of a downward vertical flow gradient at the Site. The steepest vertical gradient (0.405 ft/ft) was observed between monitoring wells MW-7S/7I, adjacent to the former lagoons. The shallowest gradient, (0.093 ft/ft), was found in MW-10S/10I. Vertical gradients in the remaining two (2) clusters, MW-8S/8I and MW-12S/12I/D, were 0.174 ft/ft and 0.165 ft/ft, respectively.

4.5.1 Conceptual Hydrogeological Model

This section presents a preliminary conceptual hydrogeological model of the Site and adjacent areas based on the results of the Phase I hydrogeological investigation. The conceptual model is developed based on the results of the on-site hydrogeological investigation. This model is then compared to the Phase I conceptual geological model.

The overburden aquifer is unconfined, and consists of at least two (2) groundwater flow regimes which correlate with the major stratigraphic units at the Site (the fill/alluvium unit and the glaciolacustrine unit). Shallow groundwater generally flows toward the south/southeast, and intermediate groundwater flows in a semi-radial pattern from the west to east in the northern portion of the Site, and from northwest to southeast in the southern portion of the Site. Both shallow and intermediate groundwater flows toward the Little River. Neither the deep unconsolidated flow patterns nor the bedrock flow patterns were evaluated during the Phase I investigation.

A downward vertical flow gradient exists as evidenced by water levels measured in December of 1993 in the four (4) monitoring well clusters at the Site. Additional well clusters installed during Phase II will allow for greater definition of flow patterns and the development of flow nets for the Site.

Many of the hydrogeological parameters of interest measured or calculated during the Phase I investigation in the vicinity of the canal and former lagoons exhibited values which differed from values obtained from other areas of the Site. Hydraulic conductivity, groundwater

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velocity, vertical gradients, and groundwater flow directions all appear to be affected by this feature. Groundwater mounding above the glaciolacustrine sediments may have occurred when the lagoons were in active use. Residual effects from this phenomenon may be affecting present groundwater flow patterns. Changes in porosity as a result of infiltration from the lagoons into the underlying alluvium/stratified drift may explain the anomalous conditions (compared to other parts of the Site) in the vicinity of the former lagoons. These conditions will be evaluated further during Phase II.

4.5.2 Data Gaps Identified in the Phase I Hydrogeological Investigation

The Phase I hydrogeological investigation identified the following data gaps. Strategies for addressing these data gaps are discussed and specific tasks for filling these data gaps are proposed for the Phase II hydrogeological investigation in the Phase II Scope of Work.

High and low groundwater table measurements are needed. Seasonal high and low groundwater level measurements will be obtained during Phase II. High groundwater generally occurs in this area in the spring, with low water table conditions occurring in the late summer or early fall.

Intermediate groundwater flow patterns not fully defined. Additional data points are needed to refine the groundwater contours in the glaciolacustrine deposits. Additional intermediate depth wells will be installed during Phase II in order to further define these contour patterns.

Additional soil porosity data is needed in the vicinity of the lagoons. Further study of hydrogeological parameters, including porosity, in the vicinity of the former lagoons is needed to explain the apparently anomalous groundwater behavior in the vicinity of this feature.

Hydrogeology of the deep overburden aquifer not adequately defined. Additional wells installed to intercept the deep glaciolacustrine/till deposits (just above bedrock) are needed in order to further define the deeper unconsolidated flow patterns and groundwater chemistry.

Bedrock hydrogeology not characterized. The Phase I Scope of Work did not include the installation of bedrock monitoring wells. Groundwater flow characteristics and chemistry of the bedrock unit are undefined and will be addressed during Phase II.

Additional groundwater velocity data is needed. Much of the groundwater velocity data generated during Phase I relies on information obtained from one (1) or two (2) monitoring wells along a given velocity flow line. Groundwater velocity data gathered during the Phase I investigation will be supplemented during Phase II.

Information regarding the interaction between the overburden aquifer and the Little River is needed. Although it is assumed that groundwater from the overburden aquifer discharges to the Little River, verification and quantification of flow into the river is needed. Flow nets will be developed during Phase II which will assist in defining the relationship between groundwater and surface water at/near the Site.

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More data is needed to determine background values for groundwater chemistry. The Phase I sampling program did not provide adequate data to develop background values for inorganics in groundwater. Background values are needed for groundwater from each stratigraphic unit. This data will be generated during Phase II.

More data is needed to define the geochemical characteristics of groundwater in each saturated stratigraphic unit. Additional analyses for major cations and amious are needed to more fully characterize the hydrodymics of these units.

4.6 SUMMARY

The following summary is derived from the results of the Phase I hydrogeological investigation.

- The overburden aquifer at the site is unconfined. Groundwater flow directions through the alluvial and glaciolacustrine deposits (shallow and intermediate flow) is toward the Little River.
- Based on the downward flow gradient evidenced in shallow/intermediate well clusters at the Site, investigation of deeper unconsolidated zones and bedrock is necessary. Chemistry data provided during the Phase I investigation must be supplemented in order to further track flow between deeper unconsolidated zones and the bedrock aquifer.
- The overburden aquifer consists of highly variable geological materials, and is poorly sorted in many areas. In addition, man-made features such as the former lagoons appear to further complicate subsurface conditions. These conditions lead to variability in hydrogeological parameters such as hydraulic conductivity, groundwater flow direction and gradients, and flow velocity.
- An apparent till layer was observed beneath the glaciolacustrine deposits during the advancement of two (2) borings in previous investigations conducted at the Site. The till may or may not act as a confining layer over the bedrock. Further investigation of the bedrock/overburden interface is needed in order to determine the geotechnical properties of the till layer. Further investigation will also to determine if the till is continuous across the Site and evaluate if this unit is an effective barrier to the vertical migration of contaminants into the bedrock aquifer.

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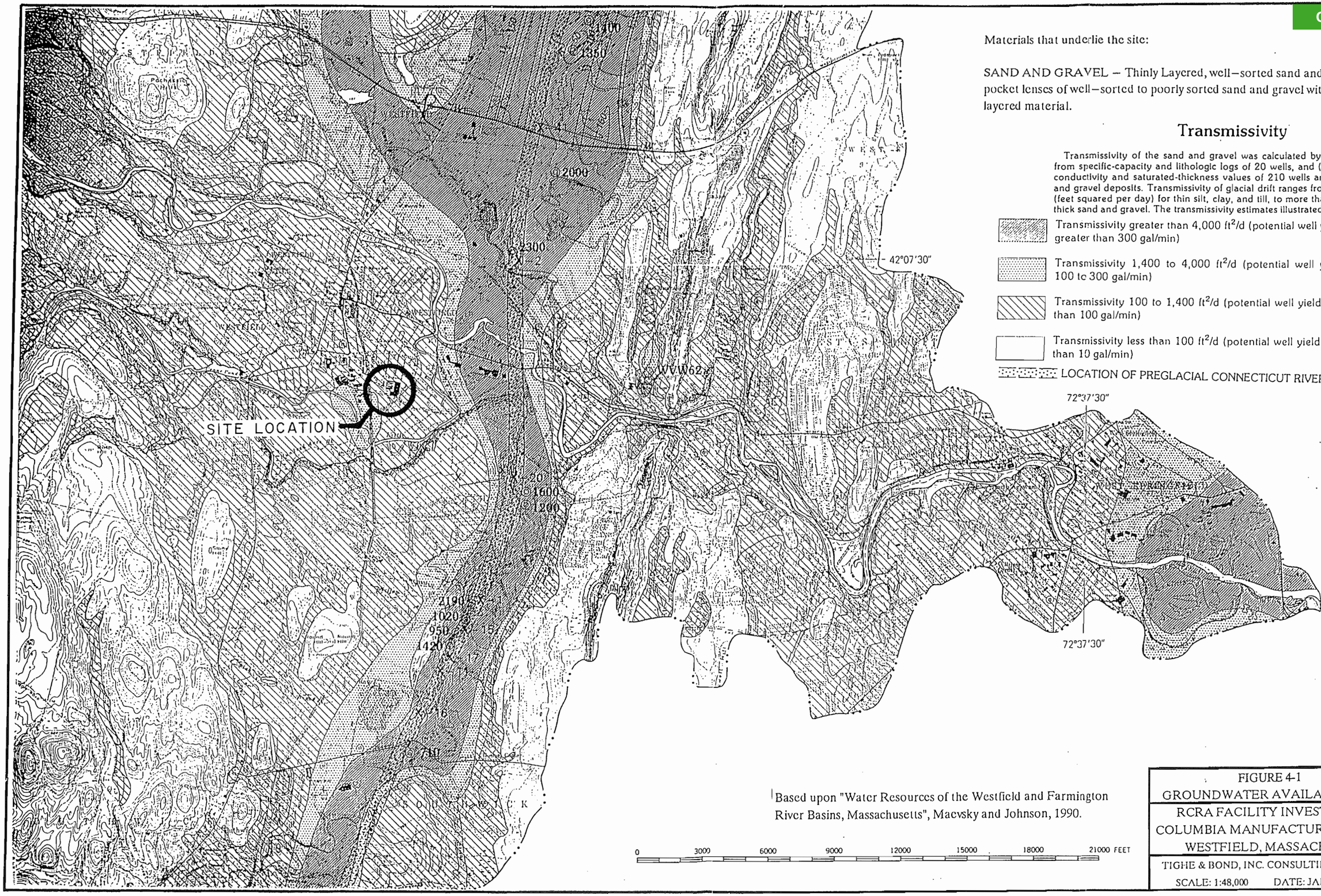


Materials that underlie the site:

SAND AND GRAVEL – Thinly Layered, well–sorted sand and gravel; or pocket lenses of well–sorted to poorly sorted sand and gravel within the layered material.

Transmissivity

Transmissivity of the sand and gravel was calculated by two methods: (1) from specific-capacity and lithologic logs of 20 wells, and (2) from hydraulic-conductivity and saturated-thickness values of 210 wells and borings in sand and gravel deposits. Transmissivity of glacial drift ranges from less than 4 ft^2/d (feet squared per day) for thin silt, clay, and till, to more than 26,500 ft^2/d for thick sand and gravel. The transmissivity estimates illustrated in figure 2 are:

- Transmissivity greater than 4,000 ft^2/d (potential well yield greater than 300 gal/min)
- Transmissivity 1,400 to 4,000 ft^2/d (potential well yield 100 to 300 gal/min)
- Transmissivity 100 to 1,400 ft^2/d (potential well yield less than 100 gal/min)
- Transmissivity less than 100 ft^2/d (potential well yield less than 10 gal/min)
- LOCATION OF PREGLACIAL CONNECTICUT RIVER CHANNEL

Based upon "Water Resources of the Westfield and Farmington River Basins, Massachusetts", Macvsky and Johnson, 1990.

FIGURE 4-1
GROUNDWATER AVAILABILITY MAP
RCRA FACILITY INVESTIGATION
COLUMBIA MANUFACTURING CO., INC.
WESTFIELD, MASSACHUSETTS
TIGHE & BOND, INC. CONSULTING ENGINEERS
SCALE: 1:48,000 DATE: JANUARY, 1994

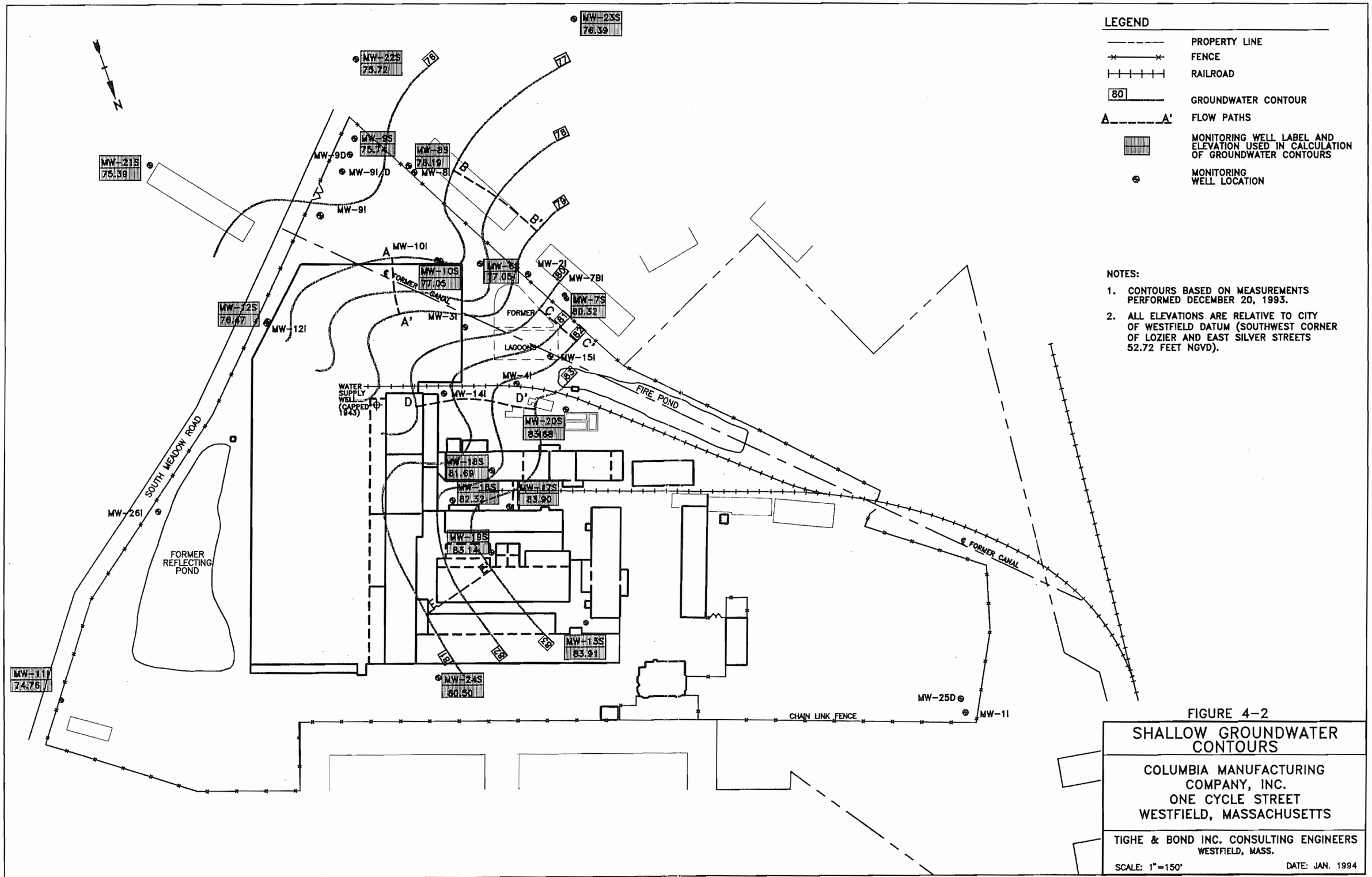


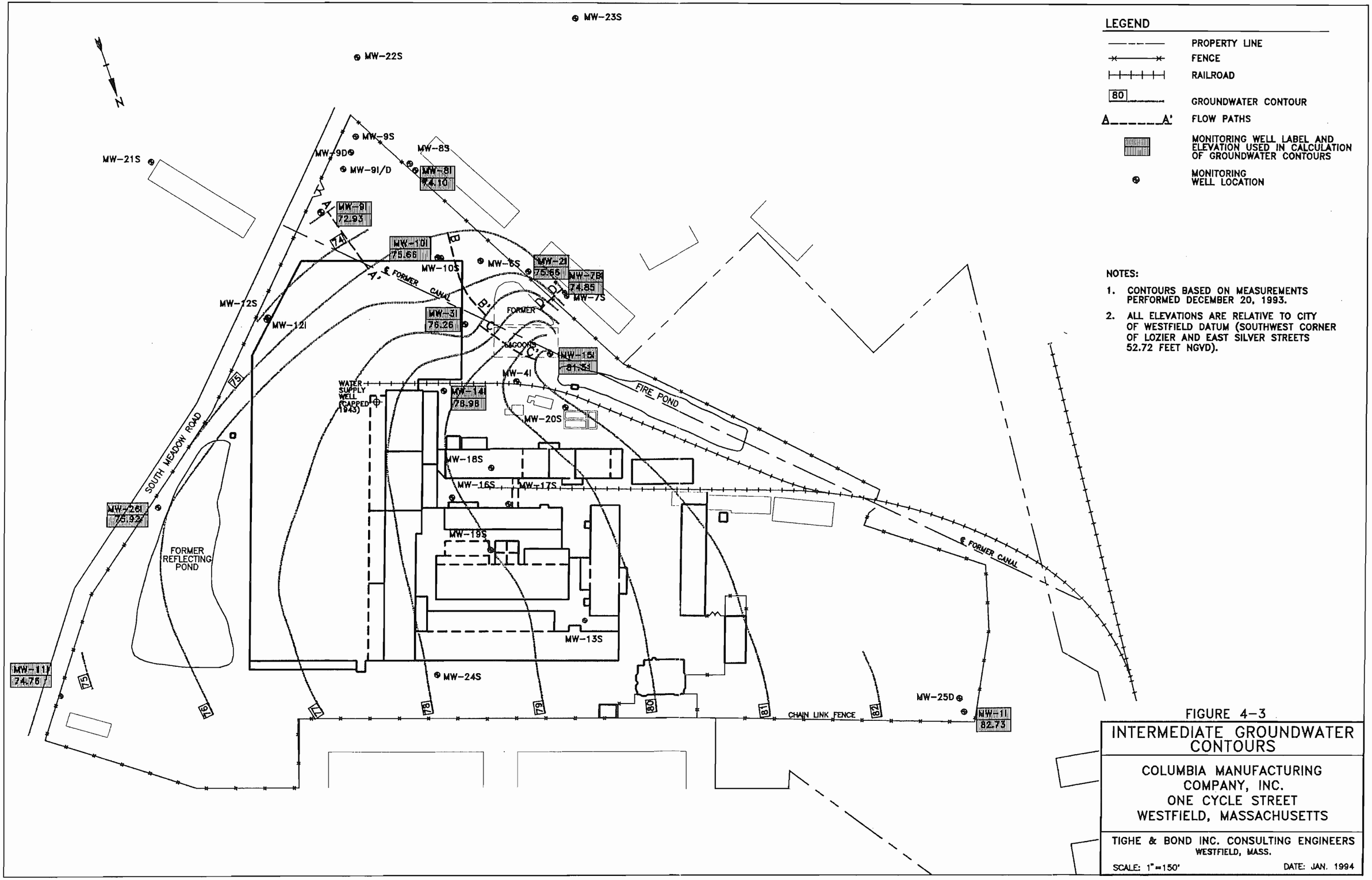
FIGURE 4-2

SHALLOW GROUNDWATER CONTOURS

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=150' DATE: JAN. 1994



LEGEND

- PROPERTY LINE
- FENCE
- RAILROAD
- 80 — GROUNDWATER CONTOUR
- A_____A' FLOW PATHS
- MONITORING WELL LABEL AND ELEVATION USED IN CALCULATION OF GROUNDWATER CONTOURS
- MONITORING WELL LOCATION

NOTES:

1. CONTOURS BASED ON MEASUREMENTS PERFORMED DECEMBER 20, 1993.
2. ALL ELEVATIONS ARE RELATIVE TO CITY OF WESTFIELD DATUM (SOUTHWEST CORNER OF LOZIER AND EAST SILVER STREETS 52.72 FEET NGVD).

FIGURE 4-3

INTERMEDIATE GROUNDWATER CONTOURS

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=150' DATE: JAN. 1994

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5
PHASE I HYDROLOGICAL INVESTIGATION

5.1 OVERVIEW

This section describes the Phase I hydrological investigation of the Site. The investigation included chemical and physical characterization of on-site and off-site water bodies and of on-site sediments. Included in the hydrologic investigation are three (3) areas that are also AOCs; the Fire Pond (AOC 34), the Reflecting Pond (AOC 16) and the Storm Sewer (AOC 17). Chemical data generated by investigations of these water bodies/conveyances are discussed in Section 12.

Until the early 1980's, the lagoons (AOC 29) constituted two (2) additional impoundments on the Site. These were filled in 1983, and are classified as former impoundments. Since the former lagoons have been filled, and are also AOCs, they are not specifically discussed in this Section. The former lagoons are discussed in Section 10.

Section 5.2 reviews the objectives of the Phase I hydrological investigation, Section 5.3 describes the methods and analyses used, and Section 5.4 discusses the results obtained. Section 5.5 presents a preliminary hydrological model of the Site and identifies data gaps determined during the Phase I investigation. A summary is included in Section 5.6.

5.2 OBJECTIVES

The overall goal of the Phase I hydrologic investigation was to evaluate those physical and chemical characteristics of on-site and off-site surface water and sediment that may be useful in determining both the extent of releases from the Site and the potential for contaminant transport through those media.

Objectives of the Phase I hydrologic investigation that were outlined in the Consent Decree include:

- identification and characterization of areas and amounts of groundwater recharge and discharge to the Little River and other important water bodies;
- description of temporal and permanent surface water bodies;
- location, elevation, surface area, depth, volume, freeboard and purpose of the lakes, ponds and impoundments;
- location, elevation, flow rates, depth, width, seasonal fluctuations, flood potential (100 yr flood) and state stream classification of all streams, ditches and channels;
- description of drainage patterns near surface water bodies;
- description of chemistries of surface water and sediment (pH, TDS, TSS, BOD, alkalinity, conductivity, dissolved oxygen profiles, nutrients NH_3, NO_3-N, PO_4, COD, TOC)
- description of sediment characteristics including depositional area(s), thickness profile(s), physical and chemical parameters (grain size distribution, density, TOC, Eh, pH), and seasonal variations in sediment transport;

Additional objectives of the Phase I hydrological investigation were to:

- identify the hydrologic characteristics of off-site water bodies, including drainage area, flow rates, flooding potential, and chemical quality;
- identify the locations and physical characteristics of all on-site surface water bodies potentially impacted by industrial activities at the Site;
- characterize the chemical characteristics of off-site sediments in the Little River;

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- characterize the physical characteristics of on-site sediments in the Fire Pond, including percent solids, percent moisture, percent saturation, wet and dry density, specific gravity, void ratio and porosity to assist in evaluating the potential for contaminant migration in this water body, which is also (AOC 34);
- arrive at a preliminary evaluation of the interaction between groundwater and surface water on the Site and in the surrounding area.

The results from the hydrological investigation were used to develop a preliminary conceptual hydrological model of the Site.

5.3 METHODS AND ANALYSES

This section describes the methods and analyses used in the Phase I hydrologic investigation, which included a literature survey, collection of surface water samples from on-site water bodies, and collection of sediment samples from on-site and off-site surface water bodies and on-site drainage structures.

5.3.1 Literature Review

The regional hydrology for Site and the area surrounding the Site was researched through review of the following published information and other literature sources:

- topographic mapping prepared by the USGS;
- the Hydrologic Atlas of Water Resources of the Westfield and Farmington River Basins (Maevsky and Johnson, 1990) published by USGS;
- open file mapping of flood prone areas prepared by the USGS;
- flood insurance mapping and rate study prepared by FEMA;
- personal communication with USGS regarding flood data;
- wetlands mapping of the National Wetlands Inventory;
- publications of the Massachusetts Water Resources Commission, Department of Environmental Quality Engineering (DEQE) and Department of Environmental Protection (DEP);
- information in CMC files;
- historical Sanborn Fire Insurance Maps;
- previous Site investigation reports;
- a report on regional flooding prepared by the Boston Society of Civil Engineers;
- wetlands mapping prepared as part of the National Wetlands Inventory program.

5.3.2 On-Site Hydrological Study

The on-site hydrological study included collection of surface water and sediment samples for chemical and physical characterization.

Surface Water Sample Collection

Surface water samples were collected from three (3) different locations in the Fire Pond on September 24, 1993 for laboratory analysis of various inorganic parameters. Field analyses were also performed at each sample location for pH, Eh, specific conductance, dissolved oxygen and temperature. All surface water sample locations are indicated on the Plates in Appendix A.

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Samples were collected from the east end, the center, and the west end of the Fire Pond. Sample collection locations are indicated on the Site Plan in Appendix A. Tighe & Bond Field Technicians reported the water depths in the pond were shallow and generally uniform in depth at the three (3) sample locations. Historically, industrial effluents were discharged to the north side of the pond from Buildings 6 and 11. The location of two (2) former discharge pipes is indicated on a plate in Appendix A entitled, Drainage Detail, dated December, 1967.

Sediment Sample Collection

Eight (8) sediment samples (including a duplicate sample) were collected at six (6) locations from surface water bodies from one (1) location in a drainage structure. Five (5) locations were on the Site and two (2) locations were in the Little River. The on-site sediment sampling locations are illustrated on the Site Plan in Appendix A. The off-site sediment sampling locations are illustrated on Figure 2-1 in Section 2. These samples were collected and analyzed to define the chemical characteristics of sediments associated with surface water bodies and storm-drainage systems potentially impacted by activities at the Site.

Sediment samples collected from the Fire Pond were analyzed for physical parameters including porosity and specific gravity to assist in determining potential contaminant migration behavior in these sediments. The sediment samples collected from the Fire Pond were collected at approximately the same locations as the surface water samples (west, center, east).

The Fire Pond, the Reflecting Pond, and the on-site drainage structure from which sediment samples were collected are also identified as AOCs and have been grouped as On-site Surface Water Bodies. The results of all field and laboratory analysis of the chemical characteristics of surface water and sediment samples from AOCs are discussed in Section 12. The results of all physical analyses of sediments collected from Fire Pond and chemical characteristics of Little River sediments on-site and off-site are discussed in Section 5.4.4.

5.4 RESULTS OBTAINED

This section describes the results of the hydrological investigation. First, a general description of major off-site water bodies in the vicinity of the Site is provided. This is followed by a description of on-site water bodies and a discussion of results obtained from sediment analyses. Next is a discussion of flooding potential and flooding history of the Site and surrounding areas. Finally, a discussion of groundwater-surface water interactions is provided.

5.4.1 General Description of Off-Site Water Bodies

Major surface water bodies in the vicinity of the Site include the Westfield River, and its major tributary, the Little River. Information gathered from the literature review regarding the chemical and physical characteristics of these water bodies is presented below.

Physical Characteristics

The drainage area for The Little River encompasses approximately 84 square miles. The elevation of the Little River in the vicinity of the site ranges from 120 to 130 feet above sea level, based upon USGS topographic mapping. The direction of flow in the Little River is generally to the east, however the river bed meanders to the west, south and east of the site, prior to its confluence with the Westfield River approximately one-half mile to the northeast of the site. The Little River has

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its confluence with the Westfield River at an elevation of approximately 120 feet above mean sea level.

Within the Little River drainage area is the Cobble Mountain Reservoir, located at the headwaters of the river approximately eight (8) miles to the west of the Site. Cobble Mountain Reservoir supplies drinking water to the City of Springfield and surrounding communities. Additionally, a hydroelectric facility operated by Western Massachusetts Electric Company (WMECO, a division of Northeast Utilities) also utilizes water in the reservoir for power generation. According to a report published by the Massachusetts Water Resources Commission in 1978, variations in flow in the Little River occur as a result of this use.

The Westfield River drainage area is much larger, and encompasses an area of approximately 517 square miles in portions of Franklin, Hampden, Hampshire and Berkshire Counties (Massachusetts Water Resources Commission, 1978).

Two (2) stream-flow gauging stations are located on the Westfield and Little Rivers in the vicinity of the Site. The Westfield River station is a USGS continuous-record gauging station located at the gap between Provin and East Mountains, and the Little River station is located at the confluence of the Little and Westfield Rivers. The Westfield River gauging stations measure flow from 497 square miles of the Westfield River drainage basin. The Little River Station measures flow from approximately 46 square miles of the Little River drainage basin below the Cobble Mountain Reservoir. Table 5-1 summarizes the stream-flow gauging data collected for both rivers.

Table 5-1
WESTFIELD AND LITTLE RIVER STREAM-FLOW GAUGING DATA
Columbia Manufacturing Company, Westfield, MA

Flow Parameter	Westfield River[1]	Little River[2]
Area of Drainage Basin Monitored[4]	497 mi^2	46 mi^2
Period of Record	1914-present[3]	1905-1962
Average Flow Rate	942 ft^3/s (through 9/84)	91 ft^3/s
Maximum Flow Rate	70,300 ft^3/s (8/55)	NA

1 Maevsky and Johnson, 1990.
2 Higgins, 1964.
3 USGS personal communication, 1994.
4 Only a portion of the drainage basin is monitored at this station.
NA Not Available

Chemical Characteristics

The water quality of the Westfield and Little Rivers was studied in the late 1970's by the Massachusetts Water Resources Commission and the Massachusetts DEQE. The purpose of the water quality studies was to monitor industrial discharges into these water bodies to ensure permit compliance and to determine the overall water quality of the Westfield River.

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It was noted in the reports that many companies were discontinuing or limiting their discharges to the rivers and were instead discharging to the sanitary sewer system. Additionally, those discharges still being sent to the rivers had been more effectively mitigated by treatment than in previous years. Table 5-2, Surface Water Quality Data, summarizes the available information regarding the chemistry of these two (2) rivers in 1978 and 1979. The locations listed in Table 5-2 are depicted on Figure 5-1.

Table 5-2
SURFACE WATER QUALITY DATA - WESTFIELD AND LITTLE RIVERS
Columbia Manufacturing Company, Westfield, MA

Water Quality Parameter	Westfield River at Frog Hole		Little River off South Meadow Road	
	1978[1]	1979[2]	1978[1]	1979[2]
Dissolved Oxygen (mg/l)	12.8	7.7	9.0	7.9
Biological Oxygen Demand (BOD_5 in mg/l)	1.9	1.5	2.6	1.9
Ammonia as Nitrogen (mg/l)	0.02	0.08	0.05	0.07
Nitrate as Nitrogen (mg/l)	0.2	NA	0.7	NA
Total Kjeldahl-Nitrogen (mg/l)	0.57	0.99	0.57	0.82
Total Phosphorous (as P in mg/l)	0.13	0.10	0.13	0.09
pH (standard units)	7.0	NA	6.5	NA
Total Alkalinity (mg/l)	13	14	11.5	19
Turbidity (NTU)	4.5	5.4	2.9	1.9
Suspended Solids (mg/l)	24	9.8	7.4	1.8
Total Solids (mg/l)	104	NA	91	NA
Chlorides (mg/l)	6	NA	10	NA
Total Coliform (per 100 ml.)	11,000	13,000	3,900	31,000
Fecal Coliform (per 100 ml.)	900	1,300	505	4,300

1 Massachusetts DEQE, 1978. Data represents averages of data collected in June and August of 1978.
2 Massachusetts DEQE, 1979. Data represents averages of data collected in July of 1979.

Massachusetts Surface Water Quality Standards (314 CMR 4.00) as revised in July, 1990 classify the Little River and the Westfield River within two (2) miles of the site as Class B waters. Class B waters are defined in those regulations as "waters designated as habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation." Class B waters are also suitable for drinking water supplies (with appropriate treatment), irrigation and industrial use. They are

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regulations also note that both rivers are impacted by discharges from combined sewer overflows.

5.4.2 Flooding Potential and Flooding History

The USGS Open-File Map of Flood-Prone Areas for the West Springfield Quadrangle, Massachusetts-Connecticut, revealed that areas to the north of the Little River and to the west of the Westfield River are prone to flooding (USGS 1976).

Examination of FEMA floodway mapping cited above indicated areas within a 100-year flood zone flanking the Little River and the Westfield River. The study Site is within the area mapped as Zone B, which is the area between the 100-year flood boundary and the 500-year flood boundary, or is subject to flooding to a depth of 1 foot or less during a 100-year flood event (FEMA, 1978). The elevation of the statistical 100-year flood on the Little River in the vicinity of the site ranges from 144 feet to 134 feet at the confluence with the Westfield River. Elevations of 500-year floods are not indicated on the map. The FEMA flood insurance rate map is reproduced as Figure 5-2.

The magnitude of flood discharge rates for the Westfield River for 50-year through 500-year recurrence intervals were obtained through personal communication with the USGS Office in Marlboro, Massachusetts. These values represent statistical projections rather than actual flood events. The values provided are as follows, in cubic feet per second (cfs):

- 50-year flood - 48,200 cfs;
- 100-year flood - 61,900 cfs;
- 200-year flood - 77,600 cfs;
- 500-year flood - 103,300 cfs.

Four (4) major flooding events have been documented in the vicinity of the Site in the twentieth century. Values for peak flood discharges for the Westfield River during each of those flooding events are summarized by the Boston Society of Civil Engineers (BSCE, 1961). Those data are presented in Table 5-3.

Table 5-3
FLOODING HISTORY OF THE WESTFIELD RIVER
Columbia Manufacturing Company, Westfield, MA

Flood Event	Peak Discharge (cfs)
1927	42,500
March, 1936	48,200
September, 1938	55,500
August, 1955	70,300(1)

(1) Discharge affected by storage in Knightville Dam.

Comparison of the data in the table above to the discharge values for various statistical recurrence intervals shows that the highest recorded discharge rate, which occurred in August, 1955, was between a 100-year and 200-year flooding event. The 1936 flood was equivalent to a 50-year

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Comparison of the data in the table above to the discharge values for various statistical recurrence intervals shows that the highest recorded discharge rate, which occurred in August, 1955, was between a 100-year and 200-year flooding event. The 1936 flood was equivalent to a 50-year flooding event. Data in USGS files confirmed that the three (3) highest values in Table 5-3 are the highest flows on record for the Westfield gauging station. Flood flows on both rivers are now controlled by the Knightville and Littleville dams.

5.4.3 General Description of On-Site Water Bodies

There are no natural lakes or ponds at the Site. Two (2) artificial surface water impoundments are currently present on the Site. The Fire Pond (AOC 34) is located centrally along the western property fence line, and the former Reflecting Pond (AOC 16) is located in the northeastern corner of the Site. These features are illustrated on the Site Plan in Appendix A. Of these impoundments, only the Fire Pond currently (and consistently) holds water. No streams, ditches or channels are present at the Site.

Physical Characteristics of Water Bodies

The Fire Pond is a remnant of the former canal that crossed the site until the late 1800's (Section 1.2.2). When the canal was backfilled, the Fire Pond was left as a back-up emergency water supply for the Site.

Sources of water entering the Fire Pond include precipitation, surface water runoff, aqueous industrial discharges, and possibly periodic groundwater discharge (See Section 5.4.5). Industrial discharges to the pond apparently originate from the boiler room through a pipe which runs between Building 5 and the eastern end of the Fire Pond. An overflow drainage structure has been constructed in the Fire Pond to allow controlled discharge to the stormwater drainage system in the event that water in the Fire Pond reaches a level at which overflow is imminent. The effects of seasonal groundwater fluctuations on recharge or discharge of water to or from the pond are currently unknown. The need for additional information to characterize the relationship between the Fire Pond and the groundwater table is addressed in Section 5.5.2.

The former Reflecting Pond is a long, shallow depression located to the east of the warehouse building (Building 13). The Reflecting Pond was originally constructed for the purpose of receiving wastewater treatment effluent from plating operations prior to discharge to the Diversion Structure and, ultimately, the Little River. The pond served no apparent treatment function and was created simply for aesthetics. A certain amount of sedimentation is likely to have occurred during the periodic discharge to this area. Currently, the former Reflecting Pond is dry for most of the year. Recharge to the former Reflecting Pond is limited to periodic precipitation events, and consists of direct rainfall or snowfall, surface water runoff from areas at higher elevations, or from water directed to the pond via roof drains. The recharge may form small pools at the lowest depressions, but these pools are temporary. There are no inlet or outlet structures associated with this feature. The former sump which directed the pond waters to the Diversion Structure has been abandoned.

Table 5-4, Surface Water Impoundment Characteristics, outlines the physical attributes of both the Fire Pond and the Reflecting Pond. Due to the shallow nature of the Fire Pond and the absence of water in the former Reflecting Pond, temperature stratification was not evaluated for either water body.

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Table 5-4
SURFACE WATER IMPOUNDMENT PHYSICAL CHARACTERISTICS
Columbia Manufacturing Company, Westfield, MA

Characteristic	Fire Pond	Reflecting Pond
Maximum Length and Width	340 ft x 47 ft	350 ft x 175 ft
Surface Area	14,116 ft^2	41,704 ft^2
Water Depth	approximately 5 ft	periodic pooling, <1 ft
Freeboard	approximately 5 ft	approximately 2 ft-3 ft
Shoreline	752 ft	992 ft
Water Elevation	86.01[1]	N/A (dry)
Volume (approximate)	300,000 gal[2]	N/A (dry)

1 Elevation relative to Westfield City Datum surveyed in 1986. City of Westfield datum + 57.21 = USGS datum. Elevation of water relative to USGS datum is 143.22.
2 Volume indicated on Sanborn Fire Insurance maps.

Another potential surface water feature at the Site is a possible wetland area in an undeveloped, wooded area along the western boundary of the Site. A topographic low in this area appears to correspond with wet conditions at the surface. Field reconnaissance of this area was conducted in January of 1994, when the ground surface was snow covered.

Based on current information, it is unclear whether this low area serves as a surface drainage feature, a seasonally wet area, or a perennially wet zone. A review of National Wetlands Inventory mapping published by the United States Fish & Wildlife Service revealed no mapped wetlands on or adjacent to the site. A copy of that map is provided as Figure 5-3. This is addressed further in Section 5.5.2.

Chemical Characteristics of Surface Water Bodies

Samples were collected from the east end, the center, and the west end of the Fire Pond. Tighe & Bond Field Technicians reported the water depths in the pond were shallow (approximately 3-4 feet) and generally uniform in depth at the three (3) sample locations. Historic industrial effluents entering the pond were apparently discharged to the western end. Samples were also collected upstream and downstream of a point where a small intermittent stream which receives flows from the Diversion Structure discharges to the Little River. Sediment samples were collected in areas with water depths of approximately one (1) foot and where sediments were comprised of fine sands and silts. The results of all field and laboratory analyses of surface water collected during Phase I are summarized in Table 5-5.

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Table 5-5
SURFACE WATER CHEMICAL CHARACTERISTICS
Columbia Manufacturing Company, Westfield, MA

Chemical Characteristic	Fire Pond		
	SW-1 (west)	SW-2[1] (center)	SW-3 (east)
FIELD ANALYSES			
Field pH (s.u.)	6.15	6.50	5.46
Field Eh (μv)	150	91	112
Specific Conductance (μmhos/cm @ 25°C)	112	96	100
Dissolved Oxygen (mg/l)	5.8	5.8	6.0
Temperature (°C)	15.4	15.8	16.6
INORGANICS			
Total Organic Carbon (TOC in mg/l)	6.24	10.2	6.24
Total Dissolved Solids (TDS in mg/l)	62	64	88
Total Suspended Solids (TSS in mg/l)	14	5U	8
Alkalinity (mg/l)	9	6	10
Biological Oxygen Demand (BOD in mg/l)	6J	3U	3U
Sulfate (SO_4 in mg/l)	23	15	20
Nitrate (NO_3 in mg/l)	0.02U	0.02U	0.02U
Chlorine (Cl_2 in mg/l)	8	8.5	8.5
Chemical Oxygen Demand (COD in mg/l)	22	14	16
Ammonia (NH_3 in mg/l)	0.022	0.02U	0.02U
Phosphate (PO_4 in mg/l)	0.37	0.26	0.40

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Chemical Characteristic	Fire Pond		
	SW-1 (west)	SW-2[1] (center)	SW-3 (east)
METALS AND CYANIDE (in µg/l)			
Calcium	5600	5050	5100
Iron	1200	1250	2100
Magnesium	790	745	1200
Manganese	45	52	70
Potassium	710	735	700
Sodium	8600	8850	8300
Cyanide	20 U	20 U	20 U

U Not detected at detection limit equal to value listed.
J Estimated value
(1) Values are average of sample and duplicate sample

Based upon the data summarized in Table 5-5, analytical results for most inorganic parameters reported are fairly consistent across the Fire Pond, with subtle differences occurring that may be attributable to proximity to the shoreline, where greater impacts from runoff may be anticipated. With the exception of manganese and iron, which are slightly elevated in the eastern end of the Fire Pond samples relative to the other sample locations, no obvious differences in water chemistry were found to be confined to specific areas of the pond.

5.4.4 Off-Site and On-Site Sediments

Nine (9) sediment samples (including two (2) duplicate samples) were collected at seven (7) locations during the Phase I hydrologic study, including four (4) locations from on-site surface water bodies, one (1) drainage structure on the Site, and two (2) off-site locations in the Little River. Locations of all sediment samples collected on the Site are illustrated on the Site Plan in Appendix A. Sediment sample locations for Little River sediments (SS-5 and SS-6) are shown on Figure 2-1 in Section 2. Table 5-6 indicates the locations of all sediment samples collected and the analyses performed on each sample. Analyses listed in the table include analyses which were not included in the Phase I scope of work, but were performed only on samples collected by the EPA oversight contractor.

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Table 5-6
SEDIMENT SAMPLE COLLECTION LOCATIONS
Columbia Manufacturing Company, Westfield, MA

Sample ID	Sample Location	Inorganics	Metals	VOCs	Semi-volatiles	Pesticides & PCBs	Physical Analysis
SS-1	Fire Pond, west	X	X				X
SS-2	Fire Pond, center	X	X				X
SS-2 (dup)	Fire Pond, center	X	X				X
SS-3	Fire Pond, east	X	X				X
SS-4	Reflecting Pond (south end, diversion structure)	X	X	X	X		
SS-5	Little River above discharge pipe	X	X	X	X		
SS-6	Little River below discharge pipe	X	X	X	X	X	
SS-6 (dup)	Little River below discharge pipe					X	
SS-8	Storm Drain	X	X	X	X		

(dup) duplicate sample

The results of chemical analysis of off-site sediments from the Little River and the physical characteristics of sediments from the Fire Pond are summarized in the following sections. The results of the chemical characteristics of the sediment samples collected from the Fire Pond and the Reflecting Pond are discussed in Section 12. The results of the chemical characteristics of the sediment samples collected from the Storm Drain are discussed in Section 13.

Chemical Analysis of Sediments

Sediment samples from all seven (7) locations were analyzed for total metals. Analysis for volatile and semi-volatile organic compounds was performed only on samples from the former Reflecting Pond Diversion Structure, the Little River and the Storm Drain. Discussion of the results of those chemical analyses is presented in Sections 12 and 13.

Chemical analysis for TOC and pH was performed on all seven (7) sediment samples collected at the Site. TOC concentrations ranged from 622 mg/kg to 106,100 mg/kg. The highest concentrations detected were in Fire Pond and Reflecting Pond sediments. The Little River and Storm Drain sediments exhibited much lower concentrations. The Fire Pond and Reflecting Pond sediments also exhibited higher pH values (7.02 - 8.55) than the other sediment samples collected during Phase I (6.21 - 6.88). Those data are summarized in Table 5-7.

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Table 5-7
SUMMARY OF SEDIMENT CHEMICAL ANALYSIS
Columbia Manufacturing Company, Westfield, MA

Sample Identification	Total Organic Carbon (mg/kg)	pH (s.u.)
SS-1	106,100	7.12
SS-2	67,800	7.40
SS-3	31,600	7.02
SS-4	24,400	8.55
SS-5	1,580	6.60
SS-6	622	6.88
SS-8	1,480	6.21

Physical Characteristics of Fire Pond Sediments

Samples from the Fire Pond were analyzed for grain-size distribution and other physical parameters by Yankee Engineering and Testing, Inc. of Worcester, Massachusetts. Sediment samples collected from all three (3) locations in the Fire Pond were classified by the laboratory as black, saturated organic silts and sand, with traces of wood particles. Table 5-7 summarizes the physical characteristics of the sediment samples collected from the Fire Pond. The grain-size distribution graphs are located in Appendix G.

Table 5-8
PHYSICAL CHARACTERISTICS OF FIRE POND SEDIMENTS
Columbia Manufacturing Company, Westfield, MA

Physical Characteristic	Fire Pond Sediment Sample Identification		
	SS-1	SS-2	SS-3
Percent Solids	13.7	34.1	55.5
Wet Density (pcf)	65.5	68.0	83.8
Dry Density (pcf)	12.7	16.6	35.4
Percent Moisture[1]	416%	305%	137%
Specific Gravity	1.35	1.45	2.00
Void Ratio	5.66	4.79	2.53
Porosity	85.0	80.6	71.7
Percent Saturation	99.6	94.9	108

1 Percent moisture is calculated by dividing the weight of the water in the sample by the weight of the solids.

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Correspondence from Yankee Engineering and Testing, Inc., presenting the analytical data noted that "...the porosity values were extremely high as the volume of solids, in the samples, was very low. Also, the saturation values should have been close to 100%, however, small errors (due to floating particles) in the specific gravity test could account for the differences for 2A and 4A." The ASTM testing methods used are intended for use on soils. Although they are widely used on sediments, the organic matter present in sediments sometimes causes difficulty in performing the analyses because of the low specific gravity of the organic matter relative to the mineral matter.

The Standard Field Procedure for sediment sample collection included in the RFI Phase I Proposal stated that sediment samples must be a minimum of 30% solids. The data from SS-1 does not meet that criterion.

5.4.5 Groundwater and Surface Water Interactions

Off-site Water Bodies

Both the Westfield and Little Rivers are perennial, and have continual interaction with groundwater. Groundwater recharge occurs within the watersheds surrounding each river, with discharge to the rivers. The watersheds are defined topographically, and are bounded by groundwater and surface water divides which generally correspond to topographic highs. Groundwater discharge, precipitation, overland runoff, upstream surface water impoundments and industrial discharges affect the quality and quantity of flow in both rivers.

As discussed in Section 6.4.1, the average annual precipitation in the Westfield area (as measured from 1978 to 1992) is approximately 49.5 inches. This quantity includes both rainfall and a converted value for snowfall. This total precipitation factors into the water balance of the drainage basin as infiltration, evapotranspiration or surface runoff. Average snowfall values alone for this same time period range from 0.3 inches to 12.2 inches per month (October through April). As the snow melts, most of this water will affect the local system in the form of surface runoff, as the ground is often still frozen in the early spring when the major snowmelt occurs. Section 6 of this Report presents more detailed climatological information relative to the Site.

Literature data and on-site activities included in the Phase I Scope of Work did not further characterize groundwater and surface water interactions in off-site water bodies.

On-Site Water Bodies

The depth to groundwater in the vicinity of the Fire Pond is fairly shallow. The water table was encountered in shallow monitoring wells in the area at depths of less than ten (10) feet. Based on available data, this depth roughly corresponds with the depth of the Fire Pond. Thus, the pond is assumed at a minimum to intersect the water table on a seasonal basis, providing the potential for interaction between groundwater and pond water. Literature data and on-site activities included in the Phase I Scope of Work did not further characterize groundwater and surface water interactions in off-site water bodies.

5.5 GENERAL DISCUSSION OF HYDROLOGY

5.5.1 Conceptual Hydrological Model

Based on area topography, proximity to the Westfield and Little Rivers, and groundwater contours developed for the Site (Section 4), the direction of regional groundwater flow is inferred to be

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toward the south/southeast, toward the Little River. Groundwater in the vicinity of the Site is assumed to discharge to the Little River. A downward flow gradient is expected in areas of recharge at distances away from the river, and this was observed in multiple point cluster wells installed on the site (Section 4). In low lying areas drained by perennially flowing rivers, an upward flow gradient is often found close to the river, as groundwater discharges contribute to flow in the river.

The water elevation in the Fire Pond is approximately 86 feet above Westfield City Datum. The water level in the shallow monitoring well in closest proximity to the Fire Pond, MW-20S, was 83.68 in December, 1993. This difference in water elevations may indicate that water in the Fire Pond is perched on a low permeability layer of silt and organic matter. Additional data needed to evaluate seasonal variations in groundwater and surface water interactions should be collected during the Phase II investigation.

5.5.2 Data Gaps Identified in the Phase I Hydrological Investigation

The Phase I hydrological investigation identified the following data gaps. Strategies for addressing these data gaps are discussed and specific tasks for filling these data gaps are proposed for the Phase II hydrological investigation (Section 20).

Delineation of potential wetland area needed. A delineation of the potential wetland area identified on the site needs to be performed. The study should identify both the Massachusetts and the Federal wetland boundaries. The season and duration of surface water ponding in this area, if any, should be evaluated.

Additional sediment samples are needed from the Fire Pond for physical analysis. Sediment sample SS-1 did not meet the requirements outlined in the RFI Phase I proposal. This analysis should be repeated.

Interaction between groundwater and Fire Pond surface water not determined. Additional information about groundwater and surface water elevations in the vicinity of the Fire Pond is needed to determine whether the Fire Pond is hydraulically connected to the groundwater beneath the Site and the nature (recharge, discharge) of any interactions on a seasonal basis.

Interaction between groundwater and Little River surface water not determined. Additional information is needed to determine whether groundwater is discharging to the river through its bed or if river flow is recharging the groundwater table. This will need to be evaluated only if data from initial Phase II analyses indicate that groundwater contamination has migrated beyond wells MW-22S, 23S and 24S, and is potentially discharging into the Little River.

Surface water and sediment quality of the Little River needs to be determined. Current data from locations upstream and downstream of the Site in the Little River are needed to evaluate impacts from Site discharges and to evaluate groundwater and surface water interactions. Additional surface water and sediment analyses will be needed only if data from initial Phase II analyses indicate that groundwater contamination has migrated beyond wells MW-22S, 23S and 24S, and is potentially discharging into the Little River.

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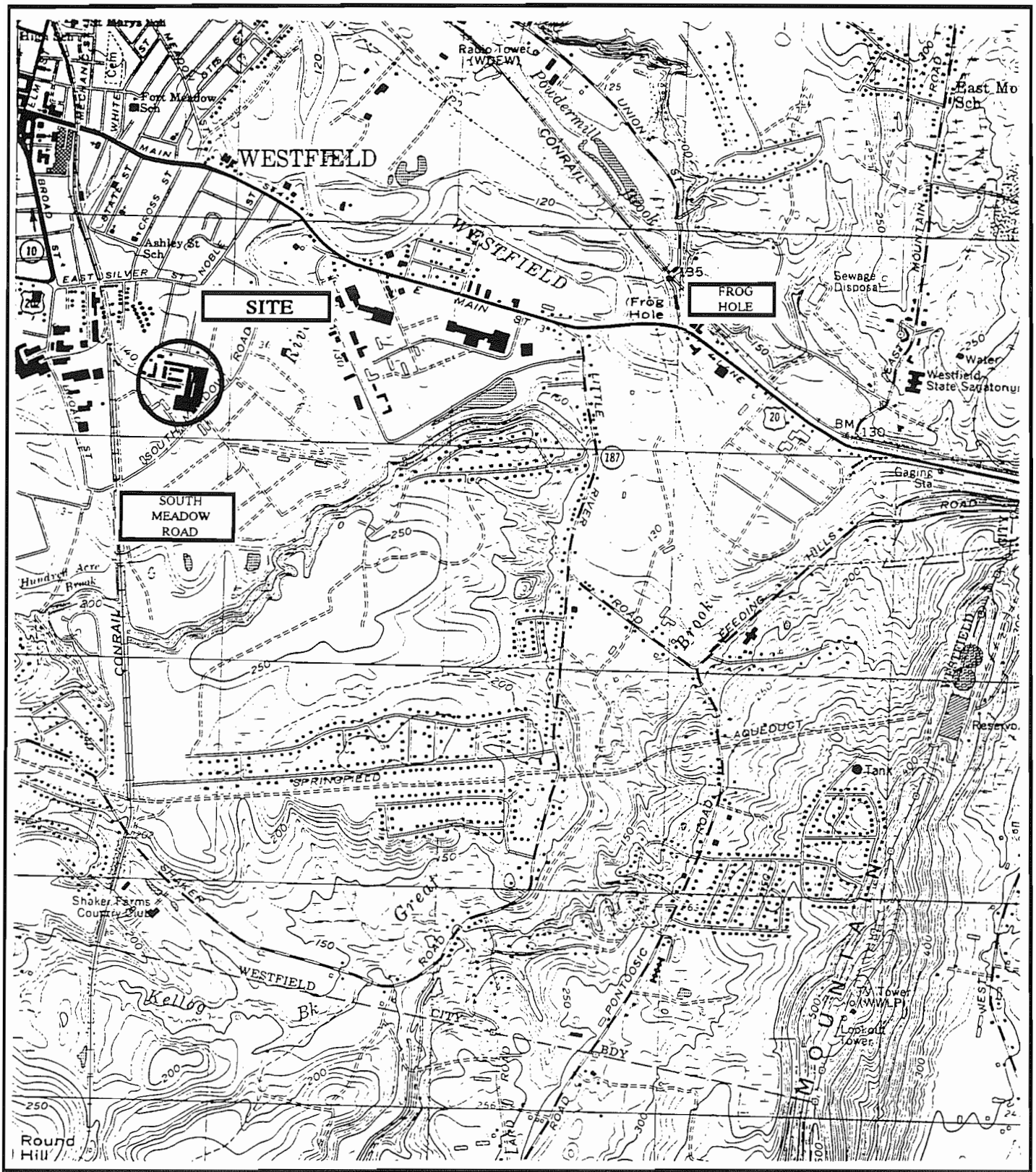
5.6 SUMMARY

This section presented the objectives of the Phase I hydrological investigation, the methods and analyses used to accomplish those objectives, and the results of the literature survey and field activities. A preliminary conceptual hydrological model was presented, and data gaps were identified. Following is a summary of the major conclusions of the Phase I hydrological investigation:

- The Site is located in the Westfield River drainage basin. This drainage basin, which encompasses an area of approximately 517 square miles, has been subject to significant flooding (50-year flood or greater) on three (3) occasions in the twentieth century. Flooding is now controlled by dams located higher within the basin. The Site is located at elevations above the 100-year flood boundary identified by FEMA, and within the 500-year flood boundary.
- The Site located within approximately one-half mile of the Little River, a major tributary to the Westfield River. The Little River flows generally eastward, however the river bed meanders to the west, south and east of the Site, prior to its confluence with the Westfield River approximately one-half mile to the northeast of the Site.
- There is one (1) surface water body on the Site that consistently holds water. That water body, the Fire Pond, is a man-made structure that is a remnant of a former canal. The water level in this surface water body was approximately 2.5 feet higher than the groundwater surface during this investigation. The Fire Pond is also an Area of Concern (AOC 34).
- The Reflecting Pond no longer holds water on a consistent basis, and did not hold water at the time of the Phase I investigation.



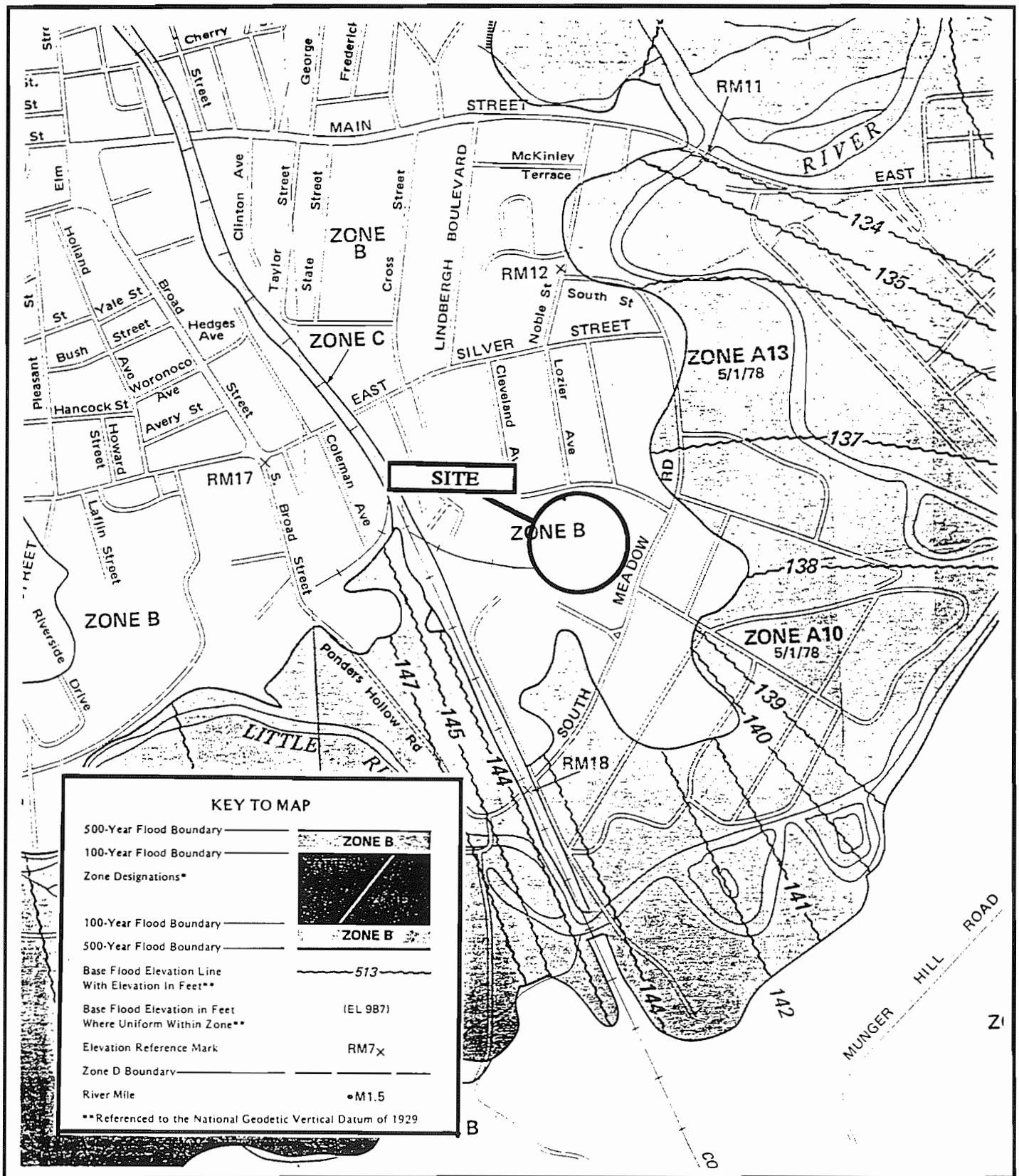
Derived from USGS West Springfield topographical quadrangle.

FIGURE 5–1
DEQE SURFACE WATER QUALITY MONITORING STATIONS

RCRA FACILITY INVESTIGATION
COLUMBIA MANUFACTURING CO., INC.
WESTFIELD, MASSACHUSETTS

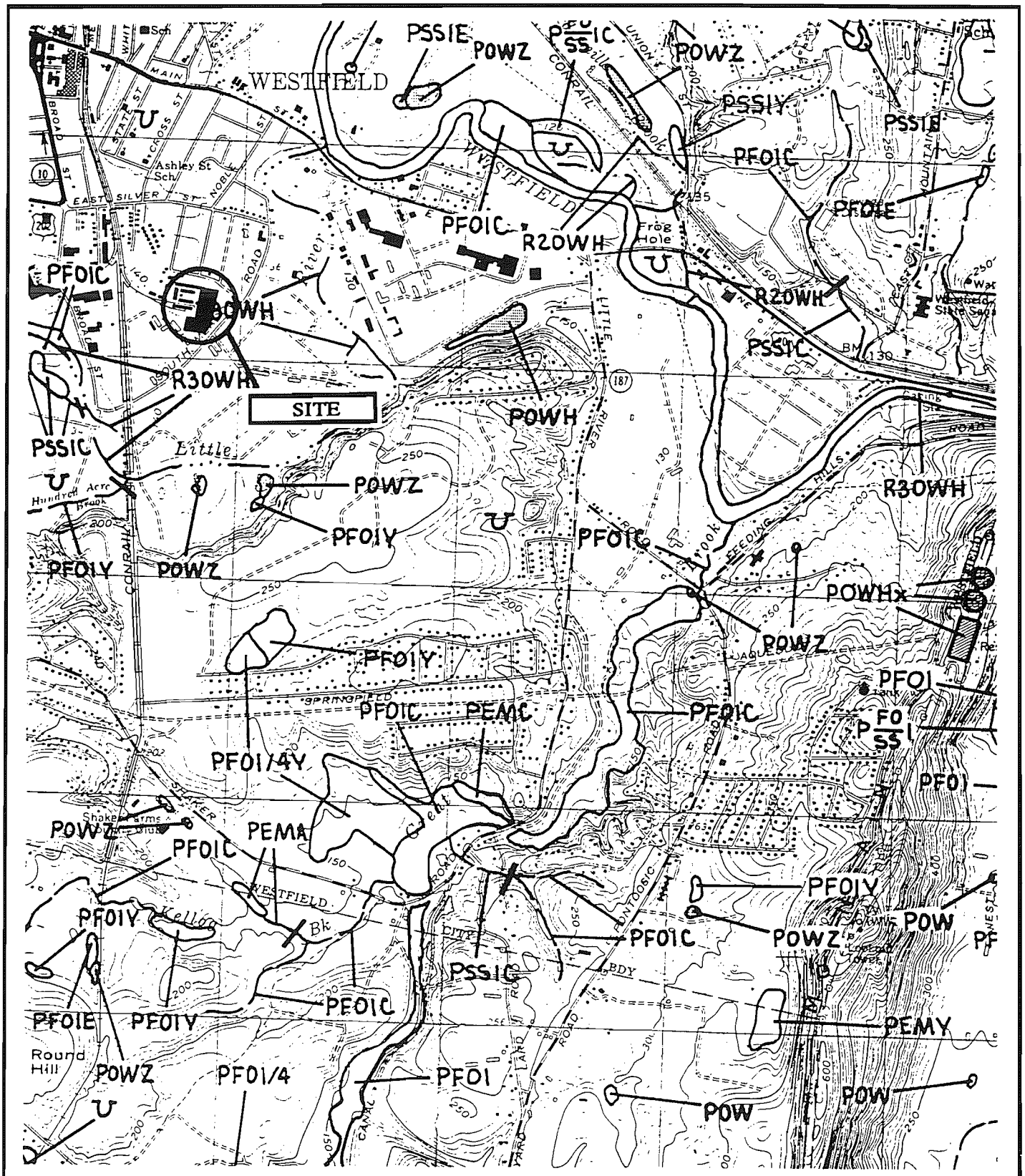
TIGHE & BOND, INC. CONSULTING ENGINEERS

SCALE: 1:25,000 DATE: SEP. 1994



Derived from National Flood Insurance Program, Flood Insurance Rate Map prepared by the Federal Emergency Management Agency for the City of Westfield, Community Panel Number 25013 0020 B, dated May 1, 1978

FIGURE 5–2
FEMA FLOOD BOUNDARY MAP
RCRA FACILITY INVESTIGATION
COLUMBIA MANUFACTURING CO., INC.
WESTFIELD, MASSACHUSETTS
TIGHE & BOND, INC. CONSULTING ENGINEERS
SCALE: 1" = 1000 FT DATE: SEP. 1994



Derived from United States Department of the Interior National Wetlands Inventory Map for the West Springfield quadrangle, prepared by the U.S. Fish & Wildlife Service based upon aerial photography performed in October, 1975.

FIGURE 5–3
NATIONAL WETLANDS INVENTORY MAP
RCRA FACILITY INVESTIGATION
COLUMBIA MANUFACTURING CO., INC.
WESTFIELD, MASSACHUSETTS
TIGHE & BOND, INC. CONSULTING ENGINEERS
SCALE: 1:24,000 DATE: SEP. 1994

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6
PHASE I CLIMATOLOGICAL INVESTIGATION

6.1 OVERVIEW

This section describes the Phase I climatological investigation of the Site. The investigation included a review of published data for local monitoring stations and on-site monitoring of ambient air. Data obtained was subsequently compiled into summaries and presented graphically. Phase I activities also included general air monitoring at the Site. Section 6.2 reviews the objectives of the Phase I climatological investigation, Section 6.3 describes the methods and analyses used, and Section 6.4 discusses the results obtained. Section 6.5 presents a preliminary airflow/emissions model of the Site and identifies data gaps determined during the Phase I investigation. A summary is included in Section 6.6.

6.2 OBJECTIVES

The objectives of the climatological investigation of the Phase I Investigation at the Site, as outlined in the Consent Decree, are to evaluate the climatic conditions in the vicinity of the Site that may cause or influence the transport of hazardous waste or hazardous constituents released from the AOCs into the atmosphere. These conditions include precipitation, temperature, and wind direction and speed. The Consent Decree also requires a description of any climatic extremes known to occur in the vicinity of the Site and topographic features which may affect airflow and emission patterns near the Site.

6.3 METHODS AND ANALYSES

A literature review was undertaken to provide data for airflow and emissions modeling, and ambient air monitoring was conducted at the Site.

6.3.1 Literature Review

Climatic data was collected from the Westover Air Force Base (AFB) in Chicopee, Massachusetts and from the National Climatic Data Center (NCDC) of the National Oceanic and Atmospheric Administration (NOAA). The NCDC data included information collected at Barnes Airport in Westfield, Massachusetts and at Bradley International Airport in Windsor Locks, Connecticut.

Precipitation data for the Site and the vicinity of the Site was supplied by the NCDC. Annual Climatological Summaries for the Barnes Airport monitoring station located are included in Appendix J. Temperature data for the Site and the vicinity of the Site was supplied by climatologist Curt Osgood of the Westover AFB. The data summary is included in Appendix J. Wind speed and direction data was provided by the NCDC from the Wind Energy Resource Information System, a data base designed for use in wind energy applications. Wind data from the Barnes Airport and Windsor Locks, Connecticut monitoring stations was supplied by the NCDC.

6.3.2 General Air Monitoring

Ambient air screening for VOCs was performed on September 13 and 17, 1993 at five (5) air monitoring stations at the Site using a PID. Screening was conducted at a shallow 6-inch deep boring at AS-1 and near the surface of the Fire Pond (AOC 34) at AS-2. The remaining background air quality samples were screened at stations AS-3, 4, and 5, which are located along northern border of the Site. These three (3) samples were collected with the monitoring equipment

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in the personal breathing space of the personnel conducting the evaluation. Air was also screened during a walk-through of Buildings 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, and 17 on September 17, 1993.

General weather conditions were recorded during both sampling dates. On September 13, 1993, the winds varied from 5 to 15 MPH out of the south/southeast. The skies were clear, with the temperatures near 80°F. On September 17, 1993, there were no perceptible winds. The skies were cloudy with temperatures near 65°F.

6.4 RESULTS OBTAINED

Precipitation, temperature, and wind characteristics at the Site were determined through a review of available data provided by NCDC and Westover AFB. The results of the ambient air monitoring are also presented.

6.4.1 Precipitation

The Barnes Airport monitoring station is located approximately 3.75 miles northeast of the Site at an elevation of 220 feet NGVD approximately 80 feet higher than the elevation of the Site. Monthly precipitation data includes the total precipitation, the departure from normal, the total snow fall, and other less important factors (eg. greatest observed precipitation during one day of the month). Precipitation includes snowfall which was converted to an equivalent rainfall precipitation.

Average monthly precipitation for the previous fifteen (15) years (1978 to 1992, inclusive) are presented in Figure 6-1, Monthly Average Precipitation, located at the end of this section. The normal precipitation indicated on the figure was calculated from the NCDC's departure from normal data. Normal precipitation values are fairly constant and are updated infrequently; the last update for this monitoring station was in 1983. As shown in Figure 6-1, there has been greater than normal precipitation during most months between 1978 and 1992; the only exceptions being March, September, and December. The greatest average precipitation, 5.54 inches, was recorded in August; the lowest, 3.23 inches, in February. Precipitation during months other than February and August ranged between 3.4 and 4.7 inches.

The total annual precipitation for the same period, 1978 to 1992, is presented in Figure 6-2, Total Annual Precipitation. The average annual precipitation during that period was 49.52 inches. The maximum precipitation, 70.73 inches, occurred in 1983; the minimum, 35.48 inches, in 1980.

6.4.2 Temperature

The data for temperature are presented in a data summary of wind, precipitation, snowfall, humidity and other data from the Westover AFB monitoring station. This station is located in Chicopee, Massachusetts, approximately 10 miles northeast of the Site. The monitoring station is located at an elevation of 245 feet NGVD, approximately 95 feet higher than the elevation of the Site. The data summary is included in Appendix J.

Two (2) sets of temperature data are included in the Westover AFB data. The first data set includes temperature readings between 6:00 AM and 10:00 PM recorded between October 1975 and September 1985. This data, presented in Figure 6-3, Monthly Temperature Means - 1975 to 1985, shows the continuous annual fluctuation from low temperatures, around 20°F during January, to high temperatures, around 70°F in July. The second data set is a summarization of the 44-year

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period prior to March 1986, when the summary was compiled. Figure 6-4, Monthly Temperature Average and Extremes - 1942 to 1986, charts the extreme maximum and minimum temperatures recorded during that period for each month relative to the average temperatures. The range is much broader than the mean maximum and minimums presented in Figure 6-3. The average temperature data in Figure 6-4 is identical to the daily mean average temperature in Figure 6-3.

6.4.3 Wind

Wind speed and direction data was provided by the NCDC from the Wind Energy Resource Information System (WERIS), a data base designed for use in wind energy applications. Wind data from WERIS for the Barnes Airport monitoring station were supplied by the NCDC. The data, included in Appendix J, details the monthly and annual average wind speed and frequency of occurrence for each of the 16 cardinal compass points. Frequency of occurrence is indicated as a percentage; speed is given in meters per second. The data was collected between January 1, 1949 and April 30, 1952. The monitoring point was 17.1 meters above ground level or approximately at an elevation of 276 feet NGVD which is approximately 136 feet higher than the elevation of the Site.

Wind roses indicating the frequency of occurrence of each cardinal compass point, for each month and annually, are included in Appendix J. Prevailing wind directions determined from the wind roses are as listed in Table 6-1, Prevailing Wind Directions. Primary and secondary prevailing wind directions were determined by the relative magnitude of the trends of each wind rose.

Wind roses indicating the average wind speed for each cardinal compass point, for each month and annually, are included in Appendix J. Wind speeds were generally less than 5 meters per second (11.2 miles per hour) at the monitoring station. The highest wind speeds (5 to 7.5 meters per second) were recorded from the west/northwest to the north/northwest for each month of the year. The highest wind speeds for each month of the year originate from the northwest, a compass direction that differs from the prevailing wind direction. Monthly highest wind speed by direction is detailed in Table 6-2, Highest Wind Speed vs. Direction.

Data for the mean annual wind speed and the fastest observed one (1) minute wind speed were also provided by NCDC. Mean annual fastest wind mile data was also requested from the NCDC, however, this data is no longer recorded. The mean annual fastest wind speed data were collected from 1949 through 1952. The fastest observed one (1) minute wind speed data were recorded over a seven year period, ending in 1992. Tables 6-1 and 6-2 contain the mean annual wind speed and fastest observed one (1) wind mile data obtained.

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Exhibit 6-1
PREVAILING WIND DIRECTIONS
Columbia Manufacturing Company, Westfield, MA

Wind Type	Month												
	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
Primary	NW-NNE	WNW-NE	WNW-NNE	NW-N	NW-NE	SSE-SW	S-SW	S-SW	S	N-NE	NW-N	NW-NE	NW-NNE
Secondary	SW	[1]	S-SW	S	S-SSW	NW	NE	N	NW,N	S-SW	S-SW	S,SW	S-SW

dir-dir All cardinal points inclusive.
dir,dir Only these specific cardinal points.
1 No secondary prevailing wind direction is apparent for this month.

Exhibit 6-2
HIGHEST WIND SPEED[1] vs. DIRECTION
Columbia Manufacturing Company, Westfield, MA

JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
NW-NNE	WNW-NNW	WNW-NNW & ENE	WNW, NNW	WNW	WNW, ENE	WNW-NW & SSW	WNW	WNW	WNW	WNW-NNW & ENE & E	WNW-NNW & ENE	WNW-NNW

dir-dir All cardinal points inclusive.
dir,dir Only these specific cardinal points.

1 Wind speeds in excess of 5 m/s.

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Table 6-3
MEAN ANNUAL FASTEST WIND SPEED
Columbia Manufacturing Company, Westfield, MA

Wind Direction	Annual Average (m/s)
North	3.5
North/Northeast	4.1
Northeast	3.3
East/Northeast	4.5
East	3.6
East/Southeast	3.2
Southeast	2.7
South/Southeast	3.6
South	3.3
South/Southwest	4.0
Southwest	3.2
West/Southwest	3.6
West	3.8
West/Northwest	5.6
Northwest	4.9
North/Northwest	5.0

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Table 6-4
FASTEST OBSERVED 1 MINUTE WIND SPEED
Columbia Manufacturing Company, Westfield, MA

Month Observed	Year Observed	Wind Speed (m/s)	Direction[1]
January	1992	13.4	24°
February	1989	16.5	29°
March	1987	16.5	18°
April	1988	14.8	29°
May	1987	12.5	05°
June	1986	11.6	30°
July	1991	15.6	35°
August	1988	17.9	18°
September[2]	1985	19.2	17°
October	1986	14.8	26°
November	1989	17.9	19°
December	1992	17.4	31°

(1) wind direction is measured in degrees, clockwise from due north.
(2) fastest minute observed during 7-year study

From Table 6-3, the highest mean annual wind speed recorded during the 1949-1952 study was 5.6 m/s from the west/northwest. Table 6-4 illustrates that the fastest observed one (1) minute wind speed was measured in September of 1985, at 19.2 m/s.

6.4.4 Results of Air Monitoring

Monitoring completed on November 13, 1993 at monitoring stations AS-2 and AS-3 did not detect any VOCs; 0.3 ppm and 0.4 ppm total VOCs were detected at stations AS-4 and AS-5, respectively. Winds were blowing out of the south/southeast during air monitoring, suggesting that plowing in the tobacco fields southeast of the Site may have been responsible for these minor concentrations. No VOCs were detected in the ambient air above the shallow boring at AS-1; however, 29.9 ppm VOCs were detected in the shallow boring. The VOCs detected at AS-1 likely resulted from a release of subsurface VOCs and not ambient air contamination. VOCs were not detected at any of the monitoring stations on September 17, 1993. In addition, there were no perceptible winds during the September 17, 1994 sampling round, further substantiating the theory that agricultural activities being performed during the September 13, 1994 monitoring event may have been responsible for low level VOCs in two (2) of the air samples monitored. The results of air monitoring are presented in Table 6-5. Monitoring during a building walkthrough conducted on September 17, 1993, detected 0.5 to 1 ppm VOCs above background near the painting operation

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in the southwest corner of the warehouse. No other elevated readings were measured during the building walk-through. Based on these data, it appears that air contamination by VOCs is not an issue at the Site.

Table 6-5
RESULTS OF VOC MONITORING IN AIR
Columbia Manufacturing Company, Westfield, MA

Monitoring Date	Air Monitoring Station				
	AS-1	AS-2	AS-3	AS-4	AS-5
September 13, 1993	0.0[1]	0.0	0.0	0.0-0.3	0.0-0.4
September 17, 1993	0.0	0.0	0.0	0.0	0.0

1 Ambient air above a shallow boring; VOCs were detected at 29.9 ppm in the boring.

6.5 GENERAL DISCUSSION OF CLIMATE

As evidenced in the data presented on precipitation, temperature, and wind, the climate of the vicinity of the Site is typical of the seasonal climate of New England. Seasonal variations occur primarily in temperature and wind and, to a lesser extent, in precipitation. As noted in Section 6.4.2, the seasonal temperature fluctuation is apparent in Figure 6-4. The average temperature throughout the year fluctuates from 24°F to 72°F. The prevailing wind direction is from the northwest during most months, but tends to shift to a southerly to southwesterly direction during the summer months (June to September). The highest velocity winds (5 to 7.5 m/s), however, are from the northwest during the entire year. Precipitation, including snow converted to equivalent rainfall, remains fairly constant throughout the year at approximately four (4) inches per month. Yearly total precipitation is approximately 50 inches per year, on average, with potential surpluses or deficits of up to 20 inches per year.

6.5.1 Conceptual Climatological Model

The Consent Decree outlines the need for an evaluation of airflow and emission patterns in the vicinity of the Site. Although neither the AOCs identified by the EPA nor the data collected during this investigation identify the air as a significant transport media of concern at the Site, we have developed a body of data to support this requirement.

Local airflow patterns are likely to be impacted by topography in the vicinity of the Site, most notably the presence of Munger Hill, located approximately 3,000 feet to the southeast. This formation rises approximately 100 feet above the alluvial plain in which the Site is located. In addition, the Provin Mountain range, which lies at an elevation 250 to 450 feet higher than the elevation of the Site, provides a nearly continuous north to south boundary 2¼ miles east of the Site. The gap in the range through which the Westfield River flows is approximately 0.75 mile wide and is located directly east of the Site. Site-specific wind speed and direction are assumed to be similar to the wind speed and direction presented in Section 6.4.3 for the Barnes Airport 3.75 miles northeast of the Site. The prevailing wind direction at the Site is, therefore, from the

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northwest during most months and from the south/southwest during the summer months (June to September). The predominant direction of the highest wind speeds is consistently northwest throughout the entire year at the Site. The impact of the topographic features to the east (Provin Mountain) and southeast (Munger Hill), therefore, cause an uplift in the airflow which passes through the Site toward the southeast.

Historical emissions at the Site may have originated from the first floor level (0 to 20 feet above ground surface) and from the stack which discharges approximately 135 feet above ground surface. Currently, the stack gases are constantly monitored and the air discharge is permitted by the DEP. Former emissions originated from the third floor level (30 to 50 feet above ground level) of Building 1. The painting operation in that building was discontinued around 1991. Based on the locations of the emission sources at the Site, Munger Hill would cause an uplift of airborn emissions migrating southeast, except for the stack which would be lifted to the east by the Provin Mountain range. Precipitation events may have directed historic airborne particulate material to exposed surfaces (surface soil, surface water bodies, and roof areas) downwind of emission sources at the Site.

6.5.2 Data Gaps Identified in the Phase I Climatological Investigation

Air is noted as a media of concern in Table 5-2 of the RFI Proposal only for the Fire Pond (AOC 34). A general air monitoring program initiated at the Site did not indicate the presence of VOCs in ambient air above the Fire Pond. No data gaps have been identified for the Phase I Climatological investigation.

6.6 SUMMARY

- **Precipitation** - Precipitation, including snow converted to equivalent rainfall, remains fairly constant throughout the year at approximately four (4) inches per month. Yearly total precipitation is approximately 50 inches per year, on average, with potential surpluses or deficits of up to 20 inches per year.

- **Temperature** - The average temperature throughout the year fluctuates from 24°F to 72°F.

- **Wind** - The prevailing wind direction is from the northwest during most months, but tends to shift to a southerly to southwesterly direction during the summer months (June to September). The highest velocity winds (5 to 7.5 m/s), however, are from the northwest during the entire year.

- **Climate** - The climate in the vicinity of the Site is typical of the seasonal climate of New England. Seasonal variations occur primarily in temperature and wind and, to a lesser extent, in precipitation.

- Air was identified as a potential media of concern in the vicinity of the Fire Pond (AOC 34) prior to initiation of this Phase I investigation. Results of the ambient air monitoring program did not identify the presence of VOCs in the air space above the Fire Pond. Based on the available data, air will no longer be included as a media of concern in future investigations at this Site.

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Figure 6-1
MONTHLY AVERAGE PRECIPITATION
Columbia Manufacturing Company, Westfield, MA

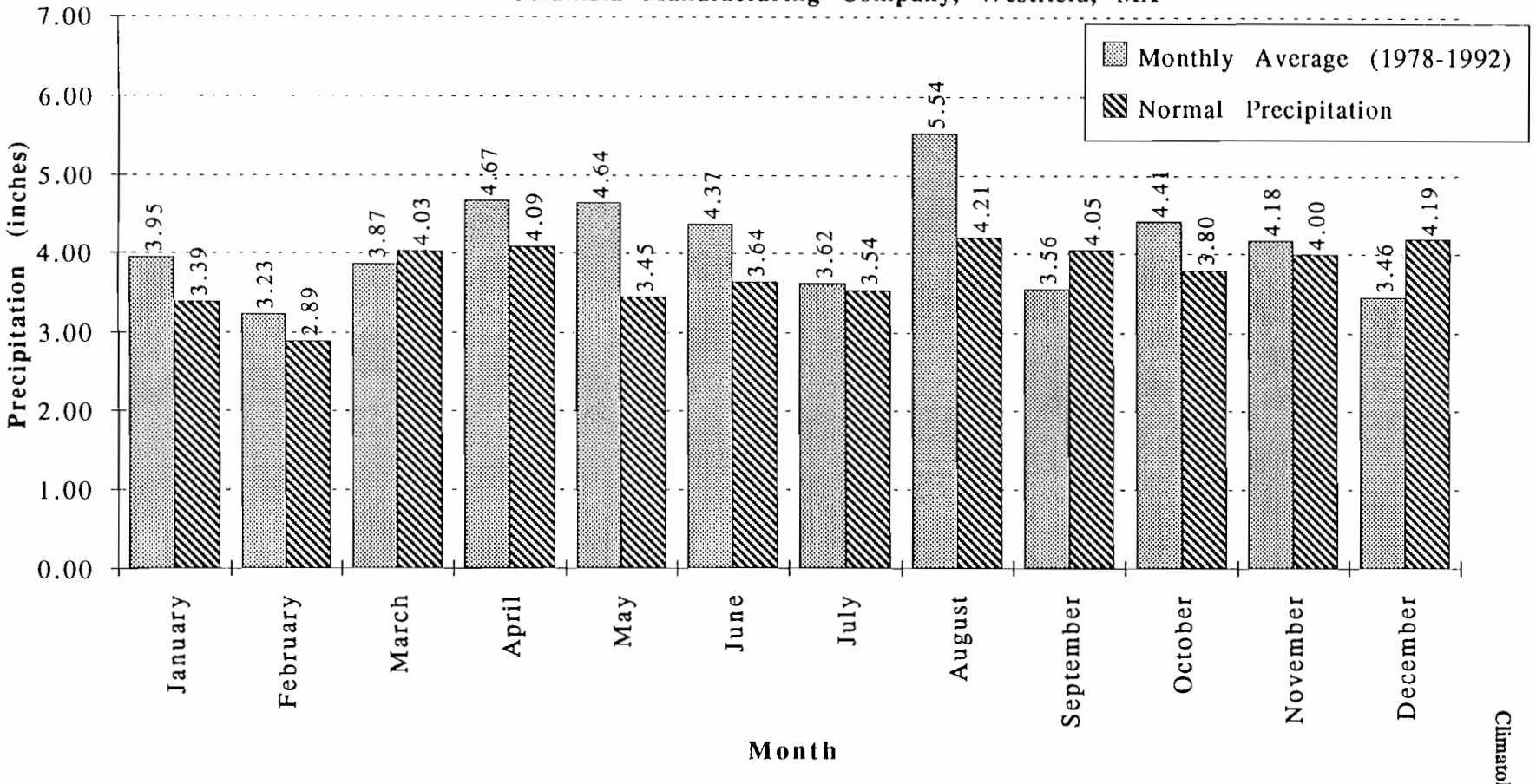

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Figure 6-2

TOTAL ANNUAL PRECIPITATION
Columbia Manufacturing Company, Westfield, MA

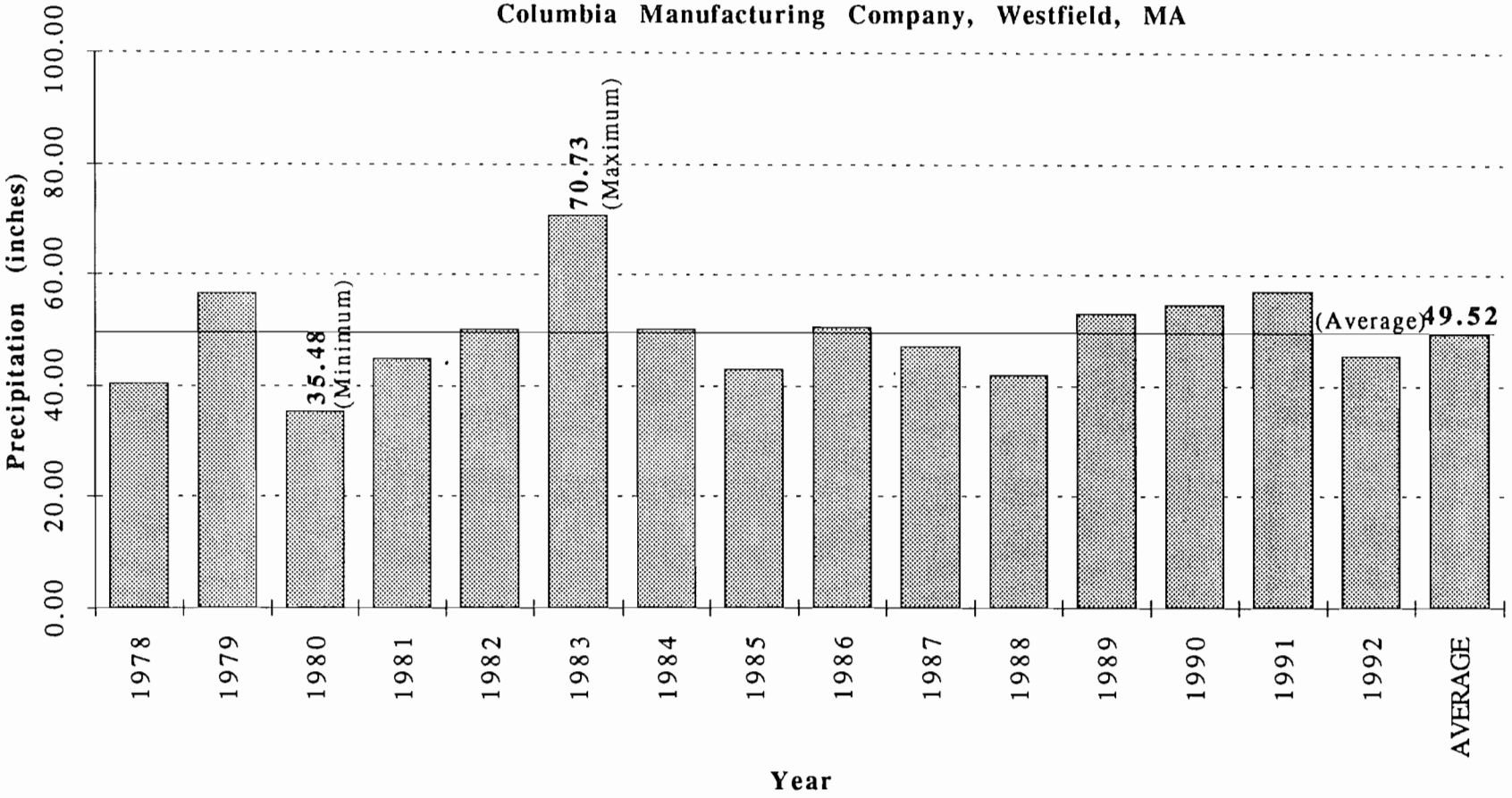

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Figure 6-3

MONTHLY TEMPERATURE MEANS - 1975 to 1985
Columbia Manufacturing Company, Westfield, MA

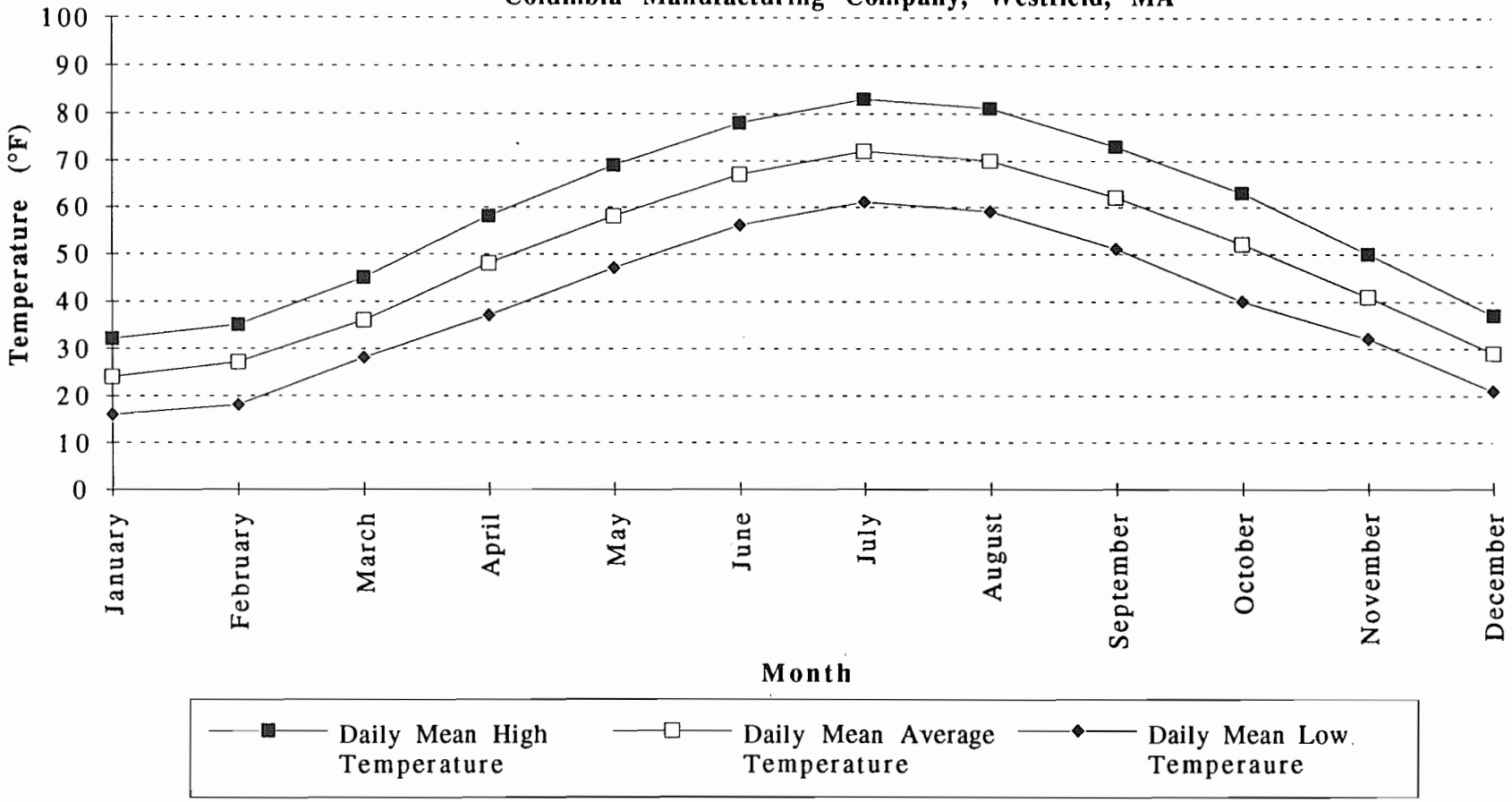

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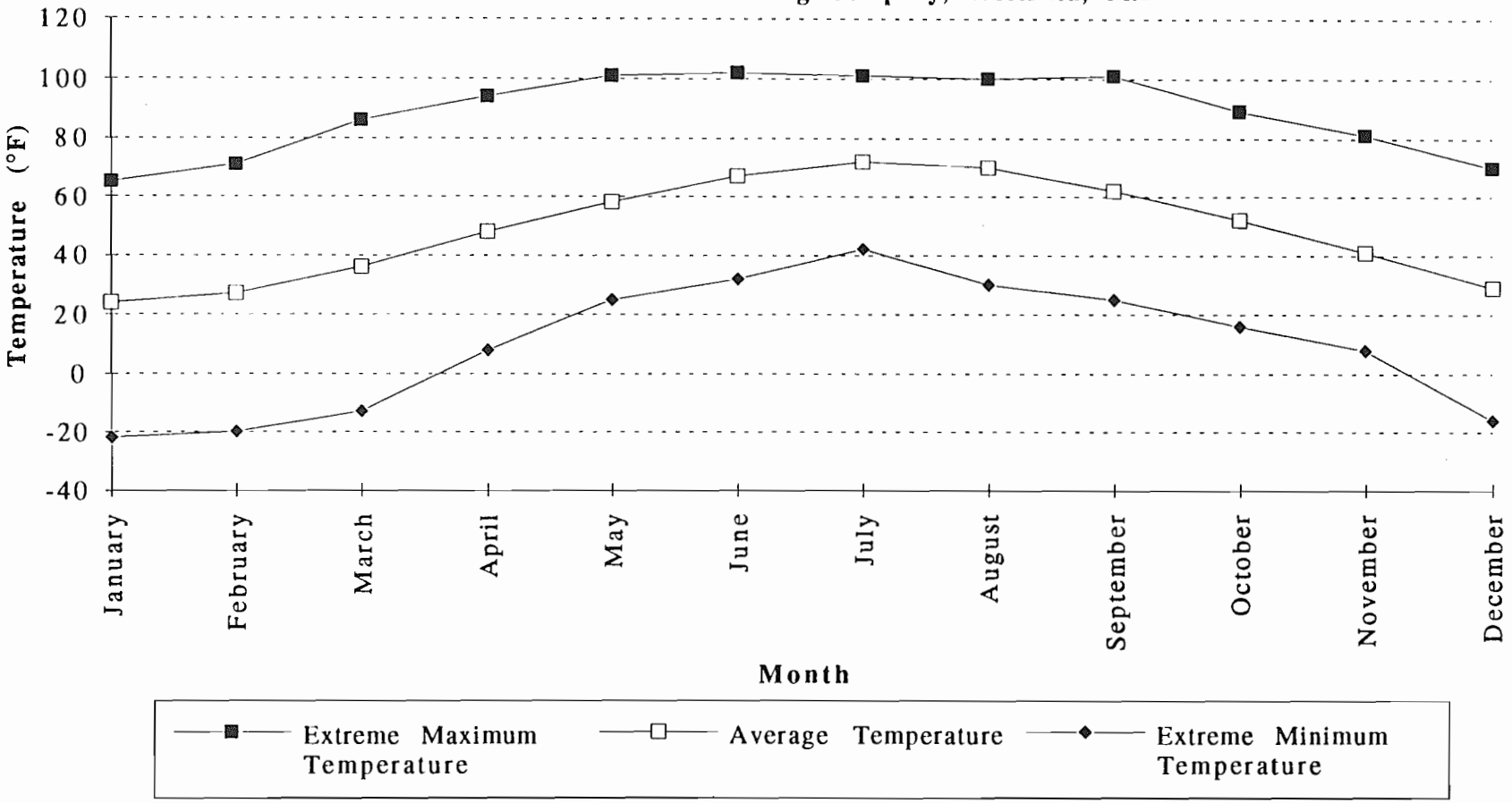
Figure 6-4

MONTHLY TEMPERATURE AVERAGE AND EXTREMES - 1942 to 1986
Columbia Manufacturing Company, Westfield, MA



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7
PHASE I RELEASE CHARACTERIZATION OVERVIEW

7.1 OVERVIEW

This section details general considerations regarding the release characterization at SWMUs which are considered to be AOCs. These AOCs are listed in Section 1.3. Section 7.2 details general objectives of the release characterization. Section 7.3 outlines the division of the AOCs into groups for further discussion. Section 7.4 discusses the specific monitoring locations for each AOC. Section 7.5 discusses the general methods of analysis utilized for the release characterization presented in Section 8 to Section 16. Section 7.6 discusses the tables outlining AOC characteristics. Section 7.7 discusses the tables utilized to summarize Phase I analytical data. A summary is presented in Section 7.8.

7.2 GENERAL OBJECTIVES OF RELEASE CHARACTERIZATION

Release characterizations were undertaken for each AOC grouping. The primary objective of the characterization was to determine if hazardous constituents were released from the AOCs. The secondary objective was to define the nature and extent of those releases into groundwater, soil, surface water, sediment, subsurface gas, or air. During Phase I, the primary objective was addressed and determinations of the nature and extent of the releases were completed on a preliminary basis. Specifically, the Phase I investigation attempted to define:

- the presence of dissolved contaminants in groundwater;
- the presence of contaminants in soil;
- the presence of dissolved contaminants in surface water;
- the presence of contamination in sediments;
- the presence of subsurface gas contaminants near the hazardous waste drum storage area (AOC 14a);
- the presence of contaminants in air originating at the Fire Pond (AOC 34);
- the concentration of background compounds in the vicinity of the Site.

7.3 ORGANIZATION OF AOC AREAS

In order to simplify the discussion of the release characterization at the 27 AOCs, eight (8) AOC groupings were created. These groupings are sorted by similar AOC operations which, in most cases, also separate the groups by location. The rationale for each grouping is presented in the following sections. The table included in Appendix L lists the AOCs and the associated groups.

7.3.1 Plating Operations

The AOCs associated with plating operations at the Site include old trenches and sumps (AOC 39), the zinc plating line trench and sump (AOC 41), and the nickel chrome plating line trench and sump (AOC 42) which are located in Building 3. These units collected (or in the case of AOC 42 continue to collect) plating wastewater. Wastewater treatment, technically part of the plating operations, has been separated for the release characterization discussion (See Section 7.3.2).

7.3.2 Wastewater Treatment

This group consists of five (5) AOCs which are associated with the on-site treatment of plating wastewater. Wastewater from the plating operations in Building 3 is transported to the WWTP via

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the wastewater treatment pipes (AOC 45). Floor spills from the nickel chrome plating line are first directed to Storage Tank 11 (AOC 12) prior to treatment in the WWTP. The former pH adjustment tank (AOC 11) and the nickel filter (AOC 10) located on the south side of Building 3 are also considered in the wastewater treatment AOCs. The wastewater treatment room sump is AOC 46.

7.3.3 On-site Sludge Disposal

These AOCs include the former lagoons (AOC 29) and the underground discharge pipe (AOC 30) which was utilized to transport sludge to the lagoons. The scrap metal fill area (AOC 33a) is also included in this grouping because it is believed to be located beneath the lagoons. The former incinerators (AOC 33b) are also located in close proximity to the lagoons.

7.3.4 Waste Storage Yard

CMC has historically used the area south of Building 4 for waste storage. The wastes include scrap metal, office waste, metal hydroxide sludge, waste paints, and waste oils. The AOCs associated with this area are the sludge roll-off box (AOC 9), current and former hazardous waste drum storage areas (AOC 14a/AOC 14b), and the runoff area from the storage yard (AOC 21).

7.3.5 On-site Surface Water Bodies

There is one (1) current surface water body at the Site, the Fire Pond (AOC 34); and one (1) former surface water body, the reflecting pond (AOC 16). Even though the reflecting pond no longer contains standing water, the sediments at the bottom are still present. Therefore, the AOC is still considered a surface water body, with the exception that surface water is no longer present for sampling.

7.3.6 Utility Lines

Two (2) underground pipe systems have been utilized for off-site disposal of liquid wastes. The storm sewer (AOC 17) was formerly utilized for the discharge of treated plating wastewater to the Little River. The sanitary sewer (AOC 18) is currently used for the discharge of treated plating wastewater to the municipal sewer system.

7.3.7 Storage Tanks

Both USTs and ASTs have been utilized for the storage of fuel oils, cutting oil, and unleaded gasoline. A UST which contained fuel oil was previously removed from the Site (AOC 35) and is no longer considered an AOC. An additional UST which formerly contained cutting oil (AOC 36) was abandoned in place and filled with a concrete slurry. The gasoline UST (AOC 47) is currently in use at the Site. Fuel oil is currently stored in three (3) ASTs located within a concrete containment, the fuel storage area (AOC 37). An additional storage tank was identified during preparation of the RFIP. This tank is apparently a concrete containment which formerly held cooling oil (AOC 48).

7.3.8 Other Operations

Other current and former operations at the Site, not including plating operations, include paint stripping, metal pickling with phosphoric acid, rim machining, and plating rack maintenance. The

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AOCs associated with these operations include the stripping area floor drains (AOC 23) and the pickling room drain and sump (AOC 40). The wooden floor of the rim room, located in Building 4, is AOC 44. The rack maintenance area was identified during the preparation of the RFIP as AOC 49.

7.3.9 Off-site Monitoring

In addition to the release characterization areas described above, off-site migration of hazardous materials southeast of the Site is discussed separately. This group does not have any associated AOCs, but instead is intended to identify the aggregate off-site impact of releases from AOCs.

7.4 MONITORING OF MEDIA OF CONCERN

Sampling locations were selected for each AOC to monitor releases. The Summary of Phase I Release Monitoring Locations in Appendix L, summarizes the monitoring locations. The summary lists the AOCs (in the appropriate groupings), the media of concern, and the sampling locations. Gray shading in the summary indicates specific monitoring of the AOC, media of concern, or sampling location indicated. The AOC name and number is shaded when at least one (1) of the media of concern for the AOC are specifically monitored. Media of concern are shaded if Phase I sampling locations specifically monitor that media. Finally, sampling locations are shaded if they specifically monitor the AOC for that row.

Monitoring wells are separated into shallow, intermediate, intermediate/deep, and deep. To specifically monitor an AOC, a monitoring well must be downgradient of the AOC as determined by the groundwater contours for the flow regime monitored by the well. The "x" markings in the Summary in Appendix L indicate monitoring detailed in the RFI Proposal. While these monitoring locations may be suitable for evaluating soil and groundwater quality on a site-wide basis, they may not be suitably located for characterization of releases from specific AOCs. All monitoring locations specifically monitor AOCs or are utilized for background or off-site monitoring.

The number of AOCs specifically monitored (gray shading in the summary in Appendix L) for each media of concern are summarized in Table 7-1. As indicated in Table 7-1, soil and groundwater are the primary media of concern at the Site. Sediment, surface water, air, and subsurface gas are only monitored at a select number of AOCs.

TABLE 7-1
QUALITATIVE SUMMARY OF MEDIA OF CONCERN
Columbia Manufacturing Company, Westfield, MA

Media of Concern	AOCs Specifically Monitored in Phase I
Soil	16
Groundwater	18
Surface Water	1
Sediment	3
Soil Gas	2
Air	2

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7.4.1 Plating Operations

Soil and groundwater, in the shallow flow regime, are monitored downgradient of the plating operation AOCs by wells MW-16S, MW-17S, MW-18S, and MW-19S.

7.4.2 Wastewater Treatment

Soil and groundwater are monitored downgradient of the former pH adjustment tank (AOC 11) in the shallow flow regime by well MW-16S monitors this AOC. Four (4) other AOCs have no media of concern or are not specifically monitored in Phase I.

7.4.3 On-site Sludge Disposal

Soil and groundwater are monitored downgradient of the on-site sludge disposal AOCs in the intermediate flow regime. Soil and groundwater downgradient of the former lagoon (AOC 29) is also monitored in the shallow flow regime. Sampling locations include monitoring wells MW-6S, MW-7S, MW-10S, MW-2I, MW-3I, MW-4I, MW-7I, MW-10I, and MW-15I; and borings BH-3, BH-4, BH-5, and BH-7.

7.4.4 Waste Storage Yard

Soil and groundwater are monitored at two (2) of the four (4) AOCs in the intermediate flow regime. Sampling locations include monitoring wells MW-4I and MW-14I, and boring BH-7. Subsurface gas was monitored at the sludge roll-off box (AOC 9) and the current hazardous waste drum storage area (AOC 14a). Air at the storage yard runoff area (AOC 21) was monitored by air sample AS-1.

7.4.5 On-site Surface Water Bodies

Soil, intermediate groundwater, and sediment (from a surficial boring) are monitored at the former reflecting pond (AOC 16). Sampling locations include monitoring wells MW-11I and MW-26I, and boring BH-1. Surface water, sediment, and air are monitored at the fire pond (AOC 34). Sampling locations include surface water/sediment sampling points SW-1/SS-1, SW-2/SS-2, and SW-3/SS-3; and air sample AS-2.

7.4.6 Utility Lines

Soil, groundwater and sediment are monitored downgradient of the storm sewer (AOC 17) and the sanitary sewer (AOC 18). Sampling locations include monitoring wells MW-12S and MW-24S (in the shallow flow regime); MW-11I and MW-12I (in the intermediate regime); and sediment samples SS-4, SS-5, SS-6, and SS-8. Sediment sample SS-7 was proposed for the sanitary sewer, but no sediment was present in the manhole. Due to the extent of these AOCs, it is possible that releases from the AOCs are monitored at other sampling locations.

7.4.7 Storage Tanks

Soil and shallow groundwater are monitored downgradient of the storage tank AOCs. Each of these AOCs has a single monitoring well adjacent to the AOC. The abandoned UST (AOC 36) is monitored by well MW-13S; the fuel storage area (AOC 37) by well MW-20S; and another

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abandoned UST (AOC 48) by MW-19S. In addition, the abandoned UST (AOC 36) is monitored by MW-24S. Two (2) other AOCs, a removed UST (AOC 35) and the gasoline UST (AOC 47), have no media of concern and are not monitored.

7.4.8 Other Operations

Soil and groundwater are monitored downgradient of the rim room (AOC 44) in the shallow flow regime at monitoring well MW-18S. Groundwater is monitored downgradient of the pickling room drain and sump (AOC 40) in the intermediate flow regime at monitoring well MW-11I. Two (2) other AOCs have no media of concern or are not specifically monitored in Phase I.

7.4.9 Background and Off-site Monitoring

Background sampling locations include monitoring wells MW-23S, MW-1I, and MW-25D, boring BH-8, and air samples AS-3, AS-4, AS-5. Although these sampling points were designed to provide background data, this goal was not met and background data represents a data gap that will be filled during Phase II activities.

Off-site migration of hazardous constituents is monitored along the southeast boundary of the Site by monitoring wells MW-9S, MW-9I, MW-9I/D, MW-9D, MW-8S, and MW-8I; and two (2) wells MW-21S and MW-22S located off-site in the field southeast of the Site. Monitoring wells MW-2I, MW-7S, and MW-7I are also located along the southern boundary of the Site, however, these wells are considered to specifically monitor the former lagoons (AOC 29) (See Section 7.4.3).

7.5 METHODS OF ANALYSIS

Phase I analytical data was summarized in tables for release characterization at the AOCs. First, summary tables were developed for the characteristics of each of the AOCs (Section 7.6). Then, tables presenting summaries of analyses were prepared (Section 7.7).

Included in the analytical evaluation was a determination of 95% completeness. 95% completeness is achieved when fewer than 5% of the results for a given analyte are rejected. A table of the 95% completeness evaluation is included in Appendix O. For those analytes which were detected in other samples analyzed or are compounds that are likely to be present as a result of historical use of that compound at the Site, these areas will be resampled. A table listing where rejected analytes were detected and which will be resampled, is presented in Section 17. Rejected analytes which were not identified in products or chemicals used at the Site (e.g. aramite, dalapon, etc.) will not be resampled in Phase II. More common contaminants or analytes likely to be detected in products/chemicals used at the Site (Lead, Cadmium, VOCs, etc.) will be resampled.

7.6 AOC CHARACTERISTIC TABLES

The details of the construction and operation of each AOC are outlined in tables included with the release characterization for each group of AOCs. A sample table is shown at the end of this Section. The tables identify AOC location and type, design and operation features, period of operation, age, physical condition, closure methods (if applicable), and other pertinent information. The titles of AOC characteristics on the tables (i.e. Location of AOC, Type of AOC, etc.) are identical so that information between AOCs can be readily compared.

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7.7 SUMMARY OF ANALYTICAL RESULTS

Analytical results from Phase I sampling were summarized in order to evaluate the nature and extent of releases from the AOCs.

7.7.1 Analytical Data Presentation

The analytical data for the media samples which monitor specific AOCs in a grouping is summarized in tables presented in Appendix L. These tables include only those detections which were reported without qualification or were estimated (J qualifier). For this reason they are called summaries of positively identified analytes. Full analytical reports for Phase I sampling have been transmitted to the USEPA. Organic and inorganic analytes in soil and groundwater are shown on four (4) different tables. Other media of concern are summarized within the text of the release characterization. The first several rows of each table indicate the AOC which is monitored by the sampling location. For groundwater samples, the monitoring well ID is listed; for soil samples the depth interval, in feet, is shown. Duplicate samples have been averaged and reported under the interval or well ID in a single column. If the duplicate or the original sample did not detect an analyte, then the detection limit was listed instead of the average. The tables of positively identified organic and inorganic analytes differ in format as discussed below.

Organic Analytes

Tables of positively identified organic analytes are divided into the following fractions: VOCs by EPA Method 8240, semivolatile organic compounds by Method 8270, pesticides by 8080, PCBs by Method 8080, organophosphorus pesticides by Method 8140, chlorinated herbicides by Method 8150, and dioxin by Method 8280. Blank cells for analyte concentrations in the table indicate that the analyte was not detected above the detection limit (U or UJ qualifiers) or that blank contamination was indicated (B qualifier). Total sample concentrations are shown for each fraction and estimated concentrations are added to detections without differentiation. If all analytes within an analytical fraction were not detected in a sample above the detection limit, the total indicates "ND". If an sample was not analyzed for a specific analyte, the table shows "NA". And, if the analytical result for an analyte was rejected, the table shows "R". The total fraction concentration for samples which were not analyzed or were rejected are shown as "-" in the tables. Dioxin results with an "X" qualifier, indicating that the value is the estimated maximum possible concentration, are shown in the tables.

Inorganic Analytes

Only positively identified metals and cyanide (reported without qualification or with J qualifiers) are shown in the summary tables for inorganic analytes. Rejected analytical results are indicated with an "R"; samples for which certain metals were not analyzed are shown as "NA". Total sample concentrations are not shown for inorganic analytes.

7.7.2 Qualitative Summaries

Qualitative summaries of the analytical data are presented in Appendix L and with the release characterization text. These summaries are specific to the AOC grouping and, thus, are indicative of releases at each of the AOC grouping areas. Qualitative summaries for organic compounds list (for each of the seven (7) analytical fractions included) the following:

- the number of samples which detected at least one analyte in a fraction versus the number of

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samples analyzed for the fraction;
- the minimum number of analytes detected in a sample (may be zero) and the maximum number of analytes detected;
- the minimum *concentration of an analyte* (may be ND, meaning less than the detection limit) and the maximum concentration of an analyte in any of the samples;
- the minimum *total sample concentration* for the fraction (may be ND, meaning less than the detection limit for all analytes in the fraction) and the maximum total sample concentration for the fraction.

The qualitative summaries for inorganic analytes list the maximum and minimum concentration of cadmium, chromium, copper, nickel, tin, vanadium, zinc, and cyanide detected in any sample analyzed within the AOC grouping. These metals are associated with plating operations and were thus selected for release characterization.

7.7.3 Comparison of Analytical Results

An attempt was made to establish background concentrations of analytes in Site soil and groundwater based on data generated during Phase I of the RFI. Background concentrations may then be used for comparison in the discussion of release characterization at each of the AOC areas. This allows an evaluation of which analytes were elevated above background concentrations as a result of releases from the AOCs.

Background levels were difficult to establish for several reasons. Apparent VOC contamination, for example, was detected in "background" samples. Furthermore, the sampling method for groundwater may have entrained suspended sediment which elevated metals levels. In addition, some of the analytes detected during Phase I may be unrelated to releases from the AOCs and may be ubiquitous in the environment (eg. PAHs) or attributable to off-site activities (eg. application of fertilizer/pesticides to tobacco fields). Additional sampling and analysis from off-site, background locations will be conducted during Phase IIA in an attempt to clarify the background issue.

For the purpose of evaluating the Phase I data, a preliminary evaluation of background conditions was attempted. Preliminary background concentrations were established using the following criteria.

Organic Fractions
Background values for certain organic fractions (VOCs, pesticides, herbicides and PCBs) are assumed to be equivalent to the detection limit for that compound. Certain semivolatiles in the polycyclic aromatic hydrocarbon (PAH) family can be naturally occurring. However, for the purposes of performing a preliminary assessment of the extent of contaminant releases in subsequent Sections of this report, the assumption was made that all semivolatiles detected were anthropogenic.

Based on the results on Phase I release characterizations, a number of compounds are proposed for elimination in Phase II activities.

There were no detections of PCB's or organophosphorus pesticides in any sample collected during Phase I. Two (2) chlorinated herbicides were detected in soil samples during Phase I. The herbicide 2,4-D was detected in one soil sample (MW-16 at 5-7') and dichloroprop was detected in a second soil sample (MW-24, 25-27'). None of these parameters (PCBs, organophosphorus pesticides, chlorinated herbicides) were detected in any groundwater sample. Analysis for these parameters was not conducted on soil or groundwater samples collected at the Site. The Phase I

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investigation and research did not indicate that any operations or chemicals used at the facility contained compounds which are found in these analytical methods. Therefore, these parameters will be eliminated from Phase II analysis. PCBs will be retained to fill a data gap in the Waste Storage Yard AOC grouping during Phase II.

Chlorinated pesticides were detected at relatively low concentrations at AOC grouping along the southern side of the Site. Agricultural fields are located along the southern boundary of the property, including the On-site Sludge Disposal AOC grouping. The climatological data presented in Section 6 indicates that the prevailing wind direction during the months of June, July and August is from the southwest toward this AOC grouping. Southwesterly winds are also the secondary wind direction during most other months of the year. Pesticide applications are likely during the summer months, when prevailing winds are likely to transport the pesticides (during application and as wind blown particle transport) toward the Site. The majority of these pesticides were detected in the upper few feet of soil, with concentrations typically decreasing with depth. Given this background and the absence of data to indicate the use of chlorinated pesticides on the Site, analysis for these compounds will not be proposed for Phase II activities.

Metals and Cyanide

The release characterization for metals in soil focused on four (4) plating metals that are known to have been used at the Site: chromium, copper, nickel, and zinc; and three (3) metals potentially associated with plating: cadmium, tin, and vanadium. Published ranges of four (4) of these metals were utilized for release characterization of metals to soil. The data detailing metals concentrations in Hadley and Winooski soil types (which underlie the Site and the vicinity of the Site) was obtained from the Soil Conservation Service (Veneman, 1985). This data did not include concentrations of cadmium, tin, or vanadium. The maximum and minimum concentrations of a metal from either soil type were utilized to widen the range to include both soil types. Table 7-2 lists the ranges utilized. The published ranges are shown in the qualitative summary tables for metals in soil.

Two metals (beryllium and thallium) were universally absent from site soils, sediments and groundwater. Further, there is no data to indicate that these metals were ever used in any operation or product at the Site. Consequently, they have been eliminated from future analysis on samples collected at the Site.

Table 7-2
PUBLISHED RANGES OF METALS IN SOIL
Columbia Manufacturing Company, Westfield, MA

Metal	Minimum (µg/kg)	Maximum (µg/kg)
Chromium	78000	100000
Copper	24000	43000
Nickel	28000	35000
Zinc	74000	105000

(Veneman, 1985)

Background metals concentration in groundwater were not adequately defined during Phase I for the purpose of release characterization. Samples were not collected using low flow sampling

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techniques or filtering. Drinking water MCLs are used as on a preliminary basis to evaluate the significance of detected metals concentrations in groundwater. Table 7-3 lists the MCLs utilized.

Table 7-3
DRINKING WATER MCLs UTILIZED FOR RELEASE CHARACTERIZATION
Columbia Manufacturing Company, Westfield, MA

Analyte	MCL (µg/L)
Cadmium	5(1)
Chromium	100(1)
Copper	1000(2)
Nickel	100(1)
Tin	-
Vanadium	-
Zinc	5000(2)
Cyanide	200(1)

1 EPA Primary Drinking Water Regulations
2 EPA Secondary Drinking Water Regulations
- There is no primary or secondary MCL for this analyte.

7.7.4 Graphical Presentation of Analytical Results

The analytical results for organic analytes were further summarized on drawings to identify the approximate extent of contamination. Inorganic analytical results from Phase I were not graphically presented since background levels were not adequately determined. The drawings include text boxes which list the total VOC concentration, the total semivolatile organic concentration, the total pesticide and herbicide concentration, the total PCB concentration, and the total dioxin concentration at each sampling location. For groundwater, surface water, and sediment, the concentration represents the total concentration in the sample collected at that location. For soil, however, the concentration represents the summation of the analysis results for all samples collected from that location. For example, if four (4) soil samples were collected from a boring, the total concentrations listed in the text box for each contaminant type would be the sum of the totals for each of the four (4) samples. This allows soil sampling locations which are more contaminated to appear more prevalent on the drawing. For air, the text box indicates the total concentration, in ppm, of VOCs detected.

7.8 SUMMARY

This section discussed the general objectives of the release characterization at the Site, the grouping of the AOCs into operation specific areas and the specific monitoring locations and analytical data which will be used for release characterization. The methods of analysis of the Phase I analytical results were discussed along with specific information required to fully understand the release

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characterization summaries.

This section also included a preliminary evaluation of those compounds which, during Phase I investigation, were found to not be likely in past or present operations at the Site. This evaluation was compared to analytical data from Phase I which indicated an absence of certain compounds or categories of compounds, or which were likely to have originated from off-site areas. Based on this evaluation, the following analytes will be proposed for Phase II activities.

- VOCs
- Semivolatiles (SVOCs)
- Metals (except beryllium and thallium)
- PCBs (only at discrete locations to fill data gaps)
- Cyanide
- Dioxins

Those compounds eliminated from further evaluation include:

- Organophosphorous pesticides
- chlorinated herbicides
- chlorinated pesticides
- PCB's (following confirmation of PCBs at two (2) locations sampled during Phase II.)

Sections 8 through 16 will provide a release characterization for each of the AOC groupings outlined in this section and evaluate the data gaps at those groupings which must be filled during Phase II activities. Section 17 will summarize the release characterization data from those sections.

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AREA GROUPINGS FOR AOCS
Columbia Manufacturing Company, Westfield, MA

AOC	Unit Name/Description	Plating Operations	Wastewater Treatment	On-site Sludge Disposal	Waste Storage Yard	On-site Surface Water Bodies	Utility Lines	Storage Tanks	Other Operations
9	Sludge Roll-off Box				X				
10	Nickel Filter		X						
11	pH Adjustment Tank (old)		X						
12	Storage Tank 11		X						
14a	Hazardous Waste Drum Storage (current)				X				
14b	Hazardous Waste Drum Storage (former)				X				
16	Reflecting Pond					X			
17	Storm Sewer						X		
18	Sanitary Sewer						X		
21	Storage Yard Runoff Area				X				
23	Stripping Area Floor Drains								X
29	Former Lagoons			X					
30	Underground Discharge Pipe			X					
33a	Scrap Metal Fill Area			X					
33b	Incinerator			X					
34	Fire Pond					X			
35	Removed UST							X	
36	Abandoned UST							X	
37	Fuel Storage Area							X	
39	Old Trenches and Sumps	X							
40	Pickling Room Drain and Sump								X
41	Zinc Plating Line Trench and Sump	X							
42	Nickel Chrome Plating Line Sump	X							
44	Rim Room								X
45	Wastewater Treatment Pipes		X						
46	Wastewater Treatment Room Sump		X						
47	Gasoline UST							X	
48	Abandoned UST No. 3							X	
49	Rack Maintenance Area								X

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SAMPLE AOC CHARACTERISTICS TABLE

AREA OF CONCERN CHARACTERISTICS	
Solid Waste Management Unit Number: Reference Number from Table 5-2 of the RFI Proposal **Item/Description:** Text description from Table 5-2 of the RFI Proposal or modified description	
Location of AOC:	*Location of the AOC relative to the Site, building numbers referenced in Section 1.2.1, or other recognizable features.*
Type of AOC:	*Varies significantly, but generally follows the descriptions in the RCRA Facility Assessment.*
Design Features	
Features of the AOC including material of construction, dimensions (as applicable), modifications, etc.	
Operating Practices	
Past	*Operating practices prior to closure or prior to a change to the current practices.*
Present	*Current operating practices if the AOC was not closed.*
Period of Operation	
Dates of startup, construction, operation, change in operation, and closure, as applicable.	
Effective Age of AOC:	*The age of the AOC as the difference between 1994 and the startup year.*
General Physical Conditions	
Observations of the integrity or deterioration of the AOC.	
Closure Method	
Activities undertaken to close the AOC, as applicable.	
Information Sources:	*Specific references for information regarding this AOC.*

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8
RELEASE CHARACTERIZATION: PLATING OPERATIONS

8.1 OVERVIEW

This section discusses the objectives, AOC characteristics, methods of analysis, and results of the release characterization for AOCs associated with the plating operations. The AOCs include old trenches and sumps (AOC 39), the zinc plating line trench and sump (AOC 41), and the nickel and chrome plating line trench and sump (AOC 42). Objectives of the release characterization and the Phase I sampling locations for the plating operations are discussed in Section 8.2. Construction and operational characteristics of the three (3) AOCs are discussed in Section 8.3. The results of sampling conducted by the EPA prior to Phase I of the RFI are discussed in Section 8.4. The results of Phase I sampling and analysis are summarized in Section 8.5. This section ends with a summary of the results of release characterization, a discussion of data gaps, and other related issues, if any (Section 8.6).

8.2 OBJECTIVES

The objective of the release characterization at the plating operation AOCs is to determine whether a release of hazardous constituents has occurred from the units. The Phase I characterization focused on releases to soil and groundwater. Phase I analysis results for soil and groundwater samples from monitoring wells MW-16S, MW-17S, MW-18S, and MW-19S are utilized for the characterization. Only releases to shallow groundwater are monitored by these wells.

8.3 AOC CHARACTERISTICS

The plating operations are located in Building 3 in the central portion of the building cluster at the Site. Plating has included nickel plating, nickel plating preceded by copper strike, chrome plating over nickel plated items, and zinc plating. These operations were originally located in the western portion of the building, but were upgraded and expanded around 1955 when the school furniture plating line (chrome on nickel) was constructed in the eastern portion of the building. Currently, there are no active plating operations in the western portion of the building.

During the RFA, eight (8) SWMUs were identified in the plating area. Three (3) of these, primarily sumps and trench drains, were classified as AOCs. The physical and operational characteristics of the AOCs are summarized in Tables 8-1, 8-2, and 8-3. Since the AOCs are integral with the concrete floor slab, releases from the units would either have overflowed onto the concrete floor slab or would have been released to the soil underlying the slab through cracks in concrete. Consistent releases from these AOCs may have impacted groundwater which is located approximately five (5) feet below ground surface near Building 3.

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TABLE 8-1
AREA OF CONCERN CHARACTERISTICS: AOC 39

Solid Waste Management Unit Number: 39 **Item/Description:** Old Trenches and Sumps	
Location of AOC:	*Western half of Building 3.*
Type of AOC:	*In-ground Trenches and Sumps*
Design Features	
The trenches and sumps were constructed of concrete.	
Operating Practices	
Past	*The trenches and sumps received spills and overflows from the former nickel/chrome and zinc plating lines. These spills contained chromium and nickel plating liquids, hydrochloric acid, sulfuric acid, nitric acid and cyanide.*
Present	*This is an inactive unit.*
Period of Operation	
The trenches are located in an area used for electroplating since at least 1900. Nickel/chrome plating was discontinued in this area around 1970.	
Effective Age of AOC:	*>94 years*
General Physical Conditions	
Cracks were observed in the brick and concrete foundation near the remaining sump during the September 1988 RFA Site visit. This sump actually contains the pipe gallery from the engine room in Building 4 and did not receive plating liquids from the trenches.	
Closure Method	
The trenches were filled with concrete between July and December 1987.	
Information Sources:	*RFI Proposal, RCRA Facility Assessment*

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TABLE 8-2
AREA OF CONCERN CHARACTERISTICS: AOC 41

Solid Waste Management Unit Number: 41 **Item/Description:** Zinc Plating Line Trench and Sump	
Location of AOC:	*Western portion of Building 3.*
Type of AOC:	*In-ground Trench and Sump.*
Design Features	
The in-ground trench and sump are constructed of concrete. The trench is 6-inches wide, 3-inches deep and 20-feet long. The 2-foot diameter sump has an approximate capacity of 50-gallons and is lined with blue plastic.	
Operating Practices	
Past	*Same as current practices.*
Present	*Currently, the trenches and sump collect spills from the zinc prewash tanks and discharge to Tank 11 (AOC 12) for treatment and discharge to the WWTP. Prewash tanks utilize electroplating rinses, potassium chloride, and water rinses.*
Period of Operation	
The trenches are located in a floor area which was reconstructed in 1987 prior to a realignment of the zinc plating line. Zinc plating is no longer conducted, but the trench and sump have not been closed.	
Effective Age of AOC:	*>94 Years*
General Physical Conditions	
The RFA investigative team observed that the blue plastic liner was in place, but the concrete of the sump was cracked. They also observed a white residue on concrete and piping in disrepair.	
Closure Method	
This is an active, but relatively unused unit.	
Information Sources:	*RFI Proposal, RCRA Facility Assessment*

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TABLE 8-3
AREA OF CONCERN CHARACTERISTICS: AOC 42

Solid Waste Management Unit Number: 42 **Item/Description:** Nickel Chrome Plating Line Trench and Sump	
Location of AOC:	*Eastern portion of Building 3.*
Type of AOC:	*Trench and Sump*
Design Features	
This unit is an in-ground concrete trench and sump. The 6-inch wide trench is 2-inches deep at the farthest point from the sump, increasing to 8-inches deep at the sump.	
Operating Practices	
Past	*Same as current practices except that the sump formerly discharged to the NPDES outfall after pH adjustment.*
Present	*The trench and sump collect spills and overflows from the nickel/chrome plating line. Plating liquids including soda ash, caustic ash, sodium bisulfite, sodium hydroxide, nickel chloride, nickel sulfoxide, boric acid, and hydrochloric acid are collected in the sump and discharged to the floor spills tank (Unit 4) of the WWTP.*
Period of Operation	
The trench and sump have been in operation since 1955 when the furniture plating room was constructed.	
Effective Age of AOC:	*39 Years*
General Physical Conditions	
The RFA investigative team observed staining and porous condition of the concrete in September 1988.	
Closure Method	
This is an active unit.	
Information Sources:	*RFI Proposal, RCRA Facility Assessment*

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8.4 PREVIOUS SAMPLING AND ANALYSIS

No media sampling was conducted relative to plating operation AOCs prior to Phase I of the RFI. The RFA included only visual observations of the AOCs.

8.5 PHASE I SAMPLING AND ANALYSIS

Release characterization sampling for plating operation AOCs focused on soil and groundwater. Samples of those media from four (4) groundwater monitoring wells installed during Phase I of the RFI are discussed in this Section.

8.5.1 Soil Sampling

Monitoring wells MW-16S and MW-17S were installed in the exposed alley between Building 3 and Building 4. Soil samples were collected from the 0- to 2-foot interval and at five (5) foot intervals thereafter. Black, visually contaminated soil was observed in the 5- to 7- foot samples, immediately above the groundwater table, in these monitoring wells.

Monitoring well MW-18S was installed through the wooden floor of Building 4. This well was primarily installed to monitor releases of cutting oil to the wooden floor in the Rim Room (AOC 44), but also to monitor releases from the plating operations in the western half of Building 3 (in the shallow flow regime). Visual and olfactory contamination was observed between four (4) and ten (10) feet below floor level. Monitoring well MW-19S was installed downgradient of an abandoned UST (AOC 48). This well, however, is also downgradient of the plating operations in the western half of Building 3. Soil samples from the installation of monitoring wells MW-18S and MW-19S were collected from continuous two (2) foot intervals.

8.5.2 Soil Analysis

Soil samples collected during the advancement of the borings for the monitoring wells were screened for the presence of VOCs with a PID. Elevated VOC levels, which were defined as readings greater than 10 ppm above background, are shown in Table 8-4. Elevated VOC levels were detected in samples from the borings for MW-16S, MW-17S, MW-18S, and MW-19S.

The soil sample collected from the 0 to 2-foot interval at MW-17S was analyzed for metals, cyanide, VOCs, semivolatile organic compounds, and PCBs. Other soil samples were analyzed for Appendix IX parameters if VOC screening results for that interval exceeded 10 ppm. Appendix IX analysis was conducted on three (3) samples from MW-16S (5-7 foot, 10-12 foot, and 15-17 foot intervals) and two (2) samples from MW-17S (5-7 foot and 14-16 foot intervals). The soil sample from the 12- to 14-foot interval at MW-17S exceeded the 10 ppm VOC threshold, but inadequate sample volume was recovered to analyze for Appendix IX parameters. The soil sample collected from the 0 to 2-foot interval at MW-16S was analyzed for Appendix IX parameters even though VOCs were less than 10 ppm.

In accordance with the RFI Proposal, soil samples from monitoring well MW-18S (originally boring BH-2) were analyzed on-site for TPH to evaluate the release of petroleum (cutting oil) in the vicinity of the well. Soil samples with TPH concentrations in excess of 50 mg/kg were submitted to the Tighe & Bond laboratory for metals, VOC, and TPH analysis. On-site TPH results are discussed in Section 14 and 15.

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Soil samples from monitoring well MW-19S with VOC screening results greater than 10 ppm were analyzed for VOCs and metals. The sample from the 10- to 12-foot interval consisted of a dark, visually contaminated sand and gravel horizon underlain by a brown sand and gravel horizon. Soil samples were analyzed for VOCs and metals from both horizons.

Table 8-4
VOC SCREENING RESPONSES FOR SOIL HEADSPACES - PLATING OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Sampling Interval (feet)	HNu Response[1] (ppm)
MW-16S	
5-7	32
10-12	20
15-17	11.0
MW-17S	
5-7	75
12-14	32
14-16	32
MW-18S(BH-2)	
4-6	48
6-8	109
8-10	29
10-12	21
MW-19S	
2-4	18
4-6	22
6-8	80
8-9.5	112
10-11	126
11-12	98

1 Screening responses greater than 10 ppm above background are listed in the table.

Summaries of positively identified analytes in soil samples collected from MW-16S, MW-17S, MW-18S, and MW-19S are included in Appendix L. The qualitative summaries included in Appendix L are presented in Table 8-5 and Table 8-6 with discussion of the substantive findings.

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Table 8-5
ORGANIC COMPOUNDS IN SOIL SAMPLES - PLATING OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (µg/kg)		Total Sample Concentration (µg/kg)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Volatile Organics	13 - 18	0	2	ND	3000	ND	3000
Semivolatile Organics	3 - 7	0	5	ND	6800	ND	6800
Pesticides	0 - 2	-	-	-	-	-	-
PCBs	0 - 4	-	-	-	-	-	-
Organophosphorus Pesticides	0 - 4	-	-	-	-	-	-
Chlorinated Herbicides	1 - 6	0	1	ND	23	ND	23
Dioxin	5 - 5	4	7	ND	3.1	3.44	4.51

VOCs: Four (4) volatile organic compounds, ethylbenzene, methylene chloride, trichloroethene, and total xylenes, were detected in soil samples analyzed for VOCs. Ethylbenzene was detected at the highest analyte concentration, 3,000 µg/kg, in the sample from the 6- to 8-foot interval in well MW-18S. The highest total VOC concentration, 3,000 µg/kg, was also detected in that interval.

Semivolatiles: Five (5) semivolatile organic compounds, benzo[a]anthracene, chrysene, fluoranthene, phenanthrene, and pyrene, were detected in soil samples analyzed for semivolatile compounds. Phenanthrene was detected at the highest analyte concentration, 6,800 µg/kg, in the sample from the 5- to 7-foot interval in well MW-16S. The highest total semivolatile organic concentration, 6,800 µg/kg, was also detected in that interval.

PCBs/Pesticides/Herbicides: One (1) chlorinated herbicide, 2,4-D, was detected in soil samples analyzed for pesticides and herbicides. The 2,4-D was detected at the highest analyte concentration, 23 µg/kg, in the duplicate sample from the 0- to 2-foot interval in well MW-16S. No 2,4-D was detected in the original sample from the same interval in MW-16S. Pesticide analysis by EPA Method 8080 was rejected for all soil samples from MW-16S.

Dioxin: Five (5) dioxin congeners, total TCCD, total PeCDD, total HxCDD, total TCDF, and total PeCDF, were detected in soil samples analyzed for dioxin. Total TCDD was detected at the highest congener concentration, 3.1 µg/kg, in the sample from the 5- to 7-foot interval in well MW-17S. The highest total dioxin concentration, 3.64 µg/kg, was detected in the same sample.

The total concentrations of VOCs, semivolatiles, PCBs/Pesticides/Herbicides, and Dioxin for the soil sample from each monitoring well are shown on Figure 8-1. These concentrations are the sum of the total sample concentrations for all samples from that location.

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Table 8-6
INORGANIC COMPOUNDS IN SOIL SAMPLES - PLATING OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of samples detecting analyte - number of samples analyzed	Concentration of Individual Analytes (µg/kg)		Published Ranges of Metals in Soil[1] (µg/kg)	
		Minimum	Maximum	Minimum	Maximum
Cadmium	10 - 17	ND	19000000	-	-
Chromium	18 - 18	3800	770000	78000	100000
Copper	18 - 18	8000	130000	24000	43000
Nickel	18 - 18	17000	1100000	28000	35000
Tin	6 - 18	ND	13000	-	-
Vanadium	18 - 18	5100	27000	-	-
Zinc	18 - 18	13000	800000	74000	105000
Cyanide	0 - 7	-	-	-	-

1 Veneman, 1985.

Metals/Cyanide: Maximum concentrations of plating metals (chromium, copper, nickel, and zinc) exceeded the published ranges for those metals. Minimum concentrations of plating metals were below published minimums for those metals. No cyanide was detected in the seven (7) samples analyzed for cyanide.

8.5.3 Groundwater Sampling

Groundwater samples were collected from monitoring wells MW-16S, MW-17S, MW-18S, and MW-19S. Additional wells are proposed for Phase II to augment the data collected from this AOC grouping.

8.5.4 Groundwater Analysis

During sample collection, groundwater samples were screened in the field for temperature, redox potential (Eh), pH, conductance, and dissolved oxygen. The results of field screening are summarized in Table 8-7.

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Table 8-7
GROUNDWATER FIELD SCREENING RESULTS - PLATING OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Parameter	MW-16S	MW-17S	MW-18S	MW-19S
Temperature (°C)	21	21	18	19
pH (pH units)	6.71	6.34	5.89	6.39
Eh (mV)	35	26	57	10
Conductance (μmhos/cm @ 25°C)	1100	920	570	500
Dissolved Oxygen (mg/L)	4	2	3	5

Groundwater samples were analyzed for VOCs, semivolatile organics, metals, and cyanide. Summaries of positively identified analytes in groundwater samples collected from MW-16S, MW-17S, MW-18S, and MW-19S are included in Appendix L. The qualitative summaries included in Appendix L are presented in Table 8-8 and Table 8-9 with discussion of the substantive findings.

Table 8-8
ORGANIC COMPOUNDS IN GROUNDWATER SAMPLES - PLATING OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (μg/L)		Total Sample Concentration (μg/L)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Volatile Organics	3 - 4	0	3	ND	170	ND	340
Semivolatile Organics	3 - 4	0	6	ND	1500	ND	2870
Pesticides	0 - 0	-	-	-	-	-	-
PCBs	0 - 0	-	-	-	-	-	-
Organophosphorus Pesticides	0 - 0	-	-	-	-	-	-
Chlorinated Herbicides	0 - 0	-	-	-	-	-	-
Dioxin	0 - 0	-	-	-	-	-	-

VOCs: Three (3) volatile organic compounds, cis-1,2-dichloroethene, etylbenzene, and trichlorethene, were detected in groundwater samples analyzed for VOCs. Ethylbenzene was detected at the highest analyte concentration, 170 μg/L, in the sample from monitoring well MW-18S. The highest total VOC concentration, 340 μg/kg, was also detected in groundwater from that well.

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Semivolatiles: Eight (8) semivolatile organic compounds, anthracene, dibenzofuran, fluoranthene, fluorene, 2-methylnapthalene, naphthalene, phenanthrene, and pyrene, were detected in groundwater samples analyzed for semivolatile compounds. 2-Methylnapthalene was detected at the highest analyte concentration, 1,500 µg/L, in the sample from monitoring well MW-19S. The highest total semivolatile organic concentration, 2870 µg/kg, was also detected in groundwater from that well.

PCBs/Pesticides/Herbicides: Phase I groundwater samples from monitoring wells MW-16S, MW-17S, MW-18S, and MW-19S were not analyzed for PCBs, pesticides, or herbicides.

Dioxin: Phase I groundwater samples from monitoring wells MW-16S, MW-17S, MW-18S, and MW-19S were not analyzed for dioxin.

The total concentrations of VOCs, semivolatiles, PCBs/Pesticides/Herbicides, and Dioxin for each monitoring well are shown on Figure 8-2. The PCB/Pesticide/Herbicide concentration is the sum of the total fraction concentrations from that well.

Table 8-9
INORGANIC COMPOUNDS IN GROUNDWATER SAMPLES - PLATING OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of samples detecting analyte - number of samples analyzed for the analyte	Concentration of Individual Analytes		MCL (µg/L)
		Minimum (µg/L)	Maximum (µg/L)	
Cadmium	4 - 4	23	1400	5
Chromium	4 - 4	1500	5000	100
Copper	4 - 4	350	4100	1000
Nickel	4 - 4	1700	6100	100
Tin	0 - 4	-	-	-
Vanadium	4 - 4	96	460	-
Zinc	4 - 4	570	19000	5000
Cyanide	1 - 4	ND	ND	200

Metals/Cyanide: Metals concentrations in groundwater appear to be elevated in comparison with MCLs. Cyanide was detected in one (1) groundwater sample at a concentration, 110 µg/L, below the MCL, 200 µg/L. Site-specific background concentrations have not been adequately determined at this time for release characterization purposes. MCLs, however, can be used as a benchmark to evaluate the significance of the data.

8.6 SUMMARY OF RELEASE CHARACTERIZATION

8.6.1 General Discussion of Results

This section discusses releases of organic and inorganic (metals/cyanide) analytes identified in soil and groundwater at the plating operation AOCs.

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Soil: Organic Compounds
Both volatile and semivolatile organic compounds were identified in soil monitored at the plating operations. The maximum VOC sample concentration ranged from below detection to 3,000 μg/kg; semivolatiles from below detection to 6,800 μg/kg. One (1) herbicide, 2,4-D, was detected at an estimated concentration of 23 μg/kg in a duplicate soil sample from monitoring well MW-16S. No other pesticides, herbicides or PCBs were detected. The maximum dioxin sample concentrations was 3.64 μg/kg.

Soil: Metals/Cyanide
Plating metals were detected at concentrations in excess of published ranges. No cyanide was detected in soil monitored at the plating operations. Metals associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN) will be included in subsequent investigations.

Groundwater: Organic Compounds
Volatile and semivolatile organic compounds were detected in shallow groundwater downgradient of the plating operation AOCs. Maximum VOC sample concentrations ranged from below detection to 340 μg/L; semivolatiles from below detection to 682 μg/L. Phase I sampling did not include pesticide, herbicide, PCB, or dioxin analysis of groundwater downgradient of plating operations. As described in Section 1, these compounds are not associated with this AOC grouping and will be eliminated from future monitoring of plating operations.

Groundwater: Metals/Cyanide
No cyanide was detected in groundwater monitored at the plating operations. Plating metals appear elevated, however, site-specific background concentrations have not been adequately determined at this time. Metals associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN) will be included in subsequent investigations.

8.6.2 Data Gaps

Based on the release characterization for the plating operation AOCs, the following data gaps have been identified. Data gaps have been organized by media since individual monitoring of each plating operation AOC was not conducted. Phase II activities designed to provide the data required are discussed in Section 20, 21 and 22.

Soil
The horizontal and vertical extent of soil contamination in the vicinity of the plating operations AOCs needs to be delineated for VOCs, semivolatile organics, dioxin, and metals. The source for the dioxin contamination must also be determined. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

Groundwater
The horizontal and vertical extent of groundwater contamination in the vicinity of the plating operations AOCs needs to be delineated for VOCs, semivolatile organics, and metals. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

8.6.3 Other Issues

Other issues could potentially include interim measures, additional media of concern for existing AOCs, and new AOCs identified during Phase I.

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Interim Measures

No interim measures are deemed necessary based on the release characterization for the plating operations.

Media of Concern

No additional media of concern were identified for plating operations.

Areas of Concern

No additional areas of concern were identified for the plating operations. Phase II tasks will focus on AOCs 39, 41 and 42. In addition to the borings and wells proposed to better delineate releases from these AOCs, Phase II tasks will include inspections of equipment operation practices to identify specific leaks, and develop system improvements to prevent future releases.

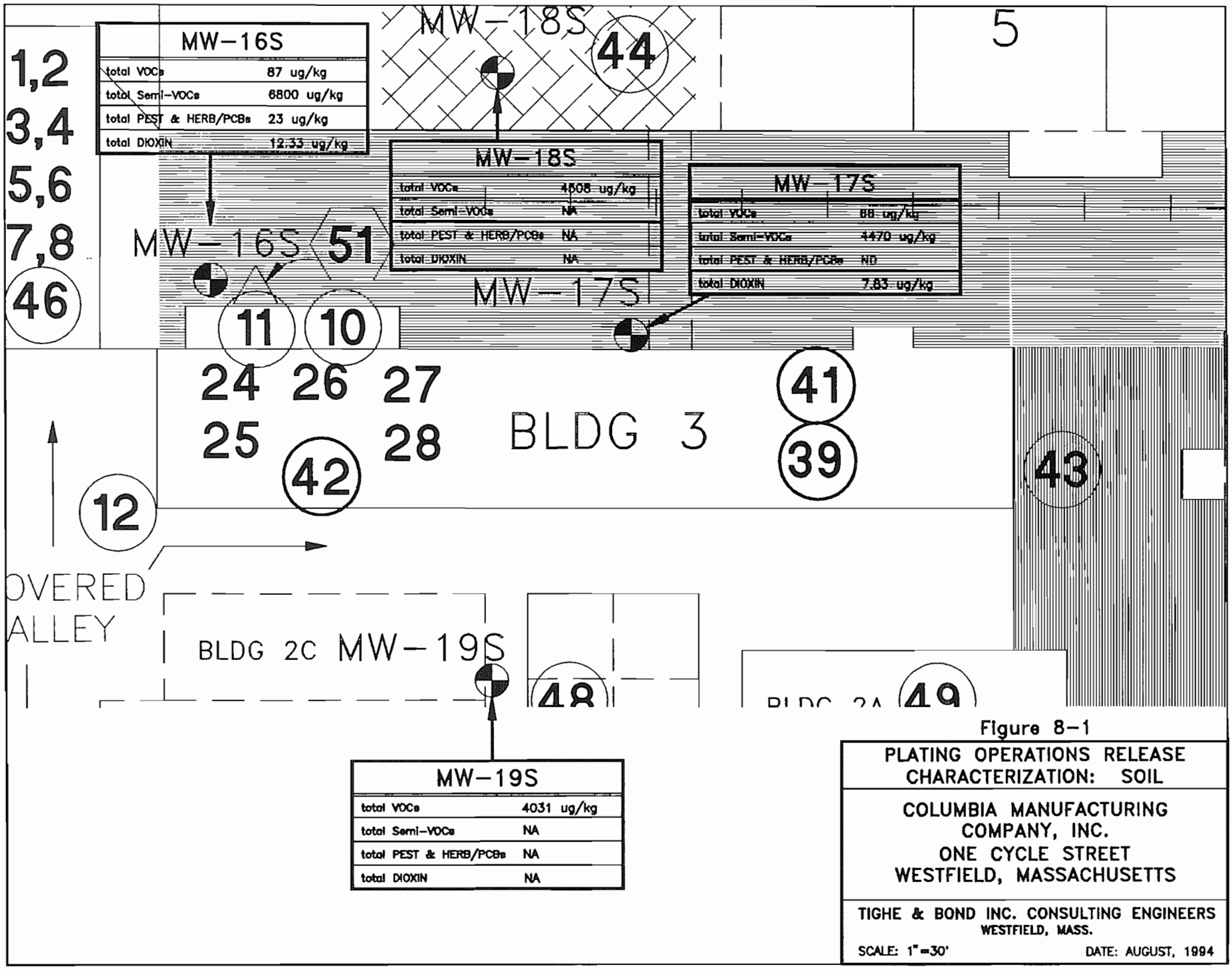

Figure 8-1

PLATING OPERATIONS RELEASE CHARACTERIZATION: SOIL

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=30' DATE: AUGUST, 1994

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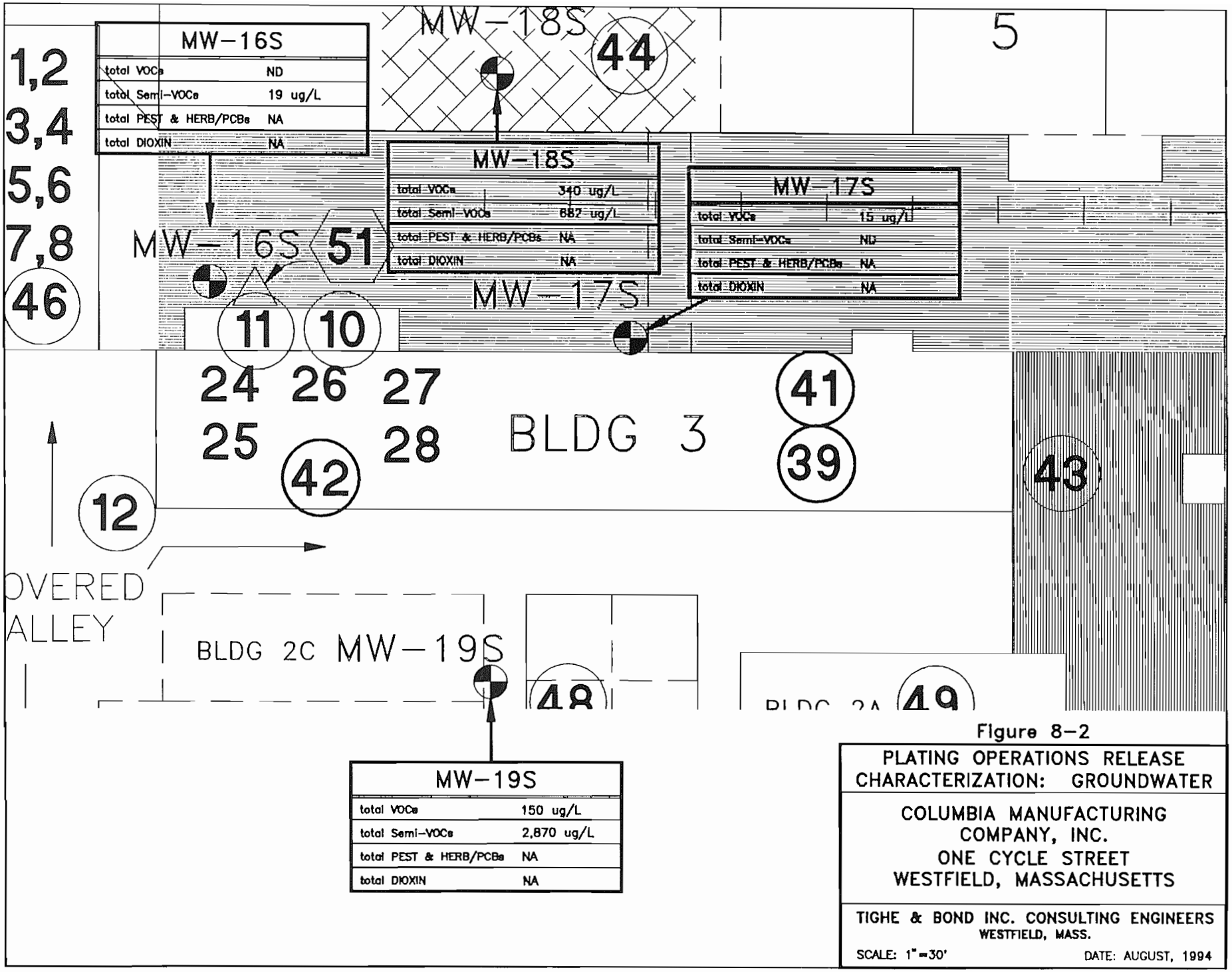

Figure 8-2

PLATING OPERATIONS RELEASE CHARACTERIZATION: GROUNDWATER

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=30' DATE: AUGUST, 1994

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9
RELEASE CHARACTERIZATION: WASTEWATER TREATMENT

9.1 OVERVIEW

This section discusses the objectives, AOC characteristics, methods of analysis, and results of the release characterization for AOCs associated with the wastewater treatment operations. The AOCs include the nickel filter (AOC 10), the former pH adjustment tank (AOC 11), Storage Tank 11 (AOC 12), wastewater treatment pipes (AOC 45), and the wastewater treatment room sump (AOC 46). Objectives of the release characterization and the Phase I sampling locations for the wastewater treatment operations are discussed in Section 9.2. Construction and operational characteristics of the five (5) AOCs are discussed in Section 9.3. The results of sampling conducted by the EPA prior to Phase I of the RFI are discussed in Section 9.4. The results of Phase I sampling and analysis are summarized in Section 9.5. Section 9.6 ends with a summary of the results of release characterization, a discussion of data gaps, and other related issues, if any.

9.2 OBJECTIVES

The objective of the release characterization at the wastewater treatment operation AOCs is to determine whether a release of hazardous constituents has occurred from these units. The Phase I characterization focused on releases to soil and groundwater. Phase I analysis results for soil and groundwater samples from monitoring well MW-16S are utilized for the characterization. Only releases to shallow groundwater are monitored by this well.

9.3 AOC CHARACTERISTICS

The wastewater treatment operations are primarily located in the western portion of Building 8, the WWTP. Other operations, nickel sludge filtering (AOC 10) and (formerly) pH adjustment (AOC 11), are located in the southern portion of Building 3 which houses the plating operations. The wastewater treatment pipes (AOC 45) transfer plating wastewater from Building 3 to the WWTP. An AST, Storage Tank 11 (AOC 12), is utilized for temporary storage of floor spills in the nickel chrome plating area prior to discharge to the WWTP.

During the RFA, 14 SWMUs were identified in the wastewater treatment area. Five (5) of these, consisting of a sump, piping and other components of the wastewater treatment system, were classified as AOCs. The physical and operational characteristics of the AOCs are summarized in Tables 9-1, 9-2, 9-3, 9-4 and 9-5. Potential releases to soil could occur through cracks in the former pH adjustment tank (AOC 11) or the wastewater treatment room sump (AOC 45). Consistent releases from these AOCs may have impacted groundwater which is located approximately five (5) feet below ground surface near the WWTP and Building 3. The nickel filter (AOC 10), Storage Tank 11 (AOC 12) and the wastewater treatment pipes (AOC 45) are located above a concrete floor slab. Releases from these AOCs are not likely to impact on-site media; no media of concern have been identified for these AOCs.

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Table 9-1
AREA OF CONCERN CHARACTERISTICS: AOC 10

Solid Waste Management Unit Number: 10 **Item/Description:** Nickel Filter	
Location of AOC:	*East end of exterior side of south wall of Building 3 in a shed addition; located immediately south of the nickel/chrome plating baths.*
Type of AOC:	*Closed Loop Filter System*
Design Features	
There are six (6) nickel filters in operation. The units, located on a concrete floor slab, are apparently connected to the nickel plating baths by clay tile pipe.	
Operating Practices	
Past	*Nickel solution from nickel plating baths was pumped through filter paper and continuously recycled back to the baths. As nickel and iron sludges built up on the filters, sludge cake was scraped into plastic trays. Sludge from the nickel filters and used filter paper was transported to the city landfill for disposal.*
Present	*Currently, nickel and iron hydroxide sludges are transferred to the sludge roll-off box (AOC 9) for off-site disposal.*
Period of Operation	
The nickel filter units were put into operation in 1971. Sludges and used filter paper were first disposed of as hazardous waste in 1989.	
Effective Age of AOC:	*23 Years*
General Physical Conditions	
During their September 1988 inspection, the RFA inspection team observed that the floor near the nickel filter unit was wet and discolored.	
Closure Method	
This is an active unit.	
Information Sources:	*RFI Proposal, RCRA Facility Assessment, CMC Files*

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Table 9-2
AREA OF CONCERN CHARACTERISTICS: AOC 11

Solid Waste Management Unit Number: 11 **Item/Description:** Former pH Adjustment Tank	
Location of AOC:	*East end of exterior side of south wall of Building 3 in the shed addition; located immediately south of the nickel/chrome plating baths.*
Type of AOC:	*pH Adjustment Tank*
Design Features	
This unit is an in-ground concrete tank 4-feet by 4-feet by 4-feet deep with a capacity of approximately 480-gallons.	
Operating Practices	
Past	*The tank was formerly utilized to adjust the pH of cleaning and rinse wastewater from the plating baths. The effluent from the tank was then discharged to the NPDES outfall in the Little River via the diversion structure. Specifically, the tank received pre- and post-acid bath water rinses and secondary and tertiary nickel treatment water rinses from the nickel/chrome plating line and rinse waters from the zinc plating line.*
Present	*The tank is currently not utilized for pH adjustment, but receives cleaning and rinse wastewater prior to discharge to the pH adjustment tank in the WWTP.*
Period of Operation	
The tank was installed in 1970 or 1971. In 1988 the system was modified and the pH adjustment tank in the WWTP was constructed.	
Effective Age of AOC:	*24 years*
General Physical Conditions	
The integrity of the tank was determined to be sound in 1988 when modifications were made to the system. In 1989, green staining was noted by the RFA investigation team along the sides of the tank.	
Closure Method	
The tank is no longer utilized for pH adjustment, but receives wastewater prior to discharge to the pH adjustment tank in the WWTP.	
Information Sources:	*RFI Proposal, EPA Draft Site Evaluation, RCRA Facility Assessment*

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Table 9-3
AREA OF CONCERN CHARACTERISTICS: AOC 12

Solid Waste Management Unit Number: 12
Item/Description: Storage Tank 11

Location of AOC: *In northeast corner of the furniture plating room in Building 3.*

Type of AOC: *Aboveground Waste Treatment and Storage Tank*

Design Features

This unit is a 3,000 gallon reinforced fiberglass AST approximately 8-feet high by 8-feet in diameter. There is an open vent off of the top of the tank. The tank is set on a 4-inch steel footing underlain by concrete flooring.

Operating Practices

Past

Tank 11 was utilized to store and treat acidic wastewater from the plating operations and spent solutions from the pickling operation in Building 7A. After neutralization with caustic soda and soda ash, the contents of the tank were discharged to the sanitary sewer. In 1989, the tank received spent phosphoric acid every 6-8 months from the pickling room; hydrochloric acid was also stored in the tank and neutralized every 3 weeks from the nickel/chrome plating line and every 8 weeks from the zinc plating line.

Present

Tank 11 is currently utilized to store and treat acidic wastewater from the plating operations, spent solutions from the pickling operation in Building 7A, and floor spills from the nickel/chrome plating area. The tank is discharged to the floor spills treatment tank in the WWTP (SWMU 4) after pH adjustment by CMC personnel. Volumes of treated waste were outlined in the Facility Design Report required under the Consent Decree. In summary, approximately 2,500-gallons of alkaline cleaner are received every 12 weeks; approximately 1,600-gallons of electroclean every 10 weeks; and 1,600-gallons of hydrochloric acid every 6 weeks.

Period of Operation

Tank 11 has been in use since 1984.

Effective Age of AOC: *10 Years*

General Physical Conditions

A crack and evidence of a release from that crack was observed in the bottom of the tank by the RFA investigative team in September 1988. A leak was also noted at the connection of an outlet pipe to the tank. The pipe connection has subsequently been repaired.

Closure Method

This is an active unit.

Information Sources: *RFI Proposal, EPA Draft Site Evaluation, RCRA Facility Assessment, Facility Design Report.*

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Table 9-4
AREA OF CONCERN CHARACTERISTICS: AOC 45

Solid Waste Management Unit Number: 45 **Item/Description:** Wastewater Treatment Pipes	
Location of AOC:	*Between Building 3 and the WWTP.*
Type of AOC:	*Wastewater Piping*
Design Features	
The wastewater piping that leads from the nickel/chrome and zinc plating lines is located above ground and is constructed of PVC pipe. The discharge of rinse waters is via underground PVC pipes which lead to and from the old pH adjustment pit to the pH adjustment tank in the WWTP.	
Operating Practices	
Past	*Same as present practices.*
Present	*Wastewaters including acids, alkali cleaners, nickel, chrome and zinc solutions are discharged from and recycled to the plating baths via the wastewater treatment pipes.*
Period of Operation	
The wastewater treatment pipes have been in use since 1970 when the WWTP was constructed.	
Effective Age of AOC:	*24 Years*
General Physical Conditions	
The integrity of the wastewater treatment pipes was deemed sound by visual inspection.	
Closure Method	
This is an active unit.	
Information Sources:	*RFI Proposal, RCRA Facility Assessment*

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Table 9-5
AREA OF CONCERN CHARACTERISTICS: AOC 46

Solid Waste Management Unit Number: 46 **Item/Description:** Wastewater Treatment Room Sump	
Location of AOC:	*WWTP west of Building 8.*
Type of AOC:	*Sump*
Design Features	
This unit is an in-ground concrete sump 1-foot by 1-foot by 2-feet deep.	
Operating Practices	
Past	*Same as current practices*
Present	*This sump collects floor spills from the WWTP and discharges to the Mixing Tank in the WWTP (SWMU 6).*
Period of Operation	
This unit was constructed as part of the WWTP construction in 1970.	
Effective Age of AOC:	*24 Years*
General Physical Conditions	
The integrity of this unit was deemed sound based on visual inspection.	
Closure Method	
This is an active unit.	
Information Sources:	*RFI Proposal, RCRA Facility Assessment*

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9.4 PREVIOUS SAMPLING AND ANALYSIS

No media sampling was conducted relative to wastewater treatment operation AOCs prior to Phase I of the RFI. The RFA included only visual observations of the AOCs.

9.5 PHASE I SAMPLING AND ANALYSIS

Release characterization sampling for wastewater treatment operation AOCs focused on soil and groundwater. Samples of those media from one (1) groundwater monitoring well installed during Phase I of the RFI are discussed in this section.

9.5.1 Soil Sampling

Monitoring well MW-16S was installed in the exposed alley between Building 3 and Building 4. Soil samples were collected from the 0- to 2-foot interval and at five (5) foot intervals thereafter. Black, visually contaminated soil was observed in the 5- to 7- foot sample, immediately above the groundwater table, in the boring for this monitoring well.

9.5.2 Soil Analysis

Soil samples collected during the advancement of the boring for the monitoring well were screened for the presence of VOCs with a PID. Elevated VOC levels, which were defined as readings greater than 10 ppm greater than background, are shown in Table 9-6. Elevated VOC levels were detected in samples from the boring for MW-16S.

The soil sample collected from the 0- to 2-foot interval at MW-16S was analyzed for metals, cyanide, VOCs, and semivolatile organic compounds. Soil samples collected from 5- to 7-foot, 10- to 12-foot and 15-to 17-foot intervals were analyzed for Appendix IX parameters.

Table 9-6
VOC SCREENING RESPONSES FOR SOIL HEADSPACES - WASTEWATER TREATMENT OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Sampling Interval (feet)	HNu Response[1] (ppm)
MW-16S	
5-7	32
10-12	20
15-17	11.0

1 Screening responses greater than 10 ppm above background are listed in the table.

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Summaries of positively identified analytes in soil samples collected from MW-16S are included in Appendix L. The qualitative summaries included in Appendix L are presented in Table 9-7 and Table 9-8 with discussion of the substantive findings.

Table 9-7
ORGANIC COMPOUNDS IN SOIL SAMPLES - WASTEWATER TREATMENT OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (µg/kg)		Total Sample Concentration (µg/kg)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Volatile Organics	2 - 4	0	1	ND	65	ND	65
Semivolatile Organics	1 - 4	0	1	ND	6800	ND	6800
Pesticides	0 - 0	-	-	-	-	-	-
PCBs	0 - 0	-	-	-	-	-	-
Organophosphorus Pesticides	0 - 3	-	-	-	-	-	-
Chlorinated Herbicides	1 - 3	0	1	ND	23	ND	23
Dioxin	3 - 3	6	7	ND	2.59	^3.51	4.51

VOCs: One (1) volatile organic compound, trichloroethene, was detected in soil samples analyzed for VOCs. Trichloroethene was detected at the highest analyte concentration, 65 µg/kg, in the sample from the 0- to 2-foot interval in well MW-16S.

Semivolatiles: One (1) semivolatile organic compound, phenanthrene, was detected in soil samples analyzed for semivolatile compounds. Phenanthrene was detected at the highest analyte concentration, 6,800 µg/kg, in the sample from the 5- to 7-foot interval in well MW-16S.

PCBs/Pesticides/Herbicides: One (1) chlorinated herbicide, 2,4-D, was detected in a soil sample analyzed for pesticides and herbicides. The 2,4-D was detected at the highest analyte concentration, 23 µg/kg, in the duplicate sample from the 5- to 7-foot interval in well MW-16S. No 2,4-D was detected in the original sample from the same interval in MW-16S. Pesticide analysis by EPA Method 8080 was rejected for all soil samples from MW-16S analyzed for chlorinated herbicides.

Dioxin: Five (5) dioxin congeners, total TCCD, total PeCDD, total HxCDD, total TCDF, and total PeCDF, were detected in soil samples analyzed for dioxin. Total TCDD was detected at the highest congener concentration, 2.59 µg/kg, in the sample from the 10- to 12-foot interval in well MW-16S. The highest total dioxin concentration, 3.3 µg/kg, was detected in the 5- to 7-foot interval of MW-16S.

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The total concentrations of VOCs, semivolatiles, PCBs/Pesticides/Herbicides, and Dioxin for each monitoring well are shown on Figure 9-1. These concentrations are the sum of the total sample concentrations for all samples from that location.

Table 9-8
INORGANIC COMPOUNDS IN SOIL SAMPLES - WASTEWATER TREATMENT OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of samples detecting analyte - number of samples analyzed	Concentration of Individual Analytes (µg/kg)		Published Ranges of Metals in Soil[1] (µg/kg)	
		Minimum	Maximum	Minimum	Maximum
Cadmium	2 - 4	1400	3750	-	-
Chromium	4 - 4	18000	431000	78000	100000
Copper	4 - 4	14000	72500	24000	43000
Nickel	4 - 4	52000	1005000	28000	35000
Tin	3 - 4	6700	10400	-	-
Vanadium	4 - 4	5100	16000	-	-
Zinc	4 - 4	20000	68000	74000	105000
Cyanide	0 - 0	-	-	-	-

1 Veneman, 1985.

Metals/Cyanide: The maximum concentration of zinc was below the minimum published range. Concentrations of other plating metals (chromium, copper, and nickel) were above the published ranges for those metals. Minimum concentrations of plating metals, except nickel, were below published minimums for those metals. No cyanide was detected in the four (4) samples analyzed for cyanide.

9.5.3 Groundwater Sampling

Groundwater samples were collected from monitoring well MW-16S. Additional wells are proposed for Phase II to augment the data collected from this well.

9.5.4 Groundwater Analysis

During sample collection, groundwater samples were screened in the field for temperature, redox potential (Eh), pH, conductance, and dissolved oxygen. The results of field screening are summarized in Table 9-9.

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Table 9-9
GROUNDWATER FIELD SCREENING RESULTS - WASTEWATER TREATMENT OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Parameter	MW-16S
Temperature (°C)	21
pH (pH units)	6.71
Eh (mV)	35
Conductance (μmhos/cm @ 25°C)	1100
Dissolved Oxygen (mg/L)	4

Groundwater samples were analyzed for VOCs and semivolatile organics. Summaries of positively identified analytes in the groundwater sample collected from MW-16S are included in Appendix L. The qualitative summary included in Appendix L is presented in Table 9-10 and Table 9-11 and lists the positively identified inorganic analytes in groundwater.

Table 9-10
ORGANIC COMPOUNDS IN GROUNDWATER SAMPLES - WASTEWATER TREATMENT OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (μg/L)		Total Sample Concentration (μg/L)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Volatile Organics	0 - 1	-	-	-	-	-	-
Semivolatile Organics	1 - 1	1	1	19	19	19	19
Pesticides	0 - 0	-	-	-	-	-	-
PCBs	0 - 0	-	-	-	-	-	-
Organophosphorus Pesticides	0 - 0	-	-	-	-	-	-
Chlorinated Herbicides	0 - 0	-	-	-	-	-	-
Dioxin	0 - 0	-	-	-	-	-	-

VOCs: No volatile organic compounds were detected in groundwater samples analyzed for VOCs.

Semivolatiles: One (1) semivolatile organic compound, phenanthrene, was detected at a

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concentration of 19 µg/L in well MW-16S.

PCBs/Pesticides/Herbicides: Phase I groundwater samples from monitoring well MW-16S were not analyzed for PCBs, pesticides, or herbicides. Research which is summarized in Section 1 indicates that these compounds were not used at this AOC grouping. Subsequent data collection designed to monitor this AOC grouping will not include these parameters.

Dioxin: Phase I groundwater samples from monitoring well MW-16S were not analyzed for dioxin. Dioxin will not be included as part of Phase II monitoring. Dioxin forming compounds were not used at this AOC grouping.

The total concentrations of VOCs, semivolatiles, PCBs/Pesticides/Herbicides, and Dioxin for each monitoring well are shown on Figure 9-2. The PCB/Pesticide Herbicide concentration is the sum of the total fraction concentrations from that well.

Table 9-11
INORGANIC COMPOUNDS IN GROUNDWATER SAMPLES - WASTEWATER TREATMENT OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Analyte	Concentration of Individual Analytes (µg/L)	MCL (µg/L)
Cadmium	23	5
Chromium	2600	100
Copper	1100	1000
Nickel	5300	100
Vanadium	150	-
Zinc	690	5000
Cyanide	110	200

- MCL not established

Metals/Cyanide: Metals concentrations in groundwater appear to be elevated in comparison with MCLs. Cyanide, however, was detected in groundwater at a concentration, 110 µg/L, below the MCL for cyanide of 200 µg/L and copper was detected at 1100 ug/L just above the MCL of 1000 mg/L. Site-specific background concentrations have not been adequately determined at this time for release characterization purposes. MCLs, however, can be used as a benchmark to evaluate the significance of the data.

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9.6 SUMMARY OF RELEASE CHARACTERIZATION

9.6.1 General Discussion of Results

This section discusses releases of organic and inorganic (metals/cyanide) analytes identified in soil and groundwater at the wastewater treatment operation AOCs.

Soil: Organic Compounds
Both volatile and semivolatile organic compounds were identified in soil monitored at the wastewater treatment operations. The maximum VOC sample concentration ranged from below detection to 65 µg/kg; semivolatiles from below detection to 6,800 µg/kg. One (1) chlorinated herbicide, 2,4-D, was detected at an estimated concentration of 23 µg/kg in a duplicate soil sample from monitoring well MW-16S. No 2,4-D was detected in the original soil sample. No other pesticides, herbicides or PCBs were detected. Given the absence of pesticides and PCB's and a single, low concentration chlorinated herbicide, these compounds will be eliminated from subsequent soil analyses on this AOC grouping. The maximum dioxin sample concentration was 3.3 µg/kg.

Soil: Metals/Cyanide
Plating metals, except zinc, were detected at concentrations in excess of published ranges. No cyanide was detected in soil monitored at the wastewater treatment operations. Metals associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN) will be included in subsequent investigations.

Groundwater: Organic Compounds
One (1) semivolatile organic compound, phenanthrene, was detected in shallow groundwater downgradient of the former pH adjustment (AOC 11) at a concentration of 19 µg/L. No VOCs were detected in the groundwater sample. Phase I sampling did not include pesticide, herbicide, PCB, or dioxin analysis of groundwater downgradient of wastewater treatment operations. Research which is summarized in Section 1 indicates that these compounds were not used at this AOC grouping. Subsequent data collection designed to monitor this AOC grouping will not include these parameters.

Groundwater: Metals/Cyanide
Cyanide was detected at a concentration below the MCL for cyanide. The concentrations of cadmium, chromium, and nickel appear elevated; however, site-specific background concentrations have not been adequately determined at this time. Metals associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN) will be included in subsequent investigations.

9.6.2 Data Gaps

Based on the release characterization for the wastewater treatment operation AOCs, the following data gaps have been identified. Data gaps have been organized by media since individual monitoring of each wastewater treatment operation AOC was not conducted. Phase II activities designed to provide the data required are discussed in Section 20, 21 and 22.

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Soil
The horizontal and vertical extent of soil contamination in the vicinity of the wastewater treatment operations AOCs needs to be delineated for VOCs, semivolatile organics, dioxin, and metals. The source for the dioxin contamination must also be determined.

Groundwater
The horizontal and vertical extent of groundwater contamination in the vicinity of the wastewater treatment operations AOCs needs to be delineated for VOCs, semivolatile organics, and metals.

9.6.3 Other Issues

Other issues could potentially include interim measures, additional media of concern for existing AOCs, and new AOCs identified during Phase I.

Interim Measures
No interim measures are deemed necessary based on the release characterization for the wastewater treatment operations.

Media of Concern
No additional media of concern were identified for wastewater treatment operations.

Areas of Concern
No additional areas of concern were identified for the wastewater treatment operations.

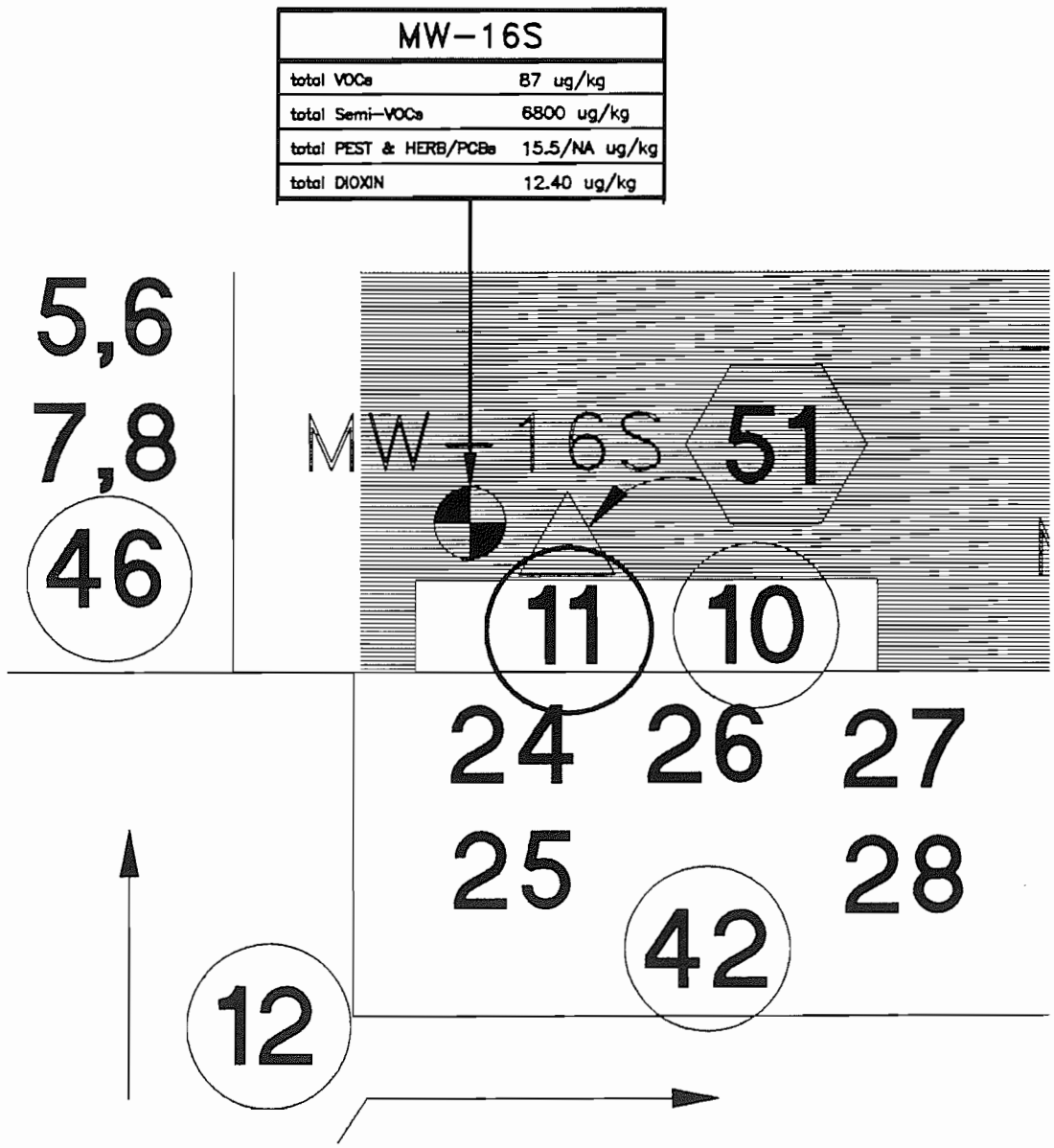

Figure 9-1

WASTEWATER TREATMENT RELEASE CHARACTERIZATION: SOIL
COLUMBIA MANUFACTURING COMPANY, INC. ONE CYCLE STREET WESTFIELD, MASSACHUSETTS
TIGHE & BOND INC. CONSULTING ENGINEERS WESTFIELD, MASS. SCALE: 1"=20' DATE: AUGUST, 1994

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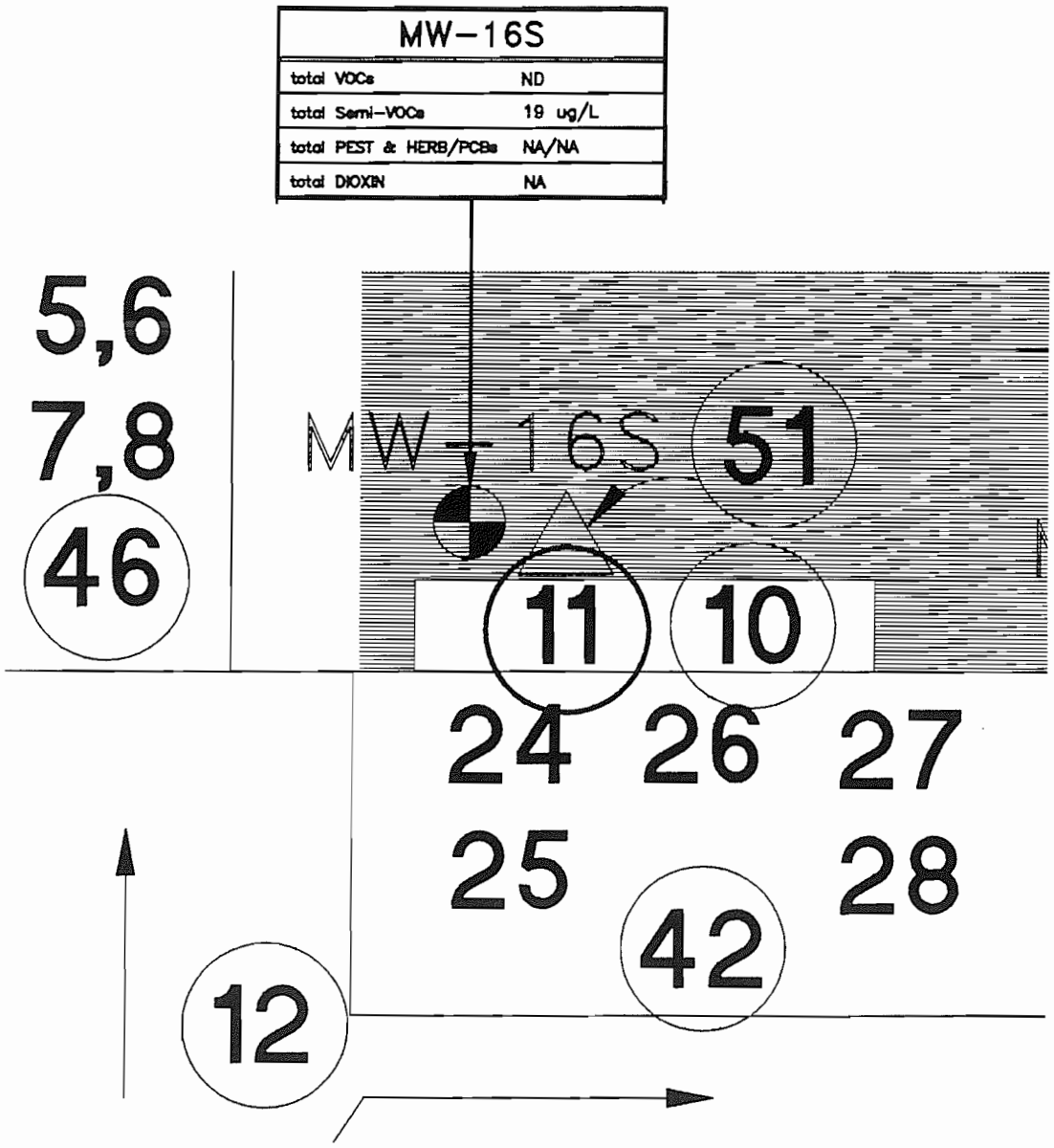

Figure 9-2

WASTEWATER TREATMENT RELEASE CHARACTERIZATION: GROUNDWATER

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=20' DATE: AUGUST, 1994

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10
RELEASE CHARACTERIZATION: ON-SITE SLUDGE DISPOSAL

10.1 OVERVIEW

This section discusses the objectives, AOC characteristics, methods of analysis, and results of the release characterization for AOCs associated with the on-site sludge disposal. The AOCs include the former lagoons (AOC 29), the underground discharge pipe (AOC 30), the scrap metal fill area (AOC 33a), and the former incinerators. Objectives of the release characterization and the Phase I sampling locations for the on-site sludge disposal are discussed in Section 10.2. Construction and operational characteristics of the four (4) AOCs are discussed in Section 10.3. The results of sampling conducted by the EPA prior to Phase I of the RFI are discussed in Section 10.4. The results of Phase I sampling and analysis are summarized in Section 10.5. Section 10.6 ends with a summary of the results of release characterization, a discussion of data gaps, and other related issues, if any.

10.2 OBJECTIVES

The objective of the release characterization at on-site sludge disposal AOCs is to determine whether a release of hazardous constituents has occurred from the units. The Phase I characterization focused on releases to soil and groundwater. Phase I analysis results for soil and groundwater samples from monitoring wells MW-6S, MW-7S, and MW-10S (in the shallow flow regime); MW-2I, MW-3I, MW-4I, MW-7I, MW-10I, and MW-15I (in the intermediate flow regime); and borings BH-3, BH-4, BH-5, and BH-7 are utilized for the characterization.

10.3 AOC CHARACTERISTICS

The AOCs associated with the on-site disposal of metal hydroxide sludge include the former, unlined drying beds (AOC 29) and the underground pipe utilized to transport sludge to the lagoons (AOC 30). These AOCs are located on the west side of the southern portion of the warehouse (Building 13). Two (2) other AOCs, the former scrap metal fill area (AOC 33a) and the former incinerators (AOC 33b), are grouped with AOCs 29 and 30 due to their location. The scrap metal fill area is believed to be located either directly beneath or just west of the former lagoons. The incinerators were originally identified at the same location, but research in Phase I revealed that the former incinerators were located just west of the warehouse and east of the former lagoons.

During the RFA, the four (4) AOCs associated with on-site sludge disposal were identified. The physical and operational characteristics of the AOCs are summarized in Tables 10-1, 10-2, 10-3, and 10-4. Hazardous constituents in the metal hydroxide sludge discharged to the lagoon (AOC 29) may impact soil and groundwater underlying the lagoons. A section of the discharge pipe (AOC 30) may still be located underground and serve as a continuing source of hazardous constituents to soil and groundwater. Excavation and soil sampling is proposed to determine if this pipe is present and what impacts it may have had on soils in this area.

The release method for hazardous constituents from the scrap metal fill area (AOC 33a) is not accurately known, although sludge drying activities above the fill area may have leached metals from the scrap metal. The wastes generated by the former incinerators (AOC 33b) may have been deposited into the scrap metal fill area (AOC 33a).

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Table 10-1
AREA OF CONCERN CHARACTERISTICS: AOC 29

Solid Waste Management Unit Number: 29 **Item/Description:** Former Lagoons	
Location of AOC:	*South of Building 4, west of the warehouse and north of the chain link fence.*
Type of AOC:	*Former Surface Impoundments*
Design Features	
The former lagoons consisted of unlined sand filter beds. The northern lagoon was 110 feet long by 50 feet wide or 5,500-square-feet in area; the southern bed was constructed in the shape of a right triangle, approximately 100-feet by 80-feet or 4,000-square-feet. A concrete splitter or distribution box was utilized to divert flow to either lagoon from the underground sludge discharge pipe (AOC 30).	
Operating Practices	
Past	*Metal hydroxide sludge from the WWTP was discharged to the lagoons for dewatering. The sludge was in slurry form with 1-2% solids. Sludge was allowed to dry by vaporization or infiltration. The sludge contained hydroxides of nickel, chromium, and zinc, and possibly cyanide. The lagoons reportedly received pH adjusted wastewater from the floor spills tank in the early 1980s. Methylene chloride from the former degreaser in the warehouse (SWMU 38) may have collected in the sump which discharged to the lagoons.*
Present	*No longer in use.*
Period of Operation	
The lagoons were utilized for sludge drying from 1970 until April 6, 1983 when the filter press (SWMU 7) was placed in operation.	
Effective Age of AOC:	*24 years*
General Physical Conditions	
The RFA investigative team observed boreholes in the soil cap overlying the lagoons in September 1988 and indicated that these boreholes may impair the integrity of the soil cap. Otherwise, the area consists of a grassed mound with no buildings or other structures on its surface. Signs have been installed on the landfill cap informing visitors that hazardous waste may be present in this area.	
Closure Method	
The sludge remaining in the lagoons after discharge of the metal hydroxide slurry was discontinued, was excavated and removed from the Site as hazardous waste. The lagoons were subsequently backfilled and covered with a soil cap.	
Information Sources:	*RFI Proposal, RCRA Facility Assessment, 1979-1980 NPDES Inspection Report*

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Table 10-2
AREA OF CONCERN CHARACTERISTICS: AOC 30

Solid Waste Management Unit Number: 30 **Item/Description:** Underground Discharge Pipe	
Location of AOC:	*The pipe extends from the west side of warehouse toward the location of the former splitter box which was located between the former lagoons (AOC 29). The location of the pipe is indicated by parallel cracking in the pavement adjacent to the warehouse, which is perpendicular to the warehouse.*
Type of AOC:	*Discharge Pipe and Former Sump*
Design Features	
A sump was used to convey the metal hydroxide slurry to the lagoons. The sump measured 2-feet by 1½-feet by 2-feet deep and was constructed of concrete. The discharge pipe was apparently constructed of 2-inch diameter PVC and a 20-foot section of the pipe still extends from the sump toward the former lagoons.	
Operating Practices	
Past	*The pipe was used to transfer metal hydroxide slurries (1 to 2% solids) to the splitter box and the former lagoons. The RFA indicates that the sump also received overflows from the methylene chloride degreaser in the warehouse (SWMU 38).*
Present	*The sump has been closed; the pipe is no longer in use, but remains in the ground.*
Period of Operation	
The period of operation is the same as that of the former lagoons, 1970 to 1983.	
Effective Age of AOC:	*24 Years*
General Physical Conditions	
The integrity or presence of the pipe is unknown at this time. CMC staff could not verify for the RFA investigative team whether the pipe was removed or not.	
Closure Method	
The sump was filled with concrete flush with the surrounding floor. The PVC inlet pipe was disconnected in the warehouse prior to the closure of the sump.	
Information Sources:	*RFI Proposal, Draft EPA Site Evaluation, RCRA Facility Assessment*

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Table 10-3
AREA OF CONCERN CHARACTERISTICS: AOC 33a

Solid Waste Management Unit Number: 33a **Item/Description:** Scrap Metal Fill Area	
Location of AOC:	*West of the warehouse, south of Building 4; directly underlying the former lagoons (AOC 29).*
Type of AOC:	*Scrap Metal Fill Area*
Design Features	
The scrap metal fill area was located directly beneath the location of the former lagoons (AOC 29) and was an unlined fill area.	
Operating Practices	
Past	*The fill area was likely used for disposal of scrap metal, ash from the paper and cardboard incinerator, and bottom or fly ash from the former coal fired boilers. CMC personnel indicated to the RFA investigative team that off-site wastes may have been disposed of in the scrap yard after operating hours.*
Present	*This unit is currently not active.*
Period of Operation	
The date of startup for the scrap metal fill area and any fly ash disposal into the area is not known.	
Effective Age of AOC:	*Unknown*
General Physical Conditions	
Could not be determined.	
Closure Method	
The former lagoons were built over the scrap metal fill area in 1970.	
Information Sources:	*RFI Proposal, EPA Draft Site Evaluation, RCRA Facility Assessment*

Table 10-4
AREA OF CONCERN CHARACTERISTICS: AOC 33b

Solid Waste Management Unit Number: 33b **Item/Description:** Former Incinerators	
Location of AOC:	*West of the warehouse, south of Building 4.*
Type of AOC:	*Waste Paper Incinerator and Incinerator Pit*
Design Features	
The office paper and packaging incinerator located near the northwest corner of the west side of the warehouse was attached to a 30-foot high brick stack and had a corrugated aluminum roof on a steel frame. A second incinerator located just south of the first unit is identified with a circle on a 1970 Factory Mutual drawing.	
Operating Practices	
Past	*The paper and cardboard incinerator reportedly burned office records, cancelled checks, and cardboard packaging. CMC personnel also reported that smoke complaints were received by the company in the late 1950s.*
Present	*This unit is currently not active.*
Period of Operation	
The incinerators may have been operated from the late 1940s to the late 1950s.	
Effective Age of AOC:	*44 to 54 Years*
General Physical Conditions	
Could not be determined.	
Closure Method	
The incinerators were demolished, possibly during the warehouse construction in 1969.	
Information Sources:	*EPA Draft Site Evaluation, RCRA Facility Assessment, 1970 Factory Mutual drawing of CMC*

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10.4 PREVIOUS SAMPLING AND ANALYSIS

In 1991, the EPA sampled intermediate depth groundwater downgradient of the on-site sludge disposal AOCs and collected soil samples at the former lagoons (AOC 29) and the former discharge pipe (AOC 30).

10.4.1 Soil Sampling

Soil samples were collected from three (3) locations at the former lagoons at depths of 56-inches (Location 1), 42-inches (Location 2), and 60-inches (Location 3). An additional sample of "crusted" soil encountered at Location 2 was collected (Location 2A). Three (3) locations were sampled at the former discharge pipe (AOC 30): Location 4 at a depth of 28-inches, Location 5 at a depth of 14-inches, and Location 6 at a depth of 16-inches.

10.4.2 Soil Analysis

These soil samples were analyzed for metals (cadmium, chromium, copper, lead, nickel, and zinc), total and amenable cyanide, and VOCs by EPA Method 8240. Soil from Location 2A was analyzed for metals and cyanide only. Summaries of positively identified analytes in 1991 EPA samples are included in Appendix B. Full laboratory analysis reports were included in Appendix I of the RFI Proposal (Volume 2).

Organics in Soil: Four (4) analytes, 1,2-dichloroethylene isomers, trichloroethylene, tetrachloroethylene, and napthalene, were detected in soil samples analyzed for VOCs. Four (4) of the six (6) locations analyzed for VOCs detected analytes. Trichloroethylene was detected at the highest analyte concentration, 960 μg/kg, in the sample from Location 1. The maximum total VOC concentration, 1,290 μg/kg, was detected in the sample from Location 3. Tentatively identified compounds (TICs) at Location 2 include hydrocarbons in the C8 carbon range; TICs at Location 3 include hydrocarbons in the C10 and C11 carbon ranges, napthalene, decahydro, bicycloheptanone, and trimethyl.

Inorganics in Soil: The results of soil sample analysis for inorganic analytes are summarized in Table 10-5. The published ranges of inorganic analytes in soil (Veneman, 1978) are shown for reference. Detected concentrations of chromium, copper, lead, nickel, and zinc exceeded published values for all samples except Location 6. Nickel in soil from Location 6 exceeded published values. Total cyanide was detected at all locations. No amenable cyanide was detected in any of the samples.

Table 10-5
INORGANIC ANALYTES IN SOIL - 1991 EPA DATA - ON-SITE SLUDGE DISPOSAL
Columbia Manufacturing Company, Westfield, MA

Analyte	EPA SAMPLING LOCATIONS							Published Ranges of Metals in Soil[1] (units)	
	AOC 29 - Former Lagoons				AOC 30 - Former Discharge Pipe				
	1	2	2A	3	4	5	6	Minimum	Maximum
Cadmium (µg/kg)	107000	287000	188000	95200	3540	36000	< 540	-	-
Chromium (µg/kg)	12300000	1720000	1740000	762000	375000	658000	14500	78000	100000
Copper (µg/kg)	6860000	10700000	7030000	5140000	1020000	3910000	29400	24000	43000
Lead (µg/kg)	900000	3660000	2990000	1330000	345000	944000	10800	13000	35000
Nickel (µg/kg)	7390000	2290000	1840000	936000	1190000	2330000	53000	28000	35000
Zinc (µg/kg)	7040000	11100000	6770000	4070000	715000	2990000	67500	74000	105000
Total Cyanide (µg/kg)	433200	38900	435700	8340	4460	3580	190	-	-
Amenable Cyanide (µg/kg)	ND	ND	NA	ND	ND	ND	NA	-	-

1 Veneman, 1978.
ND Not detected (as reported on the laboratory analysis report)
NA Not analyzed
- No published range

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10.4.3 Groundwater Sampling

In 1991, the EPA sampled intermediate depth groundwater downgradient of the on-site sludge disposal AOCs at monitoring wells MW-2I (EPA samples 01063, 01064, 01065, and 01066), MW-4I (EPA samples 01086 and 01087), and MW-7I (EPA samples 01067 and 01068).

10.4.4 Groundwater Analysis

Groundwater samples were analyzed for total and dissolved metals (cadmium, chromium, copper, nickel, and zinc), total cyanide, and VOCs by EPA Method 8240. Dissolved cyanide was included in the analysis of groundwater from well MW-2I. A duplicate sample was also collected from monitoring well MW-2I. Summaries of positively identified analytes in 1991 EPA samples are included in Appendix B. Full laboratory analysis reports were included in Appendix I of the RFIP (Volume 2).

Organics in Groundwater: Four (4) analytes, acetone, 1,2-dichloroethylene isomers, trichloroethylene, and tetrachloroethylene, were detected in groundwater samples monitoring the on-site sludge disposal AOCs. All four (4) samples analyzed for VOCs detected analytes. Total sample concentrations ranged from 12.5 μg/L to 3,400 μg/L. 1,2-dichloroethylene was detected at the highest analyte concentration, 3,400 μg/L, in the groundwater sample from MW-4I.

Inorganics in Groundwater: Total concentrations of metals were detected in groundwater from wells MW-2I, MW-4I, and MW-7I. Dissolved concentrations of nickel were detected in groundwater from wells MW-4I and MW-7I. Total concentrations of cadmium and nickel, and dissolved concentrations of nickel, exceed the MCL for that metal. Total cyanide was detected in groundwater from MW-2I above the MCL for that analyte. The analytical results of samples collected for inorganic parameters in groundwater are summarized in Table 10-6. MCLs for the inorganic analytes are shown in Table 10-6 for reference.

Table 10-6
INORGANIC ANALYTES IN GROUNDWATER - 1991 EPA DATA - ON-SITE SLUDGE DISPOSAL
Columbia Manufacturing Company, Westfield, MA

Analyte	MW-2I[1]		MW-4I		MW-7I		MCLs (μg/L)
	Total (μg/L)	Dissolved (μg/L)	Total (μg/L)	Dissolved (μg/L)	Total (μg/L)	Dissolved (μg/L)	
Cadmium (μg/L)	6.5	< 3	2	< 3	3	< 3	5
Chromium (μg/L)	24	< 5	6	< 5	15	< 5	100
Copper (μg/L)	85.5	< 12	20	< 12	25	< 12	1000
Nickel (μg/L)	4517	2126	< 20	< 20	63	30	100
Zinc (μg/L)	236	12	37	< 10	53	< 10	5000
Total Cyanide (μg/L)	652.5	NA	< 10	NA	< 10	NA	-
Amenable Cyanide (μg/L)	ND	NA	NA	NA	NA	NA	-

1 Averaged.
ND Not detected (as reported on the laboratory analysis report)
NA Not analyzed
- No MCL established.

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10.5 PHASE I SAMPLING AND ANALYSIS

Release characterization sampling for on-site sludge disposal AOCs focused on soil and groundwater. Samples of those media from two (2) groundwater monitoring well installed during Phase I of the RFI and groundwater from seven (7) previously installed wells are discussed in this Section. Soil samples from four (4) soil borings are also discussed.

10.5.1 Soil Sampling

Monitoring well MW-6S was installed southeast and directly downgradient of the former lagoons (AOC 29). This well replaced a former monitoring well which could not be located during Phase I. Well MW-15I was installed in the center of the suspected area of the scrap metal fill area (AOC 33a). Soil samples from the installation of these monitoring wells were collected from the 0- to 2-foot interval and at 5-foot intervals thereafter. Soil samples were collected at continuous 2-foot (2') intervals from borings BH-3 and BH-4. Samples were collected from, the 0- to 1-foot, 1- to 2-foot, and 5- to 6-foot intervals from borings BH-5 and BH-7.

10.5.2 Soil Analysis

Soil samples collected during the advancement of the borings were screened for the presence of VOCs with a PID. Elevated VOC levels, which were defined as readings greater than 10 ppm above background, are shown in Table 10-7. Elevated VOC levels were detected in samples from each of the four (4) borings (BH-3, BH-4, BH-5, and BH-7) advanced in this AOC grouping.

Table 10-7
VOC SCREENING RESPONSES FOR SOIL HEADSPACES - ON-SITE SLUDGE DISPOSAL
Columbia Manufacturing Company, Westfield, MA

Sampling Interval (feet)	VOC Concentration[1] (ppm)
BH-3	
0 - 2	220
2 - 4	109
4 - 6	99
6 - 8	27
6 - 8[2]	20
BH-4	
0 - 2	104
2 - 4	28
4 - 6	90

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Sampling Interval (feet)	VOC Concentration[1] (ppm)
BH-5	
0 - 2	92
2 - 4	98
BH-7	
0 - 1	94
1 - 2	92
3 - 5	170

1 Screening responses greater than 10 ppm above background are shown in the table.
2 Duplicate sample.

Soil samples from BH-3 and BH-4, collected at continuous 2-foot intervals to a depth of eight (8) feet below ground surface, were analyzed for Appendix IX parameters. Soil samples from boring BH-5 were analyzed for VOCs, semivolatiles, metals, and cyanide; samples from BH-7 were analyzed for VOCs, semivolatiles, metals, and cyanide. In addition, the 0- to 1-foot and 1- to 2-foot intervals of BH-7 were analyzed for pesticides by EPA Method 8080. The 0- to 2-foot and 5- to 7-foot intervals of wells MW-6S and MW-15I were analyzed for VOCs, semivolatiles, cyanide, and metals. The two (2) samples from MW-15I were also analyzed for dioxin in accordance with the RFIP.

Summaries of positively identified analytes in soil samples collected from MW-18S are included in Appendix L. The qualitative summary included in Appendix L are also presented in Table 10-8 and Table 10-9.

Table 10-8
ORGANIC COMPOUNDS IN SOIL SAMPLES - ON-SITE SLUDGE DISPOSAL
Columbia Manufacturing Company, Westfield, MA

Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (µg/kg)		Total Sample Concentration (µg/kg)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Volatile Organics	13 - 16	0	3	ND	1400	ND	1916
Semivolatile Organics	13 - 18	0	16	ND	75000	ND	486600
Pesticides	8 - 11	0	3	ND	1000	ND	1080
PCBs	0 - 8	-	-	-	-	-	-

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Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (µg/kg)		Total Sample Concentration (µg/kg)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Organophosphorus Pesticides	0 - 11	-	-	-	-	-	-
Chlorinated Herbicides	0 - 11	-	-	-	-	-	-
Dioxin	10 - 10	3	8	ND	14.3	2.92	25.07

VOCs: Four (4) volatile organic compounds, acetone, cis-1,2-dichloroethene, methylene chloride, and trichloroethene, were detected in soil samples analyzed for VOCs. Methylene chloride was detected at the highest analyte concentration, 1,400 µg/kg, in the sample from the 2- to 4-foot interval in boring BH-4. The highest total VOC concentration, 1,916 µg/kg, was detected in the sample from the 1- to 2-foot interval of BH-7.

Semivolatiles: Nineteen (19) semivolatile organic compounds:

- Acenaphthene
- Acenaphthylene
- Anthracene
- Benzo(a)anthracene
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Benzo(ghi)perylene
- Benzo(a)pyrene
- Bis(2-ethylhexyl)phthalate
- Chrysene
- Dibenzofuran
- Di-n-butyl phthalate
- Fluoranthene
- Fluorene
- Indeno(1,2,3-cd)pyrene
- 2-Methylnapthalene
- Naphthalene
- Phenanthrene
- Pyrene

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were detected in soil samples analyzed for semivolatiles. Phenanthrene and pyrene were detected at the highest analyte concentration, 75,000 µg/kg, in the sample from the 2- to 4-foot interval in boring BH-3. The highest total semivolatile organic concentration, 486,600 µg/kg, was detected in the same interval.

PCBs/Pesticides/Herbicides: Four (4) pesticides, lindane: gamma-BHC, dieldrin, endosulfan I, and heptachlor, were detected in soil samples analyzed for pesticides, herbicides, and PCBs. Lindane: gamma-BHC was detected at the highest analyte concentration, 1,000 µg/kg, in the sample from the 0- to 2-foot interval in boring BH-3 which is representative of the soil used to cap the lagoons. The highest total VOC concentration, 1,080 µg/kg, was detected in the same interval. The lagoons are located within 100 feet of the edge of the tobacco fields southwest of the Site. The prevailing winds (Section 6) during the months of June, July, and August are from the southwest, or toward the lagoon. The secondary wind direction during most other months of the year is also from the southwest. Research does not indicate pesticide disposal in this AOC grouping or in products manufactured or wastes produced at the Site. Therefore, given the prevailing wind direction and the months that pesticide application is likely to occur (May - August), the likely source of pesticides in the shallow soils at the on-site sludge AOCs appears to be related to the tobacco fields.

Dioxin: Eight (8) dioxin congeners, total TCDD, total PeCDD, total HxCDD, total HpCDD, total TCDF, total PeCDF, total HxCDF, and total HpCDF, were detected in soil samples analyzed for dioxin. Total TCDF was detected at the highest analyte concentration, 14.3 µg/kg, in the sample from the 4- to 6-foot interval in boring BH-4. The highest total dioxin concentration, 25.07 µg/kg, was detected in the sample from the same interval.

The total concentrations of VOCs, semivolatiles, PCBs/pesticides/herbicides, and dioxin for soil samples from the boring for monitoring well MW-18S are shown on Figure 10-1. These concentrations are the sum of the total sample concentrations for all samples from that location.

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Table 10-9
INORGANIC COMPOUNDS IN SOIL SAMPLES - ON-SITE SLUDGE DISPOSAL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of samples detecting analyte - number of samples analyzed	Concentration of Individual Analytes (µg/kg)		Published Ranges of Metals in Soil[1] (µg/kg)	
		Minimum	Maximum	Minimum	Maximum
Cadmium	14 - 17	ND	330000	-	-
Chromium	18 - 18	8800	18000000	78000	100000
Copper	18 - 18	8100	24000000	24000	43000
Nickel	18 - 18	14000	22000000	28000	35000
Tin	12 - 18	ND	460000	-	-
Vanadium	17 - 18	ND	48500	-	-
Zinc	18 - 18	21000	8400000	74000	105000
Cyanide	11 - 18	ND	440000	-	-

1 Veneman, 1985.
- No published range established.

Metals/Cyanide: Maximum concentrations of plating metals (chromium, copper, nickel, and zinc) exceeded the published range for those metals. The minimum concentrations of these metals were below the minimum published values for those metals. Cyanide was detected in 11 of the 18 soil samples analyzed for this constituent. The maximum cyanide concentration was 440,000 µg/kg.

10.5.3 Groundwater Sampling

Groundwater samples were collected from monitoring wells MW-2I, MW-3I, MW-4I, MW-6S, MW-7S, MW-10S, MW-10I, and MW-15I.

10.5.4 Groundwater Analysis

During sample collection, groundwater samples were screened in the field for temperature, redox potential (Eh), pH, conductance, and dissolved oxygen. The results of field screening are summarized in Table 10-10.

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Table 10-10
GROUNDWATER FIELD SCREENING RESULTS - ON-SITE SLUDGE DISPOSAL
Columbia Manufacturing Company, Westfield, MA

Monitoring Well	Temperature (°C)	pH (pH units)	Eh (mV)	Conductance (μmhos/cm)	Dissolved Oxygen (mg/L)
MW-2I	10	7.52	100	820	6
MW-3I	13	5.65	130	430	5
MW-3I (duplicate)	14	6.19	110	410	4
MW-4I	12	7.75	80	1100	3
MW-6S	15	5.96	76	390	5
MW-6S (duplicate)	15	6.24	69	370	4
MW-7S	12	6.56	49	200	6
MW-10S	20	5.81	94	330	2
MW-10I	19	5.86	110	340	3
MW-10I (duplicate)	20	5.84	100	330	2
MW-15I	13	7.05	110	330	5
MW-15I (duplicate)	12	6.97	86	340	4

Groundwater was analyzed for VOCs, semivolatile organics, metals, and cyanide. Summaries of positively identified analytes in groundwater collected from the wells monitoring this AOC grouping are included in Appendix L. The qualitative summaries included in Appendix L are presented in Tables 10-11 and Table 10-12 with discussion of the substantive findings.

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Table 10-11
ORGANIC COMPOUNDS IN GROUNDWATER SAMPLES - ON-SITE SLUDGE DISPOSAL
Columbia Manufacturing Company, Westfield, MA

Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (µg/L)		Total Sample Concentration (µg/L)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Volatile Organics	8 - 8	1	2	10	5200	15	5200
Semivolatile Organics	0 - 5	-	-	-	-	-	-
Pesticides	0 - 0	-	-	-	-	-	-
PCBs	0 - 0	-	-	-	-	-	-
Organophosphorus Pesticides	0 - 0	-	-	-	-	-	-
Chlorinated Herbicides	0 - 0	-	-	-	-	-	-
Dioxin	5 - 5	2	6	ND	25.25	24.3	56.52

VOCs: Two (2) volatile organic compounds, cis-1,2-dichloroethene and trichlorethene, were detected in groundwater samples analyzed for VOCs. Trichlorethene was detected at the highest analyte concentration, 5,200 µg/L in groundwater from MW-4I. The maximum total VOC concentration 5,200 µg/L, was also detected in groundwater from this well.

Semivolatiles: No semivolatile organic compounds were detected in groundwater from wells MW-3I, MW-6S, MW-10S, MW-10I, or MW-15I.

PCBs/Pesticides/Herbicides: Phase I groundwater samples from monitoring wells were not analyzed for pesticides, herbicides, or PCBs.

Dioxin: Seven (7) dioxin congeners, total TCDD, total PeCDD, total HxCDD, total HpCDD, total TCDF, total PeCDF, and total HpCDF, were detected in groundwater samples analyzed for dioxin. Total TCDD was detected at the highest analyte concentration, 25.25 ng/L, in the sample from well MW-15I. The highest total dioxin concentration, 56.52 ng/L, was detected in the groundwater sample from the same well.

The total concentrations of VOCs, semivolatiles, PCBs/pesticides/herbicides, and dioxin from the wells monitoring this AOC grouping is shown on Figure 10-2. The PCB/Pesticide/Herbicide concentration is the sum of the total fraction concentrations from that well.

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Table 10-12
INORGANIC COMPOUNDS IN GROUNDWATER - ON-SITE SLUDGE DISPOSAL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of samples detecting analyte - number of samples analyzed for the analyte	Concentration of Individual Analytes		MCL (µg/L)
		Minimum (µg/L)	Maximum (µg/L)	
Cadmium	1 - 9	ND	18.5	5
Chromium	6 - 9	ND	5900	100
Copper	5 - 9	ND	175	1000
Nickel	8 - 8	60	4600	100
Vanadium	1 - 9	ND	150	-
Zinc	9 - 9	99	615	5000
Cyanide	3 - 9	ND	2300	-

- No MCL established.

Metals/Cyanide: Cadmium, chromium, and nickel concentrations in groundwater appear to be elevated in comparison with MCLs. Cyanide was detected in three (3) of nine (9) groundwater samples analyzed for cyanide. The maximum concentration of cyanide, 2,300 µg/L, was detected in groundwater from well MW-2I. Site-specific background concentrations have not been adequately determined at this time for release characterization purposes. MCLs, however, can be used as a benchmark to evaluate the significance of the data.

10.6 SUMMARY OF RELEASE CHARACTERIZATION

10.6.1 General Discussion of Results

This section discusses releases of organic and inorganic (metals/cyanide) analytes identified in soil and groundwater at the on-site sludge disposal AOCs.

Soil: Organic Compounds
Volatile organics, semivolatiles, and pesticides were identified in soil monitored near the on-site sludge disposal AOCs. The maximum VOC sample concentration ranged from below detection to 1,916 µg/kg; semivolatiles from below detection to 486,600 µg/kg; and pesticides (by EPA Method 8080) from below detection to 1,080 µg/kg. Although elevated pesticides were detected in soils, historical and analytical data suggest an off-site source (Section 10.5.2). Therefore, pesticides and herbicides will be eliminated from Phase II analysis. Dioxin was detected in soil at total sample concentrations between 2.92 µg/kg and 25.07 µg/kg.

Soil: Metals/Cyanide
Chromium, copper, nickel, and zinc (plating metals) were detected at concentrations in excess of published ranges. Cyanide was detected at concentrations from below detection to 440,000 µg/kg.

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Groundwater: Organic Compounds
Volatile organic compounds were detected in shallow and intermediate groundwater downgradient of the on-site sludge disposal AOCs. Maximum VOC sample concentrations ranged from 15 µg/L to 5,200 µg/L. Dioxin was detected in groundwater downgradient of the on-site sludge disposal AOCs. The total sample concentrations of dioxin ranged from 24.3 ng/L to 56.52 ng/L. Phase I sampling did not include pesticide, herbicide, or PCB analysis of groundwater downgradient of the on-site sludge disposal AOCs. However, data indicates that pesticides detected in soils are related to an off-site source. As described in Section 1, these compounds are not associated with this AOC grouping or products historically manufactured at the facility and will be eliminated from future monitoring of the on-site sludge disposal AOCs.

Groundwater: Metals/Cyanide
Cadmium, chromium, and nickel concentrations in groundwater appear elevated. Cyanide was detected in groundwater monitored at concentrations from below detection to 2,300 µg/L. Plating metals appear elevated, however, site-specific background concentrations have not been adequately determined at this time. All metals, including those associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN), will be included in subsequent investigations.

10.6.2 Data Gaps

Based on the release characterization for the on-site sludge disposal AOCs, the following data gaps have been identified. Data gaps have been organized by media since individual monitoring of each plating operation AOC was not conducted. Phase II activities designed to provide the data required are discussed in Sections 20, 21 and 22.

Soil
The horizontal and vertical extent of soil contamination in the vicinity of the on-site sludge disposal AOCs needs to be delineated for VOCs, semivolatile organics, dioxin, and metals. The source for the dioxin contamination must also be determined. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

Groundwater
The horizontal and vertical extent of groundwater contamination in the vicinity of the on-site sludge disposal AOCs needs to be delineated for VOCs, semivolatile organics, metals, and cyanide. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

10.6.3 Other Issues

Other issues could potentially include interim measures, additional media of concern for existing AOCs, and new AOCs identified during Phase I.

Interim Measures
No interim measures are deemed necessary based on the release characterization for the on-site sludge disposal AOCs.

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Media of Concern

No additional media of concern were identified for on-site sludge disposal.

Areas of Concern

No additional areas of concern were identified for the on-site sludge disposal AOCs. Phase II tasks will focus on AOC 29, 30, 33a, and 33b. Borings and wells are proposed to better delineate releases from these AOC's in Phase II.

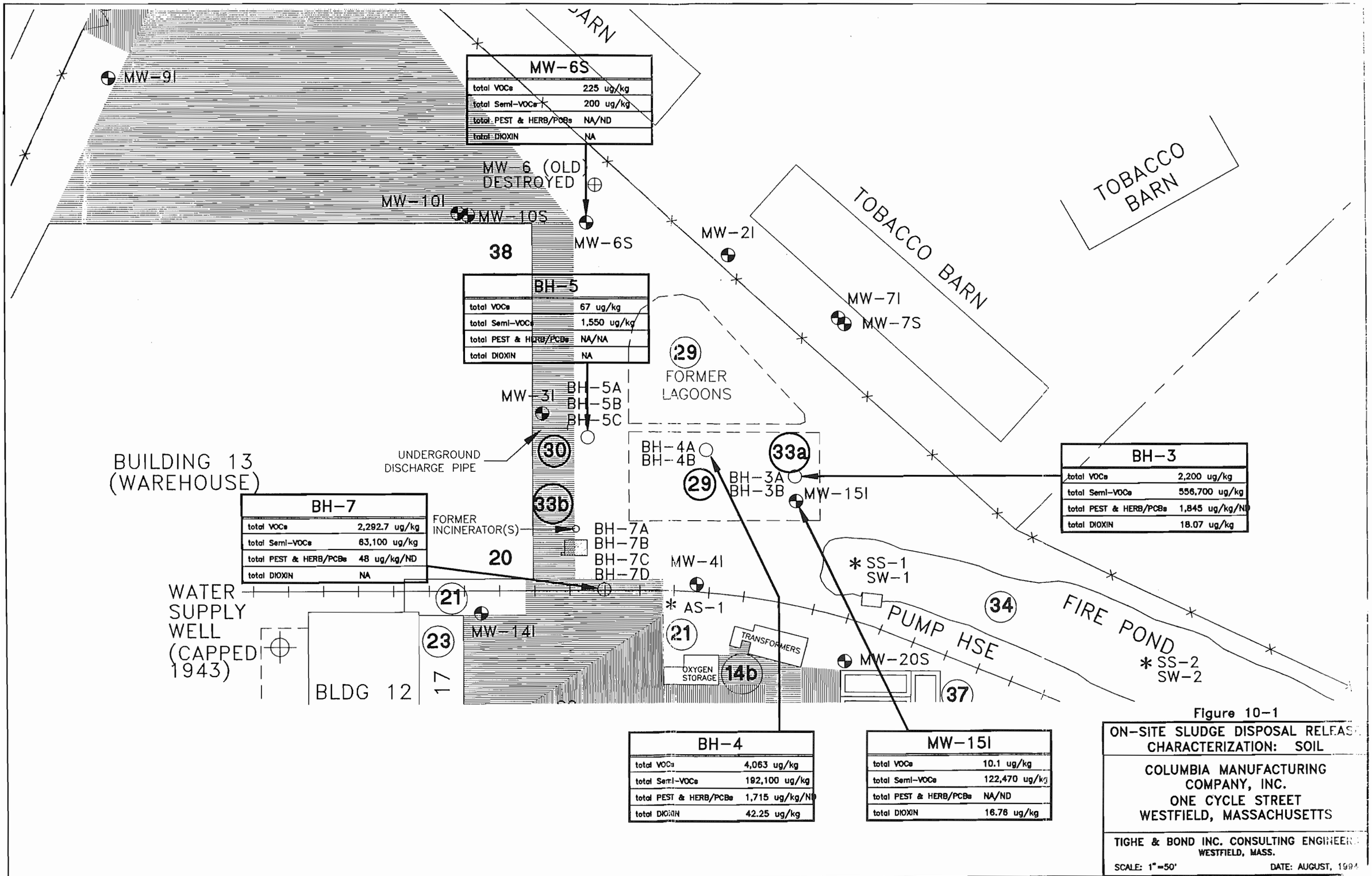

Figure 10-1

ON-SITE SLUDGE DISPOSAL RELEASE CHARACTERIZATION: SOIL

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=50' DATE: AUGUST, 1994

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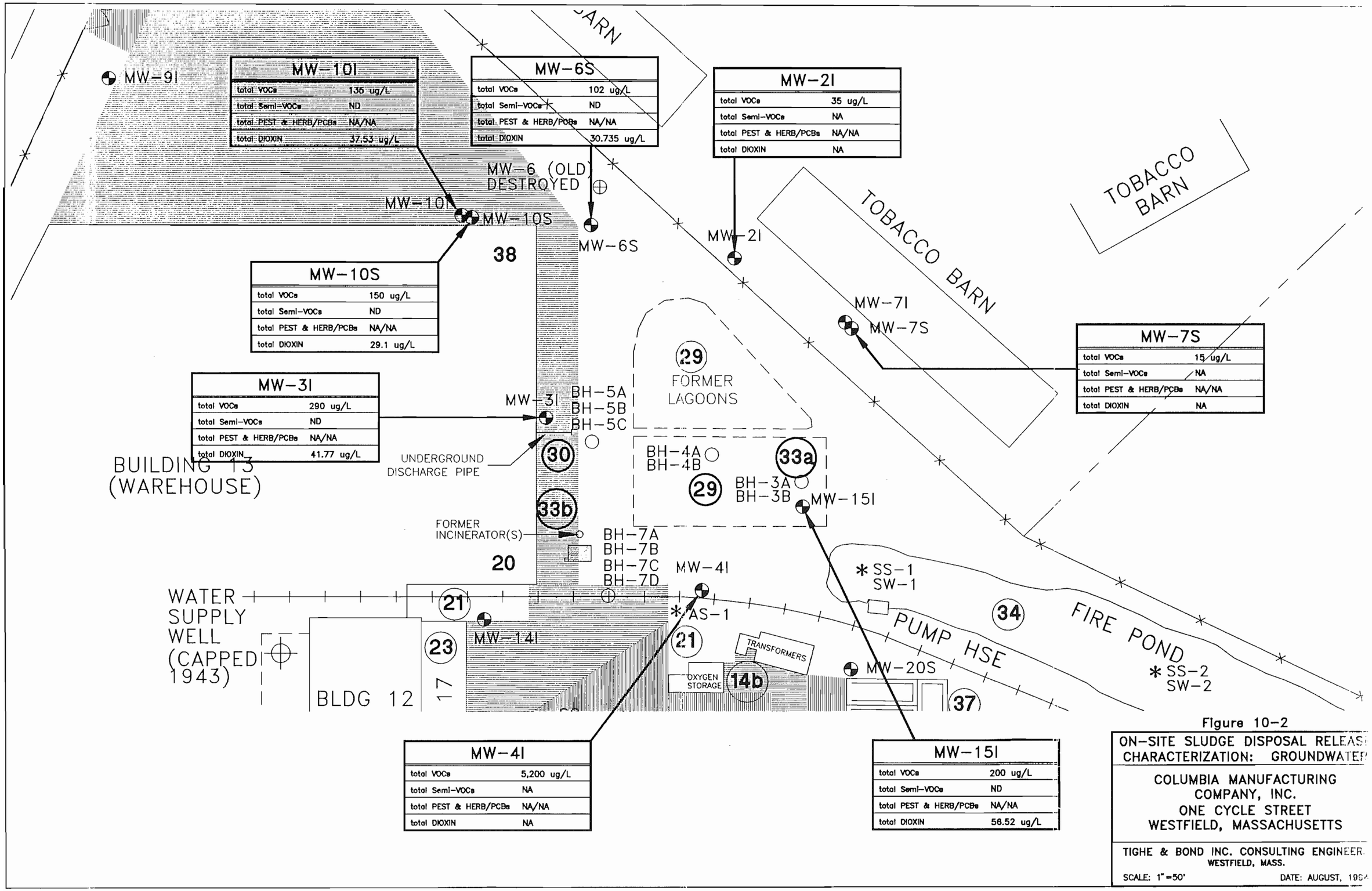

Figure 10-2

ON-SITE SLUDGE DISPOSAL RELEASE CHARACTERIZATION: GROUNDWATER

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=50' DATE: AUGUST, 1994

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11
RELEASE CHARACTERIZATION: WASTE STORAGE YARD

11.1 OVERVIEW

This section discusses the objectives, AOC characteristics, methods of analysis, and results the of release characterization for AOCs associated with the waste storage yard. The AOCs include the sludge roll-off box (AOC 9), the current and former hazardous waste drum storage areas (AOCs 14a and 14b), and the storage yard runoff area (AOC 21). Objectives of the release characterization and the Phase I sampling locations for the waste storage yard are discussed in Section 11.2. Construction and operational characteristics of the four (4) AOCs are discussed in Section 11.3. The results of sampling conducted by the EPA prior to Phase I of the RFI are discussed in Section 11.4. The results of Phase I sampling and analysis are summarized in Section 11.5. Section 11.6 discusses the results of release characterization, and summarizes data gaps, and other related issues, if any.

11.2 OBJECTIVES

The objective of the release characterization for the waste storage yard AOCs is to determine whether a release of hazardous constituents has occurred from these units. The Phase I characterization focused on releases to soil, intermediate depth groundwater, subsurface gas, and air. Phase I analysis results for soil and groundwater samples from monitoring wells MW-4I and MW-14I, soil samples from boring BH-7, subsurface gas samples from points SG-1 through SG-10, and air sample AS-1 are utilized for release characterization.

11.3 AOC CHARACTERISTICS

The waste storage yard is located south of Building 4 and west of the Warehouse (Building 13). This area has historically been utilized for the storage of waste materials including scrap metal, office waste, metal hydroxide sludge, waste paints and waste oils. Metal hydroxide sludge and drums of waste paints and oils were formerly stored in this area without cover. These materials have subsequently been moved into locations beneath roof protection.

During the RFA, seven (7) SWMUs were identified in the waste storage yard. Four (4) of which were classified as AOCs. The AOCs include the container and areas for metal hydroxide sludge and hazardous waste storage, respectively. The runoff collection area (AOC 21) which is topographically downgradient of the waste storage yard, is also included in this AOC grouping. The physical and operational characteristics of the AOCs are summarized in Tables 11-1, 11-2, 11-3, and 11-4. Releases of hazardous constituents from the waste storage yard AOCs are likely to collect on the surface of the storage yard, which is partially paved and partially underlain with concrete. Once the hazardous constituents have collected on these surfaces, they will either be transported toward the waste storage yard runoff area (AOC 21) by sheet flow runoff following a precipitation event or infiltrate through cracks in the concrete and/or paving. Hazardous constituents which have collected in the runoff area (AOC 21) may subsequently infiltrate into the soil at that unit.

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Table 11-1
AREA OF CONCERN CHARACTERISTICS: AOC 9

Solid Waste Management Unit Number: 9
Item/Description: Sludge Roll-off Box

Location of AOC: *East end of exterior side of south wall of Building 4 under a roof overhang.*

Type of AOC: *Lined Metal Dumpster*

Design Features

This unit is a metal dumpster, roll-off type, which is lined with Sealand 4 mil polyethylene plastic (60% low density, 40% linear). The dumpster was formerly located outside and covered by a plastic tarp. In 1989, a roof overhang was constructed over the dumpster. The roof has subsequently been improved to prevent any rainwater from collecting in the dumpster. The dumpsters used have a capacity of approximately 30 cubic yards.

Operating Practices

Past *Same as present practices, although design improvements have reduced the likelihood of releases from this unit.*

Present *Metal hydroxide sludges of chromium, zinc, and nickel are stored for less than 90 days prior to off-site disposal at a hazardous waste disposal facility. The sludges originate from the filter cake produced by the filter press (SWMU 7) in the WWTP and from the nickel filters (AOC 10) located near the furniture plating room in Building 3. Filter paper from the nickel filters is also disposed in the sludge roll-off boxes. Presently, approximately 10 tons of metal hydroxide sludge is transported off-site every 90 days.*

Period of Operation

The sludge roll-off boxes were first utilized to store metal hydroxide sludge in 1983 following the implementation of sludge dewatering with a filter press.

Effective Age of AOC: *11 Years*

General Physical Conditions

The dumpsters are replaced when the disposal contractor removes full or partially full dumpsters. The integrity of each replacement dumpster and the liner placed in the dumpster is verified by CMC personnel upon receipt of the replacement dumpster.

Closure Method

This is an active unit.

Information Sources: *RFI Proposal, RCRA Facility Assessment, Interviews with CMC Personnel*

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Table 11-2
AREA OF CONCERN CHARACTERISTICS: AOC 14a

Solid Waste Management Unit Number: 14a
Item/Description: Hazardous Waste Drum Storage (current)

Location of AOC:	*East end of exterior side of south wall of Building 4 under a roof extension. Note: This AOC has been subdivided into 14a and 14b to reflect research data from the Phase I investigation. See the Site Plan in Appendix A for AOC locations.*
Type of AOC:	*Drum Storage Area*

Design Features

The current storage area, with a capacity of forty, 55-gallon drums, is located beneath the roof extension which also covers the sludge roll-off box. The drums are stored on a concrete pad.

Operating Practices

Past	*This storage area may have received wastes from the 3rd floor painting operations in Building 1. These wastes included: lacquer thinner, butyl cellusolve, lacquer and high cure baked enamel, coatings and solvents which may have contained acetone, ethyl acetate, ketone, methanol, isopropyl alcohol, butyl acetate, aromatic hydrocarbons, aliphatic hydrocarbons and various pigments and resins.*
Present	*This area is currently utilized for the storage of waste paint solids, paint filters, paint solvents and waste oil. This area receives waste from the paint accumulation area (SWMU 20) and from satellite storage areas located throughout the plant buildings. Drums are held for less than 90 days and disposed by a licensed hauler.*

Period of Operation

The current area has been used since 1989.

Effective Age of AOC: *5 Years*

General Physical Conditions

The concrete pad underlying the drum storage area is cracked. No staining was observed on the concrete pad in this area.

Closure Method

This unit is active.

Information Sources: *RFI Proposal, Draft EPA Site Evaluation, RFA*

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Table 11-3
AREA OF CONCERN CHARACTERISTICS: AOC 14b

Solid Waste Management Unit Number: 14b **Item/Description:** Hazardous Waste Drum Storage (former)	
Location of AOC:	*Near the railroad spur and liquid oxygen storage tank south of Building 4.*
Type of AOC:	*Drum Storage Area*
Design Features	
The storage area consisted of an asphalt pad 40-feet long by 20-feet wide with capacity of 40 fifty-five gallon drums. The area was not covered by a roof.	
Operating Practices	
Past	*This storage area received wastes from the 3rd floor painting operations in Building 1. These wastes included: lacquer thinner, butyl cellusolve, lacquer and high cure baked enamel, coatings and solvents which may of contained acetone, ethyl acetate, ketone, methanol, isopropyl alcohol, butyl acetate, aromatic hydrocarbons, aliphatic hydrocarbons and various pigments and resins. Waste oil and waste solvents may have also been stored at this location.*
Present	*This unit is inactive.*
Period of Operation	
The former storage area was in use since at least 1970. The current hazardous waste storage area (AOC 14a) was placed in operation in 1989.	
Effective Age of AOC:	*> 24 Years*
General Physical Conditions	
The RFA investigative team reported soil staining, poor asphalt conditions, and stressed vegetation. Paint and oil stains on asphalt and the surrounding soil were reported. Runoff containing waste oil from the former storage area was suspected of discharging to the soil.	
Closure Method	
Use of the former storage area was discontinued in 1989. Drum storage was transferred to a covered area (AOC 14a).	
Information Sources:	*RFI Proposal, Draft EPA Site Evaluation, RFA*

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Table 11-4
AREA OF CONCERN CHARACTERISTICS: AOC 21

Solid Waste Management Unit Number: 21
Item/Description: Storage Yard Runoff Area

Location of AOC:	*This runoff area is located along the railroad spur which enters the warehouse (Building 13) between the warehouse and Building 12; this unit also includes runoff from the former drum storage area (AOC 14b).*
Type of AOC:	*Unlined Runoff Collection Area*

Design Features

The runoff collection area is an area of bare ground along the railroad spur which is the primary collection point for runoff from the storage areas immediately south of Building 4 and near the oxygen storage tank. The area is approximately 50-feet long by 20 feet wide. A portion of the collection area continues along the railroad spur into the warehouse. The RFA investigative team reported that a sanitary sewer manhole was acting as a storm water inlet near the warehouse. Runoff also collects to the west along the railroad spur.

Operating Practices

Past	*The former hazardous waste drum storage area (AOC 14b), the sludge roll off box (AOC 9), and yard storage of scrap metal were located within the runoff collection area. The drum storage and the dumpster were not located under a roof overhang.*
Present	*The collection area continues to receive runoff from the former drum storage area and yard storage of scrap metal. The current hazardous waste drum storage area (AOC 14a) and the sludge roll-off box are located beneath a roof overhang and runoff does not directly contact the contents of those units.*

Period of Operation

The runoff collection area was created when the warehouse was constructed in 1969.

Effective Age of AOC: *25 years*

General Physical Conditions

In September 1989, the RFA investigative team observed stains on the collection area soil and stressed or dead vegetation.

Closure Method

The former hazardous waste drum storage area and sludge roll-off box were removed form this area, thereby eliminating potential releases from these sources. Otherwise, this is an active unit.

Information Sources: *RFI Proposal, EPA Draft Site Evaluation, RCRA Facility Assessment*

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11.4 PREVIOUS SAMPLING AND ANALYSIS

In 1991, the EPA sampled surficial soils and groundwater at the waste storage yard AOCs. Three (3) soil samples (at Locations 7, 8 [a duplicate of 7], and 10) were collected near the railroad tracks in the waste storage yard runoff area (AOC 21). One (1) soil sample was collected near the former hazardous waste drum storage area (AOC 14b) at Location 9. The surficial soil samples were collected from the upper two (2) inches of soil. Soil samples were analyzed for metals (cadmium, chromium, copper, lead, nickel, and zinc), inorganics (total and amenable cyanide), and VOCs by EPA Method 8240. Groundwater was collected from monitoring well MW-4I. A groundwater samples, EPA sample number 01086/01087, was analyzed for total and dissolved metals (cadmium, chromium, copper, nickel, and zinc), total cyanide, and VOCs by EPA Method 8240. Summaries of positively identified analytes in 1991 EPA samples are included in Appendix B. Full laboratory analysis reports are included in Appendix I of the RFIP (Volume 2).

The results of soil sample analysis for inorganic analytes are summarized in Table 11-5. The published ranges of inorganic analytes in soil (Veneman, 1978) are shown for reference.

Table 11-5
INORGANIC ANALYTES IN SOIL - 1991 EPA DATA - WASTE STORAGE YARD
Columbia Manufacturing Company, Westfield, MA

Analyte	AOC 21 - Storage Yard Runoff Area		AOC 14b - Former HW Drum Storage Area	Published Ranges of Metals in Soil[1]	
	Location 7 & 8[2]	Location 10	Location 9	Minimum	Maximum
Cadmium (µg/kg)	21300	157000	7460	-	-
Chromium (µg/kg)	1285000	2800000	1100000	78000	100000
Copper (µg/kg)	1360000	124000	1490000	24000	43000
Lead (µg/kg)	816500	408000	805000	13000	35000
Nickel (µg/kg)	3995000	254000	4770000	28000	35000
Zinc (µg/kg)	1715000	2030000	2860000	74000	105000
Total Cyanide (µg/kg)	1330	NA	NA	-	-
Amenable Cyanide (µg/kg)	ND	NA	NA	-	-

1 Veneman, 1978.
2 Values are averaged.
ND Not detected (as reported on the laboratory analysis report)
NA Not analyzed
- No published value.

Description of Locations from EPA Laboratory Analysis Report
Location 7: Run-off area by railroad tracks, 0-2" deep.
Location 8: Run-off area by railroad tracks, 0-2" deep, duplicate.
Location 9: Old drum storage area, 0-2" deep.
Location 10: Run-off area from old drum storage area, 0-2" deep.

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Trichloroethylene, tetrachloroethylene, and naphthalene were detected in the soil sample from Locations 7 and 8 (averaged) at concentrations of 700 µg/kg, 550 µg/kg, and 220 µg/kg, respectively. Trichloroethylene was also detected in the soil sample from Location 10 at a concentration of 74 µg/kg. No VOCs were positively identified in the soil sample from Location 9, but hydrocarbons in the C8 carbon range were tentatively identified.

Both total and dissolved concentrations of metals were detected in groundwater from well MW-4I. Total cyanide was not detected above the detection limit of 10 µg/L. The analytical results of samples collected for inorganic parameters in groundwater are summarized in Table 11-6. MCLs for the inorganic analytes are shown in Table 11-6 for reference. None of the metals or cyanide concentrations exceeded MCLs. One (1) VOC, 1,2-dichloroethylene, was detected in groundwater from well MW-4I at a concentration of 3,400 µg/L.

Table 11-6
INORGANIC ANALYTES IN GROUNDWATER - 1991 EPA DATA
WASTE STORAGE YARD
Columbia Manufacturing Company, Westfield, MA

Analyte	MW-4I		MCLs (µg/L)
	Dissolved Concentration (µg/L)	Total Concentration (µg/L)	
Cadmium	< 3	2	5
Chromium	< 5	6	100
Copper	< 12	20	1000
Nickel	< 20	< 20	100
Zinc	< 10	37	5000
Total Cyanide	NA	< 10	200

NA Not analyzed.

11.5 PHASE I SAMPLING AND ANALYSIS

Release characterization sampling for the waste storage yard AOCs focused on soil and groundwater. Groundwater samples from monitoring well MW-4I (installed prior to Phase I) and MW-14I (installed during Phase I) are discussed in this Section. Soil samples from the boring for well MW-14I and boring BH-7 are also discussed in this Section.

11.5.1 Soil Sampling

Monitoring well MW-4I was installed in June, 1983 on the northern side of the former lagoons (AOC 29) near the railroad spur. Well MW-14I was installed adjacent to the northwestern corner

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of the warehouse (Building 13) in the area identified as the runoff collection area for the waste storage yard (AOC 21). Boring BH-7 was also installed along the railroad spur, between MW-4I and MW-14I. Soil samples were collected from the 0- to 2-foot interval and at five (5) foot intervals, thereafter, in the boring for well MW-14I. Soil samples were collected from the 0- to 1-foot, 1- to 2-foot, and 5- to 6-foot intervals in boring BH-7, as outlined in the RFI Proposal.

11.5.2 Soil Analysis

Soil samples collected during the advancement of the borings for MW-14I and BH-7 were screened for the presence of VOCs with a PID. Elevated VOC levels, which were defined as readings greater than 10 ppm above background, are shown in Table 11-7. Elevated VOC levels were detected in samples from the borings for MW-14I and BH-7.

The soil samples collected from 15- to 17-foot and 20- to 22-foot intervals from the boring for MW-14I were analyzed for Appendix IX parameters. Samples collected from 0- to 2-foot and 1- to 2-foot intervals from the same boring were analyzed for metals, cyanide, VOCs, semivolatile organic compounds, pesticides and PCBs. The three (3) soil samples collected from BH-7 were analyzed for Appendix IX parameters, except dioxin, in accordance with the RFIP.

Table 11-7
VOC SCREENING RESPONSES FOR SOIL HEADSPACE - WASTE STORAGE YARD
Columbia Manufacturing Company, Westfield, MA

Sampling Interval (feet)	HNu Response[1] (ppm)
MW-14I	
15-17	12.0
20-22	12.2
BH-7	
0-1	94
1-2	92
5-6	170

1 Screening responses greater than 10 ppm above background are listed in the table.

Summaries of positively identified analytes in soil samples collected from MW-14I and BH-7 are included in Appendix L. The qualitative summaries included in Appendix L are presented in Table 11-8 and Table 11-9 with discussion of the substantive findings.

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Table 11-8
ORGANIC COMPOUNDS IN SOIL SAMPLES - WASTE STORAGE YARD
Columbia Manufacturing Company, Westfield, MA

Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (µg/kg)		Total Sample Concentration (µg/kg)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Volatile Organics	5 - 7	0	3	ND	1800	ND	2135
Semivolatile Organics	5 - 7	0	10	ND	9400	ND	10100
Pesticides	1 - 5	0	1	ND	48	ND	48
PCBs	0 - 7	-	-	-	-	-	-
Organophosphorus Pesticides	0 - 5	-	-	-	-	-	-
Chlorinated Herbicides	0 - 5	-	-	-	-	-	-
Dioxin	2 - 2	5	5	ND	3.58	1.46	5.56

VOCs: Four (4) volatile organic compounds, cis-1,2-Dichloroethene, methylene chloride, tetrachloroethene, and trichloroethene, were detected in soil samples analyzed for VOCs. Trichloroethene was detected at the highest analyte concentration, 1,800 µg/kg, in the sample from the 0- to 2-foot interval in well MW-14I. The highest total VOC concentration, 2,135 µg/kg, was also detected in that interval.

Semivolatiles: Ten (10) semivolatile organic compounds, anthracene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, bis(2-ethylhexyl)phthalate, chrysene, fluoranthene, phenanthrene, and pyrene, were detected in soil samples analyzed for semivolatile compounds. Pyrene was detected at the highest analyte concentration, 10,100 µg/kg, in the sample from the 0- to 2-foot interval in well MW-14I. The highest total semivolatile organic concentration, 47,000 µg/kg, was also detected in that interval.

PCBs/Pesticides/Herbicides: One (1) pesticide, Lindane: gamma-BHC, was detected in the sample collected from the 1- to 2-foot interval in boring BH-7 at an estimated concentration of 48 µg/kg. No PCBs were detected in soil samples monitoring the waste storage yard.

Dioxin: Six (6) dioxin congeners, total TCCD, total PeCDD, total HpCDD, total TCDF, total PeCDF, and total HpCDF, were detected in soil samples analyzed for dioxin. Total TCDD was detected at the highest congener concentration, 3.58 µg/kg, in the sample from the 20- to 22-foot interval in well MW-14I. The highest total dioxin concentration, 5.56 µg/kg, was also detected in that interval.

The total concentrations of VOCs, semivolatiles, Pesticides & Herbicides/PCBs, and Dioxin for each sampling location are shown on Figure 11-1. These concentrations are the sum of the total

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sample concentrations for all samples from that location.

Table 11-9
INORGANIC COMPOUNDS IN SOIL SAMPLES - WASTE STORAGE YARD
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of samples detecting analyte - number of samples analyzed	Concentration of Individual Analytes (µg/kg)		Published Ranges of Metals in Soil[1] (µg/kg)	
		Minimum	Maximum	Minimum	Maximum
Cadmium	5 - 5	1600	16000	-	-
Chromium	7 - 7	17000	460000	78000	100000
Copper	7 - 7	29000	3550000	24000	43000
Nickel	7 - 7	53000	1900000	28000	35000
Tin	5 - 7	ND	5900000	-	-
Vanadium	7 - 7	6400	36000	-	-
Zinc	7 - 7	42000	4100000	74000	105000
Cyanide	0 - 7	-	-	-	-

1 Veneman, 1985.

Metals/Cyanide: Maximum concentrations of plating metals (chromium, copper, nickel, and zinc) were above the published ranges for those metals. Minimum concentrations of chromium and zinc were below published minimums for those metals. No cyanide was detected in the seven (7) samples analyzed for that parameter.

11.5.3 Groundwater Sampling

Groundwater samples were collected from monitoring wells MW-4I and MW-14I. Additional wells are proposed for Phase II to augment the data collected from these sample points.

11.5.4 Groundwater Analysis

During sample collection, groundwater samples were screened in the field for temperature, redox potential (Eh), pH, conductance, and dissolved oxygen. The results of field screening are summarized in Table 11-10.

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Table 11-10
GROUNDWATER FIELD SCREENING RESULTS - WASTE STORAGE YARD
Columbia Manufacturing Company, Westfield, MA

Parameter	MW-4I	MW-14I
Temperature (°C)	12	17
pH (pH units)	7.75	5.77
Eh (mV)	80	69
Conductance (μmhos/cm @ 25°C)	1100	1200
Dissolved Oxygen (mg/L)	3	2

Groundwater collected from MW-4I was analyzed for metals, cyanide and VOCs; groundwater from MW-14I was analyzed for metals, cyanide, VOCs and semivolatile organics. Summaries of positively identified analytes in groundwater samples collected from MW-4I and MW-14I are included in Appendix L. The qualitative summaries included in Appendix L are presented in Table 11-11 and Table 11-12 with discussion of the substantive findings.

Table 11-11
ORGANIC COMPOUNDS IN GROUNDWATER SAMPLES - WASTE STORAGE YARD
Columbia Manufacturing Company, Westfield, MA

Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (μg/L)		Total Sample Concentration (μg/L)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Volatile Organics	2 - 2	1	1	5200	5200	5200	5200
Semivolatile Organics	0 - 1	-	-	-	-	-	-
Pesticides	0 - 0	-	-	-	-	-	-
PCBs	0 - 0	-	-	-	-	-	-
Organophosphorus Pesticides	0 - 0	-	-	-	-	-	-
Chlorinated Herbicides	0 - 0	-	-	-	-	-	-
Dioxin	0 - 0	-	-	-	-	-	-

VOCs: One (1) volatile organic compound, trichloroethene, was detected in groundwater samples from both MW-4I and MW-14I at the same concentration (5,200 μg/L).

Semivolatiles: No semivolatile organic compounds were detected in the groundwater sample

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collected from MW-14I. Groundwater from MW-4I was not analyzed for semivolatile organics.

PCBs/Pesticides/Herbicides: Phase I groundwater samples from monitoring wells MW-4I and MW-14I were not analyzed for PCBs, pesticides, or herbicides.

Dioxin: Phase I groundwater samples from monitoring wells MW-4I and MW-14I were not analyzed for dioxin.

The total concentrations of VOCs and semivolatiles for each monitoring well are shown on Figure 11-2.

Table 11-12
INORGANIC COMPOUNDS IN GROUNDWATER SAMPLES - WASTE STORAGE YARD
Columbia Manufacturing Company, Westfield, MA

Analyte	Concentration of Individual Analytes		MCLs (µg/L)
	Minimum (µg/L)	Maximum (µg/L)	
Cadmium	ND	12	5
Chromium	ND	2900	100
Copper	42	58	1000
Nickel	60	2900	100
Zinc	110	330	5000
Cyanide	-	-	200

Metals/Cyanide: Metals concentrations, except for copper and zinc, in groundwater appear to be elevated. Concentrations of cadmium, chromium and nickel exceeded the MCLs for these metals. No cyanide was detected in groundwater samples from these wells. Site-specific background concentrations have not been adequately determined at this time for release characterization purposes. MCLs, however, can be used as a benchmark to evaluate the significance of the data.

11.5.5 Subsurface Gas Sampling

Subsurface gas samples were collected from sampling locations SG-01 to SG-10 on October 25, 1993.

11.5.6 Subsurface Gas Analysis

Prior to sample collection, subsurface gas samples were screened with a PID for the presence of VOCs. An air sample, AS-1, was screened in the field with a PID on September 13, 1993. The results indicate that no ambient VOC concentrations could be detected, but that air immediately above the hole in the ground contained VOCs at a maximum concentration of 29.9 ppm.

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Subsurface gas was analyzed for VOCs by modified EPA Methods 8010/8020. Five (5) volatile organic compounds were detected in subsurface gas samples collected from beneath the concrete apron adjacent to AOC 9 and 14a. The results of the survey indicate that concentrations of VOC's increased in concentration in a southerly direction toward AOC 21. The primary VOCs detected during the subsurface gas investigation included trichloroethene and cis-1,2-dichloroethene at maximum concentrations of 590 mg/m^3 and 61.0 mg/m^3, respectively. Other detected compounds included tetrachloroethene, trans-1,2-dichloroethane, and 1,1,1-trichloroethene. The concentrations of these analytes in soil gas is shown on Figure 11-3.

11.6 SUMMARY OF RELEASE CHARACTERIZATION

11.6.1 General Discussion of Results

This section discusses releases of organic and inorganic (metals/cyanide) analytes identified in soil and groundwater at the plating operation AOCs.

Soil: Organic Compounds
Both volatile and semivolatile organic compounds were identified in soil monitored at the waste storage yard. The maximum VOC sample concentration ranged from below detection to 2,135 $\mu g/kg$; semivolatiles from below detection to 10,100 $\mu g/kg$. One (1) pesticide, Lindane: Gamma and BHC, was detected at an estimated concentration of 48 $\mu g/kg$ in a soil sample from Boring BH-7. No other pesticides, herbicides or PCBs were detected. Research which is summarized in Section 1 indicates that these compounds were not used at this AOC grouping. Given the absence of pesticides and PCB's in samples collected, and a single low concentration herbicide, these parameters will not be included as part of the Phase II monitoring. The maximum dioxin sample concentrations was 3.64 $\mu g/kg$.

Soil: Metals/Cyanide
Plating metals were detected at concentrations in excess of published ranges. No cyanide was detected in soil monitored at the waste storage yard. Metals associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn and CN) will be included in subsequent investigations.

Groundwater: Organic Compounds
Volatile organic compounds were detected in intermediate groundwater downgradient of the waste storage yard. The VOC sample concentrations were 5,200 mg/L in wells MW-4I and MW-14I. Phase I sampling did not include pesticide, herbicide, PCB, or dioxin analysis of groundwater downgradient of waste storage yard. Research which is summarized in Section 1 indicates that pesticides and herbicides were not used at this AOC grouping. Subsequent data collection designed to monitor at this AOC grouping will not include these parameters. Dioxin will be included in at least one (1) more round of sampling at this AOC grouping.

Groundwater: Metals/Cyanide
No cyanide was detected in groundwater monitored at the waste storage yard. Plating metals appear elevated, however, site-specific background concentrations have not been adequately determined at this time. Metals associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn and CN) will be included in subsequent investigations.

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Subsurface Gas: Organic Compounds
Subsurface gas monitoring conducted during Phase I indicated the presence of VOC's in the soil gas. Subsequent soil and groundwater monitoring will be utilized in Phase II to refine this data.

11.6.2 Data Gaps

Based on the release characterization for the plating operation AOCs, the following data gaps have been identified. Data gaps have been organized by media since individual monitoring of each plating operation AOC was not conducted. Phase II activities designed to provide the data required are discussed in Sections 20, 21 and 22.

Soil
The horizontal and vertical extent of soil contamination in the vicinity of the waste storage yard AOCs needs to be delineated for VOCs, semivolatile organics, dioxin, and metals. The source for the dioxin contamination must also be determined.

Groundwater
The horizontal and vertical extent of groundwater contamination in the vicinity of the waste storage yard AOCs needs to be delineated for VOCs, semivolatile organics, and metals.

Subsurface Gas
Subsurface gas data provided an indication of VOC releases to the soil and/or groundwater in this AOC grouping. Additional soil and groundwater investigations are proposed to refine these findings. No further subsurface gas monitoring is proposed.

11.6.3 Other Issues

Other issues could potentially include interim measures, additional media of concern for existing AOCs, and new AOCs identified during this investigation.

Interim Measures
No interim measures are deemed necessary based on the release characterization for the waste storage yard.

Media of Concern
No additional media of concern were identified for the waste storage yard.

Areas of Concern
No additional areas of concern were identified for the waste storage yard.

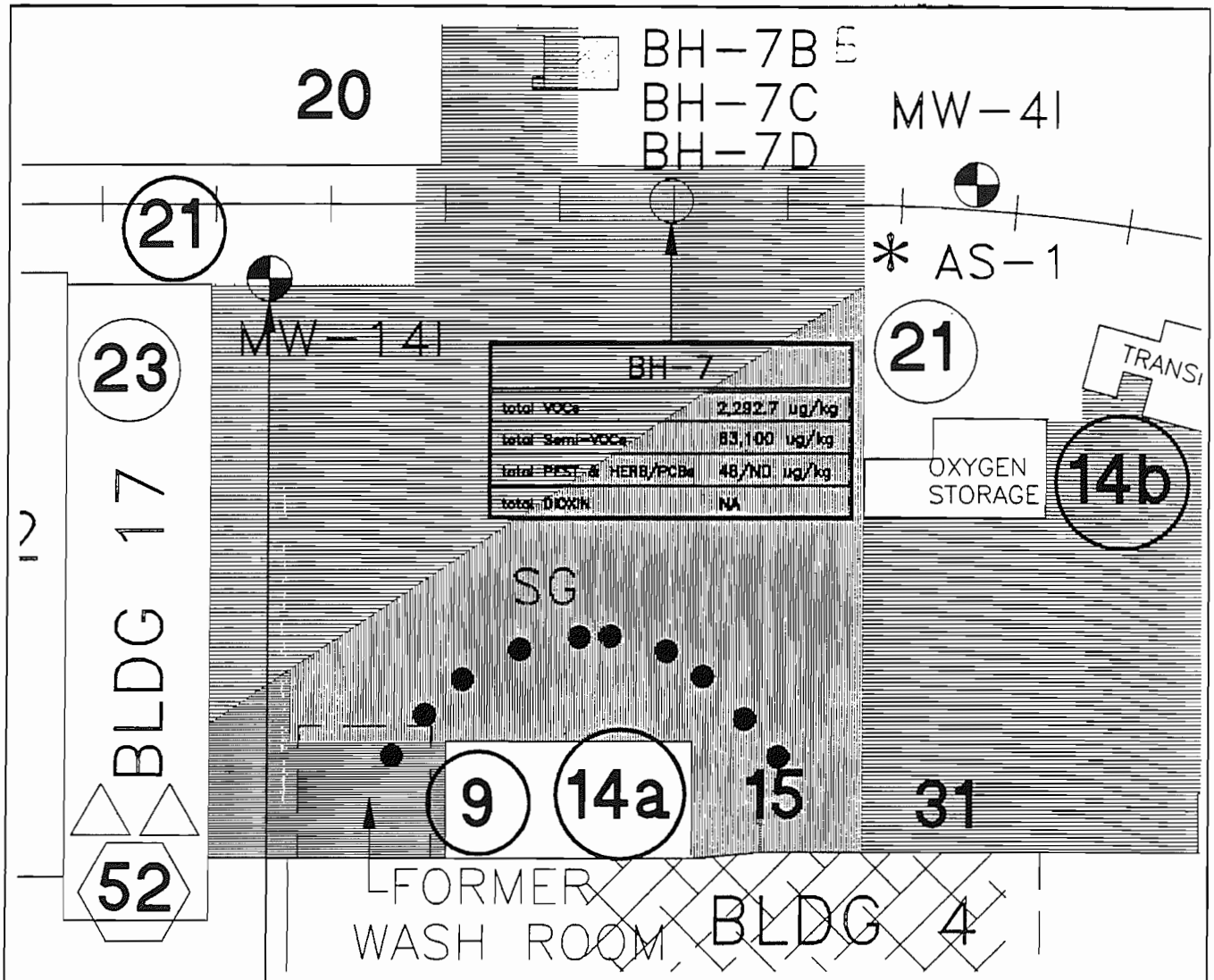

Figure 11-1

WASTE STORAGE YARD RELEASE CHARACTERIZATION: SOIL
COLUMBIA MANUFACTURING COMPANY, INC. ONE CYCLE STREET WESTFIELD, MASSACHUSETTS
TIGHE & BOND INC. CONSULTING ENGINEERS WESTFIELD, MASS. SCALE: 1"=30' DATE: FEBRUARY, 1994

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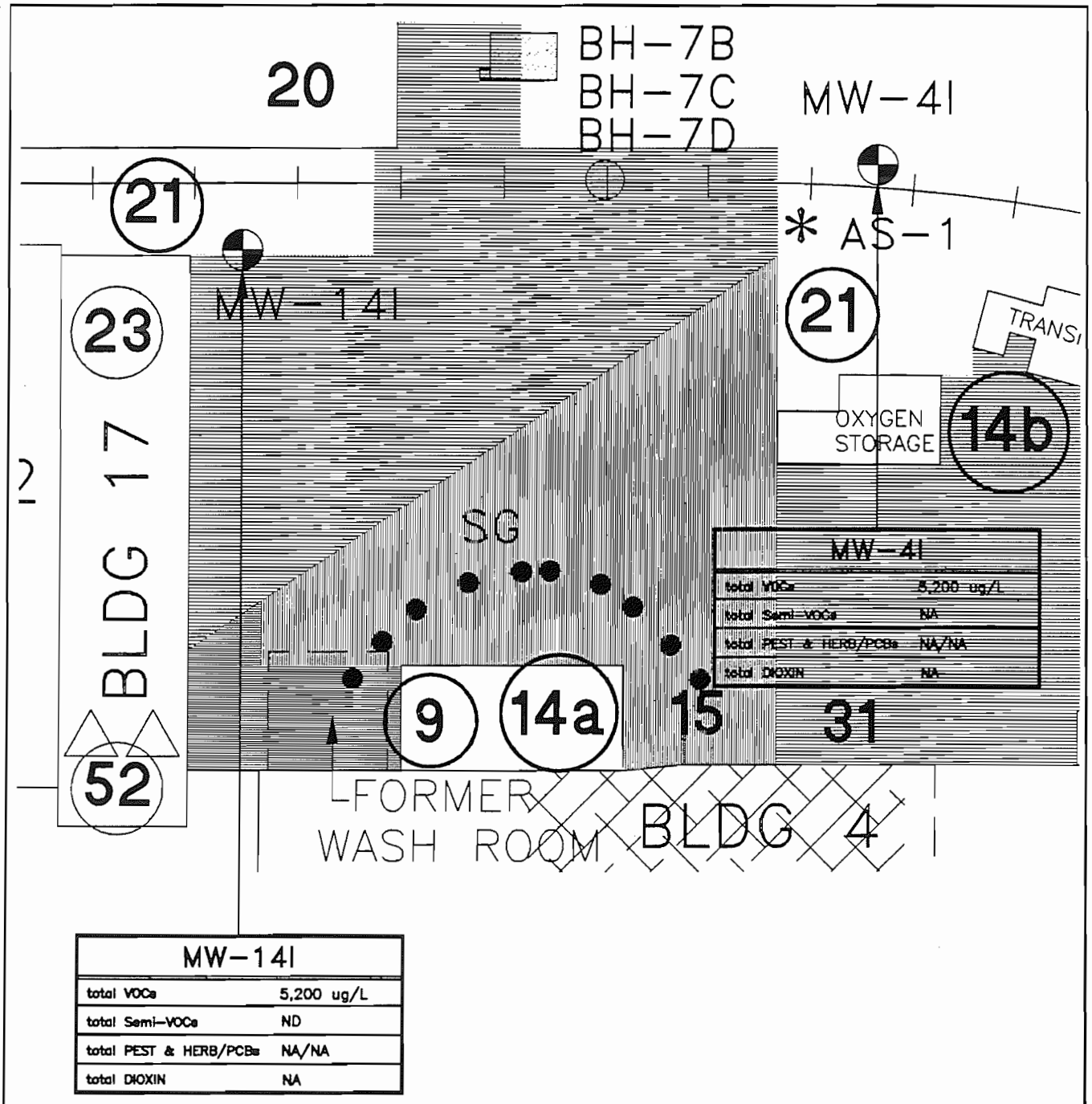

Figure 11-2

WASTE STORAGE YARD RELEASE CHARACTERIZATION: GROUNDWATER

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=30' DATE: FEBRUARY, 1994

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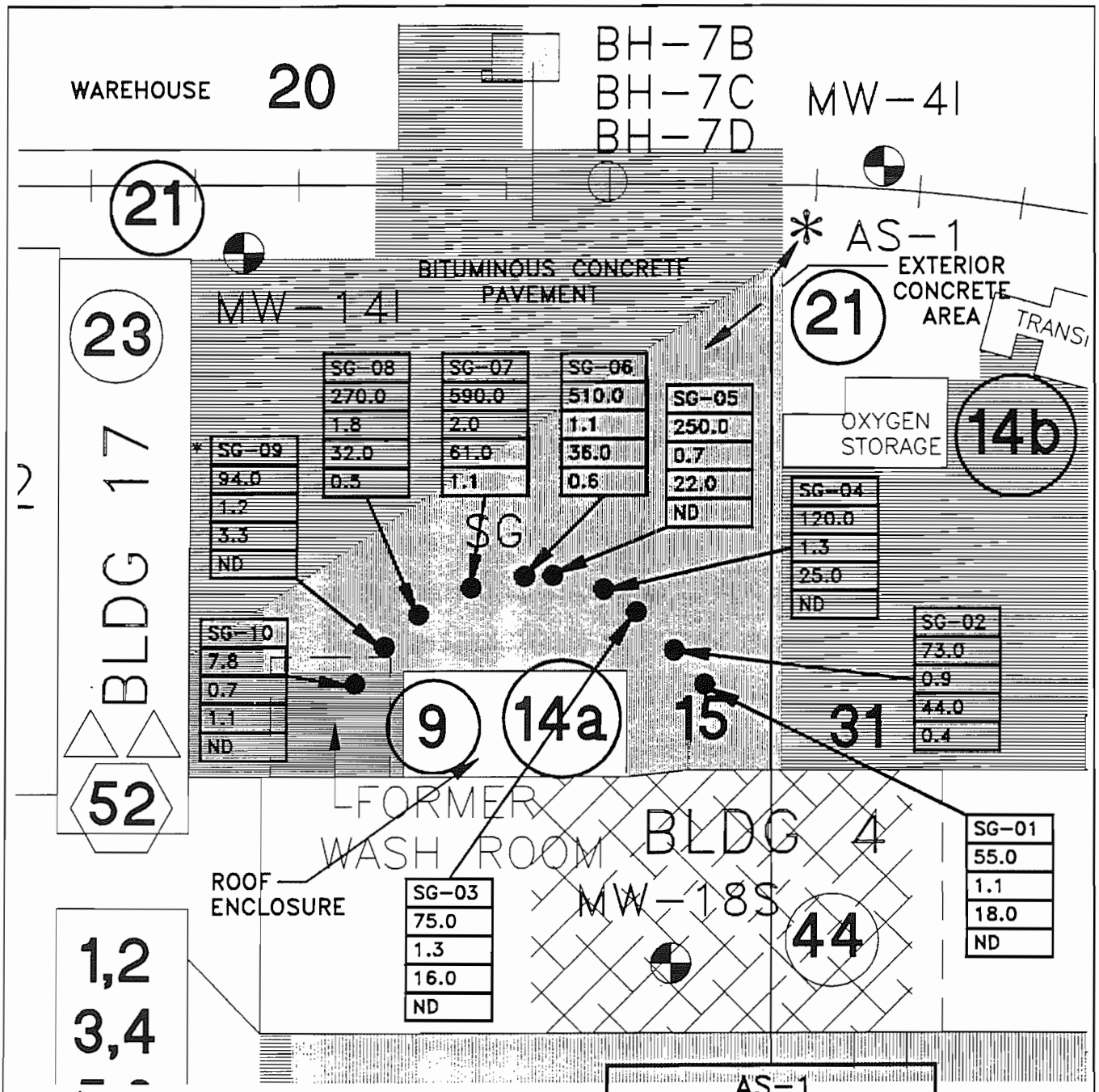

AS-1	
total VOCs	29.9 ppm**
total Semi-VOCs	NA
total PEST & HERB/PCBs	NA
total DIOXIN	NA

** MEASURED IN A SHALLOW BORING ON 9/13/93

LEGEND

SG-08
270.0
1.8
32.0
0.5

SUBSURFACE GAS SAMPLING POINT
TCE CONCENTRATION (mg/m^3)
PCE CONCENTRATION (mg/m^3)
cis-1,2-DCE CONCENTRATION (mg/m^3)
trans-1,2-DCE CONCENTRATION (mg/m^3)

● SUBSURFACE GAS SAMPLING POINT

* $0.5 mg/m^3$ 1,1,1-TCA WERE ALSO DETECTED AT SG-09

Figure 11-3

WASTE STORAGE YARD RELEASE CHARACTERIZATION: SOIL GAS

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=30' DATE: FEBRUARY, 1994

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12
RELEASE CHARACTERIZATION: ON-SITE SURFACE WATER BODIES

12.1 OVERVIEW

This section discusses the objectives, AOC characteristics, methods of analysis, and results of the release characterization for AOCs associated with the on-site surface water bodies. The AOCs include the former reflecting pond (AOC 16) and the fire pond (AOC 34). Objectives of the release characterization and the Phase I sampling locations for the on-site surface water bodies are discussed in Section 12.2. Construction and operational characteristics of the two (2) AOCs are discussed in Section 12.3. The results of sampling conducted by the EPA prior to Phase I of the RFI are discussed in Section 12.4. The results of Phase I sampling and analysis are summarized in Section 12.5. This Section 12.6 ends with a summary of the results of release characterization, a discussion of data gaps, and other related issues, if any.

12.2 OBJECTIVES

The objective of the release characterization at the on-site surface water body AOCs is to determine whether a release of hazardous constituents has occurred from the units. The Phase I characterization focused on releases to soil, groundwater, surface water, sediment, and air. Phase I analysis results for soil and shallow groundwater samples from monitoring well MW-26I, soil/sediment from boring BH-1, surface water and sediment from SW-1/SS-1, SW-2/SS-2, SW-3/SS-3, and air from AS-2 are utilized for the characterization.

12.3 AOC CHARACTERISTICS

The former reflecting pond (AOC 16) was filled for aesthetic purposes only during warm weather months with the plating wastewater discharged from the wastewater treatment operations. Since this unit is no longer active, surface water is not available for collection and sediment was collected with a truck mounted drill rig. The fire pond, historically a portion of a former canal that crossed the Site, has been used for reserve fire protection since the buildings were first constructed. This unit received tumbling and annealing wastewater and boiler blowdown from Buildings 5 and 6.

During the RFA, both water bodies were identified as AOCs. The physical and operational characteristics of the AOCs are summarized in Table 12-1 and 12-2. Releases of hazardous constituents to the surface water which currently or formerly was present in the units may have been impacted the quality of sediment, soil or groundwater underlying the units.

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Table 12-1
AREA OF CONCERN CHARACTERISTICS: AOC 16

Solid Waste Management Unit Number: 16 **Item/Description:** Reflecting Pond	
Location of AOC:	*Located in the northeast portion of the Site; east of the warehouse (Building 13).*
Type of AOC:	*Surface Impoundment*
Design Features	
The reflecting pond is unlined, approximately 350-feet long and 175-feet wide with a maximum depth of 2 to 3-feet.	
Operating Practices	
Past	*The pond was filled by pumping wastewater from the treatment plant to a header in the northern portion of the pond. The pond contents were then discharged to a sump which flowed into the diversion structure and ultimately to the NPDES outfall. This wastewater was pH adjusted and may have contained plating wastes. The pond also received stormwater from storm sewers near Building 3 and 4 and from paved areas and roof runoff around the buildings. Fire pond (AOC 34) overflow may also have been discharged to the reflecting pond via the storm drain system. The Reflecting Pond was not filled with wastewater during the winter months.*
Present	*Currently, the pond is dry and unused. Some stormwater still discharges to the pond from roof drains, but that stormwater typically infiltrates into the underlying soil rather than collecting in the pond.*
Period of Operation	
The pond was constructed in the early 1970s. In 1988, the pH adjusted plating wastes were routed to the WWTP and were no longer discharged to the Little River outfall. Therefore, wastewater was no longer available to fill the Reflecting Pond.	
Effective Age of AOC:	*24 years*
General Physical Conditions	
The depression from the former pond remains; however, surface water rarely collects in the pond in measurable volumes.	
Closure Method	
Diversion piping and the discharge head utilized to route wastewater to the head of the pond, as well as the sump have been removed.	
Information Sources:	*RFI Proposal, Draft EPA Site Evaluation, RCRA Facility Assessment, Interviews with CMC personnel*

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Table 12-2
AREA OF CONCERN CHARACTERISTICS: AOC 34

Solid Waste Management Unit Number: 34 **Item/Description:** Fire Pond	
Location of AOC:	*South of Buildings 4, 5, and 6.*
Type of AOC:	*Surface Impoundment*
Design Features	
The fire pond is an unlined surface impoundment which was formerly part of a canal which crossed the Site in the early 1800s. The pond is approximately 100-feet long by 20-feet wide and 3-5 feet deep. The canal was constructed by excavation. The approximate dimensions of the canal were: a 20-foot wide bottom, 34 to 36-feet wide at the water surface, 4-feet deep, and a minimum 2-foot high bank above the water level. The width of the fire pond was reduced in 1970 when the new railroad siding leading into the warehouse was constructed.	
Operating Practices	
Past	*The fire pond served as a backup source of fire protection water should municipal supplies fail during an emergency. The pond received discharges from Buildings 5 and 6 including annealing overflow, tumbling wastewater, and boiler blowdown.*
Present	*The pond currently receives boiler make up water and runoff and remains a source of backup fire protection.*
Period of Operation	
The canal was originally constructed around 1828 and was operated through approximately 1840. The date of filling which defined the fire pond could not be determined.	
Effective Age of AOC:	*> 100 Years*
General Physical Conditions	
The characteristics of the fire pond sediments and surface water were evaluated during Phase I investigative activities.	
Closure Method	
This is an active unit.	
Information Sources:	*RFI Proposal, EPA Draft Site Evaluation, RCRA Facility Assessment*

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12.4 PREVIOUS SAMPLING AND ANALYSIS

In 1991, the EPA sampled sediment from the east (Location 12), central (Location 13), and west (Location 13) portions of the fire pond (AOC 34). The sediment samples were collected from the upper two (2) inches of sediment. Intermediate depth groundwater downgradient of the former reflecting pond (AOC 16) was also collected from well MW-11I. Sediment samples were analyzed for VOCs by EPA Method 8240 and were matched to fuel and oil standards by gas chromatograph. A groundwater sample, EPA sample number 01057/01058, was analyzed for total and dissolved metals (cadmium, chromium, copper, nickel, and zinc), total cyanide, and VOCs by EPA Method 8240. Summaries of positively identified analytes in 1991 EPA samples are included in Appendix B. Full laboratory analysis reports were included in Appendix I of the RFI Proposal (Volume 2).

VOCs were not detected in the fire pond sediment samples. Three (3) tentatively identified analytes were detected in the sample from Location 12, indene, octahydro, hexamethyl. Trimethyl decane, along with "many" unidentified hydrocarbons, were tentatively identified in the sample from Location 13. No fuel or oils were detected in the fire pond sediment samples.

Total concentrations of chromium, nickel, and zinc were detected in groundwater from well MW-11I at concentrations of 7 μg/L, 23 μg/L, and 27 μg/L, respectively. These concentrations are below the applicable MCLs for the analytes. No total cyanide was detected (detection limit 10 μg/L) in groundwater from well MW-11I. Three (3) VOCs, 1,2-dichloroethylene isomers, trichloroethylene, and tetrachloroethylene, were detected in groundwater from MW-11I. Trichloroethylene was detected at the maximum analyte concentration, 14 μg/L. The total sample VOC concentration was 26 μg/L.

12.5 PHASE I SAMPLING AND ANALYSIS

Release characterization sampling for on-site surface water body AOCs focused on soil, groundwater, surface water, sediment, and air. Samples of those media from one (1) groundwater monitoring well, one (1) soil boring, three (3) surface water/sediment samples, and one (1) air sample are discussed in this section.

12.5.1 Soil Sampling

Monitoring well MW-26S was installed on the eastern side of the former reflecting pond (AOC 16). Soil samples were collected from the 0- to 2-foot interval and in two (2) foot lengths at five (5) foot intervals thereafter (i.e., 5-7', 10-12', etc.). No contaminated soil was observed during installation of this monitoring well.

Soil/sediment were collected from boring BH-1 located in the northern portion of the former reflecting pond (AOC 16). Samples were collected from the 0- to 1-foot, 1- to 2-foot, and 5- to 6-foot intervals at this sampling location.

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12.5.2 Soil Analysis

Soil samples collected during the advancement of the borings were screened for the presence of VOCs with a PID. Elevated VOC levels, which were defined as readings greater than 10 ppm above background, are shown in Table 12-3. Elevated VOC levels were detected in samples from boring BH-1 and well MW-26S.

Table 12-3
VOC SCREENING RESPONSES FOR SOIL HEADSPACE -
ON-SITE SURFACE WATER BODIES
Columbia Manufacturing Company, Westfield, MA

Sampling Interval	VOC Level[1] (ppm)
BH-1	
0-1	160
1-2	210
5-6	210
5-6 (duplicate)	162
MW-26S	
20-22	22

1 Screening responses greater than 10 ppm above background are listed in the table.

The soil samples collected from boring BH-1 were analyzed for metals, cyanide, VOCs, and semivolatile organic compounds. Analysis of the soil sample with the highest VOC screening response for pesticides, herbicides, and dioxin was not completed as stated in the RFI Proposal. Samples from the 0 to 2-foot and 5- to 7-foot intervals from MW-26S were analyzed for metals, cyanide, VOCs, semivolatile organic compounds, and PCBs. The sample from the 20- to 22-foot interval at MW-26S was analyzed for Appendix IX parameters.

Summaries of positively identified analytes in soil samples collected from BH-1 and MW-26S are included in Appendix L. The qualitative summaries included in Appendix L are presented in Table 12-4 and Table 12-5 with discussion of the substantive findings.

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Table 12-4
ORGANIC COMPOUNDS IN SOIL SAMPLES - ON-SITE SURFACE WATER BODIES
Columbia Manufacturing Company, Westfield, MA

Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (µg/kg)		Total Sample Concentration (µg/kg)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Volatile Organics	4 - 6	0	3	ND	280	ND	300
Semivolatile Organics	1 - 6	0	2	ND	220	ND	430
Pesticides	0 - 1	-	-	-	-	-	-
PCBs	0 - 3	-	-	-	-	-	-
Organophosphorus Pesticides	0 - 0	-	-	-	-	-	-
Chlorinated Herbicides	0 - 1	-	-	-	-	-	-
Dioxin	1 - 1	3	3	.1	2.27	2.98	2.98

VOCs: Four (4) volatile organic compounds, acetone, methylene chloride, trichloroethene, and 2-chloroethyl vinyl ether, were detected in soil samples analyzed for VOCs. Trichloroethene was detected at the highest analyte concentration, 280 µg/kg, in the sample from the 20- to 22-foot interval in well MW-26S. The highest total VOC concentration, 300 µg/kg, was also detected in that interval.

Semivolatiles: Two (2) semivolatile organic compounds, fluoranthene and pyrene, were detected in soil samples analyzed for semivolatile compounds. Fluoranthene was detected at the highest analyte concentration, 220 µg/kg, in the sample from the 0- to 2-foot interval in well MW-26S. The highest total semivolatile organic concentration, 430 µg/kg, was also detected in that interval.

PCBs/Pesticides/Herbicides: No pesticides, herbicides, or PCBs were detected in the soil sample from the 20- to 22-foot interval in MW-26I. Pesticide, herbicide, and PCB analysis, except for PCBs in samples from MW-26I, was not completed for other Phase I sampling locations for on-site surface water body AOCs.

Dioxin: Four (4) dioxin congeners, total TCCD, total PeCDD, total HpCDF, total TCDF, and total PeCDF, were detected in the soil sample analyzed for dioxin. The total dioxin concentration in the soil sample from the 20- to 22-foot interval at MW-26I was 2.98 µg/kg.

The total concentrations of VOCs, semivolatiles, PCBs/Pesticides/Herbicides, and Dioxin in soil for each sampling location are shown on Figure 12-1. These concentrations are the sum of the total sample concentrations for all samples from that location.

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Table 12-5
INORGANIC COMPOUNDS IN SOIL SAMPLES - ON-SITE SURFACE WATER BODIES
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of samples detecting analyte - number of samples analyzed	Concentration of Individual Analytes (µg/kg)		Published Ranges of Metals in Soil[1] (µg/kg)	
		Minimum	Maximum	Minimum	Maximum
Cadmium	1 - 3	ND	1900	-	-
Chromium	6 - 6	11000	280000	78000	100000
Copper	6 - 6	4300	59000	24000	43000
Nickel	6 - 6	19000	490000	28000	35000
Vanadium	6 - 6	9000	29000	-	-
Zinc	6 - 6	20000	280000	74000	105000
Cyanide	0 - 6	-	-	-	-

1 Veneman, 1985.

Metals/Cyanide: Maximum concentrations of plating metals (chromium, copper, nickel, and zinc) exceeded the published ranges for those metals. Minimum concentrations of plating metals were below published minimums for those metals. No cyanide was detected in the six (6) samples analyzed for cyanide.

12.5.3 Groundwater Sampling

A groundwater sample was collected from monitoring well MW-26S. Additional wells are proposed for Phase II to augment the data collected from this well.

12.5.4 Groundwater Analysis

During sample collection, groundwater samples were screened in the field for temperature, redox potential (Eh), pH, conductance, and dissolved oxygen. The results of field screening are summarized in Table 12-6.

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Table 12-6
GROUNDWATER FIELD SCREENING RESULTS - ON-SITE SURFACE WATER BODIES
Columbia Manufacturing Company, Westfield, MA

Parameter	MW-26I
Temperature (°C)	14
pH (pH units)	5.89
Eh (mV)	79
Conductance (μmhos/cm @ 25°C)	370
Dissolved Oxygen (mg/L)	6

The groundwater sample was analyzed for VOCs, metals, and cyanide. Summaries of positively identified analytes in groundwater collected from MW-26I are included in Appendix L. No qualitative summaries are required since only one (1) groundwater sample was collected downgradient of the on-site surface water AOCs.

VOCs: Trichloroethene was detected in groundwater from well MW-26I at a concentration of 1,500 μg/L.

Semivolatiles: The Phase I groundwater sample from monitoring well MW-26I was not analyzed for semivolatile organic compounds.

PCBs/Pesticides/Herbicides: The Phase I groundwater sample from monitoring well MW-26I was not analyzed for PCBs, pesticides, or herbicides.

Dioxin: The Phase I groundwater sample from monitoring well MW-26I was not analyzed for dioxin.

The total concentrations of VOCs, semivolatiles, PCBs/Pesticides/Herbicides, and Dioxin for monitoring well MW-26I are shown on Figure 12-2.

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Table 12-7
INORGANIC COMPOUNDS IN GROUNDWATER SAMPLES - ON-SITE SURFACE WATER BODIES
Columbia Manufacturing Company, Westfield, MA

Analyte	MW-26S (µg/L)	MCLs (µg/L)
Cadmium	< 10	5
Chromium	< 110	100
Copper	120	1000
Nickel	4400	100
Vanadium	86	-
Zinc	420	5000

Metals/Cyanide: The concentration of nickel in groundwater is elevated in comparison with MCLs. Cyanide was not detected in groundwater from MW-26S. Site-specific background concentrations have not been adequately determined at this time for release characterization purposes. MCLs, however, can be used as a benchmark to evaluate the significance of the data.

12.5.5 Surface Water Sampling

Surface water samples were collected from three (3) sampling locations in the eastern (SW-1), central (SW-2), and western (SW-3) portions of the fire pond (AOC 34). The samples were collected below the surface of the water to mitigate the effects of eddy currents.

12.5.6 Surface Water Analysis

During sample collection, surface water samples were screened in the field for temperature, redox potential (Eh), pH, and dissolved oxygen. The results of field screening are summarized in Table 12-8.

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Table 12-8
SURFACE WATER FIELD SCREENING RESULTS - ON-SITE SURFACE WATER BODIES
Columbia Manufacturing Company, Westfield, MA

Parameter	SW-1	SW-2	SW-2 (dupe)	SW-3
Temperature (°C)	15	16	15	17
Eh (mV)	150	100	80	110
pH (pH units)	6.15	6.43	6.57	5.46
Dissolved Oxygen (mg/L)	5.8	5.6	6	6

Surface water samples were analyzed for VOCs and a select list of metals (calcium, copper, iron, magnesium, manganese, potassium, sodium, and zinc). Summaries of positively identified analytes in surface water samples are included in Appendix L.

VOCs: No VOCs were detected in surface water samples.

Semivolatiles: Phase I surface water samples were not analyzed for semivolatile organic compounds.

PCBs/Pesticides/Herbicides: Phase I surface water samples were not analyzed for PCBs, pesticides, or herbicides.

Dioxin: Phase I surface water samples were not analyzed for dioxin.

The total concentrations of VOCs for each surface water sampling location are shown on Figure 12-2.

Metals/Cyanide: No copper or zinc (plating metals) were detected in surface water samples from the fire pond (AOC 34). Surface water samples were not analyzed for cyanide.

12.5.7 Sediment Sampling

Sediment samples were collected from the fire pond (AOC 34) at the surface water sampling locations. Sediments were collected from the upper six inches (6") of sediment.

12.5.8 Sediment Analysis

Sediment from the fire pond (AOC 34) was analyzed for metals only. A summary of positively identified metals in sediment samples collected at SS-1, SS-2 and SS-3. are included in Appendix L.

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Table 12-9
INORGANIC COMPOUNDS IN SEDIMENT SAMPLES -
ON-SITE SURFACE WATER BODIES
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of samples detecting analyte - number of samples analyzed	Concentration of Individual Analytes in Sediment (µg/kg)		Published Ranges of Metals in Soil[1] (µg/kg)	
		Minimum	Maximum	Minimum	Maximum
Cadmium	3 - 3	2600	33000	-	-
Chromium	3 - 3	64000	250000	78000	100000
Copper	3 - 3	130000	1600000	24000	43000
Nickel	3 - 3	590000	6000000	28000	35000
Tin	2 - 3	ND	55000	-	-
Vanadium	3 - 3	32000	130000	-	-
Zinc	3 - 3	190000	1900000	74000	105000
Cyanide	0 - 0	-	-	-	-

1 Veneman, 1985.

Metals/Cyanide: Maximum concentrations of plating metals (chromium, copper, nickel, and zinc) exceeded the published ranges for those metals in soil. Cyanide analysis was not completed for sediment samples. Background concentrations of metals in sediment cannot be adequately defined since the fire pond (AOC 34) is a site-specific surface water body. Published concentrations of metals in soil are used only as a benchmark to indicate the significance of concentrations of plating metals in sediment.

12.5.9 Air Monitoring

Air was monitored above the surface of the fire pond (AOC 34) at sampling location AS-2. The sediment at that location was agitated prior to monitoring. The monitoring was completed with a PID. No VOCs were detected above the surface of the water in the pond. This result is noted on Figure 12-1.

12.6 SUMMARY OF RELEASE CHARACTERIZATION

12.6.1 General Discussion of Results

This section discusses releases of organic and inorganic (metals/cyanide) analytes identified in soil, groundwater, surface water, sediment, and air at the on-site surface water body AOCs.

Close File

Soil: Organic Compounds
Both volatile and semivolatile organic compounds were identified in soil collected from MW-26I. The maximum VOC sample concentration ranged from below detection to 300 μg/kg; semivolatiles from below detection to 430 μg/kg. No pesticides, herbicides or PCBs were detected. Given the absence of pesticides and PCB's, these compounds will be eliminated from subsequent soil analysis in the grouping. The maximum dioxin sample concentrations was 2.98 μg/kg.

Soil: Metals/Cyanide
Plating metals were detected at concentrations in excess of published ranges. No cyanide was detected in soil monitored at the on-site surface water bodies. Metals associated with on-site plating activities (Cd, Cr, Cu, Ni and Zn) will be included in subsequent investigations.

Groundwater: Organic Compounds
Volatile and semivolatile organic compounds were detected in shallow groundwater downgradient of AOC 16. Only trichloroethene was detected in groundwater from MW-26I at a concentration of 1,500 μg/L. Phase I sampling did not include pesticide, herbicide, PCB, or dioxin analysis of groundwater downgradient of on-site surface water bodies. Research summarized in Section 1 indicates that these compounds were not discharged to the on-site surface water bodies. Subsequent data collection designed to monitor the on-site surface water AOCs will not include these parameters

Groundwater: Metals/Cyanide
No cyanide was detected in groundwater monitored at AOC 16. Nickel, a plating metal, appears elevated, however, site-specific background concentrations have not been adequately determined at this time. Metals associated with on-site plating activities (Cd, Cr, Cu, Ni and Zn) will be included in subsequent investigations.

Surface Water: Organic Compounds
No VOCs were detected in surface water from the fire pond (AOC 34). Surface water was not analyzed for semivolatile organics, pesticides, herbicides, PCBs, or dioxin. Analysis for VOCs will not be included in subsequent investigations of the on-site surface water bodies.

Surface Water: Metals/Cyanide
No copper or zinc (plating metals) was detected in surface water samples. Surface water samples were not analyzed for other plating metals or cyanide.

Sediment: Metals
Concentrations of plating metals (chromium, copper, nickel, and zinc) in sediment appear elevated when compared to published concentrations of these metals in soil.

Air: Organic Compounds
No VOCs were detected above the water surface at the fire pond (AOC 34).

Close File

12.6.2 Data Gaps

Based on the release characterization for the on-site surface water body AOCs, the following data gaps have been identified. Data gaps have been organized by media since individual monitoring of each on-site surface water body AOC was not conducted. Phase II activities designed to provide the data required are discussed in Section 20, 21, and 22.

Soil
The horizontal and vertical extent of soil contamination in the vicinity of the on-site surface water bodies AOCs needs to be delineated for VOCs, semivolatile organics, dioxin, and metals. PCBs and pesticides/herbicides will not be included in subsequent investigations. The source for the dioxin contamination detected in soil from well MW-26I must also be determined.

Groundwater
The horizontal and vertical extent of groundwater contamination in the vicinity of the on-site surface water body AOCs needs to be delineated for VOCs, semivolatile organics, and metals. Phase II investigations will be designed to determine if the water bodies are a source of the contamination observed.

12.6.3 Other Issues

Other issues could potentially include interim measures, additional media of concern for existing AOCs, and new AOCs identified during Phase I.

Interim Measures
No interim measures are deemed necessary based on the release characterization for the on-site surface water bodies.

Media of Concern
No additional media of concern were identified for on-site surface water bodies.

Areas of Concern
No additional areas of concern were identified for the on-site surface water bodies. Phase II tasks will focus on AOC's 16 and 34. In addition to the borings and/or wells proposed to better delineate releases form these AOC's, Phase II tasks will include hydrogeological and hydrological investigations to define the interaction of surface water bodies with other media at the site.

MW-26I	
total VOCs	300 ug/kg
total Semi-VOCs	430 ug/kg
total PEST & HERB/PCBs	ND/ND
total DIOXIN	2.98 ug/kg

BH-1	
total VOCs	820 ug/kg
total Semi-VOCs	ND
total PEST & HERB/PCBs	NA/NA
total DIOXIN	NA

SS-1	
total VOCs	NA
total Semi-VOCs	NA
total PEST & HERB/PCBs	NA/NA
total DIOXIN	NA

SS-2	
total VOCs	NA
total Semi-VOCs	NA
total PEST & HERB/PCBs	NA/NA
total DIOXIN	NA

AS-2	
total VOCs	0 ppm*
total Semi-VOCs	NA
total PEST & HERB/PCBs	NA/NA
total DIOXIN	NA

* MEASURED OVER THE WATER SURFACE

SS-3	
total VOCs	NA
total Semi-VOCs	NA
total PEST & HERB/PCBs	NA/NA
total DIOXIN	NA

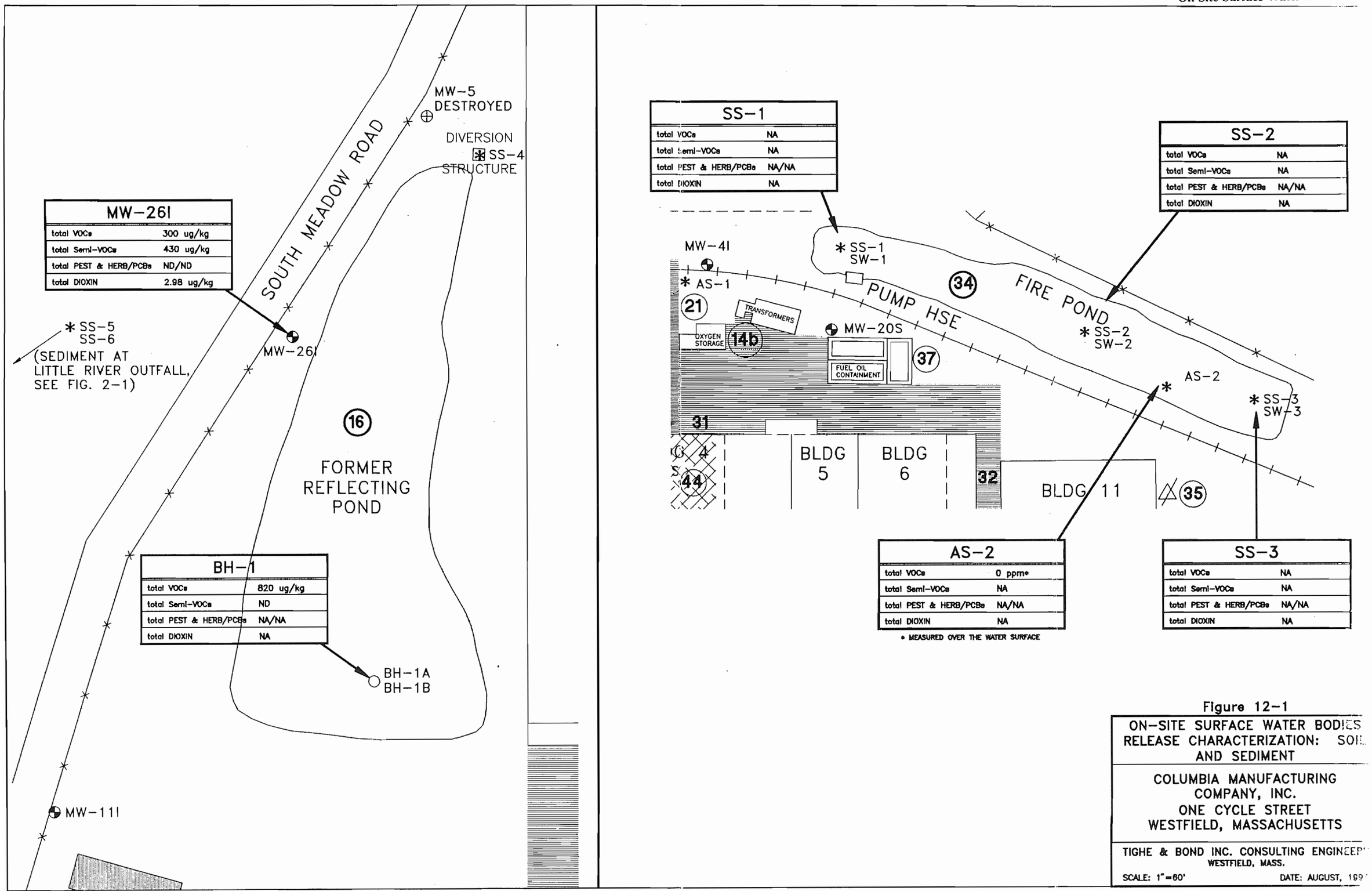


Figure 12-1

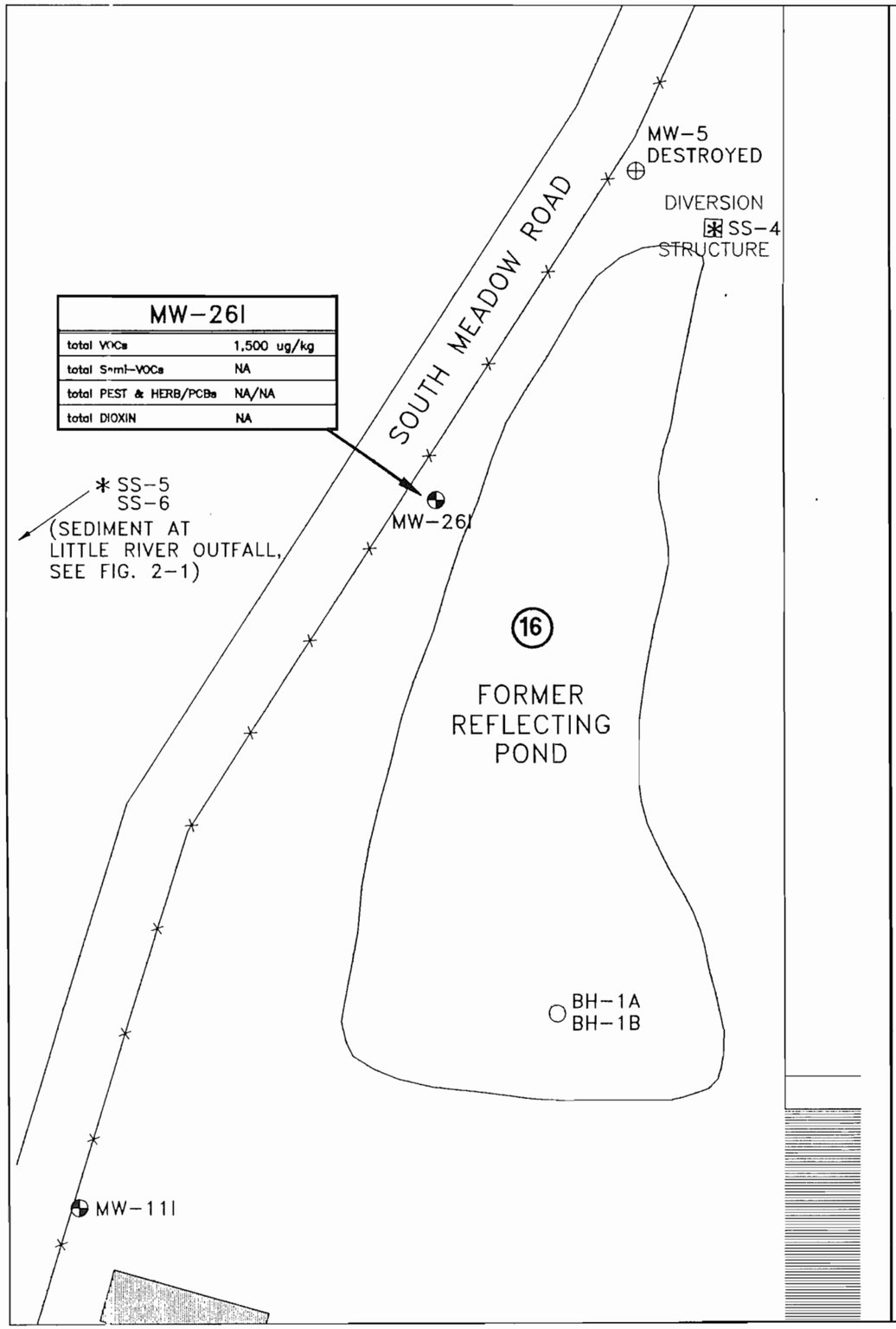
ON-SITE SURFACE WATER BODIES
RELEASE CHARACTERIZATION: SOIL
AND SEDIMENT

COLUMBIA MANUFACTURING
COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=60' DATE: AUGUST, 199

L:\W517\AOCAREA



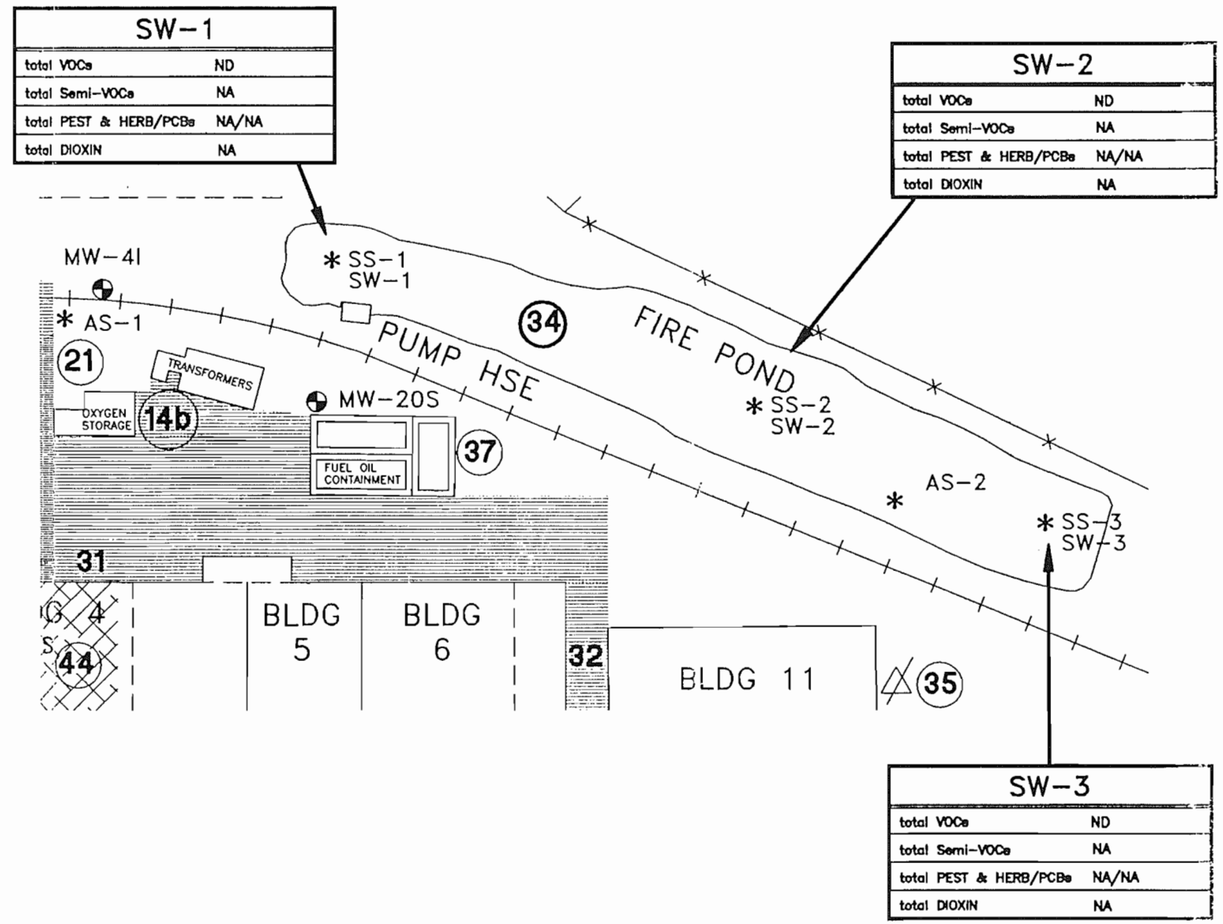


Figure 12-2

ON-SITE SURFACE WATER BODIE
RELEASE CHARACTERIZATION:
GROUNDWATER AND SURFACE WA

COLUMBIA MANUFACTURING
COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=60' DATE: AUGUST, 1

Close File

13
RELEASE CHARACTERIZATION: UTILITY LINES

13.1 OVERVIEW

This section discusses the objectives, AOC characteristics, methods of analysis, and results of the release characterization for AOCs associated with the utility lines. The AOCs include storm sewer lines (AOC 17) and sanitary sewer lines (AOC 18). Objectives of the release characterization and the Phase I sampling locations for the utility lines are discussed in Section 13.2. Construction and operational characteristics of the two (2) AOCs are discussed in Section 13.3. The results of sampling conducted by the EPA prior to Phase I of the RFI are discussed in Section 13.4. The results of Phase I sampling and analysis are summarized in Section 13.5. Section 13.6 ends with a summary of the results of release characterization, a discussion of data gaps, and other related issues, if any.

13.2 OBJECTIVES

The objective of the release characterization at the utility lines AOCs is to determine whether a release of hazardous constituents has occurred from the units. The Phase I characterization focused on releases to soil, sediments and groundwater. Phase I analysis results for soil and groundwater samples from monitoring wells MW-12S, MW-12I, and MW-24S were utilized for release characterization. Releases to shallow and intermediate groundwater are monitored by these wells. Analytical results from two (2) sediment samples collected from the Little River (SS-5 and SS-6) and from the storm drain system (SS-4 and SS-8) are also utilized for the characterization.

13.3 AOC CHARACTERISTICS

Formerly, the storm drain system (AOC 17) carried all wastewater from on-site operations to a discharge point on the Little River. Subsequently, the treated wastewater has been redirected to the sanitary sewer (AOC 18) which discharges to the municipal sewer system in Westfield.

During the RFA, the sanitary and storm sewer system were identified as AOCs. The physical and operational characteristics of the AOCs are summarized in Tables 13-1 and 13-2. Since the AOCs are located below ground over the majority of the developed portion of the Site, the units are difficult to monitor. Releases from the utility lines may impact soil and groundwater underlying the Site. The sediment associated with the storm drain system and the Little River are also considered media of concern for the storm drain system (AOC 17).

Close File

TABLE 13-1
AREA OF CONCERN CHARACTERISTICS: AOC 17

Solid Waste Management Unit Number: 17 **Item/Description:** Storm Sewer Lines	
Location of AOC:	*Underlying the developed portion of the Site.*
Type of AOC:	*Underground Storm Sewer System*
Design Features	
The system consists of steel catch basins with PVC or concrete piping. A dual 1,500-foot outfall for stormwater discharges to the Little River east of the Site. Approximately 20 catch basins are located throughout the Site, including several located in indoor locations.	
Operating Practices	
Past	*Stormwater and pH adjusted process wastewater was discharged to the Little River outfall via the diversion structure. Excess flow was diverted into the Reflecting Pond (AOC 16) prior to discharge.*
Present	*Currently, only storm water discharges to the Little River outfall. A separate system located in the northern portion of the Site discharges stormwater to the municipal system on Cleveland Avenue.*
Period of Operation	
The storm drain system has been used since the facility was first constructed around 1900.	
Effective Age of AOC:	*>94 years*
General Physical Conditions	
The integrity of the individual pipe sections is not known.	
Closure Method	
Stormwater drains are believed to have been fully separated from all process wastewater discharges. The system is still in operation for stormwater only.	
Information Sources:	*RFI Proposal, EPA Draft Site Evaluation, RCRA Facility Assessment*

Close File

TABLE 13-2
AREA OF CONCERN CHARACTERISTICS: AOC 18

Solid Waste Management Unit Number: 18
Item/Description: Sanitary Sewer Lines

Location of AOC:	*Underlying the developed portion of the Site.*
Type of AOC:	*Underground Sanitary Sewer System*

Design Features

Consists of approximately 3,000-linear-feet of clay, tile, iron or PVC pipe with diameters ranging from 8 to 12-inches. Two (2) separate systems exist on the Site. The system in the northern portion of the Site discharges to the sewer system on Cleveland Avenue and collects sanitary wastes from Buildings 9, 10, 14, 15, and 16. The second system discharges to Lozier Avenue from a manhole located north of Building 1 (the location of proposed sediment sample SS-7 during Phase I of the RFI). Three lines feed this manhole: (1) a floor drain and sump in the western portion of Building 1; (2) floor drains, sumps and lavatories in Building 1A and 2; (3) and the effluent from a large diameter manhole located in the northeast portion of the Site. This manhole receives wastewater from sumps, lavatories, and floor drains in Buildings 7A, 7, 17, 4, 5, and the warehouse; stripping area floor drains (AOC 23); effluent from the pH adjustment tank; and treated effluent from the wastewater treatment plant.

Operating Practices

Past	*In the past, process wastewaters were discharged primarily through the storm drain system to the NPDES outfall. The sanitary sewer system carried primarily sanitary wastes and various sumps and floor drains.*
Present	*Currently, the sanitary sewer system receives all process and sanitary wastewater from the Site. Process wastewater consists of pretreated rinse waters, cleaners, and acids. The primary sources of wastewater in the sanitary sewer system are the effluent from the pH adjustment tank, the WWTP (SWMUs 1 to 7), and stripping area floor drains (AOC 23). The wastes contained in the wastewater discharged to the POTW will vary depending on the nature and volume of the effluent from each of these sources.*

Period of Operation

The sanitary sewer system has been used since approximately 1900.

Effective Age of AOC: *>94 years*

General Physical Conditions

In September 1988, the RFA investigative team observed a bubbling sanitary sewer manhole in the former degreaser room in Building 1A indicating infiltration of floor spills into the manhole. The manhole is located near the methylene chloride distillation tank.

Closure Method

This is an active unit.

Information Sources: *RFI Proposal, EPA Draft Site Evaluation, RCRA Facility Assessment, Facility Design Report*

Close File

13.4 PREVIOUS SAMPLING AND ANALYSIS

No media sampling was conducted relative to utility line AOCs prior to Phase I of the RFI. The RFA included only visual observations of the AOCs.

13.5 PHASE I SAMPLING AND ANALYSIS

Release characterization sampling for utility line AOCs focused on soil, groundwater and sediment. Samples of those media from three (3) groundwater monitoring wells installed during Phase I of the RFI, two (2) locations in the Little River, and two (2) sediment sampling locations in the storm drain system are discussed in this section.

13.5.1 Soil Sampling

Monitoring wells MW-12S, MW-12I were installed on the east side of the Warehouse (Building 13) near the storm sewer line. Well MW-24S was installed on the north side of Building 1 near the sanitary manhole which discharges to the municipal sewer system. Soil samples were collected from the borings for these wells at the 0- to 2-foot interval and at five foot (5') intervals thereafter.

13.5.2 Soil Analysis

Soil samples collected during the advancement of the borings for the monitoring wells were screened for the presence of VOCs with a PID. Elevated VOC levels, which were defined as readings greater than 10 ppm above background, are shown in Table 13-3. Elevated VOC levels were only detected in samples from the boring for MW-24S.

The soil sample collected from the 0- to 2-foot and 5- to 7-foot intervals in all three (3) monitoring wells were analyzed for metals, cyanide, VOCs, semivolatile organic compounds, pesticides, and PCBs. Analysis for Appendix IX parameters was conducted on two (2) samples from MW-24S (15- to 17-foot and 20- to 22-foot intervals). Soil samples from the 0- to 2-foot and 5- to 7-foot interval of wells MW-12S and MW-24S were also analyzed for organophosphorus pesticides and chlorinated herbicides.

Table 13-3
VOC SCREENING RESPONSES FOR SOIL HEADSPACE - UTILITY LINES
Columbia Manufacturing Company, Westfield, MA

Sampling Interval (feet)	HNu Response[1] (ppm)
MW-24S	
15-17	46
18.5-20.5[2]	38
20-22[2]	52

1 Screening responses greater than 10 ppm above background are listed in the table.
2 Combined for one (1) Appendix IX sample.

Close File

Summaries of positively identified analytes in soil samples collected from MW-12S, MW-12I, and MW-24S are included in Appendix L. The qualitative summaries included in Appendix L are presented in Table 13-4 and Table 13-5 with discussion of the substantive findings.

Table 13-4
ORGANIC COMPOUNDS IN SOIL SAMPLES - UTILITY LINES
Columbia Manufacturing Company, Westfield, MA

Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (µg/kg)		Total Sample Concentration (µg/kg)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Volatile Organics	2 - 8	0	1	ND	270	ND	270
Semivolatile Organics	3 - 8	0	9	ND	1900	ND	8150
Pesticides	0 - 6	-	-	-	-	-	-
PCBs	0 - 8	-	-	-	-	-	-
Organophosphorus Pesticides	0 - 6	-	-	-	-	-	-
Chlorinated Herbicides	0 - 6	-	-	-	-	-	-
Dioxin	2 - 2	5	5	0.03	3.37	.97	4.67

VOCs: One (1) volatile organic compound, trichloroethene, was detected in soil samples analyzed for VOCs. Trichloroethene was detected at the highest analyte concentration and highest total VOC concentration, 270 µg/kg, in the sample from the 20- to 22-foot interval in well MW-24S.

Semivolatiles: Nine (9) semivolatile organic compounds, anthracene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, chrysene, fluoranthene, phenanthrene, and pyrene, were detected in soil samples analyzed for semivolatile compounds. Pyrene was detected at the highest analyte concentration, 1,900 µg/kg, in the sample from the 0- to 2-foot interval in well MW-24S. The highest total semivolatile organic concentration, 8,150 µg/kg, was also detected in that interval.

PCBs/Pesticides/Herbicides: No pesticides, PCBs, or chlorinated herbicides were detected in soil samples analyzed for pesticides and herbicides.

Dioxin: Six (6) dioxin congeners, total TCCD, total PeCDD, total HxCDD, total PeCDF, total HxCDF, and total HpCDF, were detected in soil samples analyzed for dioxin. Total TCDD was detected at the highest congener concentration, 3.37 µg/kg, in the sample from the 20- to 22-foot interval in well MW-24S. The highest total dioxin concentration, 4.67 µg/kg, was detected in the same sample.

The total concentrations of VOCs, semivolatiles, PCBs/Pesticides/Herbicides, and Dioxin for each monitoring well are shown on Figure 13-1. These concentrations are the sum of the total sample concentrations for all samples from that location.

Close File

Table 13-5
INORGANIC COMPOUNDS IN SOIL SAMPLES - UTILITY LINES
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of samples detecting analyte - number of samples analyzed	Concentration of Individual Analytes (µg/kg)		Published Ranges of Metals in Soil[1] (µg/kg)	
		Minimum	Maximum	Minimum	Maximum
Cadmium	2 - 5	ND	4900	-	-
Chromium	8 - 8	8400	2300	78000	100000
Copper	7 - 8	ND	270000	24000	43000
Nickel	8 - 8	14000	36000	28000	35000
Tin	1 - 8	ND	6200	-	-
Vanadium	8 - 8	7800	25000	-	-
Zinc	8 - 8	22000	210000	74000	105000
Cyanide	0 - 8	-	-	-	-

1 Veneman, 1985.

Metals/Cyanide: Maximum concentrations of copper, nickel and zinc exceeded the published ranges for those metals. Minimum concentrations of plating metals were below published minimums for those metals. No cyanide was detected in the eight (8) samples analyzed for cyanide.

13.5.3 Groundwater Sampling

Groundwater samples were collected from monitoring wells MW-12S, MW-12I, and MW-24S. Additional wells are proposed for Phase II to augment the data collected from this AOC grouping.

13.5.4 Groundwater Analysis

During sample collection, groundwater samples were screened in the field for temperature, redox potential (Eh), pH, conductance, and dissolved oxygen. The results of field screening are summarized in Table 13-6.

Close File

Table 13-6
GROUNDWATER FIELD SCREENING RESULTS - UTILITY LINES
Columbia Manufacturing Company, Westfield, MA

Parameter	MW-12S	MW-12I	MW-24S
Temperature (°C)	16	14	14
pH (pH units)	5.66	7.89	6.12
Eh (mV)	63	47	73
Conductance (μmhos/cm @ 25°C)	140	240	630
Dissolved Oxygen (mg/L)	5	6	4

Groundwater samples were analyzed for VOCs, metals, and cyanide. Summaries of positively identified analytes in groundwater samples collected from MW-12S, MW-12I, and MW-24S are included in Appendix L. The qualitative summaries included in Appendix L are presented in Table 13-7 and Table 13-8 with discussion of the substantive findings.

Table 13-7
ORGANIC COMPOUNDS IN GROUNDWATER SAMPLES - UTILITY LINES
Columbia Manufacturing Company, Westfield, MA

Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (μg/L)		Total Sample Concentration (μg/L)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Volatile Organics	3 - 3	1	3	ND	9000	77	9000
Semivolatile Organics	0 - 0	-	-	-	-	-	-
Pesticides	0 - 0	-	-	-	-	-	-
PCBs	0 - 0	-	-	-	-	-	-
Organophosphorus Pesticides	0 - 0	-	-	-	-	-	-
Chlorinated Herbicides	0 - 0	-	-	-	-	-	-
Dioxin	0 - 0	-	-	-	-	-	-

VOCs: Three (3) volatile organic compounds, cis-1,2-dichloroethene, tetrachloroethylene, and trichlorethene, were detected in groundwater samples analyzed for VOCs. Trichloroethylene was detected at the highest analyte concentration, 9,000 μg/L, in the sample from monitoring well MW-24S. The highest total VOC concentration, 9,000 μg/L, was also detected in groundwater from that well.

Semivolatiles: Phase I groundwater samples from monitoring wells MW-12S, MW-12I, and MW-24S were not analyzed for semivolatile organic compounds.

Close File

PCBs/Pesticides/Herbicides: Phase I groundwater samples from monitoring wells MW-12S, MW-12I, and MW-24S were not analyzed for PCBs, pesticides, or herbicides.

Dioxin: Phase I groundwater samples from monitoring wells MW-12S, MW-12I, and MW-24S were not analyzed for dioxin.

The total concentrations of VOCs for each monitoring well are shown on Figure 13-2.

Table 13-8
INORGANIC COMPOUNDS IN GROUNDWATER SAMPLES - UTILITY LINES
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of samples detecting analyte - number of samples analyzed for the analyte	Concentration of Individual Analytes		MCL (µg/L)
		Minimum (µg/L)	Maximum (µg/L)	
Chromium	3 - 3	53	82	100
Copper	1 - 3	ND	71	1000
Nickel	3 - 3	100	1700	100
Vanadium	1 - 3	ND	70	-
Zinc	3 - 3	260	310	5000
Cyanide	0 - 3	ND	ND	200

Metals/Cyanide: Nickel in groundwater appears to be elevated in comparison with MCLs. Cyanide was not detected in any of the groundwater samples analyzed for cyanide. Site-specific background concentrations have not been adequately determined at this time for release characterization purposes. MCLs, however, can be used as a benchmark to evaluate the significance of the data.

13.5.5 Sediment Sampling

Five (5) sediment samples, SS-4, SS-5, SS-6, SS-7 and SS-8, were collected from various areas around the facility (Figure 13-1). The sample at SS-4 was collected from the diversion structure near the southern end of the Fire Pond: Little River sediments were collected at locations up-stream (SS-5) and downstream (SS-6), of the confluence of the river with the intermittent stream. The facility's two (2) 16-inch (16") storm drain outfall pipes are located on the intermittent stream. Little River sediments were collected from the upper six (6") inches of sediment. SS-7 was to be collected from the most downgradient sewer manhole at the Site, between Building 1 and Cycle Street, but no sediment was present in the manhole for collection. Sample SS-8 was collected from a storm drain manhole between Buildings 14 and 15.

13.5.6 Sediment Analysis

Sediment samples from the sampling locations were analyzed for metals, VOCs and semivolatile organics. A summary of positively identified metals in the sediment samples are included in Appendix L.

Close File

Table 13-9
ORGANIC COMPOUNDS IN SEDIMENT SAMPLES - UTILITY LINES
Columbia Manufacturing Company, Westfield, MA

Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (µg/kg)		Total Sample Concentration (µg/L)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Volatile Organics	3 - 4	0	3	ND	150	ND	150
Semivolatile Organics	2 - 4	0	12	ND	54000	ND	281500
Pesticides	0 - 0	-	-	-	-	-	-
PCBs	0 - 0	-	-	-	-	-	-
Organophosphorus Pesticides	0 - 0	-	-	-	-	-	-
Chlorinated Herbicides	0 - 0	-	-	-	-	-	-
Dioxin	0 - 0	-	-	-	-	-	-

VOCs: Four (4) volatile organic compounds, acetone, ethylbenzene, methylene chloride and trichloroethene, were detected in sediment samples analyzed for VOCs. Acetone was detected at the highest analyte and highest total sample concentration of 150 µg/kg in the sample collected upstream of the Little River outfall (SS-5).

Semivolatiles: Thirteen (13) semivolatile organic compounds, acenaphthylene, anthracene, Benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene, benzo(a)pyrene, bis(2-ethylhexyl)phthalate, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene, were detected in sediment samples analyzed for semivolatile organic compounds. Pyrene was detected at the highest analyte concentration, 54,000 µg/kg, in sample SS-4. The highest total semivolatile concentration, 281,500 µg/kg, was also detected in this sample.

PCBs/Pesticides/Herbicides: Phase I sediment samples SS-4, SS-5, SS-6, and SS-8 were not analyzed for PCBs, pesticides, or herbicides.

Dioxin: Phase I sediment samples SS-4, SS-5, SS-6, and SS-8 were not analyzed for dioxin.

The total concentrations of VOCs and semivolatile organics for each sediment sample location are shown on Figure 13-1.

Close File

Table 13-10
INORGANIC COMPOUNDS IN SEDIMENT SAMPLES -
UTILITY LINES
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of samples detecting analyte - number of samples analyzed	Concentration of Individual Analytes in Sediment (µg/kg)		Published Ranges of Metals in Soil[1] (µg/kg)	
		Minimum	Maximum	Minimum	Maximum
Cadmium	0 - 1	ND	ND	-	-
Chromium	4 - 4	5700	2000000	78000	100000
Copper	4 - 4	5500	300000	24000	43000
Nickel	4 - 4	11000	3900000	28000	35000
Tin	1 - 4	ND	34000	-	-
Vanadium	4 - 4	4100	20000	-	-
Zinc	4 - 4	23000	890000	74000	105000

1 Veneman, 1985.

Metals/Cyanide: Maximum concentrations of plating metals (chromium, copper, nickel, and zinc) in sediment exceeded the published ranges for those metals in soil. Cyanide analysis was not performed for sediment samples. Published concentrations of metals in soil are used only as a benchmark to indicate the significance of concentrations of plating metals in sediment. Background concentrations of metals in Little River sediments will be determined during the Phase II hydrologic investigation.

13.6 SUMMARY OF RELEASE CHARACTERIZATION

13.6.1 General Discussion of Results

This section discusses releases of organic and inorganic (metals/cyanide) analytes identified in soil, groundwater and sediment at the utility line AOCs.

Soil: Organic Compounds
Both volatile and semivolatile organic compounds were identified in soil monitored in the vicinity of the utility lines. The maximum VOC sample concentration ranged from below detection to 270 µg/kg; semivolatiles from below detection to 8,150 µg/kg. No other pesticides, herbicides or PCBs were detected. The maximum dioxin sample concentrations was 4.67 µg/kg.

Soil: Metals/Cyanide
Plating metals (copper, nickel, and zinc) were detected at concentrations in excess of published ranges. No cyanide was detected in soil monitored at the utility lines. Metals, including those associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN), will be included in subsequent investigations.

Groundwater: Organic Compounds
Volatile organic compounds were detected in groundwater downgradient of the utility line AOCs.

Close File

Maximum VOC sample concentrations ranged from 77 µg/L to 9,000 µg/L. Phase I sampling did not include pesticide, herbicide, PCB, or dioxin analysis of groundwater downgradient of the utility lines. As described in Section 1, these compounds are not associated with this AOC grouping and will be eliminated from future monitoring of utility lines.

Groundwater: Metals/Cyanide
No cyanide was detected in groundwater monitored at the utility lines. Nickel appears elevated, however, site-specific background concentrations have not been adequately determined at this time. Metals, including those associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN), will be included in subsequent investigations.

13.6.2 Data Gaps

Based on the release characterization for the utility line AOCs, the following data gaps have been identified. Data gaps have been organized by media since individual monitoring of each utility line AOC was not conducted. Phase II activities designed to provide the data required are discussed in Sections 20, 21 and 22.

Soil
The horizontal and vertical extent of soil contamination in the vicinity of the utility line AOCs needs to be delineated for VOCs, semivolatile organics, dioxin, and metals. The source for the dioxin contamination must also be determined. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

Groundwater
The horizontal and vertical extent of groundwater contamination in the vicinity of the utility line AOCs needs to be delineated for VOCs, semivolatile organics, and metals. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

13.6.3 Other Issues

Other issues could potentially include interim measures, additional media of concern for existing AOCs, and new AOCs identified during Phase I.

Interim Measures
No interim measures are deemed necessary based on the release characterization for the utility lines.

Media of Concern
No additional media of concern were identified for the utility lines.

Areas of Concern
No additional areas of concern were identified for the utility line AOCs. Phase II tasks will focus on AOCs 17 and 18. In addition to the borings and wells proposed to better delineate releases from these AOC's, Phase II tasks will include inspection of utility lines to determine integrity of specific sections of the lines.

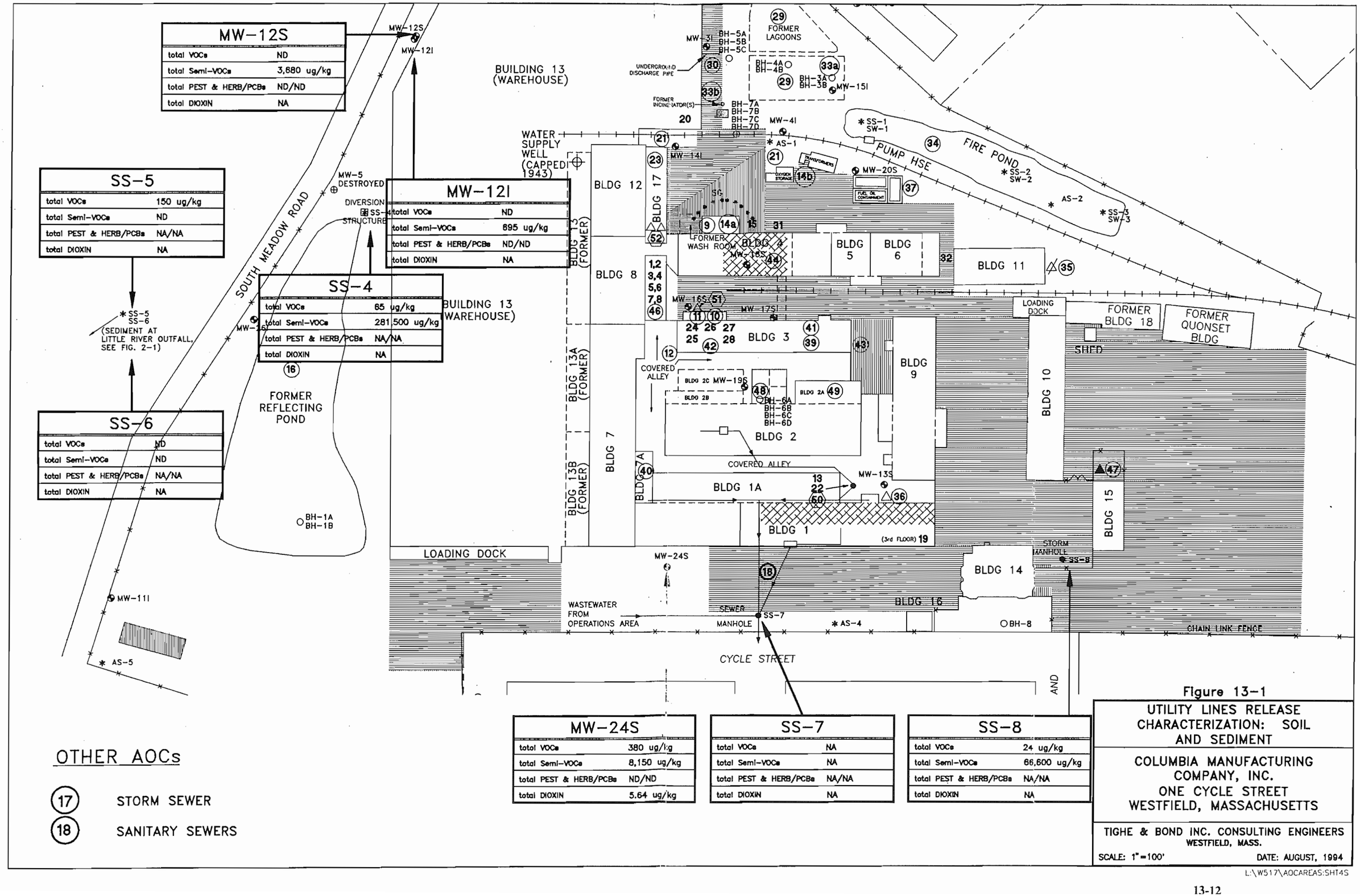


Figure 13-1

UTILITY LINES RELEASE CHARACTERIZATION: SOIL AND SEDIMENT

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=100' DATE: AUGUST, 1994

L:\W517\AOCAREAS:SHT4S

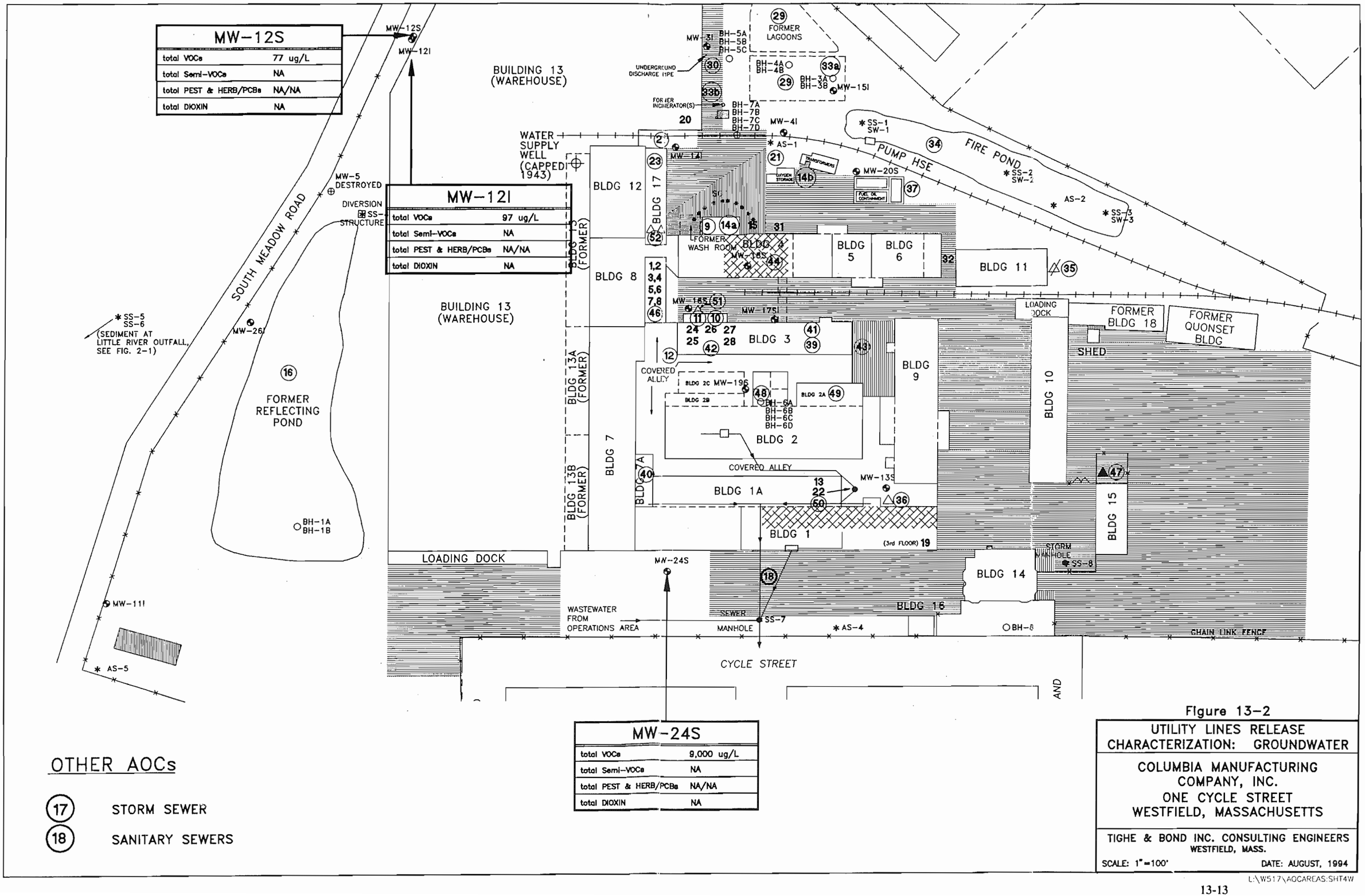


Figure 13-2

UTILITY LINES RELEASE CHARACTERIZATION: GROUNDWATER

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=100' DATE: AUGUST, 1994

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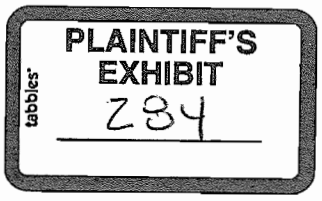
VOLUME 2
SECTIONS 14 THROUGH 25

RCRA FACILITY INVESTIGATION
REVISED PHASE I INTERIM REPORT
FOR
COLUMBIA MANUFACTURING COMPANY
WESTFIELD, MASSACHUSETTS

SEPTEMBER, 1994



Tighe&Bond
Consulting Engineers
Environmental Specialists

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14
RELEASE CHARACTERIZATION: STORAGE TANKS

14.1 OVERVIEW

This section discusses the objectives, AOC characteristics, methods of analysis, and results of the release characterization for the storage tanks AOCs. The AOCs include a removed UST (AOC 35), an abandoned UST (AOC 36), the fuel storage area (AOC 37), a gasoline UST (AOC 47) and a second abandoned UST (AOC 48). Objectives of the release characterization and the Phase I sampling locations for the storage tanks are discussed in Section 14.2. Construction and operational characteristics of the five (5) AOCs are discussed in Section 14.3. The results of sampling conducted by the EPA prior to Phase I of the RFI are discussed in Section 14.4. The results of Phase I sampling and analysis are summarized in Section 14.5. Section 14.6 ends with a summary of the results of release characterization, a discussion of data gaps, and other related issues, if any.

14.2 OBJECTIVES

The objective of the release characterization at the storage tank AOCs is to determine whether a release of hazardous constituents has occurred from the units. The Phase I characterization focused on releases to soil and groundwater. Phase I analytical results for soil and groundwater samples from monitoring wells MW-13S, MW-19S, MW-20S, and MW-24S are utilized for the characterization. Releases to shallow groundwater are monitored by these wells. The analytical results from borings BH-6A, BH-6B, BH-6C, and BH-6D are also utilized for characterization.

14.3 AOC CHARACTERISTICS

Storage tanks include underground storage tanks (USTs) which held fuel oil (AOC 35), cutting oil (AOC 36), cooling oil (AOC 48), and gasoline (AOC 47). Three (3) above ground storage tanks (ASTs) which store fuel oil are located in a concrete containment structure called the fuel storage area (AOC 37).

During the RFA, four (4) AOCs associated with storage tanks were identified (AOC 35, AOC 36, AOC 37, and AOC 47). One (1) additional AOC was identified during preparation of the RFI Proposal. The physical and operational characteristics of the AOCs are summarized in Tables 14-1, 14-2, 14-3, 14-4, and 14-5. Releases of hazardous constituents from USTs may have impacted soil and groundwater. The fuel storage area (AOC 37) is not underlain by a concrete slab. Releases from this unit may impact soil and groundwater. AOC 35 and AOC 47 do not have media of concern and are not specifically monitored by Phase I sampling locations.

Close File

Table 14-1
AREA OF CONCERN CHARACTERISTICS: AOC 35

Solid Waste Management Unit Number: 35 **Item/Description:** Removed UST	
Location of AOC:	*West side of Building 11.*
Type of AOC:	*Underground Storage Tank*
Design Features	
The tank was constructed of heavy gauge riveted steel and had a capacity of 9,000-gallons. The tank was installed abutting a concrete structure attached to the west side of Building 11. Feed and return lines for the tank were encased in the concrete structure.	
Operating Practices	
Past	*Storage of #2 fuel oil.*
Present	*This unit is closed.*
Period of Operation	
The tank was installed in the 1940s and was inactive but still present in the ground in September 1988. The tank remained in place throughout the reconstruction of Building 11 in 1955. The DEP inspection report for the tank removal notes that the tank was removed from service between 1969 and 1979.	
Effective Age of AOC:	*54 Years*
General Physical Conditions	
During the RFA, fuel oil odor was noted in the area of tank. A vent pipe was removed by CMC personnel and liquid with a strong hydrocarbon odor was observed in the tank. Following removal of the tank, the DEP inspection report noted that the groundwater in the grave was clear - no sheen was visible and that the tank appeared to be in exceptional shape. It was decided by the DEP field inspector that the area was clean.	
Closure Method	
Tank was discovered by CMC personnel in during an in-house file search 1986. The tank was removed by excavation started on August 22, 1989. The tank was removed from CMC property on August 24, 1989 and hauled to Associated Wrecking for proper disposal. The excavation was backfilled with clean fill from an off site location. This location is no longer considered an AOC.	
Information Sources:	*RFI Proposal, CMC Documentation of UST Removal, Interview with Emil Stang, DEP File Record of Release W89-432, RCRA Facility Assessment*

Close File

Table 14-2
AREA OF CONCERN CHARACTERISTICS: AOC 36

Solid Waste Management Unit Number: 36 **Item/Description:** Abandoned UST	
Location of AOC:	*South side of Building 1 in the covered alley between Buildings 1 and 9.*
Type of AOC:	*Underground Storage Tank*
Design Features	
The tank apparently had a capacity of 2,000-gallons. No other details of the construction or installation could be determined.	
Operating Practices	
Past	*Storage of cutting oil for use in the tubing room in Building 9.*
Present	*This unit is closed.*
Period of Operation	
The date of installation and the end of service of the tank is not known	
Effective Age of AOC:	*Unknown*
General Physical Conditions	
The integrity of the UST could not be determined since the tank is filled with a concrete slurry. A Phase I monitoring well (MW-13) was installed downgradient of the tank to identify any releases from the tank. Petroleum hydrocarbons were detected in the soils adjacent to the tank.	
Closure Method	
The RFA investigative team documented the tank as abandoned. At that time, September 1988, the tank had been pumped of any cutting oil and left in place. On August 16, 1990, CMC personnel steam cleaned the inside of the tank and washed it with an alkaline cleaner. The cleaning solution was disposed of off-site as hazardous waste. On December 16, 1990, the tank was filled with 10 yards of concrete slurry.	
Information Sources:	*RFI Proposal, CMC record of tank closure, RCRA Facility Assessment*

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Table 14-3
AREA OF CONCERN CHARACTERISTICS: AOC 37

Solid Waste Management Unit Number: 37
Item/Description: Fuel Storage Area

Location of AOC: *South of Buildings 4, 5, and 6.*

Type of AOC: *Above Ground Storage Tanks and Containment Wall*

Design Features

Three fuel oil storage tanks are located within a 10-foot high concrete containment wall. The containment walls are constructed of 8-inch thick concrete set on 18-inch wide strip footings 3-feet below ground level. Two 20,000-gallon ASTs and one 15,000-gallon AST are located in the containment area. The containment area is divided into two compartments. The larger area, 27-feet by 35-feet, holds the two 20,000-gallon tanks; the smaller area, 14-feet 8-inches by 27-feet, holds the 15,000-gallon tank. Each tank is supported by three 2-foot wide piers supported by soil in the containment structure. The containment is drained by six 4-inch diameter drain lines, three per compartment, which discharge to the yard area. The pipes have intakes 6-inches above ground level in the dike and 4 to 5-feet above ground level outside the dike. The tanks are of bare steel construction. The #6 fuel oil lines are located underground in a conduit with steam lines to heat the oil. The #2 fuel oil line is believed to have been constructed of 1½" copper pipe outside of the conduit. The #2 fuel oil line crossed from the engine pit in Building 5 to a sump in Building 3 via a 12-inch concrete conduit. Past Building 3 the fuel oil line was routed through the ceiling of the buildings. The current fuel oil lines carry #4 fuel oil in an above ground conduit.

Operating Practices

Past — *The two 20,000-gallon tanks were used for the storage of #6 fuel oil which was burned in the boilers in Building 5. The 15,000-gallon tank contained #2 fuel oil which was burned in ovens and heating units located in Buildings 1 and 2.*

Present — *The oven in Building 2 currently burns natural gas. The primary fuel source for the boilers in Building 6 is #4 fuel oil from the tanks in the containment area; the secondary fuel source is natural gas.*

Period of Operation

The containment was constructed in 1958 and this unit remains in use.

Effective Age of AOC: *36 years*

General Physical Conditions

The RFA investigative team observed standing water in the dike area in September 1988. Cracks in pipe joints and rusty patches on the tanks were also noted. A sample of oil was collected by the EPA from the ground surface along the west end of the diked area on November 18, 1991. The EPA reported that the sample was likely "...a mixture of several oils, heavy hydrocarbons (greater than C_{14})."

Closure Method

This unit is currently in use.

Information Sources: *RFI Proposal, CMC Engineering Department Files, RCRA Facility Assessment*

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Table 14-4
AREA OF CONCERN CHARACTERISTICS: AOC 47

Solid Waste Management Unit Number: 47 **Item/Description:** Gasoline UST	
Location of AOC:	*South of Building 15.*
Type of AOC:	*Underground Storage Tank*
Design Features	
This unit is a 1,000-gallon unlined steel tank.	
Operating Practices	
Past	*Same as current practices.*
Present	*Unleaded gasoline is stored in this unit for on-site vehicles.*
Period of Operation	
This tank was installed around 1941.	
Effective Age of AOC:	*53 Years*
General Physical Conditions	
This tank is tightness tested every year. These tests do not indicate any leakage from the tank.	
Closure Method	
This is an active unit.	
Information Sources:	*RFI Proposal, RCRA Facility Assessment*

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Table 14-5
AREA OF CONCERN CHARACTERISTICS: AOC 48

Solid Waste Management Unit Number: 48 **Item/Description:** Abandoned UST No. 3	
Location of AOC:	*Beneath a square addition south of Building 2. Located in the current "exercise room".*
Type of AOC:	*Oil Containment*
Design Features	
This unit is a 8-foot by 12-foot by 5-foot deep concrete containment.	
Operating Practices	
Past	*This unit was formerly used for cooling oil containment for heat treatment in ovens in Building 2.*
Present	*Currently covered by the floor slab of the Building 2 addition.*
Period of Operation	
This unit was constructed around 1930 and was overlain by the building addition in 1946. Drawings from 1940 and 1941 indicate that the unit was an oil house and a cooling tank, respectively.	
Effective Age of AOC:	*64 Years*
General Physical Conditions	
The bottom of this containment was encountered during the advancement of borings in the area in the 1993 Phase I investigation. The bottom appeared to be of sound integrity; however, contamination was detected in the adjacent soils and in the groundwater in MW-19, downgradient of this unit.	
Closure Method	
Methods utilized to close this unit are not known.	
Information Sources:	*RFI Proposal, CMC Files*

Close File

14.4 PREVIOUS SAMPLING AND ANALYSIS

In 1991, the EPA collected a sample of petroleum product (Location 15) from the fuel storage area (AOC 37) and attempted to match the sample to petroleum standards. The sample was collected from the west end of the containment. No petroleum could be matched to the sample.

14.5 PHASE I SAMPLING AND ANALYSIS

Release characterization sampling for storage tank AOCs focused on soil and groundwater. Samples of those media from four (4) groundwater monitoring wells and a series of four (4) borings completed during Phase I of the RFI are discussed in this section.

14.5.1 Soil Sampling

Monitoring wells MW-13S and MW-24S are downgradient of AOC 36, well MW-19S is downgradient of AOC 48, and well MW-20S is downgradient of AOC 37. Borings BH-6A, BH-6B, BH-6C, and BH-6D were advanced at the suspected location of the former cooling oil UST (AOC 48)

14.5.2 Soil Analysis

Soil samples collected during the advancement of the borings for wells MW-13S, MW-19S, MW-20S, and MW-24S were screened for the presence of VOCs with a PID. Elevated VOC levels, which were defined as readings greater than 10 ppm above background, are shown in Table 14-6. Elevated VOC levels were detected in soil samples from wells MW-13S, MW-19S, MW-20S, and MW-24S; and from boring BH-6C.

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Table 14-6
VOC SCREENING RESPONSES FOR SOIL HEADSPACE - STORAGE TANKS
Columbia Manufacturing Company, Westfield, MA

Sample Interval (feet)	VOC Concentration[1]
BH-6C	
4-6	56
6-6.8	62
MW-13S/BH-9	
4-6	172
6-8	88
8-10	12
10-12	46
MW-19S	
2-4	18
4-6	22
6-8	80
8-9.5	112
10-11	126
11-12	98
MW-20S	
5-7	39
10-12	15.8
15-17	12.0
MW-24S	
10-12	9.8
15-17	46
18.5-20.5[2]	38

Close File

Sample Interval (feet)	VOC Concentration[1]
BH-6C	
20-22[2]	52

1 Screening responses greater than 10 ppm above background are shown in the table.
2 Combined into one (1) Appendix IX sample.

In accordance with the RFI Proposal, soil samples from monitoring wells MW-13S (originally boring BH-9) and BH-6C were analyzed on-site for TPH to evaluate the release of petroleum from the USTs. Soil samples with TPH concentrations in excess of 50 mg/kg were submitted to the Tighe & Bond laboratory for metals and VOC analysis. All samples analyzed for TPH on-site contained concentrations of TPH greater than 50 mg/kg. The results of on-site analysis for TPH are shown in Table 14-7.

Table 14-7
SUMMARY OF ON-SITE TPH ANALYSIS - STORAGE TANKS
Columbia Manufacturing Company, Westfield, MA

Interval (feet)	TPH Concentration (mg/kg)
BH-6C	
0 - 2	470
2 - 4	4800
4 - 6	2500
6 - 6.5	9900
MW-13S/BH-9	
4 - 6	9500
6 - 7.5	4900
8 - 10	1100
10 - 12	1400

Summaries of positively identified analytes in soil samples collected from BH-6C, MW-13S, MW-19S, MW-20S and MW-24S are included in Appendix L. The qualitative summary included in Appendix L is also presented in Table 14-8 and Table 14-9.

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Table 14-8
ORGANIC COMPOUNDS IN SOIL SAMPLES - STORAGE TANKS
Columbia Manufacturing Company, Westfield, MA

Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (µg/kg)		Total Sample Concentration (µg/kg)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Volatile Organics	13 - 21	0	2	ND	1350	ND	1516.5
Semivolatile Organics	2 - 8	0	9	ND	1900	ND	8150
Pesticides	0 - 7	-	-	-	-	-	-
PCBs	0 - 8	-	-	-	-	-	-
Organophosphorus Pesticides	1 - 7	0	1	ND	76	ND	76
Chlorinated Herbicides	0 - 7	-	-	-	-	-	-
Dioxin	5 - 5	4	7	ND	4.33	0.96	7.70

VOCs: Six (6) volatile organic compounds, acetone, ethylbenzene, methylene chloride, tetrachloroethene, trichloroethene, and total xylenes were detected in soil samples analyzed for VOCs. Ethylbenzene was detected at the highest analyte concentration, 1,350 µg/kg, in the sample from the 9- to 10-foot interval in well MW-19S. The highest total VOC concentration, 1,516.5 µg/kg, was also detected in that interval.

Semivolatiles: Nine (9) semivolatile organic compounds, anthracene, benzo(a)anthracene, benzo(b)anthracene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, fluoranthene, phenanthrene, and pyrene were detected in soil samples analyzed for semivolatile organics. Pyrene was detected at the highest analyte concentration, 1,900 µg/kg, in the sample collected from the 0- to 2-foot interval in the boring for monitoring well MW-24S. The highest total semivolatile organic concentration, 8,150 µg/kg, was also detected at this interval.

PCBs/Pesticides/Herbicides: One (1) organophosphorous pesticide, dichloroprop was detected in soil samples analyzed for pesticides and herbicides. Dichloroprop was detected at concentration of 76 µg/kg in the soil sample collected at the 20- to 22-foot interval from the boring for MW-24S. No other herbicides, pesticides, or PCBs were detected in the soil samples analyzed for herbicides and pesticides.

Dioxin: Eight (8) dioxin congeners, total TCCD, total PeCDD, total HxCDD, total HpCDD, total TCDF, total PeCDF, total HxCDF, and total HpCDF were detected in soil samples analyzed for dioxin. Total TCCD was detected at the highest analyte concentration of 4.33 µg/kg in the sample collected from the 5- to 7-foot interval in the boring for MW-20S. The highest total dioxin concentration, 7.70 µg/kg, was also detected at this interval.

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The total concentrations of VOCs, semivolatiles, PCBs/pesticides/herbicides, and dioxin for monitoring wells MW-13S, MW-19S, MW-20S, MW-24S and BH-6C are shown on Figure 14-1. These concentrations are the sum of the total sample concentrations for all samples from that location.

Table 14-9
INORGANIC COMPOUNDS IN SOIL SAMPLES - STORAGE TANKS
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of samples detecting analyte - number of samples analyzed	Concentration of Individual Analytes (µg/kg)		Published Ranges of Metals in Soil[1] (µg/kg)	
		Minimum	Maximum	Minimum	Maximum
Cadmium	14 - 21	ND	19000000	-	-
Chromium	9 - 15	3800	99000	78000	100000
Copper	21 - 21	6500	360000	24000	43000
Nickel	21 - 21	14000	1700000	28000	35000
Tin	10 - 21	ND	36000	-	-
Vanadium	21 - 21	6800	290000	-	-
Zinc	21 - 21	20000	1100000	74000	105000
Cyanide	0 - 8	-	-	-	-

1 Veneman, 1985.

Metals/Cyanide: Maximum concentrations of copper, nickel, and zinc (plating metals) exceeded the published range for those metals. No cyanide was detected in the samples analyzed for cyanide.

14.5.3 Groundwater Sampling

Groundwater samples were collected from monitoring wells MW-13S, MW-19S, MW-20S, and MW-24S.

14.5.4 Groundwater Analysis

During sample collection, groundwater samples were screened in the field for temperature, redox potential (Eh), pH, conductance, and dissolved oxygen. The results of field screening are summarized in Table 14-10.

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Table 14-10
GROUNDWATER FIELD SCREENING RESULTS - STORAGE TANKS
Columbia Manufacturing Company, Westfield, MA

Parameter	MW-13S	MW-19S	MW-20S	MW-24S
Temperature (°C)	17	19	16	14
pH (pH units)	6.61	6.39	6.5	6.12
Eh (mV)	73	10	74	73
Conductance (μmhos/cm @ 25°C)	390	500	570	630
Dissolved Oxygen (mg/L)	6	5	3	4

Groundwater was analyzed for VOCs, semivolatile organics, metals, and cyanide. Summaries of positively identified analytes in groundwater collected from MW-13S, MW-19S, MW-20S, and MW-24S are included in Appendix L. The qualitative summaries included in Appendix L are presented in Table 14-11 and Table 14-12 with discussion of the substantive findings.

Table 14-11
ORGANIC COMPOUNDS IN GROUNDWATER SAMPLES - STORAGE TANKS
Columbia Manufacturing Company, Westfield, MA

Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (μg/L)		Total Sample Concentration (μg/L)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Volatile Organics	4 - 4	1	3	ND	9000	48	9000
Semivolatile Organics	1 - 2	0	6	ND	470	ND	2600
Pesticides	0 - 0	-	-	-	-	-	-
PCBs	0 - 0	-	-	-	-	-	-
Organophosphorus Pesticides	0 - 0	-	-	-	-	-	-
Chlorinated Herbicides	0 - 0	-	-	-	-	-	-
Dioxin	0 - 0	-	-	-	-	-	-

VOCs: Four (4) volatile organic compounds, benzene, 1,1-dichloroethene, ethylbenzene, and trichlorethene, were detected in groundwater samples analyzed for VOCs. Trichloroethene was detected at the highest analyte and highest total VOC concentration, 9,000 μg/L, in groundwater collected from monitoring well MW-24S.

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Semivolatiles: Six (6) semivolatile organic compounds, anthracene, dibenzofuran, fluorene, 2-methylnapthalene, naphthalene, and phenanthrene, were detected in the groundwater sample from MW-19S. 2-methylnapthalene was detected at the highest analyte concentration, 1,500 µg/L, in groundwater from MW-19S. The highest total semivolatile organic concentration was 2,870 µg/L detected in groundwater from MW-19S.

PCBs/Pesticides/Herbicides: Phase I groundwater samples from monitoring wells MW-13S, MW-19S, MW-20S, and MW-24S were not analyzed for PCBs, pesticides, or herbicides.

Dioxin: Phase I groundwater samples from monitoring wells MW-13S, MW-19S, MW-20S, and MW-24S were not analyzed for dioxin.

The total concentrations of VOCs and semivolatiles from MW-13S, MW-19S, MW-20S, and MW-24S are shown on Figure 14-2.

Table 14-12
INORGANIC COMPOUNDS IN GROUNDWATER - STORAGE TANKS
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Samples Detecting Analyte/Number of Samples Analyzed for Analyte	Concentration of Analyte (µg/L)		MCLs(µg/L)
		Minimum	Maximum	
Cadmium	1 - 4	ND	1400	5
Chromium	1 - 4	ND	1500	100
Copper	4 - 4	40	4100	1000
Nickel	4 - 4	400	5800	100
Vanadium	2 - 4	ND	460	-
Zinc	4 - 4	140	9000	5000
Cyanide	0 - 4	-	-	200

Metals/Cyanide: Cadmium, chromium, copper, nickel, and zinc concentrations in groundwater appear to be elevated in comparison with MCLs. Cyanide was not detected in any groundwater samples analyzed for cyanide. Site-specific background concentrations have not been adequately determined at this time for release characterization purposes. MCLs, however, can be used as a benchmark to evaluate the significance of the data.

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14.6 SUMMARY OF RELEASE CHARACTERIZATION

14.6.1 General Discussion of Results

This section discusses releases of organic and inorganic (metals/cyanide) analytes identified in soil and groundwater at the storage tank AOCs.

Soil: Organic Compounds
Volatile organic compounds were detected in soil monitored at the abandoned cutting oil UST (AOC 36), the fuel storage area (AOC 37), and the abandoned cooling oil UST (AOC 48). The maximum VOC sample concentration ranged from below detection to 1,516.5 μg/kg. On-site analysis of soil samples identified TPH in concentrations ranging from 470 to 9,900 mg/kg. Phase I sampling did not include analysis for semivolatile organics, pesticides, herbicides, PCBs, or dioxin.

Soil: Metals/Cyanide
Nickel (a plating metal) was detected at concentrations in excess of published ranges. Cyanide analysis was not conducted on Phase I soil samples.

Groundwater: Organic Compounds
Volatile and semivolatile organic compounds were detected in shallow groundwater downgradient of the abandoned UST (AOC 36). Maximum VOC sample concentrations ranged from below detection to 9000 μg/L; semivolatiles from below detection to 2600 μg/L. Phase I sampling did not include pesticide, herbicide, PCB, or dioxin analysis of groundwater downgradient of other operations. As described in Section 1, these compounds are not associated with this AOC grouping and will be eliminated from future monitoring of the storage tank AOCs.

Groundwater: Metals/Cyanide
No cyanide was detected in groundwater monitored at storage tank AOCs. Plating metals appear elevated, however, site-specific background concentrations have not been adequately determined at this time. Metals, including those associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN), will be included in subsequent investigations.

14.6.2 Data Gaps

Based on the release characterization for the storage tank AOCs, the following data gaps have been identified. Data gaps have been organized by media. Phase II activities designed to provide the data required are discussed in Sections 20, 21, and 22.

Soil
The horizontal and vertical extent of soil contamination in the vicinity of the other AOCs operations needs to be delineated for VOCs, semivolatile organics, and metals. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

Groundwater

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The horizontal and vertical extent of groundwater contamination in the vicinity of the other operations AOCs needs to be delineated for VOCs, semivolatile organics, and metals. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

14.6.3 Other Issues

Other issues could potentially include interim measures, additional media of concern for existing AOCs, and new AOCs identified during Phase I.

Interim Measures
No interim measures are deemed necessary based on the release characterization for the other operations.

Media of Concern
No additional media of concern were identified for other operations.

Areas of Concern
Two (2) additional storage tank AOCs were identified during the Phase I investigation. The tanks are fuel oil USTs identified on drawings reviewed at the Site. A 10,200-gallon UST, AOC 51, was formerly located in the east end of the alley between Building 3 and 4. Two (2) other fuel-oil USTs, AOC 52, are located beneath the north wall of Building 17. The locations of the new AOCs are shown on the Site Plan in Appendix A. The media of concern for the AOCs are shown on Table 14-13. The operation and design characteristics of the AOCs are shown on Tables 14-14 and 14-15. Phase II sample locations will monitor these AOCs (Sections 20, 21, and 22).

Table 14-13
MEDIA OF CONCERN FOR NEWLY IDENTIFIED AOCs
Columbia Manufacturing Company, Westfield, MA

AOC	Unit Name/Description	Media of Concern					
		Soil	GW	SW	SS	SG	Air
51	Former Fuel Oil UST	X	X				
52	Former Fuel Oil USTs	X	X				

GW Groundwater
SW Surface water
SS Sediment
SG Subsurface gas

Close File

Table 14-14
AREA OF CONCERN CHARACTERISTICS: AOC 51

Solid Waste Management Unit Number: 51
Item/Description: Former Fuel Oil UST

Location of AOC:	*East end of exterior side of south side of Building 3; at the current location of the shed containing the former pH adjustment tank (AOC 11) and the nickel filters (AOC 10).*
Type of AOC:	*Fuel Oil UST*

Design Features

The UST is shown on Sanborn Fire Insurance Maps and Factory Mutual drawings from 1924 through 1970. The UST had a capacity of 10,200 gallons.

Operating Practices

Past	*Storage of fuel oil.*
Present	*The UST is no longer in use.*

Period of Operation

The UST was present from 1924 until at least 1970.

Effective Age of AOC: *70 Years*

General Physical Conditions

No physical evidence of the existence of the UST was identified during Phase I. Analysis of soil samples taken from the boring for monitoring well MW-16 detected phenanthrene, a key indicator compound for oil, as did analysis of a groundwater sample from the well. Visual contamination was documented during the completion of the monitoring well.

Closure Method

In 1971, the former pH adjustment pit and the nickel filter shed were either constructed over the former UST or the UST was removed. No other information on tank closure is known.

Information Sources: *Historic Sanborn Fire Insurance Maps and Factory Mutual Drawings*

Close File

Table 14-15
AREA OF CONCERN CHARACTERISTICS: AOC 52

Solid Waste Management Unit Number: 52 **Item/Description:** Former Fuel Oil USTs	
Location of AOC:	*Beneath the northern wall of Building 17; oriented north-south parallel to the east wall of Building 4.*
Type of AOC:	*Fuel Oil USTs*
Design Features	
The two USTs are shown on Sanborn Fire Insurance Maps and Factory Mutual drawings from 1924 through 1970. Each UST had a capacity of 10,000 gallons.	
Operating Practices	
Past	*Storage of fuel oil.*
Present	*The USTs are no longer in use.*
Period of Operation	
The USTs were present from 1924 until at least 1970.	
Effective Age of AOC:	*70 Years*
General Physical Conditions	
No physical evidence of the existence of the UST was identified during Phase I.	
Closure Method	
No documentation was found indicating that the USTs were removed.	
Information Sources:	*Historic Sanborn Fire Insurance Maps and Factory Mutual Drawings*

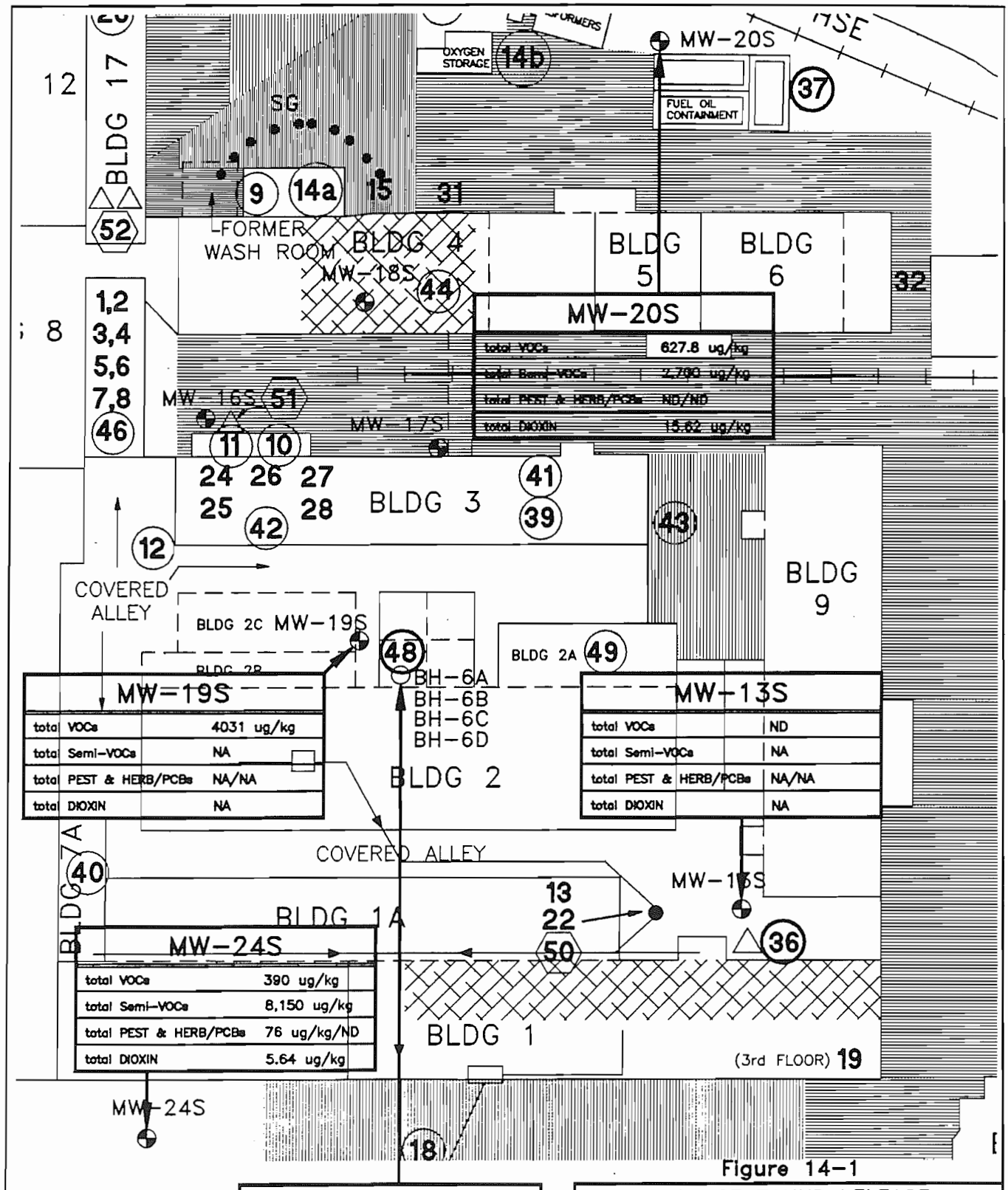

Figure 14-1

STORAGE TANKS RELEASE CHARACTERIZATION: SOIL

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=60' DATE: AUGUST, 1994

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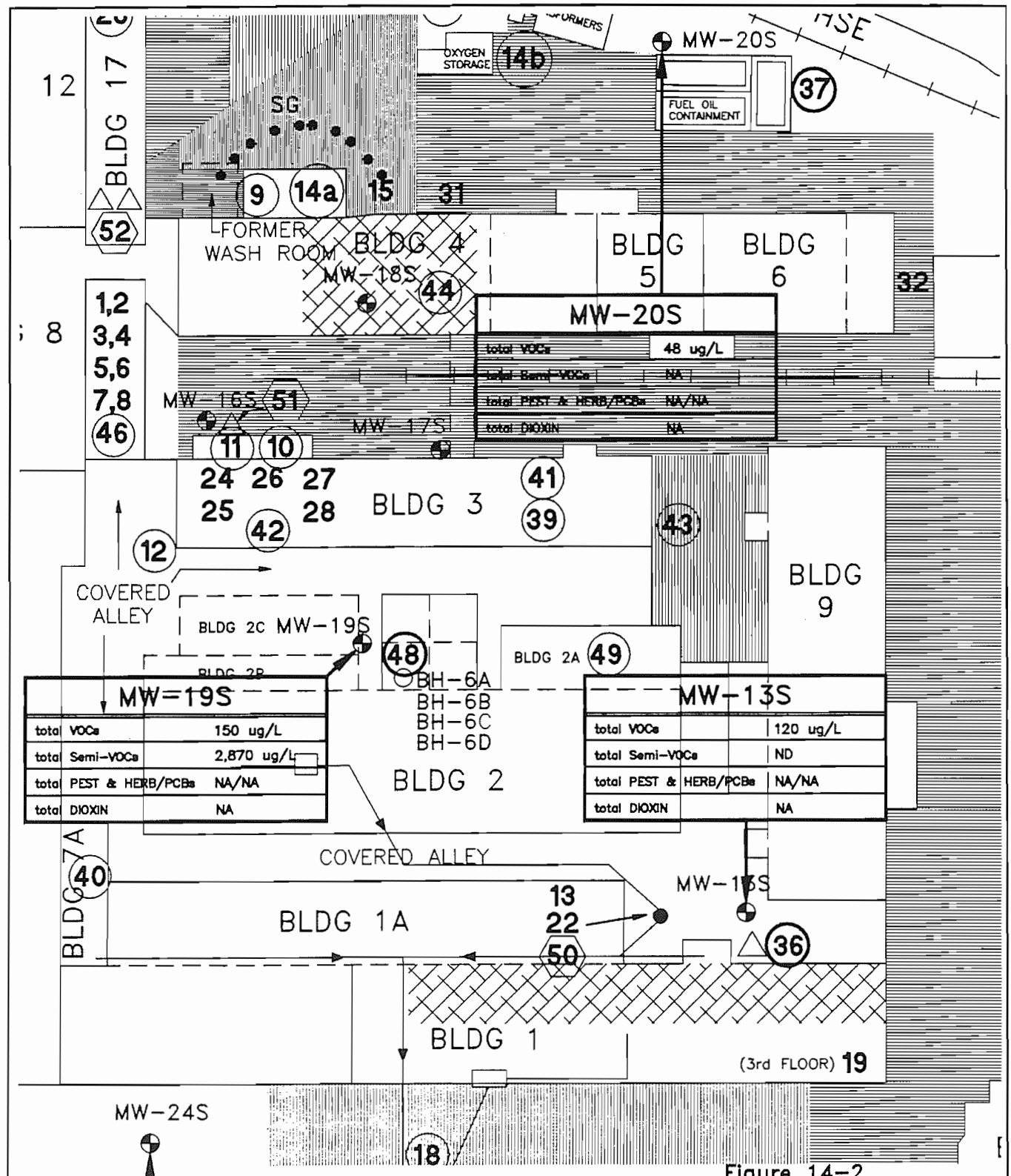

Figure 14-2

STORAGE TANKS RELEASE CHARACTERIZATION: GROUNDWATER

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=60' DATE: AUGUST, 1994

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15
RELEASE CHARACTERIZATION: OTHER OPERATIONS

15.1 OVERVIEW

This section discusses the objectives, AOC characteristics, methods of analysis, and results of the release characterization for AOCs associated with the other on-site operations. The AOCs include the stripping area floor drains (AOC 23), the pickling room drain and sump (AOC 40), the rim room (AOC 44), and the rack maintenance area (AOC 49). Objectives of the release characterization and the Phase I sampling locations for the other operations are discussed in Section 15.2. Construction and operational characteristics of the four (4) AOCs are discussed in Section 15.3. The results of sampling conducted by the EPA prior to Phase I of the RFI are discussed in Section 15.4. The results of Phase I sampling and analysis are summarized in Section 15.5. Section 15.6 ends with a summary of the results of release characterization, a discussion of data gaps, and other related issues, if any.

15.2 OBJECTIVES

The objective of the release characterization at other operation AOCs is to determine whether a release of hazardous constituents has occurred from the units. The Phase I characterization focused on releases to soil and groundwater. Phase I analytical results for soil and groundwater samples from monitoring wells MW-18S and MW-11I are utilized for the characterization. Releases to shallow and intermediate groundwater are monitored by these wells.

15.3 AOC CHARACTERISTICS

The other operations include operations at the Site not directly related to plating and wastewater treatment. These include paint stripping in Building 17, metal pickling in Building 7A, rim machining in Building 4, and plating rack maintenance in Building 2A. Currently, only the rack maintenance area (AOC 49) is actively utilized.

During the RFA, three (3) AOCs associated with other operations were identified (AOC 23, AOC 40, and AOC 44). One (1) additional AOC was identified during preparation of the RFI Proposal. The physical and operational characteristics of the AOCs are summarized in Tables 15-1, 15-2, 15-3, and 15-4. Concrete floor slabs underlie the stripping area floor drains (AOC 23), the pickling room drain and sump (AOC 40), and the rack maintenance area (AOC 49). Releases from these units may have migrated through cracks in the concrete and impacted soil and groundwater underlying the concrete. The rim room (AOC 44) is underlain by a wooden floor overlying a thin asphalt veneer (which may not be continuous) and soil. Releases to the wooden floor may impact soil and groundwater beneath Building 4.

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Table 15-1
AREA OF CONCERN CHARACTERISTICS: AOC 23

Solid Waste Management Unit Number: 23 **Item/Description:** Stripping Area Floor Drains	
Location of AOC:	*Building 12.*
Type of AOC:	*Floor Drains*
Design Features	
The drains are "U" trenches 20-feet long by 6-inches deep constructed of concrete and covered by with steel grates.	
Operating Practices	
Past	*Same as present practices.*
Present	*Spills and leaks of alkalis and phosphates from the paint stripping vats are collected in the trench drains and discharged to the sanitary sewer via a sump.*
Period of Operation	
The trench drains have been in operation since 1984.	
Effective Age of AOC:	*10 Years*
General Physical Conditions	
The integrity of this unit was deemed sound upon visual inspection.	
Closure Method	
This is an active unit.	
Information Sources:	*RFI Proposal, Draft EPA Site Evaluation, RCRA Facility Assessment*

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Table 15-2
AREA OF CONCERN CHARACTERISTICS: AOC 40

Solid Waste Management Unit Number: 40 **Item/Description:** Pickling Room Drain and Sump	
Location of AOC:	*Building 7A; the sump is located just south of Building 7A.*
Type of AOC:	*Floor Drains and Sump*
Design Features	
The floor drains and sump are constructed of concrete covered by steel grates. The sump is 4-feet by 4-feet by 1-foot deep.	
Operating Practices	
Past	*The drains and sump received overflows, spills and discharges of spent phosphoric acid and soda ash from the pickling operation. The sump discharged to the sanitary sewer.*
Present	*Spent pickling liquids are now pH adjusted in Tank 11 (AOC 12) prior to discharge to the WWTP. Currently, the pickling area is utilized very infrequently; the pickling area is not in the current production line.*
Period of Operation	
Building 7A was constructed in 1953 to house the pickling operation.	
Effective Age of AOC:	*41 Years*
General Physical Conditions	
The integrity of the units appeared sound based on visual observations. Metal corrosion was evident, but did not appear to affect the integrity of the unit.	
Closure Method	
This is an active, but rarely used, unit.	
Information Sources:	*RFI Proposal, RCRA Facility Assessment*

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Table 15-3
AREA OF CONCERN CHARACTERISTICS: AOC 44

Solid Waste Management Unit Number: 44 **Item/Description:** Rim Room	
Location of AOC:	*Building 4*
Type of AOC:	*Rim Manufacturing Area with Wooden Floor*
Design Features	
The wooden floor near the rim machines is underlain by a thin layer of asphalt over soil. Approximately 2,200-square-feet of wooden floor is located in Building 4.	
Operating Practices	
Past	*Water soluble cutting oil utilized by the rim machines appears to have been spilled onto the wooden floor during normal operation. The majority of the cutting oil was placed in barrels and transported off-site.*
Present	*No current manufacturing activities are conducted in this area.*
Period of Operation	
The wooden flooring and asphalt layer was part of the original building construction completed around 1915. Manufacturing no longer takes place over the wooden floor area.	
Effective Age of AOC:	*79 Years*
General Physical Conditions	
In September 1988, the RFA investigative team noted oil collection containers under the rim machines on the wooden floor and observed that the wood floor was apparently stained with cutting oil. Soil samples exhibiting elevated levels of petroleum hydrocarbons were collected from beneath this floor during Phase I activities.	
Closure Method	
Rim manufacturing operations were discontinued around 1991.	
Information Sources:	*RFI Proposal, EPA Draft Site Evaluation, RCRA Facility Assessment*

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Table 15-4
AREA OF CONCERN CHARACTERISTICS: AOC 49

Solid Waste Management Unit Number: 49 **Item/Description:** Rack Maintenance Area	
Location of AOC:	*In the covered alley between Buildings 2 and 3.*
Type of AOC:	*Rack Maintenance Area*
Design Features	
This area is underlain by a concrete floor slab.	
Operating Practices	
Past	*Same as current practices.*
Present	*In this area metal plated to racks is chipped off and a PVC epoxy is applied to the racks. MOCAP 84 is utilized to coat the racks.*
Period of Operation	
The startup date of this unit and the use of PVC epoxy is not known.	
Effective Age of AOC:	*Unknown*
General Physical Conditions	
The floor in this area is covered with metal plating chips. The concrete floor slab in this area appears to be of sound integrity by visual observation.	
Closure Method	
This is an active unit.	
Information Sources:	*RFI Proposal*

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15.4 PREVIOUS SAMPLING AND ANALYSIS

In 1991, the EPA sampled intermediate depth groundwater downgradient of the pickling room drain and sump (AOC 40) at well MW-11I. A groundwater sample, EPA sample number 01057/01058, was analyzed for total and dissolved metals (cadmium, chromium, copper, nickel, and zinc), total cyanide, and VOCs by EPA Method 8240. The EPA also collected a soil sample (Location 11) from 10-inches below the floor of the rim room (AOC 44) near the south wall. The soil sample was analyzed for VOCs by EPA Method 8240. Summaries of positively identified analytes in 1991 EPA samples are included in Appendix B. Full laboratory analysis reports were included in Appendix I of the RFI Proposal (Volume 2).

Two (2) VOCs, trichloroethylene and napthalene, were positively detected in the soil sample beneath the rim room floor at concentrations of 240 μg/kg and 580 μg/kg, respectively. Four (4) compounds were tentatively identified in the sample, napthalene (methyl substituted), napthalene (dimethyl substituted), acenaphthene, and 1,1,-biphenyl.

Total concentrations of chromium, nickel, and zinc were detected in groundwater from well MW-11I at concentrations of 7 μg/L, 23 μg/L, and 27 μg/L, respectively. These concentrations are below the applicable MCLs for the analytes. No total cyanide was detected (detection limit 10 μg/L) in groundwater from well MW-11I. Three (3) VOCs, 1,2-dichloroethylene isomers, trichloroethylene, and tetrachloroethylene, were detected in groundwater from MW-11I. Trichloroethylene was detected at the maximum analyte concentration, 14 μg/L. The total VOC sample concentration was 26 μg/L.

15.5 PHASE I SAMPLING AND ANALYSIS

Release characterization sampling for other operation AOCs focused on soil and groundwater. Samples of those media from one (1) groundwater monitoring well, MW-18S, installed during Phase I of the RFI are discussed in this section.

15.5.1 Soil Sampling

Monitoring well MW-18S was installed through the wooden floor of Building 4. Visual and olfactory contamination was observed between four (4) and ten (10) feet below floor level. Soil samples from the installation of monitoring well MW-18S were collected from continuous two foot (2') intervals.

15.5.2 Soil Analysis

Soil samples collected during the advancement of the boring for well MW-18S were screened for the presence of VOCs with a PID. Elevated VOC levels, which were defined as readings greater than 10 ppm above background, are shown in Table 15-5. Elevated VOC levels were detected in samples from four (4') to ten (10') feet below floor level in the boring for MW-18S.

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Table 15-5
VOC SCREENING RESPONSES FOR SOIL HEADSPACE - OTHER OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Sampling Interval (feet)	VOC Concentration[1] (ppm)
MW-18S	
4-6	48
6-8	109
8-10	29
10-12	21

1 Screening responses greater than 10 ppm above background are shown in the table.

In accordance with the RFI Proposal, soil samples from monitoring well MW-18S (originally boring BH-2) were analyzed on-site for TPH to evaluate the release of petroleum (cutting oil) in the vicinity of the well. Soil samples with TPH concentrations in excess of 50 mg/kg were submitted to the Tighe & Bond laboratory for metals, VOC, and TPH analysis. All samples analyzed for TPH on-site contained concentrations of TPH greater than 50 mg/kg. The results of on-site analysis for TPH are shown in Table 15-6.

Table 15-6
SUMMARY OF ON-SITE TPH ANALYSIS - OTHER OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Interval (feet)	TPH Concentration (mg/kg)
MW-18S	
0 - 2	490
2 - 4	700
4 - 6	23000
6 - 8	8300
8 - 10	6400

Summaries of positively identified analytes in soil samples collected from MW-18S are included in Appendix L. The qualitative summaries included in Appendix L are also presented in Table 15-7 and Table 15-8.

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Table 15-7
ORGANIC COMPOUNDS IN SOIL SAMPLES - OTHER OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (µg/kg)		Total Sample Concentration (µg/kg)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Volatile Organics	4 - 5	0	1	ND	3000	ND	3000
Semivolatile Organics	0 - 0	-	-	-	-	-	-
Pesticides	0 - 0	-	-	-	-	-	-
PCBs	0 - 0	-	-	-	-	-	-
Organophosphorus Pesticides	0 - 0	-	-	-	-	-	-
Chlorinated Herbicides	0 - 0	-	-	-	-	-	-
Dioxin	0 - 0	-	-	-	-	-	-

VOCs: Two (2) volatile organic compounds, ethylbenzene and methylene chloride, were detected in soil samples analyzed for VOCs. Ethylbenzene was detected at the highest analyte concentration, 3,000 µg/kg, in the sample from the 6- to 8-foot interval in well MW-18S. The highest total VOC concentration, 3,000 µg/kg, was also detected in that interval.

Semivolatiles: Phase I groundwater samples from monitoring well MW-18S were not analyzed for semivolatile organic compounds.

PCBs/Pesticides/Herbicides: Phase I groundwater samples from monitoring well MW-18S were not analyzed for PCBs, pesticides, or herbicides.

Dioxin: Phase I groundwater samples from monitoring well MW-18S were not analyzed for dioxin.

The total concentrations of VOCs, semivolatiles, PCBs/Pesticides/Herbicides, and Dioxin for monitoring well MW-18S are shown on Figure 15-1. These concentrations are the sum of the total sample concentrations for all samples from that location.

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Table 15-8
INORGANIC COMPOUNDS IN SOIL SAMPLES - OTHER OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of samples detecting analyte - number of samples analyzed	Concentration of Individual Analytes (µg/kg)		Published Ranges of Metals in Soil[1] (µg/kg)	
		Minimum	Maximum	Minimum	Maximum
Chromium	5 - 5	11000	17000	78000	100000
Copper	5 - 5	8000	11000	24000	43000
Nickel	5 - 5	17000	90500	28000	35000
Vanadium	5 - 5	12000	27000	-	-
Zinc	5 - 5	26000	65500	74000	105000
Cyanide	0 - 0	-	-	-	-

1 Veneman, 1985.

Metals/Cyanide: Maximum concentrations of nickel (a plating metal) exceeded the published range for that metal. Cyanide analysis was not completed on Phase I soil samples from well MW-18S.

15.5.3 Groundwater Sampling

A groundwater sample was collected from monitoring well MW-18S. Additional wells are proposed in Phase II for this AOC grouping to augment the data collected from this monitoring well.

15.5.4 Groundwater Analysis

During sample collection, groundwater samples were screened in the field for temperature, redox potential (Eh), pH, conductance, and dissolved oxygen. The results of field screening are summarized in Table 15-9.

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Table 15-9
GROUNDWATER FIELD SCREENING RESULTS - OTHER OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Parameter	MW-18S
Temperature (°C)	18
pH (pH units)	5.89
Eh (mV)	57
Conductance (μmhos/cm @ 25°C)	570
Dissolved Oxygen (mg/L)	3

Groundwater was analyzed for VOCs, semivolatile organics, metals, and cyanide. Summaries of positively identified analytes in groundwater collected from MW-18S are included in Appendix L. No qualitative summaries are required since only one groundwater sample is utilized for characterization.

VOCs: Three (3) volatile organic compounds, cis-1,2-dichloroethene, etylbenzene, and trichlorethene, were detected in groundwater samples analyzed for VOCs. Ethylbenzene was detected at the highest analyte concentration, 170 μg/L. The total VOC concentration was 340 μg/kg.

Semivolatiles: Five (5) semivolatile organic compounds, dibenzofuran, fluoranthene, fluorene, phenanthrene, and pyrene, were detected in groundwater from MW-18S. Phenanthrene was detected at the highest analyte concentration, 260 μg/L. The total semivolatile organic concentration was 340 μg/L.

PCBs/Pesticides/Herbicides: Phase I groundwater samples from monitoring well MW-18S were not analyzed for PCBs, pesticides, or herbicides.

Dioxin: Phase I groundwater samples from monitoring well MW-18S was not analyzed for dioxin.

The total concentrations of VOCs and semivolatiles from MW-18S are shown on Figure 15-2.

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Table 15-10
INORGANIC COMPOUNDS IN GROUNDWATER - OTHER OPERATIONS
Columbia Manufacturing Company, Westfield, MA

Analyte	MW-18S (µg/L)	MCLs(µg/L)
Cadmium	27	5
Chromium	3100	100
Copper	350	1000
Nickel	1700	100
Vanadium	220	-
Zinc	1200	5000

Metals/Cyanide: Cadmium, chromium, and nickel concentrations in groundwater appear to be elevated in comparison with MCLs. Cyanide was not detected groundwater from MW-18S. Site-specific background concentrations have not been adequately determined at this time for release characterization purposes. MCLs, however, can be used as a benchmark to evaluate the significance of the data.

15.6 SUMMARY OF RELEASE CHARACTERIZATION

15.6.1 General Discussion of Results

This section discusses releases of organic and inorganic (metals/cyanide) analytes identified in soil and groundwater at the other operation AOCs.

Soil: Organic Compounds
Volatile organic compounds were identified in soil monitored at the rim room (AOC 44). The maximum VOC sample concentration ranged from below detection to 3,000 µg/kg. On-site analysis of soil samples identified TPH in concentrations ranging from 490 to 23,000 mg/kg. Phase I sampling did not include analysis for semivolatile organics, pesticides, herbicides, PCBs, or dioxin.

Soil: Metals/Cyanide
Nickel (a plating metal) was detected at concentrations in excess of published ranges. Cyanide analysis was not conducted on Phase I soil samples.

Groundwater: Organic Compounds
Volatile and semivolatile organic compounds were detected in shallow groundwater downgradient of the rim room (AOC 44). Maximum VOC sample concentrations ranged from below detection to 340 µg/L; semivolatiles from below detection to 340 µg/L. Phase I sampling did not include pesticide, herbicide, PCB, or dioxin analysis of groundwater from MW-18S. As described in Section 1, these compounds are not associated with this AOC grouping and will be eliminated from

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future monitoring of the rim room (AOC 44).

Groundwater: Metals/Cyanide
No cyanide was detected in groundwater monitored at the rim room (AOC 44). Plating metals appear elevated, however, site-specific background concentrations have not been adequately determined at this time. Metals associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN) will be included in subsequent investigations.

15.6.2 Data Gaps

Based on the release characterization for the other operation AOCs, the following data gaps have been identified. Data gaps have been organized by media since individual monitoring of each AOC was not conducted. Phase II activities designed to provide the data required for release characterization are discussed in Sections 20, 21 and 22.

Soil
The horizontal and vertical extent of soil contamination in the vicinity of the other operations AOCs needs to be delineated for VOCs, semivolatile organics, and metals. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

Groundwater
The horizontal and vertical extent of groundwater contamination in the vicinity of the other operations AOCs needs to be delineated for VOCs, semivolatile organics, and metals. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

15.6.3 Other Issues

Other issues could potentially include interim measures, additional media of concern for existing AOCs, and new AOCs identified during Phase I.

Interim Measures
No interim measures are deemed necessary based on the release characterization for the other operations.

Media of Concern
No additional media of concern were identified for other operations.

Areas of Concern

An additional AOC, the degreasers located in the west end of Building 1A, are now identified as AOC 50. The location of SWMU 38, a methylene chloride degreaser originally believed to be located in Building 1A, was actually in the southwest area of the warehouse as indicated in the RFA. The construction and operational characteristics of the degreasers are summarized in Table 15-11.

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Table 15-11
AREA OF CONCERN CHARACTERISTICS: AOC 50

Solid Waste Management Unit Number: 50 **Item/Description:** Degreasers	
Location of AOC:	*Degreaser room in the west end of Building 1A*
Type of AOC:	*Solvent degreasers*
Design Features	
The two degreasers are located in concrete lined pits in the concrete floor slab. The pits are shown on a 1956 proposed layout drawing of Building 1A. The pits are 7-feet wide by 10-feet long and are 2-1/2-feet deep. The concrete walls of the pit are shown as being a minimum of 6-inches thick. A 1-foot by 1-foot by 1-foot deep sump was constructed in each of the pits. The sumps discharge to the sanitary sewer.	
Operating Practices	
Past	*The degreasers formerly utilized trichloroethene (TCE) and were later converted to methylene chloride.*
Present	*The degreasers are not currently in operation.*
Period of Operation	
The degreasers were in use since construction of Building 1A, approximately 1956, until approximately 1991 when bicycle manufacturing ceased. The degreasers utilized TCE until, approximately, the late 1970s. In 1988, both degreasers were in operation and both used methylene chloride; in 1990, one degreaser was in operation, using methylene chloride.	
Effective Age of AOC:	*38 Years*
General Physical Conditions	
The integrity of the concrete lined pits was deemed satisfactory based on visual observations.	
Closure Method	
These units are active, but currently are not in use.	
Information Sources:	*CMC Engineering Files*

Phase II tasks will focus on AOC 23, 40, and 44 only. In addition to the borings and wells proposed to better delineate releases from these AOCs, Phase II tasks will include inspections of equipment operation practices to identify specific leaks, and develop system improvements to prevent future releases from this AOC grouping. The rim room will not be included in these inspections as it is no longer an active unit. Additional research will be performed during Phase II to investigate the history of operation at the rim room (AOC 44).

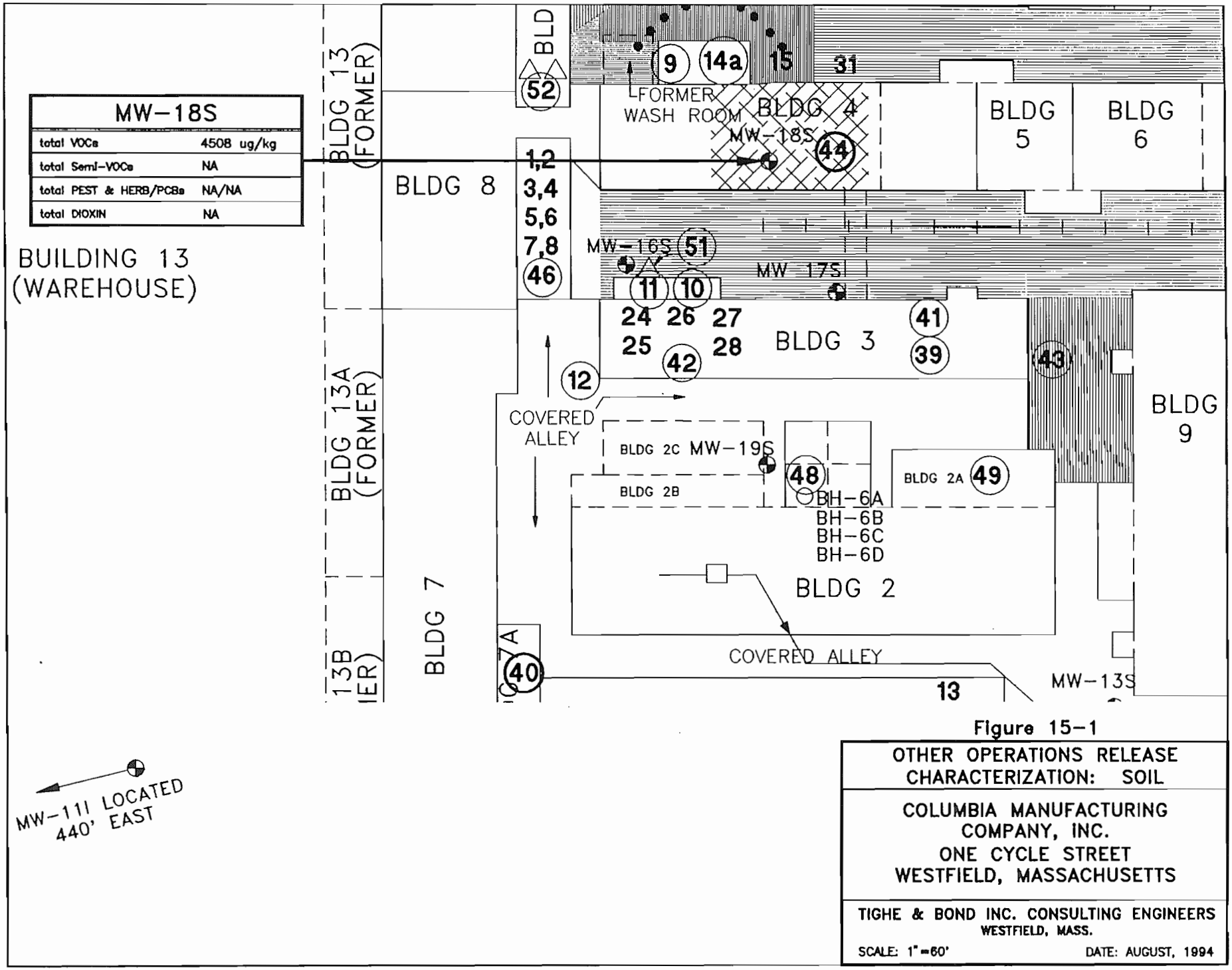

Figure 15-1

OTHER OPERATIONS RELEASE CHARACTERIZATION: SOIL

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=60' DATE: AUGUST, 1994

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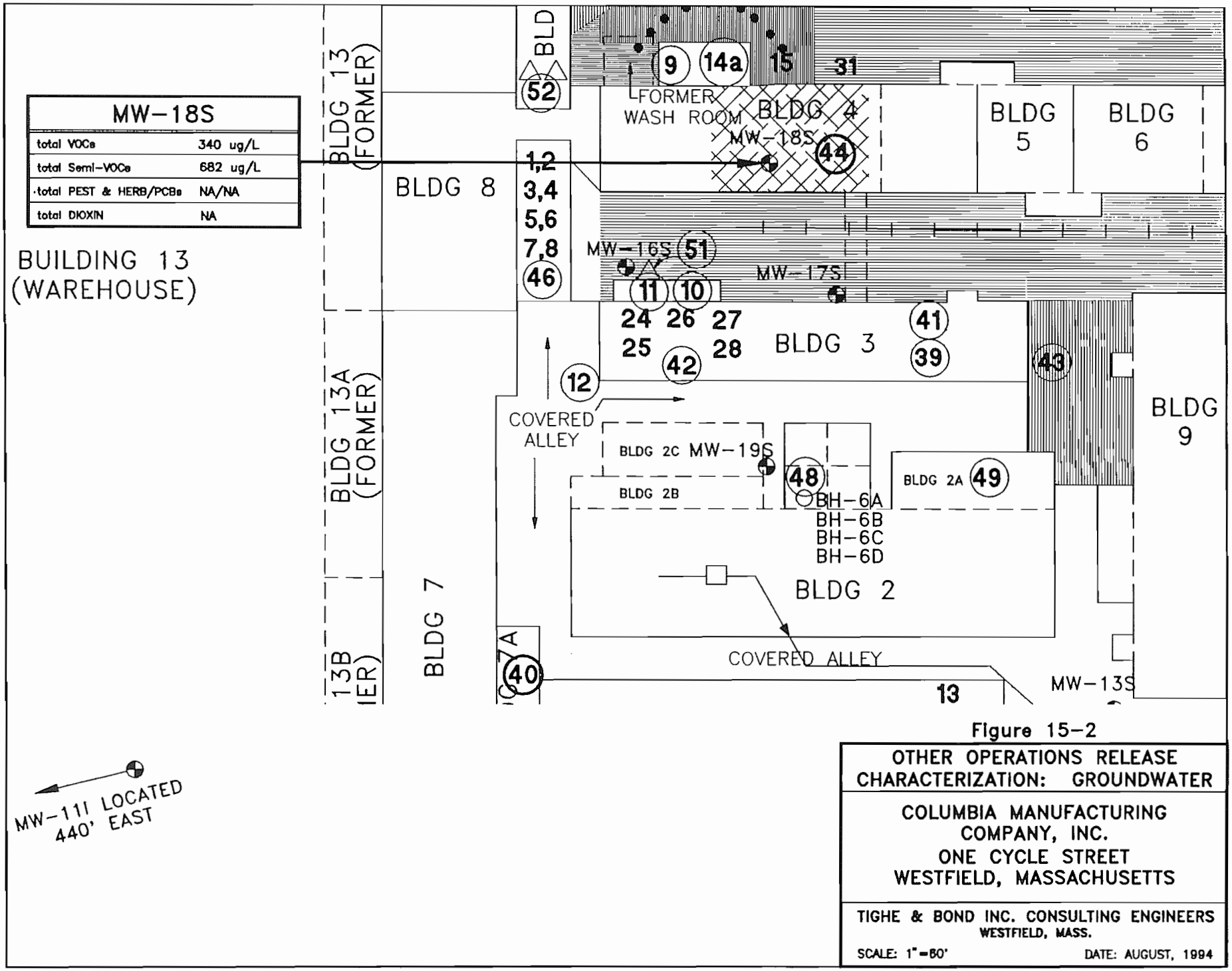

Figure 15-2

OTHER OPERATIONS RELEASE CHARACTERIZATION: GROUNDWATER

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=60' DATE: AUGUST, 1994

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16
OFF-SITE RELEASE CHARACTERIZATION

16.1 OVERVIEW

This section discusses the objectives, methods of analysis, and results of the off-site release characterization. Objectives of the release characterization and the Phase I sampling locations for the off-site release characterization are discussed in Section 16.2. The results of sampling conducted by the EPA prior to Phase I of the RFI are discussed in Section 16.3. The results of Phase I sampling and analysis are summarized in Section 16.4. Section 16.5 ends with a summary of the results of release characterization, a discussion of data gaps, and other related issues, if any.

16.2 OBJECTIVES

The objective of the off-site release characterization is to determine whether releases of hazardous constituents at the Site have migrated off-site. No AOCs are specifically targeted in this release characterization. The Phase I off-site release characterization focused on releases to soil and groundwater. Phase I analysis results for soil and groundwater samples from monitoring wells MW-9I/D, MW-21S, and MW-22S; and results for groundwater samples from wells MW-8S, MW-9S, MW-9I, and MW-9D are utilized for the characterization.

The MW-8 series and MW-9 series (MW-8S, MW-8I, MW-9S, MW-9I, MW-9I/D, and MW-9D) are located along the property boundary in the southeast portion of the Site. These wells monitor shallow, intermediate, intermediate/deep, and deep groundwater. Monitoring wells MW-21S and MW-22S are located off-site to the south and southeast, respectively. These wells monitor shallow groundwater only. Well MW-23S is cross gradient of the site in shallow groundwater.

16.3 PREVIOUS SAMPLING AND ANALYSIS

In 1991, the EPA sampled intermediate depth groundwater at monitoring well MW-8I (EPA samples 01059 and 01060). Groundwater was analyzed for total and dissolved metals (cadmium, chromium, copper, nickel, and zinc), total cyanide, and VOCs by EPA Method 8240. Summaries of positively identified analytes in 1991 EPA samples are included in Appendix B. Full laboratory analysis reports were included in Appendix I of the RFIP (Volume 2).

One (1) VOC, acetone, was detected in groundwater from well MW-8I at a concentration of 2 μg/L. Total and dissolved concentrations of metals were detected in groundwater from well MW-8I. The analytical results of samples collected for inorganic parameters in groundwater are summarized in Table 16-1. MCLs for the inorganic analytes are shown in Table 16-1 for reference.

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Table 16-1
INORGANIC ANALYTES IN GROUNDWATER - 1991 EPA DATA -
OFF-SITE MONITORING
Columbia Manufacturing Company, Westfield, MA

Analyte	MW-8I		MCLs (µg/L)
	Total (µg/L)	Dissolved (µg/L)	
Cadmium (µg/L)	15	10	5
Chromium (µg/L)	1789	1176	100
Copper (µg/L)	46	< 12	1000
Nickel (µg/L)	9364	6596	100
Zinc (µg/L)	110	56	5000
Total Cyanide (µg/L)	14	NA	-
Amenable Cyanide (µg/L)	NA	NA	-

NA Not analyzed
- No MCL established

16.4 PHASE I SAMPLING AND ANALYSIS

Off-site release characterization sampling focused on soil and groundwater. Samples of those media from three (3) groundwater monitoring wells installed during Phase I of the RFI and groundwater from four (4) previously installed wells are discussed in this section.

16.4.1 Soil Sampling

Monitoring well MW-9I/D was installed along the southeast boundary of the Site between previously installed wells MW-9S and MW-9D. Wells MW-21S was installed on the east side of a tobacco barn located east of the Site and MW-22S was installed along the east side of South Meadow Road. Soil samples from the installation of these monitoring wells were collected from the 0- to 2-foot interval and at 5-foot intervals thereafter.

16.4.2 Soil Analysis

Soil samples collected during the advancement of the borings were screened for the presence of VOCs with a PID. No elevated VOC levels, those greater than 10 ppm above background, were detected in samples from the borings for MW-9I/D, MW-21S, or MW-22S.

Soil samples from the 0- to 2-foot and 5- to 7-foot intervals of wells MW-9I/D, MW-21S, and MW-22S were analyzed for VOCs, semivolatile organics, PCBs, metals and cyanide. Summaries of positively identified analytes in soil samples collected from MW-18S are included in Appendix O. The qualitative summaries included in Appendix L are also presented in Table 16-2 and Table 16-3.

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Table 16-2
ORGANIC COMPOUNDS IN SOIL SAMPLES - OFF-SITE MONITORING
Columbia Manufacturing Company, Westfield, MA

Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (µg/kg)		Total Sample Concentration (µg/kg)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Volatile Organics	1 - 6	0	4	ND	29	ND	73.9
Semivolatile Organics	1 - 3	0	3	ND	345	ND	845
Pesticides	0 - 0	-	-	-	-	-	-
PCBs	0 - 6	-	-	-	-	-	-
Organophosphorus Pesticides	0 - 0	-	-	-	-	-	-
Chlorinated Herbicides	0 - 0	-	-	-	-	-	-
Dioxin	0 - 0	-	-	-	-	-	-

VOCs: Four (4) volatile organic compounds, ethylbenzene, methylene chloride, 1,1,1-trichloroethane, and toluene, were detected in one (1) of six (6) soil samples analyzed for VOCs. Toluene was detected at the highest analyte concentration, 29 µg/kg, in the sample from the 0- to 2-foot interval in well MW-21S. The highest total VOC concentration, 73.9 µg/kg, was also detected in that sample.

Semivolatiles: Three (3) semivolatile organic compounds, di-n-butyl phthalate, fluoranthene, and pyrene, were detected in one (1) of three (3) soil samples analyzed for semivolatiles. Fluoranthene was detected at the highest analyte concentration, 300 µg/kg, in the sample from the 0- to 2-foot interval in well MW-21S. The highest total semivolatile organic concentration, 845 µg/kg, was also detected in the same interval.

PCBs/Pesticides/Herbicides: No PCBs were detected in soil samples monitoring off-site migration. Phase I soil samples from monitoring wells MW-9I/D, MW-21S, and MW-22S were not analyzed for pesticides or herbicides.

Dioxin: Phase I soil samples from monitoring wells MW-9I/D, MW-21S, and MW-22S were not analyzed for dioxin.

The total concentrations of VOCs, semivolatiles and PCBs for soils from borings for monitoring wells MW-9I/D, MW-21S, and MW-22S are shown on Figure 16-1. These concentrations are the sum of the total sample concentrations for all samples from that location.

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Table 16-3
INORGANIC COMPOUNDS IN SOIL SAMPLES - OFF-SITE MONITORING
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of samples detecting analyte - number of samples analyzed	Concentration of Individual Analytes (µg/kg)		Published Ranges of Metals in Soil[1] (µg/kg)	
		Minimum	Maximum	Minimum	Maximum
Cadmium	0 - 6	-	-	-	-
Chromium	6 - 6	7900	15000	78000	100000
Copper	4 - 6	ND	55500	24000	43000
Nickel	6 - 6	9800	24000	28000	35000
Tin	2 - 6	ND	6500	-	-
Vanadium	6 - 6	11000	20000	-	-
Zinc	5 - 6	ND	54000	74000	105000
Cyanide	0 - 6	-	-	-	-

1 Veneman, 1985.
- No published range for this metal from the reference.

Metals/Cyanide: Maximum concentrations of plating metals (chromium, nickel, and zinc) were below the maximum concentrations of published ranges for those metals. The maximum concentration of copper, 55,500 µg/kg, exceeds the maximum concentration of the published range for the metal. Copper was not detected in soil samples from MW-9I/D. Cyanide was not detected in soil samples monitoring off-site release migration.

16.4.3 Groundwater Sampling

Groundwater samples were collected from monitoring wells MW-8S, MW-9S, MW-9I, MW-9I/D, MW-9D, MW-21S, and MW-22S.

16.4.4 Groundwater Analysis

During sample collection, groundwater samples were screened in the field for temperature, redox potential (Eh), pH, conductance, and dissolved oxygen. The results of field screening are summarized in Table 16-4.

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Table 16-4
GROUNDWATER FIELD SCREENING RESULTS - OFF-SITE MONITORING
Columbia Manufacturing Company, Westfield, MA

Monitoring Well	Temperature (°C)	pH (pH units)	Eh (mV)	Conductance (μmhos/cm)	Dissolved Oxygen (mg/L)
MW-8S	12	6.19	64	230	5
MW-9S	14	5.71	93	390	5
MW-9I	18	5.15	94	440	4
MW-9I/D	12	5.69	53	310	7
MW-9D	12	8.61	45	550	2
MW-21S	13	5.94	110	280	6
MW-22S	15	5.89	120	610	3

Groundwater was analyzed for VOCs, metals, and cyanide. Summaries of positively identified analytes in groundwater are included in Appendix L. The qualitative summaries included in Appendix L are presented in Tables 16-5 and Table 16-6 with discussion of the substantive findi ngs.

Table 16-5
ORGANIC COMPOUNDS IN GROUNDWATER SAMPLES - OFF-SITE MONITORING
Columbia Manufacturing Company, Westfield, MA

Analytical Fraction	Number of Detections - Number Analyzed	Number of Analytes Detected/Sample		Concentration of Individual Analytes (μg/L)		Total Sample Concentration (μg/L)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Volatile Organics	7 - 7	1	3	ND	330	18	743.5
Semivolatile Organics	0 - 0	-	-	-	-	-	-
Pesticides	0 - 0	-	-	-	-	-	-
PCBs	0 - 2	-	-	-	-	-	-
Organophosphorus Pesticides	0 - 0	-	-	-	-	-	-
Chlorinated Herbicides	0 - 0	-	-	-	-	-	-
Dioxin	0 - 0	-	-	-	-	-	-

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VOCs: Three (3) volatile organic compounds, cis-1,2-dichloroethene, tetrachloroethene, and trichlorethene, were detected in groundwater samples analyzed for VOCs. Trichlorethene was detected at the highest analyte concentration, 330 µg/L in groundwater from MW-22S. The maximum total VOC concentration 743.5 µg/L, was also detected in groundwater from this well.

Semivolatiles: Phase I groundwater samples from wells monitoring off-site release migration were not analyzed for semivolatile organic compounds.

PCBs/Pesticides/Herbicides: Phase I groundwater samples from wells monitoring off-site release migration were not analyzed for pesticides or herbicides. PCBs were not detected in the two wells where this parameter was analyzed.

Dioxin: Phase I groundwater samples from wells monitoring off-site release migration were not analyzed for dioxin.

The total concentrations of VOCs, semivolatiles and PCBs are shown on Figure 16-2.

Table 16-6
INORGANIC COMPOUNDS IN GROUNDWATER - OFF-SITE MONITORING
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of samples detecting analyte - number of samples analyzed for the analyte	Concentration of Individual Analytes		MCL (µg/L)
		Minimum (µg/L)	Maximum (µg/L)	
Cadmium	0 - 7	-	-	5
Chromium	5 - 7	ND	2600	100
Copper	2 - 7	ND	59	1000
Nickel	6 - 7	ND	5300	100
Vanadium	1 - 7	ND	56	-
Zinc	5 - 7	ND	220	5000
Cyanide	0 - 7	-	-	200

- MCL not established

Metals/Cyanide: Chromium and nickel concentrations in groundwater appear to be elevated in comparison with MCLs. Cyanide was not detected in groundwater monitoring off-site release migration. Site-specific background concentrations have not been adequately determined at this t ime for release characterization purposes. MCLs, however, can be used as a benchmark to eval uate the significance of the data.

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16.5 SUMMARY OF RELEASE CHARACTERIZATION

16.5.1 General Discussion of Results

This section discusses releases of organic and inorganic (metals/cyanide) analytes identified in soil and groundwater which are indicative of off-site migration of hazardous constituents.

Soil: Organic Compounds
Volatile and semivolatile organic compounds were detected in one surficial (0- to 2- foot interval) soil sample located off-site at well MW-21S. The source of these compounds is unknown, but two compounds (ethylbenzene and toluene) are not common Site compounds and the sample was from a shallow, unsaturated depth near a tobacco barn. This suggests that the source of ethylbenzene and toluene is unrelated to releases at the site. Additional background data will be collected during Phase II to evaluate potential sources of these compounds.

Soil: Metals/Cyanide
Copper was detected at concentrations in excess of published ranges at off-site locations (MW-21S and MW-22S). Cyanide was not detected in off-site soil samples.

Groundwater: Organic Compounds
Volatile organic compounds were detected in shallow groundwater monitored by off-site sampling locations. VOCs were detected in shallow, intermediate, intermediate/deep, and deep groundwater along the southeast boundary of the Site. Phase I off-site release migration sampling did not include pesticide, herbicide, or dioxin analysis of groundwater. PCB's were not detected in groundwater in off-site wells.

Groundwater: Metals/Cyanide
Chromium and nickel concentrations in groundwater appear elevated in comparison with MCLs. Cyanide was not detected in groundwater from off-site release monitoring locations.

16.5.2 Data Gaps

Based on the release characterization for the on-site sludge disposal AOCs, the following data gaps have been identified. Data gaps are organized by media. Phase II activities designed to provide the data required are discussed in Sections 20, 21 and 22.

Soil
The horizontal and vertical extent of soil contamination in the vicinity of the off-site sampling location needs to be delineated for VOCs, semivolatile organics, and metals. Background samples will be collected from additional borings/monitoring wells proposed in Phase II to achieve this goal.

Groundwater
The horizontal and vertical extent of groundwater contamination in the vicinity of the off-site sampling location needs to be delineated for VOCs, semivolatile organics, and metals. Additional borings/monitoring wells are proposed in Phase II to achieve this goal. The potential presence of a plume of vinyl chloride should be evaluated by analyzing samples from downgradient off-site wells

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for VOCs using EPA Method 524.2 to detect that analyte at the Federal MCL of 2 μg/L. Well MW-8I should be re-sampled to confirm elevated metals concentrations reported in Phase I.

16.5.3 Other Issues

Other issues could potentially include interim measures, additional media of concern for existing AOCs, and new AOCs identified during Phase I.

Interim Measures
No interim measures are deemed necessary based on the release characterization for the off-site sampling locations.

Media of Concern
No additional media of concern were identified for the off-site sampling locations.

Areas of Concern
No additional areas of concern are associated with off-site release monitoring.

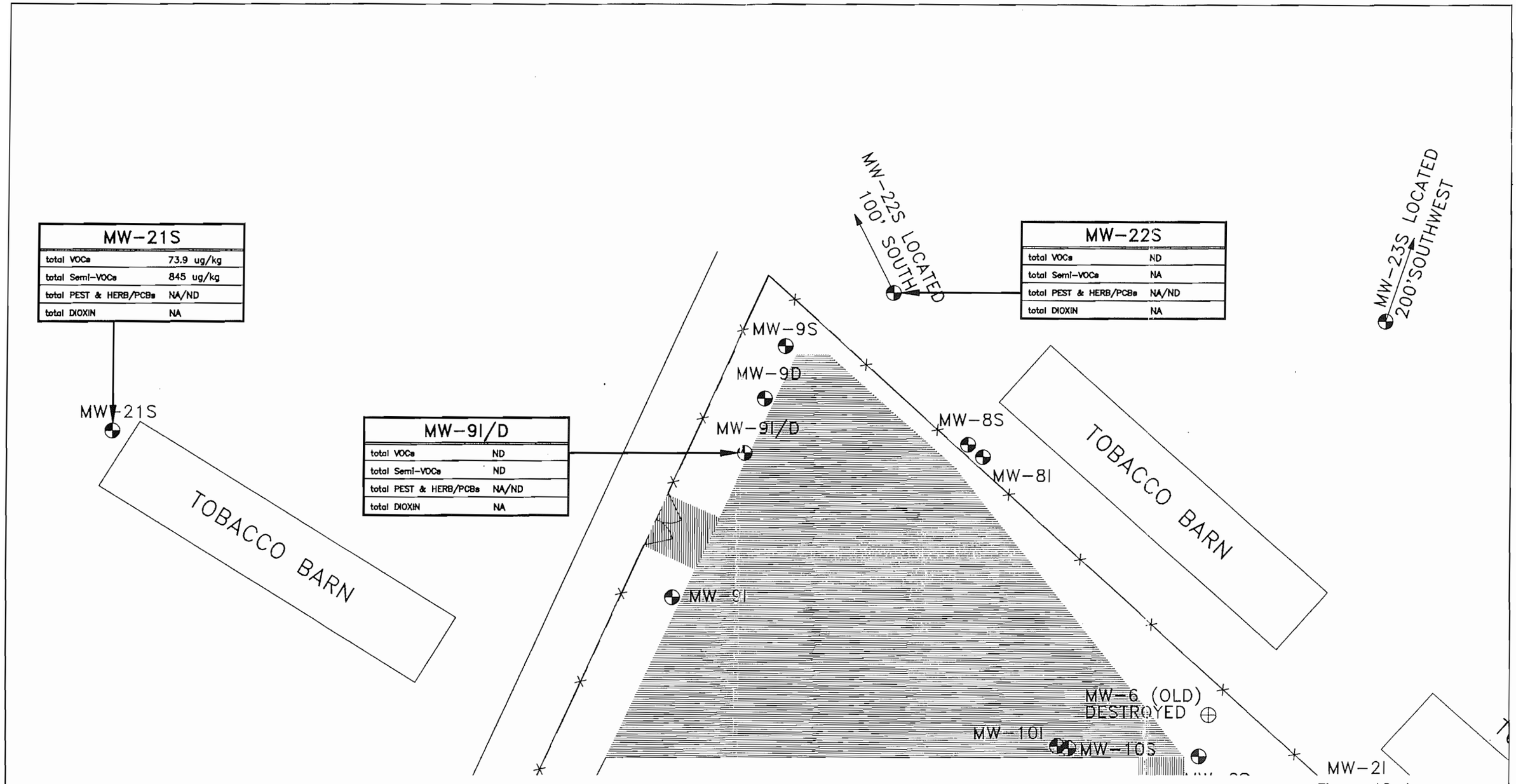

Figure 16-1

OFF-SITE MONITORING RELEASE CHARACTERIZATION: SOIL

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=50' DATE: AUGUST, 1994

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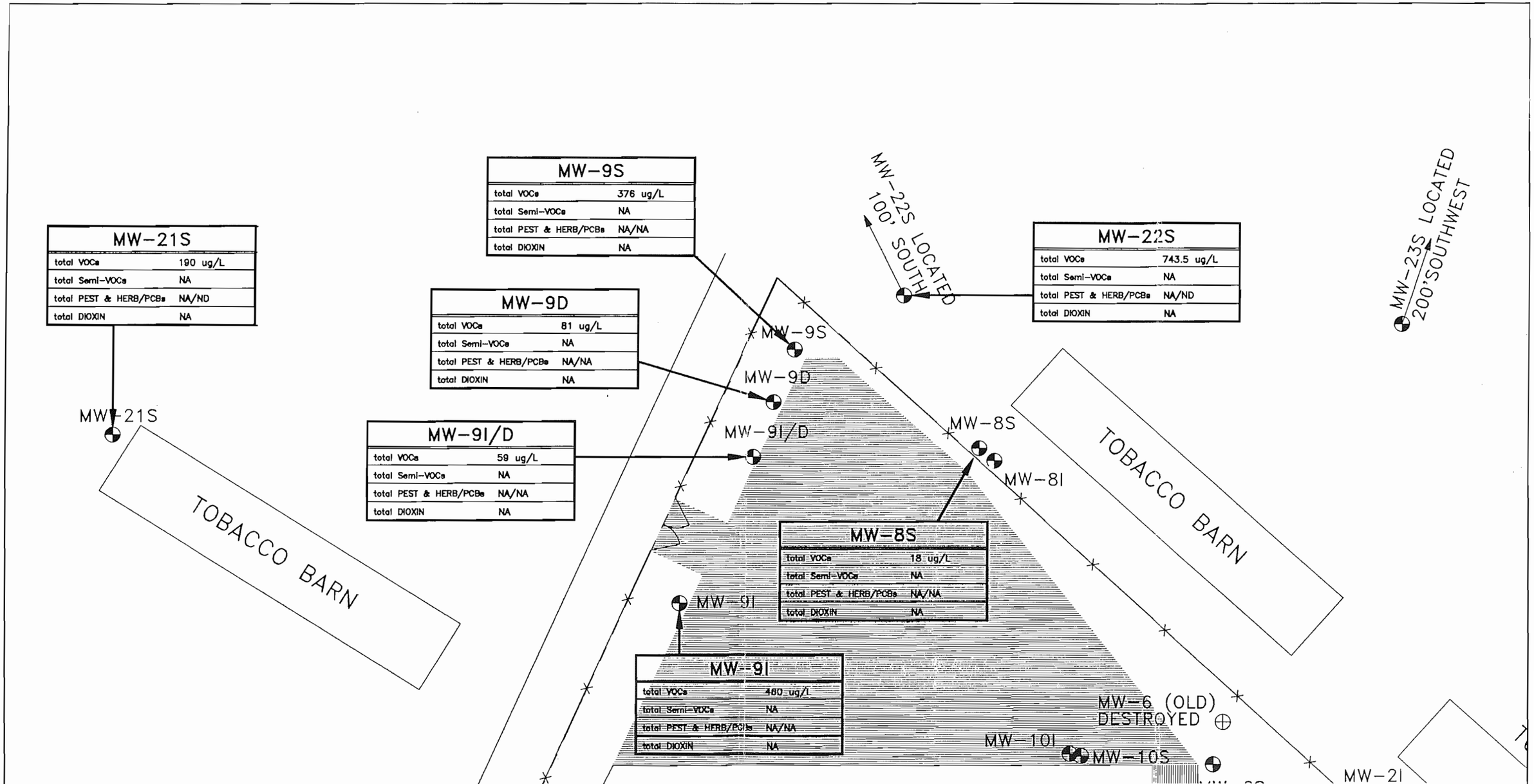

Figure 16-2

OFF-SITE MONITORING RELEASE CHARACTERIZATION: GROUNDWATER

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=50' DATE: AUGUST, 1994

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17
SUMMARY OF RELEASE CHARACTERIZATION

17.1 OVERVIEW

This Section provides an overall summary of the release characterization completed at each of the eight (8) on-site AOC groupings and the off-site release characterization. Section 17.2 summarizes the constituents identified in on-site media at each of the AOC groupings. Section 17.3 summarizes the data gaps identified in the Phase I release characterization. Section 17.4 outlines the primary findings of the release characterization.

17.2 SUMMARY OF CONSTITUENTS IDENTIFIED

To simplify the release characterization, the AOCs were sorted into groups which were separated by operational features. This also separated most groups geographically. The groupings include:

- Plating Operations
- Wastewater Treatment
- On-Site Sludge Disposal
- Waste Storage Yard
- On-Site Surface Water Bodies
- Utility Lines
- Storage Tanks
- Other Operations

The off-site release characterization does not address specific AOCs, but instead monitors the off-site migration of hazardous constituents. Table 17-1 and 17-2 summarizes the analytical fractions detected at each of the AOC areas. The concentrations shown on the table are the maximum total sample concentrations for the fractions. The maximum concentration of plating metals (Cd, Cr, Cu, Ni, Sn, V, or Zn) are shown in the metals column.

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Table 17-1
CONSTITUENTS IDENTIFIED IN SOIL AND GROUNDWATER
Columbia Manufacturing Company, Westfield, MA

AOC GROUPING	SOIL (µg/kg)						
	VOCs	SemiVOCs	Pesticides & Herbicides	PCBs	Dioxin	Metals	Cyanide
Plating Operations	3,000	6,800	23		4.51	19,000,000 (Cd)	
Wastewater Treatment	65	6,800	23		4.51	1,005,000 (Ni)	
On-Site Sludge Disposal	1,916	486,600	1,080		25.07	24,000,000 (Cu)	440,000
Waste Storage Yard	2,135	10100			5.56	5,900,000 (Sn)	
On-Site Surface Water Bodies	300	430			2.98	490,000 (Ni)	
Utility Lines	270	8150			4.67	270,000 (Cu)	
Storage Tanks	1,516.5	8150	76		7.70	19,000,000 (Cd)	
Other Operations	3,000					90,500 (Ni)	
Off-Site Monitoring	73.9	845				55,500 (Cu)	
GROUNDWATER (µg/L)							
Plating Operations	340	1,500				19,000 (Zinc)	110
Wastewater Treatment		19				5,300 (Ni)	
On-Site Sludge Disposal	5,200				56.52	5,900 (Cr)	2,300
Waste Storage Yard	5,200					2,900 (Cr + Ni)	
On-Site Surface Water Bodies	1,500					4,400 (Ni)	
Utility Lines	9,000					1,700 (Ni)	
Storage Tanks	9,000	2,600				19,000 (Zn)	
Other Operations	340	682				3,100 (Cr)	
Off-Site Monitoring	743.5					5,300 (Cr)	

(1) Shown in ng/L.

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Table 17-2
CONSTITUENTS IDENTIFIED IN SEDIMENT AND SURFACE WATER
Columbia Manufacturing Company, Westfield, MA

AOC GROUPING	SEDIMENT (µg/kg)						
	VOCs	SemiVOCs	Pesticides & Herbicides	PCBs	Dioxin	Metals	Cyanide
On-Site Surface Water Bodies						6,000,000 (Ni)	
Utility Lines	150	281,500				3,900,000 (Ni)	
SURFACE WATER (µg/L)							
On-Site Surface Water Bodies						*	
Utility Lines							

*No plating metals were included in the analysis of surface water samples.

17.3 SUMMARY OF DATA GAPS

Two (2) general data gaps have been identified in the Phase I release characterization. The first is that the nature and extent of contaminants in on-site media have not been adequately delineated. The second is rejected analytes which may inhibit the ability to characterize releases at the site.

17.3.1 Nature and Extent of Contaminants

The nature and extent of contaminants in on-site and off-site media needs to be more fully defined during Phase II. The extent, both horizontally and vertically, of fractions shaded in Table 17-3 and 17-4 in soil, groundwater, surface water, and sediment will be delineated during Phase II. The shading corresponds to the fractions detected in soil and groundwater as shown in Table 17-1, except for pesticides, herbicides, and PCBs. Since there is no historical source of pesticide or herbicide use or disposal at the Site, and since only a limited number of pesticides and herbicides were detected, these analytes will not be included in Phase II release characterization. Since PCBs were not detected in any soil or groundwater sample analyzed for the fraction, these analytes will not be included in Phase II release characterization. For consistency throughout the Site, semivolatile organics will be included in release characterization for soil and groundwater at all AOC groupings.

Table 17-4 shows the analytical fractions which will be evaluated for release characterization in Phase II at the on-site surface water bodies and utility lines. Cyanide, originally not included in the evaluation of surface water and sediment, will be added to the Phase II release characterization to determine if cyanide plating wastes have impacted these media at the Site.

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Table 17-3
ANALYTICAL FRACTIONS FOR PHASE II RELEASE CHARACTERIZATION
SOIL AND GROUNDWATER
Columbia Manufacturing Company, Westfield, MA

AOC GROUPING	SOIL (µg/kg)						
	VOCs	SemiVOCs	Pesticides & Herbicides	PCBs	Dioxin	Metals	Cyanide
Plating Operations							
Wastewater Treatment							
On-Site Sludge Disposal							
Waste Storage Yard							
On-Site Surface Water Bodies							
Utility Lines							
Storage Tanks							
Other Operations							
Off-Site Monitoring							
GROUNDWATER (µg/L)							
Plating Operations							
Wastewater Treatment							
On-Site Sludge Disposal							
Waste Storage Yard							
On-Site Surface Water Bodies							
Utility Lines							
Storage Tanks							
Other Operations							

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Table 17-4
ANALYTICAL FRACTIONS FOR PHASE II RELEASE CHARACTERIZATION - SEDIMENT AND SURFACE WATER
Columbia Manufacturing Company, Westfield, MA

AOC GROUPING	SEDIMENT (µg/kg)						
	VOCs	SemiVOCs	Pesticides & Herbicides	PCBs	Dioxin	Metals	Cyanide
On-Site Surface Water Bodies							
Utility Lines							
SURFACE WATER (µg/L)							
On-Site Surface Water Bodies							
Utility Lines							

17.3.2 Rejected Analysis Results

Analytical results were rejected at multiple locations in soil, groundwater and sediment. There were no rejected data from surface water samples collected at the Site. The data gaps caused by rejected results will be addressed in Phase II, if the lack of data limits the release characterization. For example, if an analyte is not characteristic of wastes generated at AOCs monitored by a sampling location, then no corrective sampling is proposed. A similar conclusion is drawn where the rejected analyte has not been detected at the Site. Table 17-3 identifies sample locations were analytical results were rejected, the rejected analyte or analytical fraction, the rationale utilized to determine if resampling is required, and a determination of the need for resampling.

Table 17-5
REJECTED ANALYTE RESAMPLING
Columbia Manufacturing Company

Sample IDs	Rejected Analyte/Fraction	Rationale	Resample
Soils			
BH-1, 0-1' BH-1, 1-2' BH-1, 5-6'	Cadmium	Rejected in all samples from BH-1	YES
BH-2, S-1 BH-2, S-3	Lead	Detected in the S-2 sample at BH-2	YES

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Sample IDs	Rejected Analyte/Fraction	Rationale	Resample
BH-5, 5-6'	VOCs & SemiVOCs	Rejected analytes include several detected in other on-site samples	YES
BH-8	-	Boring BH-8 will no longer be considered a background sampling location.	NO
MW-12B, S-1, duplicate	Cadmium	Detected in the S-1 sample from MW-12B (now MW-12I)	YES
MW-19, S-2 MW-19, S-3	Cadmium	Detected in other soil samples in this boring. Samples from Phase II sampling locations near MW-19 will be analyzed for cadmium.	NO(1)
MW-24, S-2 MW-24, S-4	Cadmium	Samples from Phase II sampling locations near MW-24S will be analyzed for cadmium.	NO(1)
MW-25, 35-37'	Numerous Parameters	Samples from Phase II sampling locations near MW-25D will be analyzed for Appendix IX parameters.	NO(1)
MW-14, S4-1 MW-14, S4-2	Lead & Cadmium	Cadmium and lead were detected in shallow soil samples at MW-14I. Samples from Phase II sampling locations near MW-14I will be analyzed for cadmium and lead.	NO(1)
MW-15, S2-1	VOCs & Cadmium	VOCs and cadmium were detected at other sampling locations at the Site.	YES
MW-17, S2-2 MW-17, S4-3	Lead Lead & Cadmium	Cadmium and lead were detected in the shallow soil sample (0-2' interval) in MW-17S. Elevated Lead and Cadmium in shallow sample	YES
MW-20	SemiVOCs, Cadmium, & Lead	A new boring (BH-12) will be installed to analyze for these parameters at each of the four (4) depths rejected during Phase I.	YES
MW-21	VOCs & SemiVOCs	VOCs and semivolatile organics were detected at other on-site sampling locations.	YES
MW-22	VOCs & SemiVOCs	VOCs and semivolatile organics were detected at other on-site sampling locations.	YES
GROUNDWATER	Selected volatile and semivolatile analytes were rejected during Phase I. The complete suite of Site monitoring wells will be sampled and analyzed for VOCs and semivolatiles during the Phase IIB activities.		
SEDIMENT			
SD-6	Cadmium, Lead	These analytes have been detected in soils/sediments at other on-site sampling locations.	YES

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Sample IDs	Rejected Analyte/Fraction	Rationale	Resample
SD-8	Cadmium	This analyte has been detected in soils/sediments at other on-site sampling locations.	YES
SURFACE WATER	There were no rejected analytes in surface water samples.		

1 Soils will be resampled in boreholes adjacent to original locations.

17.4 INITIAL RESULTS OF RELEASE CHARACTERIZATION

The initial release characterization portion of the Phase I investigation determined the following:

- VOC and metals were detected in soil samples from all nine (9) AOC groupings.
- Semivolatile organics were detected in soil samples from eight (8) of the nine (9) AOC groupings.
- Cyanide was detected in soil at one (1) AOC grouping, the on-site sludge disposal AOCs.
- Pesticides and herbicides were detected in soil samples from four (4) of the nine (9) AOC groupings. There were less than four (4) detections of pesticides and herbicides at and of those groupings.
- PCBs were not detected in soil samples from any AOC grouping.
- VOCs were detected in groundwater samples from eight (8) of the nine (9) AOC groupings.
- Semivolatile organics were detected in groundwater samples from four (4) of the nine (9) AOC groupings.
- Cyanide was detected in groundwater from two (2) of the nine (9) AOC groupings, plating operations and on-site sludge disposal.
- Dioxin was detected in groundwater from one (1) of the nine (9) AOC groupings, on-site sludge disposal.
- No pesticides herbicides, or PCBs were detected in groundwater samples from any of the AOC groupings.
- Metals were detected in sediment samples from two (2) AOC groupings, on-site surface water bodies and utility lines.
- VOCs and semivolatiles were detected in sediment form the utility lines.
- Metals were detected in surface water from on-site surface water bodies (specifically, the Fire Pond (AOC 34)).

Based on the findings of the initial release characterization completed in Phase I of the RCRA Facility Investigation, Phase II release characterization will be completed for analytical fractions identified or suspected at the AOC groupings. Sampling will also be conducted to re-evaluate rejected analytes at specific Phase I sampling locations.

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18
HEALTH AND ENVIRONMENTAL RISK ASSESSMENT

18.1 OVERVIEW

This section presents the Phase I Health and Environmental Risk Assessment (HERA). The Phase I HERA will be used in the preparation of a Draft Baseline Risk Assessment for the Site at the completion of the RCRA Facility Investigation. The Phase I HERA is and interim deliverable based upon the data collected during the Phase I RCRA Facility Investigation.

The Phase I objectives for the development of a Draft Baseline Risk Assessment are summarized in Section 18.2. The development of the preliminary risk assessment data set is presented in Section 18.3. Section 18.4 presents the baseline human health hazard identification, and Section 18.5 presents the human exposure assessment. Section 18.6 presents the hazard identification for the baseline ecological risk assessment. A discussion of the Phase I preliminary baseline risk assessment is presented in Section 18.7, including a summary of data gaps identified. Section 18.8 summarizes the analysis presented.

18.2 OBJECTIVES

The overall goal of the Human and Ecological Risk Assessment (HERA) of the RCRA Facility Investigation is to determine the need for interim corrective measures at the Site, and/or a Corrective Measure Study (CMS) for the Site. This is to be done by developing a set of health and environmental criteria to which measured or modelled site conditions may be compared. Development of a Draft Baseline Risk Assessment will be continued in an iterative sequence as more site data is accumulated.

The Phase I objectives for the HERA include:

- preliminary identification of human health hazards;
- preliminary assessment of human exposures (current and potential);
- preliminary identification of ecological hazards.

The data presented in the Phase I HERA will be re-evaluated and expanded upon in subsequent Phases of investigation, as described in Section 20.

18.3 DATA SOURCES AND DATA MANAGEMENT

This section describes the approach that was used to develop a preliminary data set to be used in conducting a quantitative risk assessment. In addition, the approach to developing the preliminary risk assessment data set, and a presentation of data summaries is also detailed. The full preliminary risk assessment data set for each environmental medium is presented in Appendix M. A summary of soil sample identifications and depths is also provided in that Appendix.

18.3.1 Development of the Preliminary Risk Assessment Data Set

Phase I data to be used in performing a quantitative risk assessment for the Site were derived from three (3) sources:

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- Data from samples collected by Tighe & Bond during Phase I field activities and analyzed by the Tighe & Bond Laboratory or Tighe & Bond Laboratory subcontractors. Data from this source are derived from the August, 1994 data presented in Appendix O;
- Data from split samples collected by EPA's field oversight contractor, TRC Environmental during Phase I field activities and analyzed by the Contract Laboratory Program;
- Data from samples collected by EPA in November, 1991 and analyzed by EPA's Lexington Laboratory.

These data sets were used to prepare comprehensive media-specific data sets in order to evaluate the extent of contamination in each environmental medium from which samples were analyzed.

18.3.2 Treatment of Non-detects, Duplicates and Split Samples

Multiple analyses from various locations resulted from the collection of duplicate samples in accordance with the quality assurance program outlined in the June, 1993 RFIP. These multiple analyses were averaged in the preparation of the risk assessment data set in order to avoid biasing the overall mean values. Sampling locations for which values were derived by averaging the results of multiple analyses are clearly indicated in the data sets in Appendix M.

For results reported as non-detected for all analytes in all media, ½ the detection limit was substituted as a result for calculation of ranges and averages of data.

Analytical data from duplicate sample analyses were averaged using the following protocols: if an analyte was detected in both samples then the results were averaged; if an analyte was detected in only one sample then the result of the detected analyte was utilized; if an analyte was not detected in either sample then the detection limits were averaged.

Statistical summaries of data are presented in the following sections for all positively identified analytes in each environmental medium. Statistical summary tables contain the following information:

- number of detections;
- number of analyses;
- maximum detected value;
- location of maximum;
- average concentration;
- minimum and maximum method detection limit (MDL) for non-detects.

The Frequency of Detection listed in the summary tables within the text of this section refers to the number of times each analyte was reported above the sample detection limit in the medium being summarized. At locations where multiple analyses were performed, only a single detection was included in the detection frequency.

For calculating the average value of each positively identified analyte within a medium, one half the detection limit was substituted for all non-detected results.

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Analytical data from the 1993 EPA split samples are presented separately in Appendix M. Statistical summaries calculated for those data are also presented in Appendix M. The split sample data will be compared to the data from the Tighe & Bond analyses when selecting contaminants of concern (COCs) in the next phase of the HERA. That comparison will be used to confirm the selection of COCs.

Values listed under the heading of "Maximum Detected Value" represent the highest reported value for each analyte, in that medium. The location of the maximum result is also listed. Analytes that were not detected in any sample in the medium being summarized are not listed in the summary table. As noted above, duplicate samples analyzed from a single location were averaged to remove bias from the overall mean.

18.3.3 Media Sampled and Analyses Performed

The Phase I Scope of Work specified analysis of various media at the Site for different sets of contaminants, based upon the identification of media of concern for each AOC. Categories of analyses performed on samples collected from each medium are summarized in Table 18-1 below.

Table 18-1
SUMMARY OF ANALYSES BY MEDIA
Columbia Manufacturing Company, Westfield, MA

Analyses (Method)	Soil	Groundwater	Surface Water	Sediment	Subsurface Gas
Metals[1]	X	X	X	X	X
Inorganics[1]	X	X	X	X	
Volatile Organics (8240)	X	X		X	
Semivolatile Organics (8270)	X	X		X	
Polychlorinated Biphenyls (8080)	X	X			
Organochlorinated Pesticides (8080)	X	X			
Organophosphorous Pesticides (8140)	X	X			
Dioxins (DFL M01.0)	X	X			
TPH (418.1)	X				
Total Organic Carbon[2]	X	X		X	

1 Analytes included for each medium are listed in media-specific tables in Section 2.
2 Analysis for TOC in soil and sediments was performed by the Lloyd Kahn Method. Analysis of TOC in groundwater and surface water was performed by EPA Method 9060.

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In the following sections, the extent of contamination is discussed for the analyses performed in each of the following groups:

- metals;
- volatile organics (VOCs);
- semivolatile organics (SVOCs);
- polychlorinated biphenyls (PCBs);
- pesticides and herbicides;
- dioxins;
- cyanide.

Analysis of TPH, and additional inorganics are not addressed in this section. TPH analysis is typically performed as an indicator of contamination more accurately characterized by VOC and SVOC analysis, and is not readily used for risk assessment.

Inorganics other than cyanide are not discussed in this section. Although they may indicate changes in environmental quality due to releases, they do not represent compounds known or suspected to have been used, stored or released at the Site. TOC results are not discussed below. TOC data may be used in later phases of assessment to evaluate the binding capacity of the Site media for various contaminants.

Analytical data for surface water and subsurface gas are not summarized in this section. The number of samples and analyses performed were not considered adequate to arrive at general statements regarding the extent of contamination in those media. Collection of additional surface water samples may be incorporated into the Phase IIB field activities. Data summaries for surface water analyses are included in Appendix M. The summaries will be updated if additional data are collected in future phases of the RFI.

Exceedances of MCLs are summarized for groundwater in Section 18.4. MCLs are not available for other environmental media.

18.4 HUMAN HEALTH HAZARD IDENTIFICATION

This section presents the Phase I data used to arrive at a preliminary evaluation of human health risks posed by the Site. This Phase I human health hazards identification includes identifying the extent of contamination at the Site in each environmental medium sampled. Data summaries are presented for all contaminants in each medium in which they were analyzed. The data are summarized in tabular form, illustrating the detection frequency, maximum detected concentration, location of the maximum detection, average concentration, and the minimum and maximum MDL for each analyte.

The 1993 EPA data summaries (located in Appendix M) were compared with the Phase I data summaries in this section (Tables 18-2 through 18-26). This comparison did not reveal any maximum detected values in the EPA data for any analyte which significantly exceeded maximum values in the Phase I data summarized below.

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18.4.1 Extent of Soil Contamination

Soil samples were collected at various depths from 25 soil borings advanced at the Site. Each of the soil samples was analyzed for parameters that were selected based upon the suspected contaminants present, as specified in the RFI Proposal.

The extent of contamination in Site soils was assessed by analysis of metals, VOCs, SVOCs, PCBs, pesticides, herbicides, dioxin and cyanide. The results of those analyses are discussed below for shallow (0-2'), intermediate (2-15') and deep (>15') soil zones. All analytical data for soils are reported in µg/kg. The number of samples analyzed by Tighe & Bond in each depth interval for each class of contaminants is listed in Table 18-2. Multiple analyses from a single location that were averaged are counted as a single analysis in the table below.

Statistical summaries from the 1993 EPA data (located in Appendix M) indicate that most of the maximum detected values for all parameters analyzed were found in soil located at boring BH-6 from six (6) to eight (8) feet deep.

Table 18-2
SOIL ANALYSIS SUMMARY
Columbia Manufacturing Company, Westfield, MA.

Depth Interval	VOCs	SVOCs	Metals	Herbi-cides	Pesti-cides	PCBs	Dioxins	Cyanide
Shallow (0-2')	26	24	26	7	7	7	3	23
Intermediate (2-15')	44	27	43	15	16	16	13	27
Deep (>15')	9	9	9	9	9	9	8	9

Metals

A total of 23 metals were analyzed in soil samples collected from the Site. In the discussion below, the data for only five (5) metals with a documented history of Site use and disposal are presented. These metals are used as indicators of contamination throughout this Phase I Report. Background levels of potential contaminants were not adequately characterized in Phase I to allow selection of COCs at this time. The need for additional background data is addressed in the Phase IIA proposal in Section 21. Statistical summaries and full data sets for all 23 metals are included in Appendix M.

Analytical data for five (5) indicator metals in shallow soil are summarized below. The maximum detected values for two (2) of the five (5) metals were found in soil from boring BH-3. Boring BH-3 is monitoring possible contamination from the former lagoons, the scrap metal fill area and the former incinerators. Data rejections occurred for only two (2) analytes. Cadmium data was rejected for three (3) samples, and lead data was rejected for one (1) sample. Chromium, nickel and zinc were detected in all samples analyzed.

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Table 18-3
SUMMARY OF METALS IN SHALLOW SOIL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Cadmium	15	26	300000	BH-3 0-2'	28200	500	1200
Chromium	26	26	600000	BH-3 0-2'	122000	-	-
Copper	24	26	7500000	BH-4 0-2'	874000	16000	33000
Nickel	26	26	1900000	BH-7 0-1'	390000	-	-
Zinc	26	26	6100000	BH-4 0-2'	912000	-	-

Analytical data for the five (5) indicator metals in intermediate soil are summarized below. The maximum detected values for four (4) of the five (5) metals was reported in soil from boring BH-4. Boring BH-4 is monitoring possible contamination from the former lagoons, the scrap metal fill area and the former incinerators. Data rejections occurred for only two (2) analytes. Cadmium data was rejected for seven (7) samples, and lead was rejected from three (3) samples. Chromium and Nickel were detected in all samples analyzed.

Table 18-4
SUMMARY OF METALS IN INTERMEDIATE SOIL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Cadmium	19	43	19000000	MW-19 S-4	551000	500	6000
Chromium	43	43	18000000	BH-4 4-6'	712000	-	-
Copper	38	43	24000000	BH-4 4-6'	919000	4300	11000
Nickel	43	43	22000000	BH-4 4-6'	1010000	-	-
Zinc	41	43	8400000	BH-4 2-4'	497000	20000	21000

Analytical data for four (4) indicator metals in deep soil are summarized in Table 18-5 below. Cadmium was not detected in three (3) samples, and data for that analyte was rejected in six (6) samples. The maximum detected values for two (2) of the four (4) metals was reported in soil collected from the boring for well MW-14. Well MW-14 is monitoring possible

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contamination from the waste storage yard. Chromium, nickel and zinc were detected in all samples analyzed.

Table 18-5
SUMMARY OF METALS IN DEEP SOIL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concen-tration	MDL for ND's	
						Min	Max
Chromium	9	9	200000	MW17-S4-3	44400	-	-
Copper	8	9	62000	MW14-S4-1	23700	12000	12000
Nickel	9	9	910000	MW16-S4-4	162000	-	-
Zinc	9	9	150000	MW14-S5-2	56300	-	-

Volatile Organic Compounds

A total of ten (10) VOCs were detected in soil samples collected during Phase I. The extent of contamination of soils by VOCs in the shallow, intermediate and deep soil zones is summarized below for all analytes reported above detection limits in any sample from each zone. Analytes not listed were not reported above detection limits in any sample from that zone.

Analytical data for all eight (8) VOCs detected in shallow soil are summarized in Table 18-6 below. The maximum detected values for three (3) of the eight (8) VOCs were reported in the boring for well MW-21. Well MW-21 is an off-site well monitoring possible contamination from the plating operations, wastewater treatment room sump, on-site sludge disposal, waste storage yard, stripping area floor drains, and pickling room drain and sump. The most frequently detected analyte was methylene chloride (14 detections). The analyte with the highest reported concentration in shallow soil was trichloroethene, detected at a concentration of 1,100 μg/kg in the averaged sample from MW-14I. Average concentrations were considerably more elevated in the shallow and intermediate soils as compared with deep soils.

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Table 18-6
SUMMARY OF VOCs IN SHALLOW (0-2') SOIL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Acetone	4	26	160	BH-6D S-1	121	80	1000
cis-1,2-Dichloroethene	1	26	46	BH-7 1-2'	7.68	5	62.5
Ethylbenzene	1	26	5.9	MW21-S1-1 AVERAGED	6.62	5	62.5
Methylene chloride	14	26	1100	BH-4 0-2'	132	10	125
Tetrachloroethene	1	26	335	MW 14-S1 AVERAGED	18.2	5	50
Toluene	1	26	26	MW21-S1-1 AVERAGED	7.39	5	62.5
1,1,1-Trichloroethane	1	26	29	MW21-S1-1 AVERAGED	7.51	5	62.5
Trichloroethene	7	26	1800	MW 14-S1 AVERAGED	128	5	50

Analytical data for all six (6) VOCs detected in intermediate soil are summarized in Table 18-7 below. The maximum detected values for two (2) of the six (6) VOCs were reported in soil collected from boring BH-4. Boring BH-4 is monitoring possible contamination from the former lagoons, the scrap metal fill area and the former incinerators. The most frequently detected analyte was methylene chloride (11 detections), which was also the compound with the highest reported concentration in shallow soil (1,100 μg/kg). Ethylbenzene was detected in nine (9) samples, with a maximum concentration of 3,000 μg/kg. The highest average and maximum values for most of the positively identified analytes were reported in samples from the intermediate soil zone. The apparently elevated average concentration of acetone in samples from this depth interval reflects elevated detection limits.

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Table 18-7
SUMMARY OF VOCs IN INTERMEDIATE (2-15') SOIL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Acetone	3	44	210	MW-6-S2-2	1410	80	48000
Ethylbenzene	9	44	3000	BH2 S-4	275	5	3000
Methylene chloride	11	44	1400	BH-4 2-4'	292	10	6000
1,1,1-Trichloroethane	1	44	6	MW-23 S2-3 AVERAGED	87.6	5	3000
Trichloroethene	5	44	130	BH-4 2-4'	94	5	3000
Total Xylenes	4	44	166.5	MW-19 S-5 AVERAGED	97.3	5	3000

Analytical data for all five (5) VOCs detected in deep soil are summarized in Table 18-8 below. The maximum detected values of two (2) of the five (5) VOCs were reported in soil collected from well MW-20. Well MW-20 is monitoring possible contamination from the fuel storage area. Average concentrations were considerably more elevated in the shallow soils as compared with intermediate and deep soils.

Table 18-8
SUMMARY OF VOCs IN DEEP (>15') SOIL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
2-Chloroethyl vinyl ether	1	9	10	MW12, S-5	20.6	10	150
cis-1,2-Dichloroethene	2	9	350	MW20-S4-4	49.8	5	50
Methylene chloride	2	9	11	MW-25 35-37'	21.2	10	150
Tetrachloroethene	2	9	25	MW17-S4-3	13.3	5	75
Trichloroethene	7	9	1200	MW20-S4-4	271	5	50

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Semivolatile Organics

A total of 17 semivolatile organic analytes were detected in soil samples collected during Phase I of the RFI. Analytical data for semivolatile organics in the shallow, intermediate and deep soil zones are presented in Appendix M for all analytes reported above detection limits in any sample from each zone. Seven (7) analytes were selected for summary in the following discussion based on factors such as frequency of detection, highest concentration, relative toxicity, and detection in more than one environmental medium.

Analytical data for seven (7) of the 17 semivolatile organics detected in shallow soil are summarized in Table 18-9 below. The maximum detected values for six (6) of the seven (7) semivolatile organics summarized below were reported in soil collected from the boring for MW-25. Well MW-25 is monitoring possible background contamination. The most frequently detected analytes were fluoranthene and pyrene (16 detections). The analyte with the highest reported concentration was indeno(1,2,3-cd)pyrene, which was detected at a concentration of 73,00 μg/kg (MW-25D 0-2').

Table 18-9
SUMMARY OF SEMIVOLATILE ORGANICS IN SHALLOW (0-2') SOIL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Benzo(a)anthracene	9	24	26000	MW25 0-2'	2360	200	2000
Benzo(a)pyrene	6	24	43000	MW25 0-2'	3130	200	2000
Chrysene	11	24	28000	MW25 0-2'	2560	200	1000
Fluoranthene	16	24	36000	MW25 0-2'	4330	200	400
Indeno(1,2,3-cd)pyrene	3	24	73000	MW25 0-2'	4120	200	2000
Phenanthrene	10	24	16900	MW 15-S1 AVE.	2670	200	1000
Pyrene	16	24	65000	MW25 0-2'	5970	200	400

Analytical data for seven (7) of the 16 semivolatile organics detected in intermediate soil are summarized in Table 18-10 below. The maximum detected values for all seven (7) semivolatile organics summarized below were reported in soil collected from boring BH-3, from 2-4' below grade. Boring BH-3 was advanced through the former lagoon area to monitor possible contamination from the former lagoons and the scrap metal fill area. Maximum reported concentrations for samples collected from the intermediate soil zone are generally comparable to those reported for the shallow soil zone except for data for fluoranthene, phenanthrene and pyrene. Maximum concentrations of these analytes are elevated relative to maximum concentrations reported in shallow soil samples. None of the analytes were detected in all 27 of the analyses.

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Table 18-10
SUMMARY OF SEMIVOLATILE ORGANICS IN INTERMEDIATE (2-15') SOIL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Benzo(a)anthracene	5	27	29000	BH-3 2-4'	1770	200	2500
Benzo(a)pyrene	3	27	30000	BH-3 2-4'	1860	200	2500
Chrysene	6	27	28000	BH-3 2-4'	1780	200	2500
Fluoranthene	8	27	68000	BH-3 2-4'	3710	200	2500
Indeno(1,2,3-cd)pyrene	1	27	36000	BH-3 2-4'	1790	200	2500
Phenanthrene	8	27	75000	BH-3 2-4'	4020	200	2500
Pyrene	8	27	75000	BH-3 2-4'	4480	200	2500

Analytical data for all three (3) semivolatile organics detected in deep soil are summarized in Table 18-11. The maximum detected values for all three (3) semivolatile organics were reported in soil collected from the boring for monitoring well MW-14. Well MW-14 is monitoring possible contamination in the former hazardous waste drum storage area, and the storage yard runoff area. Three (3) analytes, (fluoranthene, phenanthrene and pyrene) were detected in samples from the deep soil zone. Each analyte was detected once, in the sample collected from the 15'-17' depth interval in the boring for MW-14I. Maximum and average concentrations for these analytes were lower in this zone relative to the shallow and intermediate soil zones.

Table 18-11
SUMMARY OF SEMIVOLATILE ORGANICS IN DEEP (>15') SOIL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Fluoranthene	1	9	1800	MW14-S4-1	338	200	500
Phenanthrene	1	9	1400	MW14-S4-1	288	200	500
Pyrene	1	9	1700	MW14-S4-1	325	200	500

Only three (3) semivolatile organic analytes, (fluoranthene, phenanthrene and pyrene) were detected in samples from all three (3) soil zones identified. The highest concentrations of all three (3) of those analytes were reported in samples from the intermediate soil zone.

Polychlorinated Biphenyls

PCBs were not detected in any soil sample analyzed for those contaminants in Phase I.

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Pesticides and Herbicides

A total of five (5) pesticides and two (2) chlorinated herbicides were detected in soil samples collected during Phase I. The extent of contamination of soils by pesticides and herbicides in the shallow, intermediate and deep soil zones is summarized below for all analytes reported above detection limits in any sample from each zone. Analytes not listed were not reported above detection limits in any sample from that zone.

Analytical data for all four (4) chlorinated pesticides detected in shallow soil are summarized in Table 18-12 below. The maximum detected values for two (2) of those pesticides were reported in soil collected from boring BH-3. Boring BH-3 is monitoring possible contamination in the former lagoons and the scrap metal fill area. The chlorinated pesticide Lindane was detected with the greatest frequency (3 detections) and at the highest maximum concentration (1,000 μg/kg in BH-3, 0-2'). This is the highest detected concentration of any pesticide or herbicide in any sample collected during Phase I.

Table 18-12
SUMMARY OF PESTICIDES AND HERBICIDES IN SHALLOW (0-2') SOIL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Lindane: gamma-BHC	3	7	1000	BH-3 0-2'	200	40	40
4,4'-DDE	1	7	740	MW12A, S-1	123	40	40
Dieldrin	1	7	80	BH-3 0-2'	28.6	40	40
Heptachlor	1	7	60	BH-4 0-2'	25.7	40	40

Analytical data for all three (3) chlorinated pesticides and one (1) chlorinated herbicide detected in intermediate soil are summarized in Table 18-13 below. The maximum detected values for two (2) of the four (4) analytes detected were found in soil collected from boring BH-4. Boring BH-4 is monitoring possible contamination in the former lagoons area and the scrap metal fill area. The chlorinated pesticide Lindane was the pesticide detected with the greatest frequency in intermediate soil (5 detections) and at the highest maximum concentration (710 μg/kg in BH-3, 2-4'). The chlorinated herbicide 2,4-D was detected in soil collected from MW-16. This analyte was not detected in any other sample collected during Phase I.

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Table 18-13
SUMMARY OF PESTICIDES AND HERBICIDES IN INTERMEDIATE (2-15') SOIL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Lindane: gamma-BHC	5	16	710	BH-3 2-4'	130	40	40
Dieldrin	1	16	95	BH-4 4-6'	25.4	40	40
Endosulfan I	2	16	410	BH-4 4-6'	51.1	40	40
2,4-D	1	15	23	MW16-S2-2 AVERAGED	9.43	4	80

Analysis of nine (9) samples from the deep soil zone for pesticides and herbicides detected only one (1) analyte, the chlorinated herbicide dichloroprop. This compound was detected in soil collected from the boring for MW-24S at a depth of 20'-22'. Well MW-24 is monitoring possible contamination from the former sewer lines. Analytical data for pesticides and herbicides is summarized in Table 18-14 below.

Table 18-14
SUMMARY OF PESTICIDES AND HERBICIDES IN DEEP (>15') SOIL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Dichloroprop	1	9	76	MW-24 S-6	27.6	40	50

None of the seven (7) analytes detected by analysis of soil samples for chlorinated pesticides, organophosphorous pesticides, and chlorinated herbicides was found in all three (3) soil zones identified. Two (2) of the detected analytes were found in only one (1) sample. The analyte detected with the greatest frequency and the highest concentrations was Lindane, which was detected in soil samples collected from BH-3. Most of the maximum concentrations for analytes in this group were detected in soils from BH-3 and BH-4, which were advanced through the former lagoons.

Dioxins

The extent contamination of soils by dioxins in shallow, intermediate and deep soils is summarized below for all dioxin congeners reported above detection limits in any sample from each zone. Congeners not listed were not reported above detection limits in any sample from that zone.

Analytical data for eight (8) dioxins detected in shallow soil are summarized in Table 18-15 below. All eight (8) congeners were detected in all of the samples. The maximum detected values for four (4) of the eight (8) dioxins were reported in soils collected from boring BH-

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3. Boring BH-3 was advanced in the former lagoons to monitor possible contamination from the lagoons and the scrap metal fill area.

Table 18-15
SUMMARY OF DIOXINS IN SHALLOW (0-2') SOIL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Dioxin - Total TCCD	3	3	3.08	MW15-S1-2	2.85	-	-
Dioxin - Total PeCDD	3	3	0.09	BH-4 0-2'	0.053	-	-
Dioxin - Total HxCDD	3	3	0.58	BH-3 0-2'	0.34	-	-
Dioxin - Total HpCDD	3	3	1.61	MW15-S1-2	0.78	-	-
Furan - Total TCDF	3	3	0.51	BH-4 0-2'	0.4	-	-
Furan - Total PeCDF	3	3	1.17	BH-3 0-2'	0.68	-	-
Furan - Total HxCDF	3	3	1.38	BH-3 0-2'	0.71	-	-
Furan - Total HpCDF	3	3	0.82	MW15-S1-2	0.57	-	-

Analytical data for eight (8) dioxins detected in intermediate soil are summarized in Table 18-16 below. The maximum detected values for four (4) of the eight (8) dioxins were located at Boring - BH-4. Boring BH-4 was advanced in the former lagoons to monitor possible

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contamination from the lagoons and the scrap metal fill area. Furan - TCDF was detected in all samples analyzed, and was reported at the highest maximum concentration (14.3 μg/kg).

Table 18-16
SUMMARY OF DIOXINS IN INTERMEDIATE (2-15') SOIL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Dioxin - Total TCCD	12	12	5.75	MW20-S2-2	3.24	-	-
Dioxin - Total PeCDD	10	13	1.27	BH-4 4-6'	0.27	0	0.31
Dioxin - Total HxCDD	6	13	0.32	BH-4 4-6'	0.091	0.02	0.04
Dioxin - Total HpCDD	9	13	1.36	BH-4 4-6'	0.52	0.03	0.1
Furan - Total TCDF	13	13	14.3	BH-4 4-6'	1.8	-	-
Furan - Total PeCDF	10	13	2.4	MW15-S2-3	0.41	0.02	0.43
Furan - Total HxCDF	8	13	2.03	MW15-S2-3	0.42	0.01	0.02
Furan - Total HpCDF	9	13	1.08	BH-3 2-4'	0.28	0.05	0.88

Analytical data for eight (8) dioxins detected in deep soil are summarized in Table 18-17 below. The maximum detected values for four (4) of the eight (8) dioxins were reported in soils collected from well MW-14. Well MW-14 is monitoring possible contamination in the former hazardous waste storage area, and the storage yard runoff area. Three (3) analytes (Furan - total HpCDF, Dioxin - Total PeCDD, and Dioxin - Total TCCD) were detected in all samples analyzed.

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Table 18-17
SUMMARY OF DIOXINS IN DEEP (>15') SOIL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Dioxin - Total TCCD	8	8	3.58	MW14-S5-2	2.23	-	-
Dioxin - Total PeCDD	8	8	0.43	MW14-S4-1	0.19	-	-
Dioxin - Total HxCDD	1	8	0.07	MW-24 S-6	0.015	0.01	0.02
Dioxin - Total HpCDD	4	8	1.14	MW14-S5-2	0.46	0.01	0.04
Furan - Total TCDF	5	8	0.44	MW14-S5-2	0.24	0.32	0.54
Furan - Total PeCDF	6	8	0.98	MW-24 S-6	0.23	0.03	0.03
Furan - Total HxCDF	1	8	0.03	MW-24 S-4	0.0088	0.01	0.02
Furan - Total HpCDF	8	8	0.21	MW-24 S-4	0.14	-	-

Cyanide

The extent of contamination of soils by cyanide in the shallow and intermediate soil zones is summarized in Table 18-18 below. Cyanide was not detected in samples from the deep soil zone.

Table 18-18
SUMMARY OF CYANIDE IN SOIL
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Cyanide - Shallow	3	23	86000	BH-4 0-2'	11200	9000	20000
Cyanide - Intermediate	4	27	440000	BH-4 4-6'	26100	8000	20000

18.4.2 Extent of Groundwater Contamination

The extent of contamination in Site groundwater was assessed by analysis of metals, VOCs, SVOCs, PCBs, pesticides, herbicides, dioxin and cyanide. Those data are summarized below. Analytical data are reported in µg/L except for dioxins, which are reported in nanograms per liter (ng/L), which are equivalent to parts per trillion (ppt).

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Statistical summary from the 1993 EPA data (located in Appendix M) indicate that most of the maximum detected values for all parameters analyzed were found in groundwater located at well MW-12B.

Metals

Analysis for 23 metals was performed on groundwater samples collected during Phase I. Metals analysis was performed on unfiltered samples in accordance with the June, 1993 RFIP. Due to the field methods used for purging and sampling the wells, data from these analyses may be impacted by varying amounts of suspended sediments from the formation surrounding each well. It is proposed to perform all future sampling of groundwater for metals analysis using low flow sampling procedures to facilitate acquisition of representative samples (Pals and Powell, 1992). Therefore, to ensure that data from all sampling rounds used for the HERA are comparable, metals data from the October 1993 sampling event are not included in the proposed risk assessment data set.

Volatile Organic Compounds

Analytical data for all six (6) volatile organics detected in groundwater are summarized below. The maximum detected values for two (2) of the six (6) VOCs were located at well MW-22. Well MW-22 is monitoring possible off-site contamination downgradient of the Site to the southeast. The most frequently detected analyte in groundwater samples collected during Phase I was trichloroethane, (24 detections), which was also the analyte with the highest reported concentration in groundwater (9,000 μg/L in MW-24S).

Table 18-19
SUMMARY OF VOLATILE ORGANICS IN GROUNDWATER
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concen-tration	MDL for ND's	
						Min	Max
Benzene	1	28	6	MW-20	51.6	5	500
1,1-Dichloroethane	1	28	17	MW-20	52	5	500
cis-1,2-Dichloroethene	8	28	305	MW-22 AVERAGED	75.3	5	500
Ethylbenzene	2	28	170	MW-18	61.2	5	500
Tetrachloroethene	3	28	108.5	MW-22 AVERAGED	55	5	500
Trichloroethene	24	28	9000	MW-24	835	5	50

Semivolatile Organics

Analytical data for all eight (8) semivolatile organics detected in groundwater are summarized in Table 18-20 below. The maximum detected values for seven (7) of the eight (8) semivolatile organics detected were reported in groundwater from well MW-19, located downgradient of an

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abandoned UST. The most frequently detected analyte was phenanthrene (3 detections). The analyte reported at the highest maximum concentration was 2-methylnaphthalene, which was detected at a concentration of 1,500 μg/L in MW-19S.

Table 18-20
SUMMARY OF SEMIVOLATILE ORGANICS IN GROUNDWATER
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Anthracene	1	11	60	MW-19	9.77	5	50
Dibenzofuran	2	11	150	MW-19	28.4	5	5
Fluoranthene	1	11	53	MW-18	9.14	5	50
Fluorene	2	11	270	MW-19	41.1	5	5
2-Methylnapthalene	1	11	1500	MW-19	141	5	50
Naphthalene	1	11	470	MW-19	47	5	50
Phenanthrene	3	11	420	MW-19	65.4	5	5
Pyrene	1	11	69	MW-18	10.6	5	50

Polychlorinated Biphenyls

PCBs were not detected by analysis of groundwater samples collected from eight (8) wells on the Site during Phase I.

Pesticides and Herbicides

Chlorinated pesticides were not detected by analysis of groundwater samples collected from eight (8) monitoring wells on the Site during Phase I. Organophosphate pesticides and chlorinated herbicides were not detected by analysis of groundwater samples collected from five (5) monitoring wells on the Site during Phase I.

Dioxin

Analytical data for seven (7) dioxin congeners detected in groundwater are summarized in Table 18-21 below. The maximum detected values for three (3) of the seven (7) dioxin congeners detected were reported in groundwater from the averaged samples from MW-15I. MW-15I is monitoring possible contamination downgradient of the former lagoons and the scrap metal fill area. Dioxin - Total TCCD, and Dioxin - Total PeCDD were detected in all samples analyzed. The highest maximum detected values were also reported for these analytes.

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Table 18-21
SUMMARY OF DIOXINS IN GROUNDWATER
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Dioxin - Total TCCD	5	5	25.25	MW-15 AVERAGED	23.7	-	-
Dioxin - Total PeCDD	5	5	17.1	MW-15 AVERAGED	4.3	-	-
Dioxin - Total HxCDD	1	5	0.4	MW-6 AVERAGED	0.17	0.12	0.31
Dioxin - Total HpCDD	4	5	12.3	MW-3 AVERAGED	5.23	0.245	0.245
Furan - Total TCDF	4	5	5.105	MW-6 AVERAGED	3.49	0.65	0.65
Furan - Total PeCDF	3	5	9.39	MW-15 AVERAGED	2.32	0.11	0.44
Furan - Total HpCDF	1	5	0.76	MW-6 AVERAGED	0.44	0.54	0.83

Cyanide

Analytical data for the analysis of cyanide in groundwater samples collected from the Site are summarized in Table 18-22 below. The maximum detected value for cyanide was 2,300 μg/L in groundwater collected from MW-2I, located downgradient of the former lagoons.

Table 18-22
SUMMARY OF CYANIDE IN GROUNDWATER
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Cyanide	5	33	2300	MW-2	85.4	20	20

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The number of exceedances of MCLs is summarized in Table 18-23 below for those analytes for which MCLs are available.

Table 18-23
SUMMARY OF MCL EXCEEDANCES
Columbia Manufacturing Company, Westfield, MA

Analyte	MCL ($\mu g/L$)	Number of MCL Exceedances in Site Data
Benzene	5	1
cis-1,2-dichloroethene	70	3
Ethylbenzene	700	0
Tetrachloroethene	5	3
Trichloroethene	5	24
Cyanide	800[1]	1
Dioxin - TCDD	3×10^{-8}	5

1 Proposed MCL

Federal MCLs were exceeded for all analytes detected at the Site for which MCLs are published except for Ethylbenzene. The analyte for which the greatest number of exceedances was reported was trichloroethene (24 exceedances).

18.4.3 Extent of Sediment Contamination

The extent of contamination in Site sediments was assessed by analysis of metals, VOCs, and SVOCs. Those data are summarized below.

The 1993 EPA data includes data from two (2) locations. Those summary data are not directly comparable to the data summarized below because the EPA data does not include analyses of SS-1 or SS-4. Many of the maximum values in the data summaries presented below were detected in these two (2) samples.

Metals

Analytical data for the five (5) selected indicator metals in sediment are summarized in Table 18-24 below. Cadmium was detected in three (3) samples, and data for that analyte was rejected in three (3) samples. Chromium, copper, nickel and zinc were detected in all samples analyzed. The location of the maximum detected value for four (4) of the five (5) analytes summarized was SS-1, collected from the Fire Pond. The analyte detected at the highest maximum concentration was nickel.

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Table 18-24
SUMMARY OF METALS IN SEDIMENTS
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concentration	MDL for ND's	
						Min	Max
Cadmium	3	7	33000	SS-1	11100	700	700
Chromium	7	7	2000000	SS-4	449000	-	-
Copper	7	7	1600000	SS-1	365000	-	-
Nickel	7	7	6000000	SS-1	1930000	-	-
Zinc	7	7	1900000	SS-1	530000	-	-

Volatile Organics

A total of four (4) VOCs were detected in sediment samples collected from the Site. Those data are summarized in Table 18-25 below. The analyte detected at the highest concentration was acetone (150 μg/kg). The maximum concentration for three (3) of the four (4) analytes detected was found in SS-4, collected from the Reflecting Pond diversion structure. Trichloroethene had the lowest maximum value of the four (4) VOCs detected in sediments.

Table 18-25
SUMMARY OF VOLATILE ORGANICS IN SEDIMENTS
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concen-tration	MDL for ND's	
						Min	Max
Acetone	1	4	150	SS-5	77.5	80	160
Ethylbenzene	1	4	10	SS-4	4.38	5	5
Methylene chloride	2	4	44	SS-4	19.5	10	10
Trichloroethene	1	4	11	SS-4	4.63	5	5

Semivolatile Organics

Analytical data for seven (7) of the 13 semivolatile organics detected in sediments are summarized in Table 18-26 below. The frequency of detection for all analytes summarized was two (2) detections. Semivolatile organics were detected in SS-4 (Reflecting Pond diversion

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structure) and SS-8 (storm drain manhole). The location of the maximum detected values for all seven (7) semivolatile organics summarized below were reported in sediment sample SS-4. Semivolatile organics were not detected in SS-5 and SS-6, collected from the Little River.

Table 18-26
SUMMARY OF SEMIVOLATILE ORGANICS IN SEDIMENTS
Columbia Manufacturing Company, Westfield, MA

Analyte	Number of Detections	Number of Analyses	Maximum Detected Value	Location of Maximum	Average Concen-tration	MDL for ND's	
						Min	Max
Benzo(a)anthracene	2	4	19000	SS-4	5930	1000	1000
Benzo(a)pyrene	2	4	20000	SS-4	6480	1000	1000
Chrysene	2	4	20000	SS-4	6530	1000	1000
Fluoranthene	2	4	44000	SS-4	13500	1000	1000
Indeno(1,2,3-cd)pyrene	2	4	31000	SS-4	9830	1000	1000
Phenanthrene	2	4	41000	SS-4	12000	1000	1000
Pyrene	2	4	54000	SS-4	16800	1000	1000

Cyanide

Analysis for cyanide was not performed on sediment samples collected during Phase I.

18.5 HUMAN EXPOSURE ASSESSMENT

The purpose of this assessment is to identify all plausible present and potential future exposure pathways and exposure parameters in accordance with the Site specific data. Identification of complete exposure pathways include; a source, transport medium, and exposure route. Present and future potential exposures to site contaminants have also been identified. The applicability of various exposure pathways and whether risk assessment analysis is appropriate has also been evaluated.

The information provided below in Table 18-27, Exposure Pathway Scenarios, compares six (6) potential human receptors to various exposure routes within six (6) transport media. Potential human receptors include site workers, visitors/trespassers, recreationalists, excavation/utility workers, farm workers, and residents. These receptors were selected on the basis of zoning of the surrounding area and Site reconnaissance (see Figure 18-1). For each type of potential human receptor three (3) characteristics were evaluated: exposure duration, whether a present risk is likely, and whether a future risk is likely. Exposure duration was further described as adult, child and lifetime exposure potentials.
Decisions related to the groundwater transport media were partly based on reviewed records and sources. The Massachusetts Geographical Information System (GIS) Bureau of Waste Site Cleanup map and the Massachusetts Zone II drinking water well delineation map indicate that three (3) public drinking water wells exist within two (2) miles of the Site and greater than 1.5 miles from

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the Site. Five (5) more wells exist just beyond two (2) miles from the Site. One (1) of the wells located to the north and within two (2) miles of the Site had been determined in Zone II delineation to have recharge influence extending to the north of the well, further away from the Site. All public drinking water wells are located on the other side of the Westfield River or the Little River. According to Westfield Water Department records, no private wells exist within two (2) miles of the Site.

Table 18-27
EXPOSURE PATHWAY SCENARIOS
SITE CONDITIONS
Columbia Manufacturing Company, Westfield, MA

	Site Workers			Visitors/Trespasser			Recreation			Excavation/Utility Workers			Farm Workers			Residents		
	Ex D	Pres	Fut	Ex D	Pres	Fut	Ex D	Pres	Fut	Ex D	Pres	Fut	Ex D	Pres	Fut	Ex D	Pres	Fut
Groundwater																		
Ingestion	-	-	-	-	-	-	-	-	-	A	Y	Y	A	N	Y	L	Y	Y
Inhalation during use	-	-	-	-	-	-	-	-	-	A	Y	Y	A	N	Y	L	Y	Y
Dermal Absorption during use	-	-	-	-	-	-	-	-	-	A	Y	Y	A	N	Y	L	Y	Y
Soils																		
Incidental Ingestion	A	Y	Y	C	Y	Y	A,C	Y	Y	A	Y	Y	A	Y	Y	L,C	Y	Y
Dermal Absorption	A	Y	Y	C	Y	Y	A,C	Y	Y	A	Y	Y	A	Y	Y	L,C	Y	Y
Inhalation	A	Y	Y	C	Y	Y	A,C	Y	Y	A	Y	Y	A	Y	Y	L,C	Y	Y
Surface Water																		
Incidental Ingestion	-	-	-	C	Y	Y	A,C	Y	Y	-	-	-	A	Y	Y	L,C	Y	Y
Dermal Absorption	-	-	-	C	Y	Y	A,C	Y	Y	-	-	-	A	Y	Y	L,C	Y	Y
Sediment																		
Incidental Ingestion	A	Y	Y	A	Y	Y	A,C	Y	Y	A	Y	Y	A	Y	Y	L,C	Y	Y
Dermal Absorption	A	Y	Y	A	Y	Y	A,C	Y	Y	A	Y	Y	A	Y	Y	L,C	Y	Y
Air																		
Inhalation of vapor phase chemicals																		
Indoors	A	Y	Y	A	Y	Y	-	-	-	-	-	-	-	-	-	L	Y	Y
Outdoors	A	Y	Y	A	Y	Y	A,C	Y	Y	A	Y	Y	A	Y	Y	L	Y	Y
Inhalation of particulates																		
Indoors	A	Y	Y	A	Y	Y	-	-	-	-	-	-	-	-	-	L	Y	Y
Outdoors	A	Y	Y	A	Y	Y	A,C	Y	Y	A	Y	Y	A	Y	Y	L	Y	Y
Food																		
Ingestion of vegetables	-	-	-	A	N	Y	A,C	N	Y	-	-	-	A	N	Y	L	Y	Y

Ex D = Exposure Duration
Pres = Likelihood of present occurrence
Fut = Likelihood of future occurrence
L = Lifetime exposure
C = Exposure in children may be significantly greater than in adults
Y = Risk likely
N = Risk not likely
A = Exposure to adults
- = Exposure path does not exist at this site

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18.6 ECOLOGICAL HAZARD IDENTIFICATION

The Phase I ecological hazards identification includes identifying the extent of contamination at the Site in each environmental medium sampled. Data summaries are presented in the human health hazards evaluation section. The same data set will be used as potential contaminants of concern for the ecological hazard identification. The following media have been selected as potentially contaminated:

- Shallow depth soil (0-2')
- Intermediate depth soil (2-15')
- Surface water
- Sediment

Media which were not selected as potentially contaminated include deep soil (>15'), and groundwater. Deep soil and groundwater were not selected since no biota of concern exist within these media.

Contaminants of concern will be selected based upon factors such as persistence, bioaccumulation, biomagnification, toxicity, frequency of detection, and concentrations detected. These factors will be compared to a background data set to be collected in Phase IIA.

Indicator species and endpoints will also be selected based on such factors as importance and position of the species within the ecosystem, sensitivity, seasonality, relevance to the specific ecosystem found at the Site and to human beneficial uses, Trustee or regulatory concerns, and availability of practical methods for prediction and measurement.

Reviewed resource mapping indicated the closest estimated habitat of rare wetland wildlife was approximately two (2) miles from the Site. No Massachusetts defined areas of critical environmental concern (ACEC), state, Federal, Municipal, non-profit, or private open space or recreational facilities were identified within two (2) miles from the Site.

18.7 DISCUSSION OF THE BASELINE RISK ASSESSMENT

18.7.1 Developing a Baseline Risk Analysis

The Phase I investigation has completed the following tasks:

- A preliminary identification of exposure paths and scenarios for six (6) potential receptor groups.
- A preliminary Risk assessment data set has been identified for use in hazard identification
- Data sets were presented for the following media:
    - Metals in shallow, intermediate, and deep soil
    - Volatile organics in shallow, intermediate, and deep soil
    - Semivolatile organics in shallow, intermediate, and deep soil
    - Dioxin in shallow, intermediate, and deep soil
    - Cyanide in soil
    - Metals in groundwater
    - Volatile organics in groundwater
    - Semivolatile organics in groundwater

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- Dioxin in groundwater
- Metals in surface water
- Metals in sediments
- Volatile organics in sediments
- Semivolatile organics in sediments

18.7.2 Data Gaps Identified in the Phase I Baseline Risk Assessment

The preliminary Phase I Health and Environmental Risk Assessment (HERA) identified the data gaps discussed below. Strategies for addressing these data gaps are discussed and specific tasks for filling these data gaps are proposed for the Phase II HERA investigation discussed in the Phase II Scope of Work.

Contaminants of Concern (COCs) not determined. Analytical data from background soil and groundwater sampling locations should be evaluated to assist in selection of contaminants of concern (COCs) for the Site.

Potential ecological receptors an endpoints not identified. Potential receptors and endpoints need to be identified to adequately evaluate the ecological risk assessment.

Additional groundwater samples need to be collected for metals analysis. Groundwater samples should be collected for metals analysis using low flow sampling methods to provide groundwater metals data for the HERA.

Dose-response evaluation is needed. A dose-response evaluation is needed for EPA approved contaminants of concern (COCs).

Ecological exposure assessment is needed. An ecological exposure assessment is needed as a part of the complete HERA

Data requirements for the third interim deliverable needed. All data requirements for the third interim deliverable identified in the consent decree must be met.

Data requirements for the Draft Baseline Risk Assessment needed. All data requirements for the Draft Baseline Risk Assessment as identified in the consent decree must be met.

18.8 SUMMARY

The overall goal of the Human and Ecological Risk Assessment (HERA) of the RCRA Facility Investigation is to determine the need for interim corrective measures at the Site, and/or a Corrective Measure Study (CMS) for the Site. This is to be done by developing a set of health and environmental criteria to which measured or modelled site conditions may be compared. Development of a Draft Baseline Risk Assessment will be continued in an iterative sequence as more site data is accumulated.

The Phase I RCRA facility investigation has identified a preliminary data set and a preliminary set of exposure scenarios. Additional data is needed to identify potential ecological receptors and endpoints to complete the first interim submittal of the Draft Baseline Risk Assessment.

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19
CONCLUSIONS AND DATA GAPS

19.1 OVERVIEW

This section provides an overview of the conclusions reached from the Phase I RCRA Facility Investigation in Section 19.2, and presents a preliminary conceptual model of the physical characteristics of the Site in Section 19.3. This is followed in Section 19.4 by a summary of the data gaps identified in Phase I, and concludes with a summary in Section 19.5.

19.2 CONCLUSIONS FROM THE PHASE I INVESTIGATION

This Section summarizes the conclusions from the physical characterization, the on-site release characterization, and the off-site release characterization performed during Phase I.

19.2.1 Conclusions from the Phase I Physical Characterization

This Section includes the conclusions reached from the geological, hydrogeological, hydrological and climatological characterization performed during the Phase I Investigation of the Site.

Phase I Geological Investigation
The Phase I geological investigation arrived at the following conclusions:

- Five (5) major stratigraphic units were identified in the overburden deposits beneath the Site by the Phase I field activities and the literature review of previous borings and cross-sections. These units include: fill, eolian sands, alluvium/stratified drift, glaciolacustrine deposits, and till (tentatively identified). This interpretation is in good agreement with the results of the literature survey.
- The thickness of overburden deposits beneath the site was estimated between 97 and 132 feet based upon previous boring logs. This estimate agrees with published information gathered during the literature survey.
- The bedrock unit beneath the site was determined by the literature survey to be the Portland Arkose formation. This was not confirmed by Phase I field investigations.
- Sieve analysis data revealed variations in grain sizes that were correlated with different stratigraphic units on the site. The differences in grain sizes may correlate to differences in physical and chemical properties that influence migration of contaminants in the subsurface.

Phase I Hydrogeological Investigation
The Phase I hydrogeological investigation arrived at the following conclusions:

- The overburden aquifer at the site is unconfined. Groundwater flow directions through the alluvial and glaciolacustrine deposits (shallow and intermediate flow) is toward the Little River.
- Based on the downward flow gradient evidenced in shallow/intermediate well clusters at the Site, investigation of deeper unconsolidated zones and bedrock is necessary. Chemistry data provided during the Phase I investigation must be supplemented in order to further track flow between deeper unconsolidated zones and the bedrock aquifer.
- The overburden aquifer consists of highly variable geological materials, and is poorly sorted in many areas. In addition, man-made features such as the former lagoons appear to further complicate subsurface conditions. This inconsistency leads to variability in hydrogeological

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parameters such as hydraulic conductivity, groundwater flow direction and gradients, and flow velocity.

- A till layer was observed beneath the glaciolacustrine deposits during the advancement of two (2) borings at the Site. The till may or may not act as a confining layer over the bedrock. Further investigation of the bedrock/overburden interface is needed in order to determine the geotechnical properties of the till layer, and also to determine if the till is continuous across the Site.

Phase I Hydrological Investigation

The Phase I hydrological investigation arrived at the following conclusions:

- The site is located in the Westfield River drainage basin. This drainage basin, which encompasses an area of approximately 517 square miles, has been subject to significant flooding (50-year flood or greater) on three (3) occasions in the twentieth century. Flooding is now controlled by dams located higher within the basin. The site us located above the 100-year flood boundary identified by FEMA, and within the 500-year flood boundary.
- The site is located within approximately one-half mile of the Little River, a major tributary to the Westfield River. The Little River flows generally eastward, however the river bed meanders to the west, south and east of the site, prior to its confluence with the Westfield River approximately one-half mile to the northeast of the site.
- There is one (1) surface water body on the site that consistently holds water. That water body, the Fire Pond, is a man-made structure that is a remnant of a former canal. The water level in this surface water body was approximately 2.5 feet higher than the groundwater surface during this investigation. The Fire Pond is also an Area of Concern (AOC 34).
- The Reflecting Pond no longer holds water on a consistent basis, and did not hold water at the time of the Phase I investigation.

Phase I Climatological Investigation

The Phase I climatological investigation arrived at the following conclusions:

- Precipitation, including snow converted to equivalent rainfall, remains fairly constant throughout the year at approximately four (4) inches per month. Yearly total precipitation is approximately 50 inches per year, on average, with potential surpluses or deficits of up to 20 inches per year.
- The average temperature throughout the year fluctuates from 24°F to 72°F.
- The prevailing wind direction is from the northwest during most months, but tends to shift to a southerly to southwesterly direction during the summer months (June to September). The highest velocity winds (5 to 7.5 meters per second), however, are from the northwest during the entire year.
- The climate in the vicinity of the Site is typical of the seasonal climate of New England. Seasonal variations occur primarily in temperature and wind and, to a lesser extent, in precipitation.
- Air was identified as a potential media of concern in the vicinity of the Fire Pond (AOC 34) prior to initiation of this Phase I investigation. Results of the ambient air monitoring program did not identify the presence of VOCs in the air space above the Fire Pond. Based on the available data, air will no longer be included as a media of concern in future investigations at this Site.

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19.2.2 Conclusions from the Phase I On-Site Release Characterization

This section includes the conclusions reached from the release characterization in the plating operations area, the wastewater treatment area, the on-site sludge disposal area, the waste storage yard, the on-site surface water bodies, the utility lines, the underground storage tanks, and other operations at the Site.

Phase I Plating Operations Area Release Characterization
The Phase I plating operations area release characterization arrived at the following conclusions:

Soil: Organic Compounds
Both volatile and semivolatile organic compounds were identified in soil monitored at the plating operations. The maximum VOC sample concentration ranged from below detection to 3,000 μg/kg; semivolatiles from below detection to 6,800 μg/kg. One (1) herbicide, 2,4-D, was detected at an estimated concentration of 23 μg/kg in a duplicate soil sample from monitoring well MW-16S. No other pesticides, herbicides or PCBs were detected. The maximum dioxin sample concentrations was 3.64 μg/kg.

Soil: Metals/Cyanide
Plating metals were detected at concentrations in excess of published ranges. No cyanide was detected in soil monitored at the plating operations. Metals associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN) will be included in subsequent investigations.

Groundwater: Organic Compounds
Volatile and semivolatile organic compounds were detected in shallow groundwater downgradient of the plating operation AOCs. Maximum VOC sample concentrations ranged from below detection to 340 μg/L; semivolatiles from below detection to 682 μg/L. Phase I sampling did not include pesticide, herbicide, PCB, or dioxin analysis of groundwater downgradient of plating operations. As described in Section 1, these compounds are not associated with this AOC grouping and will be eliminated from future monitoring of plating operations.

Groundwater: Metals/Cyanide
No cyanide was detected in groundwater monitored at the plating operations. Plating metals appear elevated, however, site-specific background concentrations have not been adequately determined at this time. Metals associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN) will be included in subsequent investigations.

Phase I Wastewater Treatment Release Characterization
The Phase I wastewater treatment release characterization arrived at the following conclusions:

Soil: Organic Compounds
Both volatile and semivolatile organic compounds were identified in soil monitored at the wastewater treatment operations. The maximum VOC sample concentration ranged from below detection to 65 μg/kg; semivolatiles from below detection to 6,800 μg/kg. One (1) chlorinated herbicide, 2,4-D, was detected at an estimated concentration of 23 μg/kg in a duplicate soil sample from monitoring well MW-16S. No other pesticides, herbicides or PCBs were detected. Given the absence of pesticides and PCB's and a single, low concentration chlorinated herbicide, these compounds will be eliminated from subsequent soil analyses on this AOC grouping. The maximum dioxin sample concentration was 3.3 μg/kg.

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Soil: Metals/Cyanide
Plating metals, except zinc, were detected at concentrations in excess of published ranges. No cyanide was detected in soil monitored at the wastewater treatment operations. Metals associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN) will be included in subsequent investigations.

Groundwater: Organic Compounds
One (1) semivolatile organic compound, phenanthrene, was detected in shallow groundwater downgradient of the former Ph adjustment (AOC 11) at a concentration of 19 μg/L. No VOCs were detected in the groundwater sample. Phase I sampling did not include pesticide, herbicide, PCB, or dioxin analysis of groundwater downgradient of wastewater treatment operations. Research which is summarized in Section 1 indicates that these compounds were not used at this AOC grouping. Subsequent data collection designed to monitor this AOC grouping will not include these parameters. Dioxin will not be included as part of Phase II monitoring. Dioxin forming compounds were not used at this AOC grouping.

Groundwater: Metals/Cyanide
Cyanide was detected at a concentration below the MCL for cyanide. The concentrations of cadmium, chromium, lead and nickel appear elevated; however, site-specific background concentrations have not been adequately determined at this time. Metals associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN) will be included in subsequent investigations.

Phase I On-Site Sludge Disposal Release Characterization
The Phase I on-site sludge disposal release characterization arrived at the following conclusions:

Soil: Organic Compounds
Volatile organics, semivolatiles, and pesticides were identified in soil monitored near the on-site sludge disposal AOCs. The maximum VOC sample concentration ranged from below detection to 1,916 μg/kg; semivolatiles from below detection to 486,600 μg/kg; and pesticides (by EPA Method 8080) from below detection to 1,080 μg/kg. Although elevated pesticides were detected in soils, historical and analytical data suggest an off-site source (Section 10.5.2). Therefore, pesticides and herbicides will be eliminated from Phase II analysis. Dioxin was detected in soil at total sample concentrations between 2.92 μg/kg and 25.07 μg/kg.

Soil: Metals/Cyanide
Chromium, copper, nickel, and zinc (plating metals) were detected at concentrations in excess of published ranges. Cyanide was detected at concentrations from below detection to 440,000 μg/kg.

Groundwater: Organic Compounds
Volatile organic compounds were detected in shallow and intermediate groundwater downgradient of the on-site sludge disposal AOCs. Maximum VOC sample concentrations ranged from 15 μg/L to 5,200 μg/L. Dioxin was detected in groundwater downgradient of the on-site sludge disposal AOCs. The total sample concentrations of dioxin ranged from 24.3 ng/L to 56.52 ng/L. Phase I sampling did not include pesticide, herbicide, or PCB analysis of groundwater downgradient of the on-site sludge disposal AOCs. However, data indicates that pesticides detected in soils are related to an off-site source. As described in Section 1, these compounds are not associated with this AOC grouping or products historically manufactured at the facility and will be eliminated from future monitoring of the on-site sludge disposal AOCs.

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Groundwater: Metals/Cyanide
Cadmium, chromium, and nickel concentrations in groundwater appear elevated. Cyanide was detected in groundwater monitored at concentrations from below detection to 2,300 μg/L. Plating metals appear elevated, however, site-specific background concentrations have not been adequately determined at this time. All metals, including those associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN), will be included in subsequent investigations.

Phase I Waste Storage Yard Release Characterization
The Phase I waste storage yard release characterization arrived at the following conclusions:

Soil: Organic Compounds
Both volatile and semivolatile organic compounds were identified in soil monitored at the waste storage yard. The maximum VOC sample concentration ranged from below detection to 3,000 μg/kg; semivolatiles from below detection to 6,800 μg/kg. One (1) herbicide, 2,4-D, was detected at an estimated concentration of 23 μg/kg in a duplicate soil sample from monitoring well MW-16S. No other pesticides, herbicides or PCBs were detected. Research which is summarized in Section 1 indicates that these compounds were not used at this AOC grouping. Given the absence of pesticides and PCB's in samples collected, and a single low concentration herbicide, these parameters will not be included as part of the Phase II monitoring. The maximum dioxin sample concentrations was 3.64 μg/kg.

Soil: Metals/Cyanide
Plating metals were detected at concentrations in excess of published ranges. No cyanide was detected in soil monitored at the waste storage yard. Metals associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn and CN) will be included in subsequent investigations.

Groundwater: Organic Compounds
Volatile and semivolatile organic compounds were detected in shallow groundwater downgradient of the plating operation AOCs. Maximum VOC sample concentrations ranged from below detection to 340 μg/L; semivolatiles from below detection to 682 μg/L. Phase I sampling did not include pesticide, herbicide, PCB, or dioxin analysis of groundwater downgradient of waste storage yard. Research which is summarized in Section 1 indicates that pesticides and herbicides were not used at this AOC grouping. Subsequent data collection designed to monitor this media at this AOC grouping will not include these parameters.

Groundwater: Metals/Cyanide
No cyanide was detected in groundwater monitored at the waste storage yard. Plating metals appear elevated, however, site-specific background concentrations have not been adequately determined at this time. Metals associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn and CN) will be included in subsequent investigations.

Subsurface Gas: Organic Compounds
Subsurface gas monitoring conducted during Phase I indicated the presence of VOC's in the soil gas. Subsequent soil and groundwater monitoring will be utilized in Phase II to refine this data.

Phase I On-Site Surface Water Bodies Release Characterization
The Phase I on-site surface water bodies release characterization arrived at the following conclusions:

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Soil: Organic Compounds
Both volatile and semivolatile organic compounds were identified in soil collected from MW-26I. The maximum VOC sample concentration ranged from below detection to 300 μg/kg; semivolatiles from below detection to 430 μg/kg. No pesticides, herbicides or PCBs were detected. Given the absence of pesticides and PCB's, these compounds will be eliminated from subsequent soil analysis in the grouping. The maximum dioxin sample concentrations was 2.98 μg/kg.

Soil: Metals/Cyanide
Plating metals were detected at concentrations in excess of published ranges. No cyanide was detected in soil monitored at the on-site surface water bodies. Metals associated with on-site plating activities (Cd, Cr, Cu, Ni and Zn) will be included in subsequent investigations.

Groundwater: Organic Compounds
Volatile and semivolatile organic compounds were detected in shallow groundwater downgradient of AOC 16. Only trichloroethene was detected in groundwater from MW-26I at a concentration of 1,500 μg/L. Phase I sampling did not include pesticide, herbicide, PCB, or dioxin analysis of groundwater downgradient of on-site surface water bodies. Research summarized in Section 1 indicates that these compounds were not discharged to the on-site surface water bodies. Subsequent data collection designed to monitor the on-site surface water AOCs will not include these parameters

Groundwater: Metals/Cyanide
No cyanide was detected in groundwater monitored at AOC 16. Nickel, a plating metal, appears elevated, however, site-specific background concentrations have not been adequately determined at this time. Metals associated with on-site plating activities (Cd, Cr, Cu, Ni and Zn) will be included in subsequent investigations.

Surface Water: Organic Compounds
No VOCs were detected in surface water from the Fire Pond (AOC 34). Surface water was not analyzed for semivolatile organics, pesticides, herbicides, PCBs, or dioxin. Analysis for VOCs will not be included in subsequent investigations of the on-site surface water bodies.

Surface Water: Metals/Cyanide
No copper or zinc (plating metals) was detected in surface water samples. Surface water samples were not analyzed for other plating metals or cyanide.

Sediment: Metals
Concentrations of plating metals (chromium, copper, nickel, and zinc) in sediment appear elevated when compared to published concentrations of these metals in soil.

Air: Organic Compounds
No VOCs were detected above the water surface at the Fire Pond (AOC 34).

Phase I Utility Lines Release Characterization
The Phase I utility lines release characterization arrived at the following conclusions:

Soil: Organic Compounds
Both volatile and semivolatile organic compounds were identified in soil monitored at the utility lines. The maximum VOC sample concentration ranged from below detection to 270 μg/kg; semivolatiles from below detection to 8,150 μg/kg. No other pesticides, herbicides or PCBs were

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detected. The maximum dioxin sample concentrations was 4.67 μg/kg.

Soil: Metals/Cyanide
Plating metals (copper, nickel, and zinc) were detected at concentrations in excess of published ranges. No cyanide was detected in soil monitored at the utility lines. Metals associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN) will be included in subsequent investigations.

Groundwater: Organic Compounds
Volatile organic compounds were detected in groundwater downgradient of the utility line AOCs. Maximum VOC sample concentrations ranged from 77 μg/L to 9,000 μg/L. Phase I sampling did not include pesticide, herbicide, PCB, or dioxin analysis of groundwater downgradient of the utility lines. As described in Section 1, these compounds are not associated with this AOC grouping and will be eliminated from future monitoring of utility lines.

Groundwater: Metals/Cyanide
No cyanide was detected in groundwater monitored at the utility lines. Nickel appears elevated, however, site-specific background concentrations have not been adequately determined at this time. Metals associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN) will be included in subsequent investigations.

Phase I Storage Tanks Release Characterization
The Phase I storage tanks release characterization arrived at the following conclusions:

Soil: Organic Compounds
Volatile organic compounds were detected in soil monitored at the abandoned cutting oil UST (AOC 36), the fuel storage area (AOC 37), and the abandoned cooling oil UST (AOC 48). The maximum VOC sample concentration ranged from below detection to 1,516.5 μg/kg. On-site analysis of soil samples identified TPH in concentrations ranging from 470 to 9,900 mg/kg. Phase I sampling did not include analysis for semivolatile organics, pesticides, herbicides, PCBs, or dioxin.

Soil: Metals/Cyanide
Nickel (a plating metal) was detected at concentrations in excess of published ranges. Cyanide analysis was not conducted on Phase I soil samples.

Groundwater: Organic Compounds
Volatile and semivolatile organic compounds were detected in shallow groundwater downgradient of the abandoned UST (AOC 36). Maximum VOC sample concentrations ranged from below detection to 9000 μg/L; semivolatiles from below detection to 2600 μg/L. Phase I sampling did not include pesticide, herbicide, PCB, or dioxin analysis of groundwater downgradient of other operations. As described in Section 1, these compounds are not associated with this AOC grouping and will be eliminated from future monitoring of the storage tank AOCs.

Groundwater: Metals/Cyanide
No cyanide was detected in groundwater monitored at storage tank AOCs. Plating metals appear elevated, however, site-specific background concentrations have not been adequately determined at this time. Metals associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN) will be included in subsequent investigations.

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Phase I Other Operations Release Characterization

Soil: Organic Compounds
Volatile organic compounds were identified in soil monitored at the rim room (AOC 44). The maximum VOC sample concentration ranged from below detection to 3,000 µg/kg. On-site analysis of soil samples identified TPH in concentrations ranging from 490 to 23,000 mg/kg. Phase I sampling did not include analysis for semivolatile organics, pesticides, herbicides, PCBs, or dioxin.

Soil: Metals/Cyanide
Nickel (a plating metal) was detected at concentrations in excess of published ranges. Cyanide analysis was not conducted on Phase I soil samples.

Groundwater: Organic Compounds
Volatile and semivolatile organic compounds were detected in shallow groundwater downgradient of the rim room (AOC 44). Maximum VOC sample concentrations ranged from below detection to 340 µg/L; semivolatiles from below detection to 340 µg/L. Phase I sampling did not include pesticide, herbicide, PCB, or dioxin analysis of groundwater from MW-18S. As described in Section 1, these compounds are not associated with this AOC grouping and will be eliminated from future monitoring of the rim room (AOC 44).

Groundwater: Metals/Cyanide
No cyanide was detected in groundwater monitored at the rim room (AOC 44). Plating metals appear elevated, however, site-specific background concentrations have not been adequately determined at this time. Metals associated with this AOC grouping (Cd, Cr, Cu, Ni, Zn, and CN) will be included in subsequent investigations.

19.2.3 Conclusions from Phase I Off-Site Release Characterization

Soil: Organic Compounds
Volatile and semivolatile organic compounds were detected in one surficial (0- to 2- foot interval) soil sample located off-site at well MW-21S. The source of these compounds is unknown, but two compounds (ethylbenzene and toluene) are not common Site compounds and the sample was from a shallow, unsaturated depth near a tobacco barn. This suggests that the source of ethylbenzene and toluene is unrelated to releases at the site. Additional background data will be collected during Phase II to evaluate potential sources of these compounds.

Soil: Metals/Cyanide
Copper was detected at concentrations in excess of published ranges at off-site locations (MW-21S and MW-22S). Cyanide was not detected in off-site soil samples.

Groundwater: Organic Compounds
Volatile organic compounds were detected in shallow groundwater monitored by off-site sampling locations. VOCs were detected in shallow, intermediate, intermediate/deep, and deep groundwater along the southeast boundary of the Site. Phase I off-site release migration sampling did not include pesticide, herbicide, or dioxin analysis of groundwater. PCB's were not detected in groundwater in off-site wells.

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Groundwater: Metals/Cyanide
Chromium and nickel concentrations in groundwater appear elevated in comparison with MCLs. Cyanide was not detected in groundwater from off-site release monitoring locations.

19.3 PRELIMINARY CONCEPTUAL MODEL OF THE SITE

19.3.1 Preliminary Geologic Conceptual Model

This section presents a preliminary conceptual geological model of the Site and adjacent areas based on the results of the Phase I geological investigation.

Geologic cross-sections were developed on six (6) section lines in a variety of orientations. The cross-sections are presented on two (2) plates in Appendix H. Cross-section locations were chosen based on availability of adequate stratigraphic information for accurate cross-section development and the relative interest of the section in terms of proximity to AOCs. A plan view of the Site identifying the locations of the cross-sections is included on the first plate. Cross-section locations are also indicated on the plan entitled Geologic Cross-Section Locations in Appendix H. This plate is prepared at the same horizontal scale as the cross-sections. The proximity of each AOC to the cross-sections is also illustrated on that plate.

Fill was identified in many areas of the Site in close proximity to buildings and other areas altered by human activities. Locations where fill was encountered are depicted on all cross-sections except for cross-section B-B'. Fill material may be highly variable in terms of grain size and composition, and may be composed of re-worked soils from the Site.

A layer of eolian sands identified in the literature was encountered on the Site in areas that have not been reworked by human activities. Cross-section B-B' illustrates the location of a deposit of eolian sand in the southern portion of the Site. These deposits are well sorted, and had a maximum depth of seven (7) feet in borings on the Site.

Alluvium and stratified drift is found beneath the fill and eolian sand deposits, and is sometimes found at the surface. In this area of the Site, alluvium may have been deposited by flooding of the Little River as discussed in Section 5.4. This deposit generally overlies stratified drift, and often is not readily distinguishable from the coarser stratified drift materials. These units have been grouped together as a single unit.

Alluvium and coarser stratified drift materials are both deposited by moving water. The degree of sorting varies as water velocities vary due to changes in hydrology. In the case of stratified drift deposits, the grain size characteristics may reflect the proximity of that deposit to a stream or river delta, or shoaling of a water body.

The coarse deposits found within the alluvium/stratified drift unit may represent fluvial deposits from glacial or more modern streams. These deposits are identified on all cross-sections, however, they do not form a continuous stratigraphic unit. They are identified primarily because of the variability of grain size, hydraulic conductivity and other soil properties within the alluvium/stratified drift unit. This variability is in part a reflection of the presence of these deposits.

The alluvium/stratified drift deposits consist of multimineralic particles in the coarser grain size fractions as well as sand size particles composed primarily of quartz. The high proportion of silica

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in these deposits makes them less chemically reactive than soils composed predominantly of silt and clay sized particles.

Glaciolacustrine deposits were identified throughout the Site. These deposits represent a deep water, low energy depositional environment and are predominantly composed of fine sand, silt and clay carried from streams of glacial runoff. The mineralogy of these deposits includes a much smaller proportion of silica than the alluvium/stratified drift deposits due to the low stability of silica when it is reduced to silt sized particles. The layered clay minerals typically found in these deposits are more chemically reactive than silica and have significant concentrations of various metals.

Till was tentatively identified in two locations beneath the site (MW-1I, MW-3I) during previous on-site investigations. The borings were backfilled to within 40 feet of the ground surface before installation of monitoring wells in those locations. In a third location (MW-9C), refusal was reported at a depth of 132 feet without notation of any till unit. Till was not encountered during Phase I activities.

The depth of overburden deposits beneath the site correlates well with published geophysical data. Limited Site-specific information was available in the literature for determining the depth to bedrock beneath the Site. Bedrock mapping of the area indicates that the bedrock unit beneath the area is the New Haven Arkose. The type and depth of the bedrock unit was not confirmed in Phase I.

In general, the surficial materials encountered beneath the Site during the Phase I geological investigation correspond well to the materials described in published information from sources noted in Section 3.4.1. Unconsolidated materials at the study Site are comparable to the alluvium underlain by stratified drift of similar composition, as described by the USGS.

19.3.2 Preliminary Hydrogeological Conceptual Model

This section presents a preliminary conceptual hydrogeological model of the Site and adjacent areas based on the results of the Phase I hydrogeological investigation.

The overburden aquifer is unconfined, and consists of at least two (2) groundwater flow regimes which correlate with the major stratigraphic units at the Site (the fill/alluvium unit and the glaciolacustrine unit). Shallow groundwater generally flows toward the south/southeast, and intermediate groundwater flows in a semi-radial pattern from the west to east in the northern portion of the Site, and from northwest to southeast in the southern portion of the Site. Both shallow and intermediate groundwater flows toward the Little River. Neither the deep unconsolidated flow patterns nor the bedrock flow patterns were evaluated during the Phase I investigation.

A downward vertical flow gradient exists as evidenced by water levels measured in December of 1993 in the four (4) monitoring well clusters at the Site. Additional well clusters installed during Phase II will allow for greater definition of flow patterns and the development of flow nets for the Site.

Many of the hydrogeological parameters of interest measured or calculated during the Phase I investigation in the vicinity of the canal and former lagoons exhibited values which differed from values obtained from other areas of the Site. Hydraulic conductivity, groundwater velocity, vertical gradients, and groundwater flow directions all appear to be affected by this feature. Groundwater mounding above the glaciolacustrine sediments may have occurred when the lagoons were in active

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use. Residual effects from this phenomenon may be affecting present groundwater flow patterns. Changes in porosity as a result of infiltration from the lagoons into the underlying alluvium/stratified drift may explain the anomalous conditions (compared to other parts of the Site) in the vicinity of the former lagoons. These conditions will be evaluated further during Phase II.

19.3.3 Preliminary Hydrological Conceptual Model

This section presents a preliminary conceptual hydrological model of the Site and adjacent areas based on the results of the Phase I hydrological investigation.

Based on area topography, proximity to the Westfield and Little Rivers, and groundwater contours developed for the Site (Section 4), the direction of regional groundwater flow is inferred to be toward the south/southeast, toward the Little River. Groundwater in the vicinity of the Site is assumed to discharge to the Little River. A downward flow gradient is expected in areas of recharge at distances away from the river, and this was observed in multiple point cluster wells installed on the site (Section 4). In low lying areas drained by perennially flowing rivers, an upward flow gradient is often found close to the river, as groundwater discharges contribute to flow in the river.

The water elevation in the Fire Pond is approximately 86 feet above Westfield City Datum. The water level in the shallow monitoring well in closest proximity to the Fire Pond, MW-20S, was 83.68 in December, 1993. This difference in water elevations may indicate that water in the Fire Pond is perched on a low permeability layer of silt and organic matter. Additional data needed to evaluate seasonal variations in groundwater and surface water interactions should be collected during the Phase II investigation.

19.3.4 Preliminary Climatalogical Model

This section presents a preliminary conceptual climatalogical model of the Site and adjacent areas based on the results of the Phase I climatalogical investigation.

Local airflow patterns are likely to be impacted by topography in the vicinity of the Site, most notably the presence of Munger Hill, located approximately 3,000 feet to the southeast. This formation rises approximately 100 feet above the alluvial plain in which the Site is located. In addition, the Provin Mountain range, which lies at an elevation 250 to 450 feet higher than the elevation of the Site, provides a nearly continuous north to south boundary 2¼ miles east of the Site. The gap in the range through which the Westfield River flows is approximately 0.75 mile wide and is located directly east of the Site. Site-specific wind speed and direction are assumed to be similar to the wind speed and direction presented in Section 6.4.3 for the Barnes Airport 3.75 miles northeast of the Site. The prevailing wind direction at the Site is, therefore, from the northwest during most months and from the south/southwest during the summer months (June to September). The predominant direction of the highest wind speeds is consistently northwest throughout the entire year at the Site. The impact of the topographic features to the east (Provin Mountain) and southeast (Munger Hill), therefore, cause an uplift in the airflow which passes through the Site toward the southeast.

Historical emissions at the Site may have originated from the first floor level (0 to 20 feet above ground surface) and from the stack which discharges approximately 135 feet above ground surface. Currently, the stack gases are constantly monitored and the air discharge is permitted by the DEP. Former emissions originated from the third floor level (30 to 50 feet above ground level) of Building 1. The painting operation in that building was discontinued around 1991. Based on the

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locations of the emission sources at the Site, Munger Hill would cause an uplift of airborn emissions migrating southeast, except for the stack which would be lifted to the east by the Provin Mountain range. Precipitation events may have directed historic airborne particulate material to exposed surfaces (surface soil, surface water bodies, and roof areas) downwind of emission sources at the Site.

19.4 DATA GAPS IDENTIFIED IN PHASE I

This Section provides a summary of the data gaps identified during the physical characterization, the on-site release characterization, and the off-site release characterization performed during Phase I. The data gaps are summarized in tabular form in Appendix N.

19.4.1 Data Gaps Identified in the Phase I Physical Characterization

This Section presents the data gaps identified during the geological, hydrogeological, hydrological and climatological characterization performed during the Phase I Investigation of the Site.

Phase I Geological Investigation

The Phase I geological investigation identified five (5) data gaps:

Hydraulic conductivities and porosities of unsaturated units not determined. These values were not estimated due to non-uniform grain size and lack of porosity data. Samples should be collected for determination of the porosity of all unsaturated units at the Site.

Vertical hydraulic conductivities of overburden units not determined. Vertical hydraulic conductivities were not determined during the Phase I investigation. Undisturbed samples should be collected from saturated overburden units for laboratory permeability testing.

Till unit requires additional characterization. The till unit tentatively identified beneath the glaciolacustrine deposits requires further investigation to characterize the depth, continuity, chemical quality, physical properties and hydraulic conductivity of that unit.

Bedrock unit not characterized. The Phase I Scope of Work did not include advancement of bedrock cores. The depth to bedrock, degree of fracturing of the bedrock surface, and the chemical quality of the groundwater in the bedrock is unknown.

More data is needed to determine background values for soils. The Phase I sampling program did not provide adequate data to develop background values for certain metals, PAHs, dioxins, pesticides and herbicides for soils. Background values are needed for soils at various depths.

Phase I Hydrogeological Investigation

The Phase I hydrogeological investigation identified eight (8) data gaps:

High and low groundwater table measurements are needed. Seasonal high and low groundwater level measurements will be obtained during Phase II. High groundwater generally occurs in this area in the spring, with low water table conditions occurring in the late summer or early fall.

More data is needed to define the geochemical characteristics of groundwater in each saturated stratigraphic unit. Additional analyses for major cations are needed to fully characterize the hydrodynamics of these units.

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Intermediate and deep groundwater flow patterns not fully defined. Additional data points are needed to refine the groundwater contours in the glaciolacustrine deposits. Additional intermediate depth wells will be installed during Phase II in order to further define these contour patterns.

Additional soil porosity data is needed in the vicinity of the lagoons. Further study of hydrogeological parameters, including porosity, in the vicinity of the former lagoons is needed to explain the apparently anomalous groundwater behavior in the vicinity of this feature.

Hydrogeology of the deep overburden aquifer not adequately defined. Additional wells installed to intercept the deep glaciolacustrine/till deposits (just above bedrock) are needed in order to further define the deeper unconsolidated flow patterns and groundwater chemistry.

Bedrock hydrogeology not characterized. The Phase I Scope of Work did not include the installation of bedrock monitoring wells. Groundwater flow characteristics and chemistry of the bedrock unit are undefined and will be addressed during Phase II.

Additional groundwater velocity data is needed. Much of the groundwater velocity data generated during Phase I relies on information obtained from one (1) or two (2) monitoring wells along a given velocity flow line. Groundwater velocity data gathered during the Phase I investigation will be supplemented during Phase II.

Information regarding the interaction between the overburden aquifer and the Little River is needed. Although it is assumed that groundwater from the overburden aquifer discharges to the Little River, verification and quantification of flow into the river is needed. Flow nets will be developed during Phase II which will assist in defining the relationship between groundwater and surface water at/near the Site.

More data is needed to determine background values for groundwater chemistry. The Phase I sampling program did not provide adequate data to develop background values for inorganics in groundwater. Background values are needed for groundwater from each stratigraphic unit. This data will be generated during Phase II.

Phase I Hydrological Investigation

The Phase I hydrological investigation identified five (5) data gaps:

Delineation of potential wetland area needed. A delineation of the potential wetland area identified on the site need to be performed. The study should identify both the Massachusetts and the Federal wetland boundaries. The season and duration of surface water ponding in this area, if any, should be evaluated.

Additional sediment samples are needed from the Fire Pond for physical analysis. Sediment sample SS-1 did not meet the requirements outlined in the RFI Phase I proposal. This analyses should be repeated.

Interaction between groundwater and Fire Pond surface water not determined. Additional information about groundwater and surface water elevations in the vicinity of the Fire Pond is needed to determine whether the Fire Pond is hydraulically connected to the groundwater beneath the site and the nature (recharge, discharge) of any interactions on a seasonal basis.

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Interaction between groundwater and Little River surface water not determined. Additional information is needed to determine whether groundwater is discharging to the river through its bed or if river flow is recharging the groundwater table. This will need to be evaluated only if data from initial Phase II analyses indicate that groundwater contamination has migrated beyond wells MW-22S, 23S and 24S, and is potentially discharging into the Little River.

Surface water and sediment quality of the Little River needs to be determined. Current data from locations upstream and downstream of the site in the Little River are needed to evaluate impacts from site discharges and to evaluate groundwater and surface water interactions. Additional surface water and sediment analyses will be needed only if data from initial Phase II analyses indicate that groundwater contamination has migrated beyond wells MW-22S, 23S and 24S, and is potentially discharging into the Little River.

Phase I Climatological Investigation
No data gaps were identified at the conclusion of the Phase I climatological investigation.

19.4.2 Data Gaps Identified in the Phase I Release Characterization

This Section presents the data gaps identified during the Phase I release characterization in the plating operations area, the wastewater treatment area, the on-site sludge disposal area, the waste storage yard, the on-site surface water bodies, the utility lines, the underground storage tanks, and other operations at the Site. The data gaps are summarized in section 17.3. Data gaps have been organized by media since individual monitoring of each plating operation AOC was not conducted. Phase II activities designed to provide the data required are discussed in Section 20, 21 and 22.

Phase I Plating Operations Area Release Characterization
Based on the release characterization for the plating operation AOCs, the following data gaps have been identified.

Soil
The horizontal and vertical extent of soil contamination in the vicinity of the plating operations AOCs needs to be delineated for VOCs, semivolatile organics, dioxin, and metals. The source for the dioxin contamination must also be determined. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

Groundwater
The horizontal and vertical extent of groundwater contamination in the vicinity of the plating operations AOCs needs to be delineated for VOCs, semivolatile organics, and metals. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

Phase I Wastewater Treatment Area Release Characterization
Based on the release characterization for the wastewater treatment operation AOCs, the following data gaps have been identified.

Soil
The horizontal and vertical extent of soil contamination in the vicinity of the wastewater treatment operations AOCs needs to be delineated for VOCs, semivolatile organics, dioxin, and metals. The source for the dioxin contamination must also be determined.

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Groundwater
The horizontal and vertical extent of groundwater contamination in the vicinity of the wastewater treatment operations AOCs needs to be delineated for VOCs, semivolatile organics, and selected metals.

Phase I On-Site Sludge Disposal Release Characterization
Based on the release characterization for the on-site sludge disposal AOCs, the following data gaps have been identified.

Soil
The horizontal and vertical extent of soil contamination in the vicinity of the on-site sludge disposal AOCs needs to be delineated for VOCs, semivolatile organics, dioxin, and metals. The source for the dioxin contamination must also be determined. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

Groundwater
The horizontal and vertical extent of groundwater contamination in the vicinity of the on-site sludge disposal AOCs needs to be delineated for VOCs, semivolatile organics, metals, and cyanide. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

Phase I Waste Storage Yard Release Characterization
Based on the release characterization for the plating operation AOCs, the following data gaps have been identified.

Soil
The horizontal and vertical extent of soil contamination in the vicinity of the waste storage yard AOCs needs to be delineated for VOCs, semivolatile organics, dioxin, and metals. The source for the dioxin contamination must also be determined.

Groundwater
The horizontal and vertical extent of groundwater contamination in the vicinity of the waste storage yard AOCs needs to be delineated for VOCs, semivolatile organics, and metals.

Subsurface Gas
Subsurface gas data provided an indication of VOC releases to the soil and/or groundwater in this AOC grouping. Additional soil and groundwater investigations are proposed to refine these findings. No further subsurface gas monitoring is proposed.

Phase I On-Site Surface Water Bodies Release Characterization
Based on the release characterization for the on-site surface water body AOCs, the following data gaps have been identified.

Soil
The horizontal and vertical extent of soil contamination in the vicinity of the on-site surface water bodies AOCs needs to be delineated for VOCs, semivolatile organics, dioxin, and metals. PCBs and pesticides/herbicides will not be included in subsequent investigations. The source for the dioxin contamination detected in soil from well MW-26I must also be determined.

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Groundwater
The horizontal and vertical extent of groundwater contamination in the vicinity of the on-site surface water body AOCs needs to be delineated for VOCs, semivolatile organics, and metals. Phase II investigations will be designed to determine if the water bodies are a source of the contamination observed.

Phase I Utility Lines Release Characterization
Based on the release characterization for the utility line AOCs, the following data gaps have been identified.

Soil
The horizontal and vertical extent of soil contamination in the vicinity of the utility line AOCs needs to be delineated for VOCs, semivolatile organics, dioxin, and metals. The source for the dioxin contamination must also be determined. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

Groundwater
The horizontal and vertical extent of groundwater contamination in the vicinity of the utility line AOCs needs to be delineated for VOCs, semivolatile organics, and metals. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

Phase I Storage Tanks Release Characterization
Based on the release characterization for the storage tank AOCs, the following data gaps have been identified.

Soil
The horizontal and vertical extent of soil contamination in the vicinity of the other AOCs operations needs to be delineated for VOCs, semivolatile organics, and metals. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

Groundwater
The horizontal and vertical extent of groundwater contamination in the vicinity of the other operations AOCs needs to be delineated for VOCs, semivolatile organics, and metals. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

Phase I Other Operations Release Characterization
Based on the release characterization for the other operation AOCs, the following data gaps have been identified.

Soil
The horizontal and vertical extent of soil contamination in the vicinity of the other operations AOCs needs to be delineated for VOCs, semivolatile organics, and metals. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

Groundwater
The horizontal and vertical extent of groundwater contamination in the vicinity of the other operations AOCs needs to be delineated for VOCs, semivolatile organics, and metals. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

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19.4.3 Data Gaps Identified in the Phase I Off-Site Investigation

Based on the release characterization for the on-site sludge disposal AOCs, the following data gaps have been identified. Data gaps are organized by media. Phase II activities designed to provide the data required are discussed in Sections 20, 21 and 22.

Soil

The horizontal and vertical extent of soil contamination in the vicinity of the off-site sampling location needs to be delineated for VOCs, semivolatile organics, and metals. Background samples will be collected from additional borings/monitoring wells proposed in Phase II to achieve this goal.

Groundwater

The horizontal and vertical extent of groundwater contamination in the vicinity of the off-site sampling location needs to be delineated for VOCs, semivolatile organics, and metals. Additional borings/monitoring wells are proposed in Phase II to achieve this goal.

19.5 SUMMARY

This section summarized the conclusions of the physical characterization, release characterization, and off-site characterization performed during the Phase I RCRA Facility Investigation of this Site. A preliminary conceptual model of the Site was presented based upon the conclusions arrived at from each of those investigations. Additional conclusions reached from the Phase I Investigation, including additional media of concern, additional SWMUs or AOCs, and the need for any interim measures were also discussed. Finally, the data gaps identified at the conclusion of those investigations were summarized. The Phase II Proposal, presented in Sections 20 through 23, presents an approach to filling each of the data gaps identified in this Section.

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20
INTRODUCTION TO THE PHASE II PROPOSAL

20.1 OVERVIEW

This section presents an introduction to the Phase II RCRA Facility Investigation Proposal. Information to be detailed in each of the next five (5) sections is outlined herein. Phase II proposals for the Site physical characterization, on-site release characterization and off-site release characterization are introduced. The Phase II proposal is presented in this section in the context of data gaps identified during the Phase I physical characterization, on-site release characterization, off-site release characterization and the HERA. This summary is followed in section 20.6 by a brief description of the Phase II strategy for filling the data gaps. The strategies will be developed into a detailed list of Phase II activities in subsequent sections.

The Phase II Proposal is presented in three (3) stages of investigation to ensure that all data gaps are filled at the conclusion of Phase II. Each subsequent stage of investigation will be designed to address data gaps remaining after the previous stage. The goal of the first stage (Phase IIA) is to perform a preliminary investigation to provide data needed to further refine the scope of the remaining Phase II investigation. The Phase IIB proposal presented in this document will be re-evaluated at the end of Phase IIA, and the Phase IIA report will include proposed changes to the scope of the Phase IIB investigation. The goal of the second stage of investigation (Phase IIB) is to fully characterize the horizontal and vertical extent of contamination at the site in all media of concern. The Phase IIB report will identify any data gaps remaining at the end of that investigation. Those data gaps will be filled by the Phase IIC investigation.

Each stage of the Phase II investigation includes four (4) components which are described in the sections that follow; the physical characterization (Section 20.2), the on-site release characterization (Section 20.3), the off-site release characterization (Section 20.4) and the HERA (Section 20.5). Each of these components will be addressed in each stage of the Phase II investigation. The general format of the staged approach is described in Section 20.6. More specific details regarding methods and analyses proposed for each stage are included in Section 21 (Phase IIA Proposal), Section 22 (Phase IIB Proposal), and Section 23 (Phase IIC Proposal).

Table N-1, located in Appendix N, summarizes the data gaps identified in Phase I and indicates the associated stage of the Phase II investigation which is designed to address each individual data gap. Table N-2 lists each of the wells and borings proposed for the Phase II investigation. Proposed wells for the Phase IIA investigation are listed first, followed by a listing of wells and borings proposed for Phase IIB. Proposed well locations are shown on Figure 20-1 and Figure 20-2. Table N-3 summarizes the AOCs monitored by all existing and proposed wells in each flow regime (shallow, intermediate, deep and bedrock). Table N-3 also lists the media of concern for each AOC, and the AOCs monitored by all propsed and existing soil borings and samples from other environmental media (surface water, sediment, soil gas, air).

20.2 PHASE II PHYSICAL CHARACTERIZATION

Included in the Phase II physical characterization are geological, hydrogeological, and hydrological investigations designed to address the data gaps identified during the Phase I physical characterization.

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The data generated during Phase II will allow for the refinement of the preliminary conceptual physical models developed during Phase I. There were no data gaps identified at the conclusion of the Phase I climatological investigation, and therefore no climatological investigations are proposed for Phase II.

The Phase IIA physical investigations are primarily designed to establish background physical and chemical characteristics of soil and groundwater, and to preliminarily describe the interaction between surface water and groundwater, and between groundwater in the overburden and bedrock aquifers. Phase IIB and Phase IIC are designed to further refine the Phase I physical models, as they pertain to the horizontal and vertical extent of soil and groundwater contamination both on-site and off-site, and to more fully characterize interactions between surface water and groundwater, and between the overburden/bedrock. The Phase IIB and IIC physical investigations will be redesigned as necessary, based upon the results of the Phase IIA and Phase IIB investigations, respectively.

20.3 PHASE II ON-SITE RELEASE CHARACTERIZATION

Included in the Phase II on-site release characterization are further investigations of releases in the plating operations area, wastewater treatment area, on-site sludge disposal structures, waste storage yard, on-site surface water bodies, utility lines, storage tanks, and other operations. Data gaps identified during the Phase I investigation regarding the horizontal and vertical extent of soil and groundwater contamination present as a result of operations at these locations will be addressed by this segment of the Phase II characterization. Specific data gaps associated with various AOCs are outlined in Table N-1, and also in Sections 21 and 22.

On-site release characterization will occur throughout the Phase II investigation, however, the majority of the characterization activities are concentrated in Phase IIB. The Phase IIA release characterization activities will focus on determining the depth of contamination on the Site, including assessment of potential contamination in bedrock. The Phase IIB and IIC on-site release characterization investigations will be re-evaluated based upon the results of the Phase IIA investigation.

20.4 PHASE II OFF-SITE RELEASE CHARACTERIZATION

Included in the Phase II off-site release characterization are further investigations of the horizontal and vertical extent of soil and groundwater to the south, east and north of the Site. The horizontal extent of contamination identified in Phase IIA will be used to determine the need for well clusters near the Little River in Phase IIB. If those wells near the Little River are installed, data from those wells will be used to assess the need for surface water and sediment samples from the river. Thus, the scope of off-site activities in Phase IIB and Phase IIC are not yet determined. Those investigations will be designed, as necessary, based upon the results of the Phase IIA and Phase IIB investigations, respectively.

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20.5 PHASE II HERA

Included in the Phase II HERA proposals are activities needed to achieve the submittal of a Draft Baseline Risk Assessment along with the RFI Report. Data gaps identified during Phase I included the need to characterize background concentrations of various analytes detected at the Site and to identify contaminants of concern (COCs). A delineation of wetlands and other wildlife habitat areas, and identification of indicator species and endpoints is also needed. Dose-response evaluation for potential human receptors are needed for all approved COCs. These activities are included in the Phase IIA proposal in two (2) submittals. The second submittal will achieve the objectives of the first interim deliverable outlined in the consent decree.

Following EPA review of those documents, the additional tasks needed to complete the second and third interim deliverables outlined in the consent decree will be performed in Phases IIB and IIC, respectively. This includes estimation of exposure levels and evaluation of carcinogenic and non-carcinogenic risks.

20.6 FORMAT OF THE PHASE II INVESTIGATION

The proposed Phase II investigation uses a staged approach to ensure that all data gaps are filled at the conclusion of Phase II. The contents of each of the proposed stages is outlined below.

20.6.1 Contents of the Phase IIA Investigation

Objectives

The first proposed stage of research and field activities (Phase IIA) is designed to meet the following objectives:

- develop a set of soil and groundwater background values for comparison to analytes detected on the site;
- document seasonal high or low groundwater levels;
- further refine the preliminary conceptual geological, hydrogeological and hydrological models of the Site;
- assess the vertical extent of soil and groundwater contamination in areas where the highest levels of chlorinated VOCs were detected in Phase I;
- assess the horizontal extent of soil and groundwater contamination in off-site areas;
- provide additional information needed for the HERA, including proposed contaminants of concern (COCs) and the ecological risk assessment hazard identification and exposure assessment.

The field activities proposed to meet those objectives will also achieve the following objectives:

- confirm the depth of overburden beneath the site;
- determine whether till is present beneath the site;
- if till is encountered beneath the site, gather data to evaluate the permeability, areal and vertical extent, and chemical quality of groundwater in the till;
- evaluate the depth to bedrock beneath the site;

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- determine the degree of fracturing in the upper portion of the bedrock;
- evaluate groundwater quality in shallow portions of the bedrock;
- evaluate vertical flow gradients in areas where the highest concentrations of chlorinated VOCs were detected during Phase I;

Approach

The proposed Phase IIA Physical Characterization will evaluate background conditions and refine the preliminary conceptual geologic, hydrogeologic, and hydrologic models by performing the following activities:

- advancing borings in three (3) on-site background locations and collecting soil samples from each stratigraphic unit for chemical characterization;
- installing multiple point upgradient groundwater monitoring wells in the three (3) background locations, including one (1) well completed in bedrock, and collecting background groundwater samples;
- installing a staff gauge in the Fire Pond for the purpose of interpreting the interaction between groundwater and surface water on-site;
- performing staff gauge readings and groundwater measurements from all monitoring wells if a seasonal high or low groundwater period coincides with the Phase IIA activities.

The proposed Phase IIA Release Characterization will evaluate the vertical extent of contamination beneath the site and provide additional information for refining the conceptual geological and hydrogeological models by performing the following preliminary bedrock investigation:

- advancing borings into bedrock in two (2) areas where the highest levels of chlorinated solvents were detected in Phase I, and collecting soil samples for evaluating vertical extent of soil contamination;
- installing additional wells to achieve a four-point well cluster at both locations (including shallow, intermediate, deep and bedrock wells), and collecting groundwater samples for evaluating vertical extent of groundwater contamination.

The proposed Phase IIA Off-site Investigations will evaluate the horizontal and vertical extent of contamination and provide additional information for refining the conceptual geological and hydrogeological models by implementing the following activities:

- advancing eleven (11) borings in off-site investigation areas, and collecting soil samples for evaluating horizontal and vertical extent of soil contamination;
- installing wells in southern, southeastern and northern off-site areas, and collecting groundwater samples for evaluating horizontal and vertical extent of groundwater contamination.

The proposed Phase IIA HERA will develop a list of COCs for the Site and provide a preliminary ecological risk assessment. This objective will be addressed by:

- comparing data in the Phase I preliminary risk assessment data set to background values and toxicity data to develop a proposed list of contaminants of concern;

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- performing a wetland and wildlife habitat delineation.

Deliverables

The following deliverables will be submitted to the EPA as part of Phase IIA:

- monthly progress reports;
- an interim HERA submittal consisting of a proposed list of COCs for the human and ecological risk assessments (to be submitted after background analytical data have been evaluated) and description of proposed indicator species and endpoints for the ecological risk assessment.
- a Phase IIA report.

The Phase IIA report will describe the results obtained from these investigations and will outline proposed changes to the Phase IIB Proposal necessitated by findings of the Phase IIA work. The report will also propose a list of contaminants of concern. The Phase IIB proposal will be based upon analysis of the following information:

- the laboratory analytical data from the Phase IIA Physical Characterization which will be used to determine background concentrations for inorganic analytes, semivolatile organics, dioxins, pesticides, herbicides and PCBs.
- the boring logs from the Phase IIA Physical Characterization, Release Characterization and Off-Site Investigations which will be used to refine the preliminary conceptual geological, hydrogeological and hydrological models of the site. The Phase IIB Physical Characterization proposal will be re-evaluated to determine whether tasks should be added or eliminated based upon data collected during Phase IIA.
- the laboratory analytical data from the Phase IIA Release Characterization will be evaluated to determine the vertical extent of soil and groundwater contamination. Soil and groundwater analytical data from borings and wells advanced into the till unit (if found) and bedrock unit beneath the Site will be evaluated to establish if these geologic units have been impacted by releases at the Site. If contamination is not detected in bedrock wells, the Phase IIB proposal will be tailored to further evaluate those stratigraphic units above the bedrock which may have been impacted by releases from the AOCs.
- the data from the Phase IIA Off-site Investigations will be evaluated to determine whether the horizontal and vertical extent of the release has been defined. If the extent of contamination is defined in these areas by the Phase IIA activities, the Phase IIB proposal will be re-evaluated to determine whether all of the additional off-site investigations included in the Phase IIB proposal will be needed.
- the EPA's comments on the Phase I HERA will be used to revise the human hazard identification and exposure pathways and parameters identified in the Phase I report. A dose-response evaluation will be provided for the list of COCs approved by EPA. The Agency's comments on the ecological hazard identification provided in the interim submittal will be incorporated into a revised ecological hazard assessment, and an ecological exposure assessment will be presented. This submittal will conform with the second interim deliverable identified in the Consent Decree.

The purpose of Phase IIA is to provide additional data needed to refine the scope of the Phase IIB

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investigation. Therefore, to streamline the project timeline, the Phase IIA report will not include detailed plans, cross-sections, and calculations beyond the extent needed to justify proposed modifications to Phase IIB.

20.6.2 Contents of the Phase IIB Investigation

Objectives

The second proposed stage of research and field activities (Phase IIB) is designed to meet the following objectives:

- fill remaining data gaps from the Phase IIA geological, hydrogeological and hydrological investigations;
- collect any additional data needed to prepare the Media Protection Standards (MPS) Proposal;
- document seasonal high or low groundwater levels;
- characterize the horizontal and vertical extent of the releases from the site if this was not accomplished by the Phase IIA investigations to an adequate degree to perform the Corrective Measures Study (CMS);
- complete the third interim deliverable of the HERA.

Approach

The approach to conducting Phase IIB activities will be as follows:

The Phase IIB Physical Characterization will fill any data gaps remaining after the Phase IIA activities by:

- collection of additional soil samples from borings for proposed monitoring wells for analysis of physical parameters;
- perform staff gauge readings and groundwater measurements on all monitoring wells if a seasonal high or low groundwater period coincides with the Phase IIA activities.

The proposed Phase IIB Release Characterization will be designed to fill all data gaps identified in the Phase IIA Release Characterization within the horizontal and vertical limits of contamination established by the Phase IIA activities. Those data gaps will be filled by:

- advancing borings for monitoring well installation in areas of the Site not adequately characterized during Phase IIA and collecting soil samples for evaluating the nature and extent of soil contamination;
- installing an adequate number of well clusters to delineate the nature and extent of contamination throughout the site;
- performing a comprehensive monitoring round incorporating sampling of all on-site and off-site wells.

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The proposed Phase IIB Off-site Investigations will further delineate the extent off-site release migration if needed by:

- the installation of additional well clusters near the Little River if contamination is detected in the southern and southeastern off-site area in Phase IIA;
- the installation of additional well clusters in the northern area if contamination is detected in the northern off-site well in Phase IIA

The proposed Phase IIB HERA will include preparation of the third interim deliverable for the Health and Environmental Risk Assessment by:

- incorporating validated data from Phases IIA and IIB into the preliminary risk assessment data set;
- expanding the human exposure assessment to include average and reasonable maximum exposure levels
- performing a risk characterization for carcinogenic and non-carcinogenic risks
- identifying limitations and uncertainties
- revising the ecological risk assessment to incorporate Agency comments on the Phase IIA submittal and validated data from Phases IIA and IIB.

Deliverables

The following deliverables will be submitted to the EPA as part of Phase IIB:

- monthly progress reports;
- a Phase IIB report.

The Phase IIB report will provide a comprehensive summary of all data obtained from the Phase IIA and Phase IIB activities. The Phase IIB report will also outline proposed changes to the Phase IIC Proposal. The Phase IIC proposal will be based upon the following analysis:

- the field logs and laboratory analytical data from the Phase IIA and IIB Physical Characterization will be used to further refine the conceptual geologic, hydrogeologic and hydrologic models of the site. Revised geologic cross-sections will be prepared based upon data in boring logs from Phase IIA and Phase IIB. Seasonal high or low groundwater measurements will be used to construct groundwater contours and flow nets. Interactions between groundwater and surface water will be evaluated based upon data from Phases IIA and IIB.

- the laboratory analytical data from the Phase IIB Release Characterization will be used to describe the nature and extent of the contamination in the media of concern for each AOC.

- the data from the Phase IIB Off-site Investigations will be evaluated to determine whether the horizontal and vertical extent of the releases have been defined. If the extent of contamination is defined in these areas by the Phase IIA and IIB activities, the Phase IIC proposal will be re-evaluated to determine whether all of the additional off-site investigations included in the Phase IIC proposal will be needed.

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20.6.3 Contents of the Phase IIC Investigation

Objectives
The third and final proposed stage of research and field activities (Phase IIC) is designed to meet the following objectives:

- fill remaining data gaps from the Phase IIB Physical Investigation, Release Characterization and Off-Site Investigations.
- document seasonal high or low groundwater levels;
- submit the Draft Baseline Risk Assessment

Approach
The proposed Phase IIC Physical Characterization will fill any data gaps remaining after the Phase IIB activities by:

- performing staff gauge readings and groundwater measurements on all monitoring wells if a seasonal high or low groundwater period coincides with the Phase IIC activities.
- collecting additional samples from locations where critical analytical data were rejected.
- installing additional wells to further delineate the extent of contamination, if necessary.

The proposed Phase IIC Off-site Investigations will further delineate the extent off-site release migration if needed by completing the following activities:

- collecting surface water and sediment samples from the Little River if Phase IIB field and analytical data indicate that contaminated groundwater attributable to releases from AOCs at the Site is discharging to that water body.

The proposed Phase IIC HERA will include preparation of the Draft Baseline Risk Assessment by completing the following activities:

- compiling information accepted by the EPA in all interim submittals into a comprehensive document incorporating any new validated data obtained during Phase IIC in a report format conforming to the outline provided in the Consent Decree.

Deliverables
The following deliverables will be submitted to the EPA as part of Phase IIC:

- monthly progress reports;
- a complete RFI Report.

The RFI report will include the following:

- a full characterization of the physical characteristics of the site and surrounding area based upon data obtained from all phases of the RFI;
- evaluation of the nature and extent of contamination of environmental media;
- a Media Protection Standards Proposal;

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- a further evaluation of corrective measures;
- a Draft Baseline Risk Assessment;
- appendices containing all supporting data.

20.7 SUMMARY

The Phase II Proposal, to be presented in Sections 21, 22, and 23, is designed to be completed in three (3) stages of investigation to ensure that all data gaps are addressed at the conclusion of Phase II. The primary goals of these investigations are to fully characterize of the physical characteristics of the site and surrounding area, to evaluate the nature and extent of contamination of environmental media, to provide proposed Media Protection Standards, to preliminarily evaluate available corrective measures, and to provide a Draft Baseline Risk Assessment. The purpose of the Phase IIA discussed in Section 21, is to perform a preliminary investigation to provide data needed to further refine the scope of the remaining Phase II investigation. The Phase IIB proposal, presented in Section 22, will be re-evaluated at the end of Phase IIA, and proposed changes to the scope of the Phase IIB investigation will be included in the Phase IIA report. The goal of the Phase IIB investigation is to fully characterize the horizontal and vertical extent of contamination at the site in all media of concern. Data gaps remaining at the end of Phase IIB will be addressed by the Phase IIC investigation, as outlined in Section 23.

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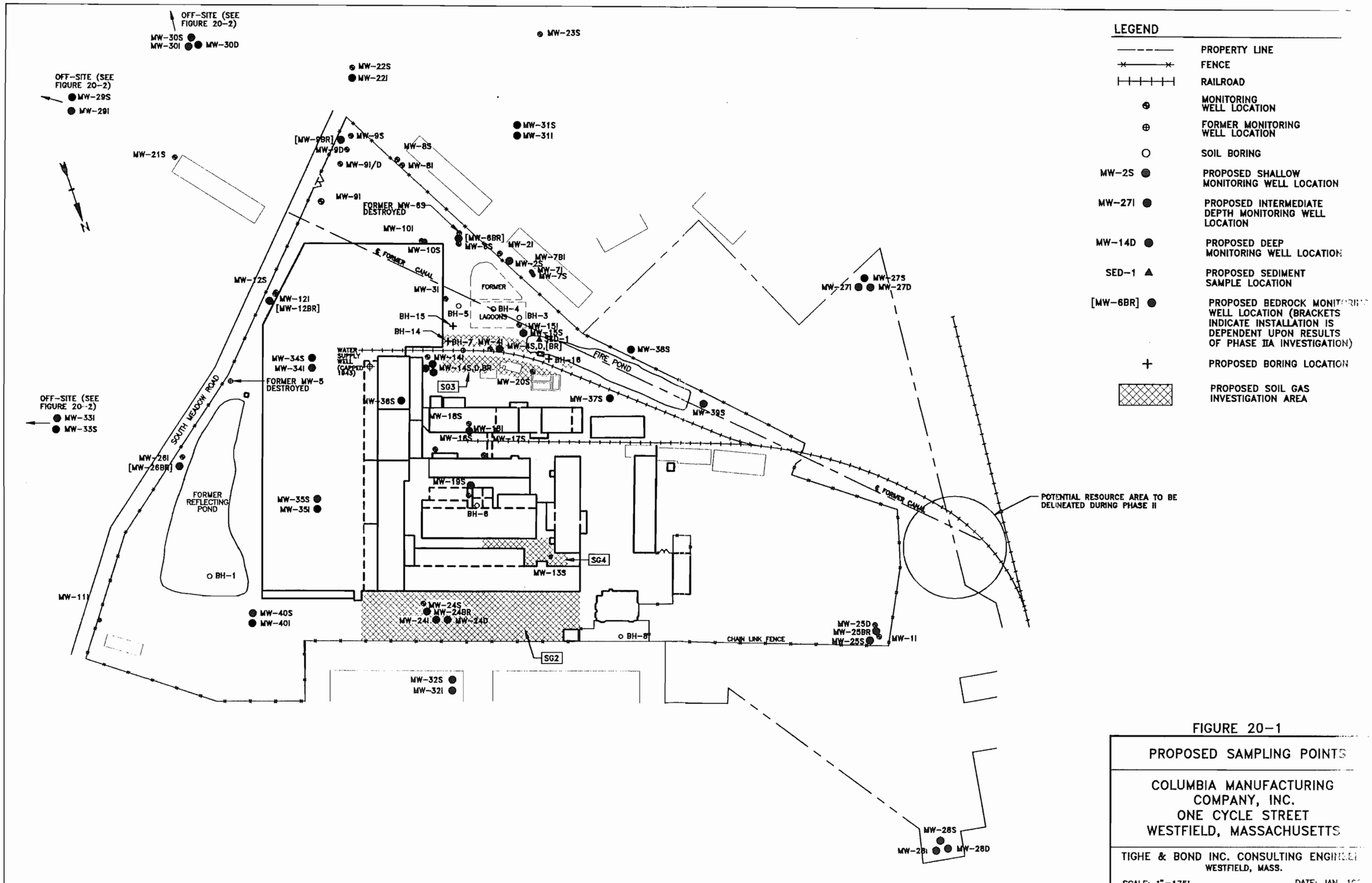

FIGURE 20-1

PROPOSED SAMPLING POINTS

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=175'

DATE: JAN. 19

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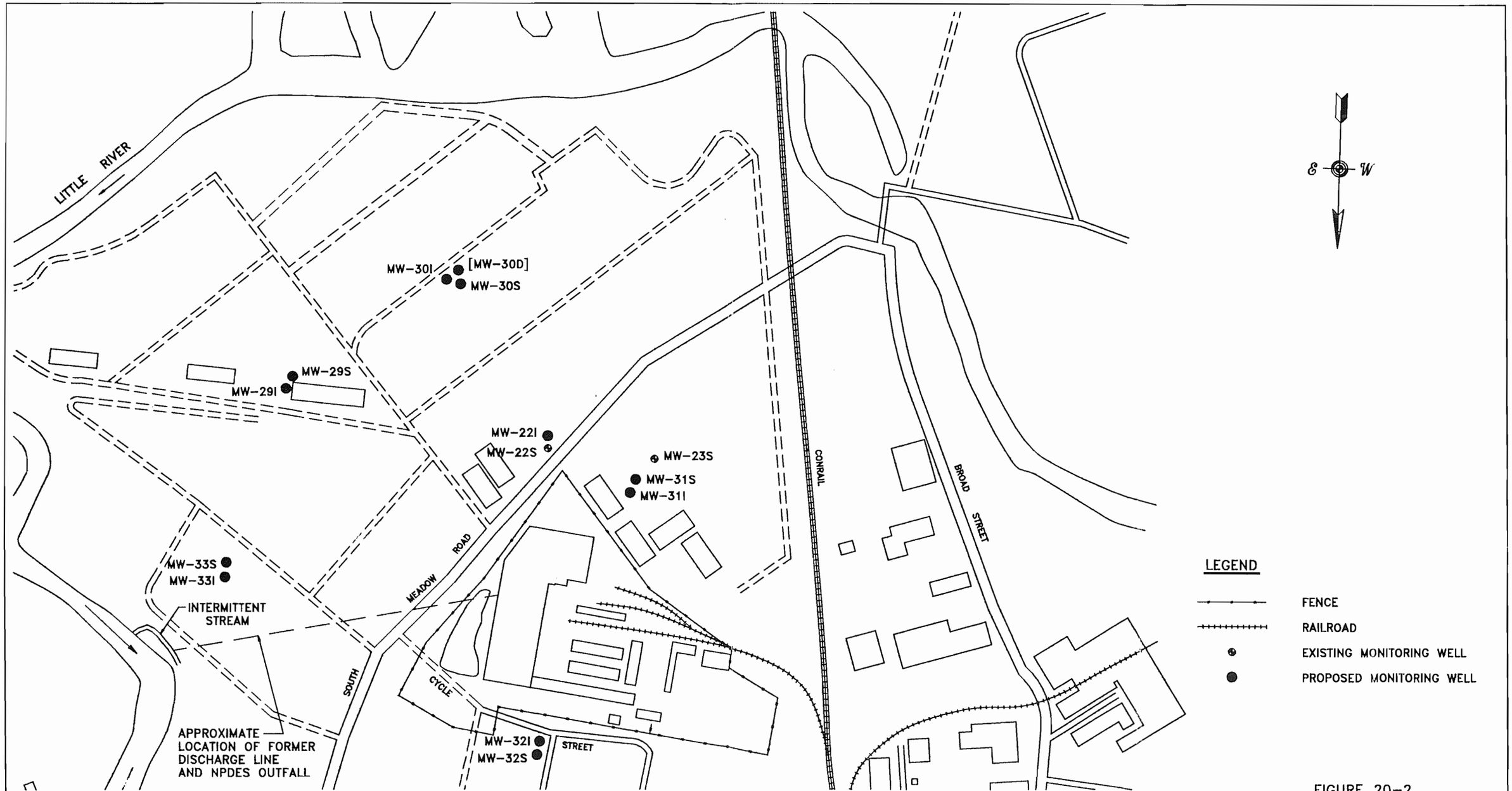

FIGURE 20-2

PROPOSED OFF-SITE WELL LOCATIONS

COLUMBIA MANUFACTURING COMPANY, INC
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=400' DATE: SEPTEMBER 1994

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21
PHASE IIA PROPOSAL

21.1 OVERVIEW

This section presents the scope of work for the Phase IIA investigation of the Site. The Phase IIA Proposal includes each of the three (3) investigations that were incorporated into the Phase I investigation. These were the:

- Physical characterization;
- Release characterization; and
- Off-site investigation.

In addition, a proposal for Phase II HERA activities is provided. The activities proposed for the Phase IIA investigation are detailed in the following sections. Appendix N includes summary tables outlining the activities described herein. Section 21.2 describes the objectives of the Phase IIA investigation. The Phase IIA physical characterization proposal is presented in Sections 21.3 through 21.6. The Phase IIA release characterization proposal is presented in Section 21.7, and the Phase IIA off-site investigation proposal is included in Section 21.8. The Phase IIA HERA proposal is presented in Section 21.9. The proposed Phase IIA Interim Report is described in Section 21.10, and a summary is presented in Section 21.11.

The Phase II work will be completed using procedures detailed in the June, 1993 RFIP. Written procedures for field activities not performed during Phase I, or procedures which will be updated for Phase II, will be submitted to the EPA for approval. Each of the new procedures (for example, bedrock monitoring well installation and low flow groundwater sampling procedures) will be briefly discussed and referenced within this section. Detailed plans for the work will be submitted to the EPA prior to commencement of Phase IIA field activities.

Proposed amendments to the list of analyses to be performed on samples collected are described in Section 21.7 The analyte list detailed in that section is referred to as "selected" Appendix IX analytes throughout this section. The proposed analyte list is based upon the analytical data from Phase I that were discussed in the preceding sections of this report.

21.2 OBJECTIVES OF THE PHASE IIA INVESTIGATION

The Phase IIA investigation is designed to meet the following objectives:

- develop a set of soil and groundwater background values for comparison to analytes detected on the site;
- document seasonal high or low groundwater levels;
- further refine the preliminary conceptual geological, hydrogeological and hydrological models of the Site;
- assess the vertical extent of soil and groundwater contamination in on-site areas where the highest levels of chlorinated VOCs were detected in Phase I;
- assess the horizontal extent of soil and groundwater contamination in off-site areas;

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- provide additional information needed for the HERA, including proposed contaminants of concern (COCs) and the ecological risk assessment hazard identification and exposure assessment;
- fill analytical data gaps identified in the Phase I investigation.

The field activities proposed to meet those objectives will also achieve the following objectives:

- confirm the depth of overburden beneath the site;
- evaluate whether till is present beneath the site;
- if till is encountered beneath the site, gather data to evaluate the permeability, areal and vertical extent, and chemical quality of groundwater in the till;
- confirm the type of bedrock unit present beneath the site;
- determine the degree of fracturing in the upper portion of the bedrock;
- evaluate groundwater quality in shallow portions of the bedrock;
- evaluate vertical flow gradients in areas where the highest concentrations of chlorinated VOCs were detected during Phase I;

These objectives were designed to fill data gaps identified during the Phase I RCRA Facility Investigation. Some of the data gaps will be addressed by activities proposed for Phase IIA; the remaining data gaps are to be addressed by proposed Phase IIB activities. Only the data gaps to be addressed by Phase IIA activities are discussed in the following sections. A proposal for addressing data gaps remaining from Phase IIA will be provided in the Phase IIA Interim Report.

21.3 THE PHASE IIA PHYSICAL CHARACTERIZATION

The goal of the Phase IIA physical characterization proposal that follows is to fill data gaps identified at the end of the Phase I investigation, allowing the refinement of the preliminary conceptual geological, hydrogeological and hydrological models of the Site that were developed at the end of Phase I. Specifically, the following tasks will be completed:

- develop a set of soil and groundwater background values for comparison to analytes detected on the site;
- document seasonal high or low groundwater levels;
- combine hydrological data with information gathered from the hydrogeological investigation to determine the interaction between groundwater and surface water bodies and further define the impact of Site activities on sediment and surface water.
- further refine the preliminary conceptual geological, hydrogeological and hydrological models of the Site;
- fill analytical data gaps identified in the Phase I investigation.

The geological investigation is discussed in Section 21.4, the hydrogeological investigation is discussed in Section 21.5, and the hydrological investigation is discussed in Section 21.6.

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21.4 PHASE IIA GEOLOGICAL INVESTIGATION

This section presents the scope of work for the Phase IIA geological investigation. The objectives of the Phase IIA geological investigation are as follows:

- develop a set of soil background values for analytes detected on the Site;
- confirm the depth of overburden beneath the site;
- verify the presence of the till unit beneath the site;
- characterize the depth, extent, permeability and chemical quality of the till unit if encountered;
- confirm the bedrock unit beneath the site, and assess the degree of fracturing of bedrock;
- further refine the preliminary conceptual geological model of the Site.

21.4.1 Summary of the Phase I Geological Results

The Phase I geological investigation reached the following conclusions:

- Five (5) major stratigraphic units were identified in the overburden deposits beneath the Site. These units include: fill, eolian sands, alluvium/stratified drift, glaciolacustrine deposits, and till (tentatively identified). This interpretation is in good agreement with data presented in the literature;
- The thickness of overburden deposits beneath the site was estimated between 97 and 132 feet based upon previous boring logs. This estimate agrees with published information;
- The bedrock unit beneath the site was determined by the literature survey to be the New Haven Arkose formation. This was not confirmed by Phase I field investigations;
- Sieve analysis data revealed variations in grain sizes that were correlated with different stratigraphic units on the site. The differences in grain sizes correlate to differences in physical and chemical properties that may influence migration of contaminants in the subsurface.

21.4.2 Data Gaps to be Addressed by the Phase IIA Geological Investigation

The Phase IIA geological investigation is designed to fill the following data gaps identified by the Phase I geological investigation:

Hydraulic conductivities of unsaturated units not determined These values were not estimated due to non-uniform grain size and lack of porosity data. Samples should be collected for determination of the porosity of all unsaturated units at the Site.

Vertical flow rate of overburden units not determined. Vertical hydraulic conductivities were not determined during the Phase I investigation. Undisturbed samples should be collected from saturated overburden units for laboratory permeability testing.

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Till unit requires additional characterization. The till unit tentatively identified beneath the glaciolacustrine deposits requires further investigation to characterize the depth, thickness, continuity, chemical quality, physical properties and hydraulic conductivity of that unit.

Bedrock unit not characterized. The Phase I Scope of Work did not include advancement of bedrock cores. The depth to bedrock, degree of fracturing of the bedrock surface, and presence of contamination in that unit are therefore unknown.

More data is needed to determine background values for soils. The Phase I sampling program did not provide adequate data to develop background values for metals, PAHs, and dioxins for soils. Background values are needed for soils at various depths.

21.4.3 Phase IIA Activities for Filling Geological Data Gaps

The following activities are proposed for the Phase IIA geological investigation:

- advance two (2) borings to the top of the bedrock surface and one (1) boring into bedrock in on-site background locations upgradient of release areas;
- advance borings into bedrock at two (2) locations where releases have occurred;
- advance six (6) borings into the glaciolacustrine unit in off-site locations downgradient of release areas;
- perform headspace analysis and lithologic logging on samples collected from all borings.
- collect selected samples from each lithologic unit for physical analysis;
- collect selected samples from each lithologic unit in the background locations for chemical analysis.

Groundwater monitoring wells will be installed in these borings and additional shallower borings will also be advanced at these locations as described in Section 21.5. Borings that are to be completed as wells are identified by the proposed well number. Locations of all proposed borings and wells are illustrated on Figure 20-1 and 20-2.

All proposed well installations will result in the completion of multiple-point well clusters. Soil samples will be collected only during advancement of the deepest boring at each location. Lithologic logging of these samples will be used to select the screened interval of adjacent shallower wells. Samples will be collected during advancement of shallower wells only if additional soils samples are needed to meet all analytical requirements. In locations where new wells are being installed adjacent to existing wells, collection of soil samples will begin at the top of the five foot (5') increment below the last sample collected for the previous well installation.

Advancement of all soil borings for monitoring well installation, collection of soil samples for lithologic logging, physical analysis and headspace analysis, and collection of soil samples from on-site background boring locations is discussed below. Analysis of groundwater samples collected from the upgradient locations is discussed in Section 21.5 Chemical analysis of soil and groundwater samples collected from borings and wells installed in the two (2) release area

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locations is described in Section 21.7. Chemical analysis of soil and groundwater samples collected from borings and wells installed in the six (6) off-site locations is described in Section 21.8. The proposed Phase IIA Sampling Plan is summarized in Table N-4 in Appendix N.

The activities proposed for the Phase IIA geological investigation are detailed below.

Advance two (2) borings to the bedrock surface and one (1) boring into bedrock in on-site background locations upgradient of release areas Borings will be advanced to the top of the bedrock surface in background locations MW-27D and MW-28D. A boring will be extended into the bedrock unit beneath the Site at the location of MW-25BR. Groundwater monitoring wells will be installed in these borings and additional shallower borings will also be advanced into the alluvium/stratified drift, glaciolacustrine, and till units at these locations as described in Section 21.5. Locations of all proposed borings and wells are illustrated on Figure 20-1 and 20-2. During the advancement of these borings, the following samples will be collected:

- Split-spoon samples will be collected at five-foot (5') intervals except where undisturbed samples are collected. All split-spoon samples will be collected for headspace analysis and lithologic logging;
- Three (3) split-spoon samples, including one (1) from each background boring location, will be selected from each of the five (5) overburden stratigraphic units to be analyzed for Appendix IX VOCs, semivolatiles organics, dioxins, cyanide and metals;
- Additional samples will be collected as needed to ensure that selected Appendix IX analyses are performed on samples from each background location at each of the three (3) depth intervals identified in the HERA. Those intervals are zero to two feet (0-2'), two to fifteen feet (2-15'), and greater than fifteen feet (>15').
- Three (3) split-spoon samples, including one (1) from each background boring location, will be selected from the glaciolacustrine unit for sieve and hydrometer analysis;
- Three (3) split-spoon samples, including one (1) from each background boring location, will be selected from the till unit for sieve and hydrometer analysis;
- Three (3) undisturbed samples, including one (1) from each background boring location, will be selected from each of the five (5) major overburden stratigraphic units encountered to be analyzed for physical characteristics;
- A fifteen-foot (15') rock core sample will be collected from the bedrock unit. The Rock Quality Designation (RQD) index will be calculated for the rock core.

Advance borings into bedrock at two (2) locations where releases have occurred Borings will be extended into the bedrock unit beneath the site at proposed locations for MW-14BR and MW-24BR. Additional shallower borings will also be advanced into the alluvium/stratified drift, glaciolacustrine and till units at these locations and groundwater monitoring wells will be installed in these borings as described in Section 21.5. During the advancement of these borings, the following samples will be collected:

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- Split-spoon samples will be collected at five-foot (5') intervals except where undisturbed samples are collected. All split-spoon samples will be collected for headspace analysis and lithologic logging;
- Two (2) split-spoon samples, one (1) from each location, will be selected from the glaciolacustrine unit for sieve and hydrometer analysis;
- Two (2) split-spoon samples, one (1) from each location, will be selected from the till unit for sieve and hydrometer analysis;
- Two (2) undisturbed samples, one (1) from each location, will be selected from each of the five (5) major overburden stratigraphic units to be analyzed for physical characteristics;
- Two (2) fifteen-foot (15') rock core samples, one (1) from each location, will be collected from the bedrock unit. The Rock Quality Designation (RQD) index will be calculated for the rock core.

Collection of additional samples for chemical analysis from these borings and associated borings for well cluster installation is discussed in Section 21.7.

Advance six (6) borings into the glaciolacustrine unit in off-site locations downgradient of release areas. Borings will be advanced into the glaciolacustrine unit in downgradient locations MW-22I, MW-29I, MW-30I, MW-31I, MW-32I and MW-33I. Additional shallower borings will also be advanced into the alluvium/stratified drift and groundwater monitoring wells will be installed in these borings, as described in Section 21.5. During the advancement of these borings, the following samples will be collected:

- Split-spoon samples will be collected at five-foot (5') intervals except where undisturbed samples are collected. All split-spoon samples will be collected for headspace analysis and lithologic logging;
- Six (6) undisturbed samples, one (1) from each downgradient boring location, will be collected from the fill or eolian sand unit (as encountered), the alluvium/stratified drift unit, and the glaciolacustrine unit to be analyzed for physical characteristics.

Collection of additional samples for chemical analysis from these borings and associated borings for well cluster installation is discussed in Section 21.7.

21.4.4 Phase II Geological Investigation Additional Considerations

The relationship of the Phase II geological investigation to other Phase II investigations and any contingencies that could impact the Phase II scope of work are discussed below.

Relationship with Other Phase II Investigations

The field activities proposed for the Phase IIA geological investigation will be performed in conjunction with the field activities for all other Phase IIA investigations. Additional borings for monitoring well installations, installation of monitoring wells, and collection of soil and groundwater samples for chemical analysis for release characterization and off-site investigation will be completed in conjunction with the tasks described above.

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The data obtained from the Phase IIA geological investigation will be used to refine the geological, hydrogeological, and release characterization models for the Site, and to augment risk assessment data collected for the HERA. In addition, the data will be used to develop the Phase IIB and Phase IIC geological and hydrogeological investigations, as follows:

- data obtained from lithologic logging and headspace analysis of samples from these borings may be used to select appropriate depths for the screened intervals of the wells to be installed in each location during the Phase IIA and Phase IIB hydrogeological investigation.
- data obtained from the physical analysis of samples collected from these borings will allow more detailed analysis of the groundwater flow pathways during the Phase IIB hydrogeological investigation.
- data from the chemical analysis of samples collected from the background boring locations will allow a more accurate determination of the extent of Site-related contamination in soils during the Phase IIB release characterization.
- data obtained from chemical analysis of soil samples collected at the background locations will be used to identify contaminants of concern (COCs) for the Phase IIA HERA.

Contingencies

Till unit not encountered. In cases where the till unit is not encountered, the sampling plan will be diminished to eliminate the proposed samples from that unit.

New stratigraphic unit identified. If a stratigraphic unit that was not encountered during the Phase I investigation is identified during Phase IIA, the sampling plan will be expanded to include collection of samples for physical characterization. If the unit is encountered in the background location, samples will also be collected for chemical characterization.

Inadequate split-sample volume recovered for all chemical analyses needed. In this event, the split-spoon sampler may be lowered into the augers again. If the sampler returns to the top of the previously sampled interval, the sampler may be re-driven. Alternatively, samples from the same depth may be collected from subsequent borings for adjacent well installation or by advancing offset borings. Offset borings must be within ten feet (10') of the original sample location unless field conditions preclude this.

Shelby tube samples cannot be collected. Shelby tubes may have poor recovery in unconsolidated materials. It may be impossible to push Shelby tubes in coarse-grained or dense materials. If a Shelby tube is found to contain inadequate material for the proposed analyses, a Shelby tube will be pushed a second time after advancement of the next auger flight. If the second attempt is unsuccessful, Shelby tube sampling will not be completed in that unit in that boring, but will be attempted in subsequent borings advancing through that unit at the same location for well installations. If all attempts at a location are unsuccessful, values for physical analyses from the same unit at other locations will be averaged and applied to that location. In addition, variable head permeability tests (slug tests) will be performed during Phase IIB on all Phase IIA and Phase IIB wells to generate hydraulic conductivity values. If Shelby tubes cannot

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be pushed in coarse-grained or dense stratigraphic units, the drilling inspector may eliminate Shelby tube sampling of that unit. The reason for eliminating the sample will be documented in the Phase IIA Report.

Access to off-site areas denied or delayed. If access to off-site areas cannot be gained by CMC at the time that the Phase IIA field activities are scheduled to begin, borings may not be advanced in those areas. CMC will notify the EPA if such a situation arises or is anticipated.

21.4.5 Summary of the Phase IIA Geological Investigation

The purpose of the Phase IIA geological investigation is to further define on-site stratigraphy, including the characterization of the till and bedrock units, to develop soil chemical background values for comparison to contaminant concentration data, and to gather additional soil analytical data for the HERA. In order to accomplish these goals, soil borings will be advanced in eleven (11) locations. Borings will be extended into bedrock at three (3) locations, to the top of the bedrock surface in two (2) locations, and into the glaciolacustrine deposits in six (6) locations. Soil samples will be collected for lithological logging, field screening, and physical and chemical analysis. The data gathered will be evaluated and used to refine the preliminary conceptual geological, hydrogeological, and hydrological for the Site, and to augment risk assessment data collected for the HERA.

21.5 PHASE IIA HYDROGEOLOGICAL INVESTIGATION

This section presents the scope of work for the Phase IIA hydrogeological investigation. The objectives of the Phase IIA hydrogeological investigation are as follows:

- develop a set of groundwater background values for comparison to analytes detected on the site;
- further refine the preliminary conceptual hydrogeological model of the Site;
- document seasonal high and low groundwater levels;
- provide additional analytical data needed for the HERA;
- refine groundwater contours in the two (2) groundwater flow regimes for which contours were drawn in the Phase I investigation;
- augment piezometric data for the deep flow zone to allow contouring in that zone;
- evaluate relative piezometric elevations in the bedrock;
- further evaluate vertical flow gradients at the Site;
- fill analytical data gaps identified in the Phase I investigation.

21.5.1 Summary of the Phase I Hydrogeological Results

The Phase I hydrogeological investigation reached the following conclusions:

- The overburden aquifer at the site is unconfined. Groundwater flow directions through the alluvial and glaciolacustrine deposits (shallow and intermediate flow) is toward the Little River.

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- Based on the downward flow gradient evidenced in shallow/intermediate well clusters at the Site, investigation of deeper unconsolidated zones and bedrock is necessary. Chemistry data provided during the Phase I investigation must be supplemented in order to further track flow between deeper unconsolidated zones and the bedrock aquifer.
- The overburden aquifer consists of highly variable geological materials, and is poorly sorted in many areas. In addition, man-made features such as the former lagoons appear to further complicate subsurface conditions. These conditions lead to variability in hydrogeological parameters such as hydraulic conductivity, groundwater flow direction and gradients, and flow velocity.
- A till layer was observed beneath the glaciolacustrine deposits during the advancement of two (2) borings at the Site. The till may or may not act as a confining layer over the bedrock. Further investigation of the bedrock/overburden interface is needed in order to determine the geotechnical properties of the till layer, to determine if the till is continuous across the Site and to evaluate if the till is an effective barrier to the vertical migration of contaminants into the bedrock aquifer.

21.5.2 Data Gaps to be Addressed by the Phase IIA Hydrogeological Investigation

The Phase IIA hydrogeological investigation is designed to fill the following data gaps identified by the Phase I hydrogeological investigation:

High and low groundwater table measurements are needed. Seasonal high and low groundwater level measurements will be obtained during Phase II. High groundwater generally occurs in this area in the spring, with low water table conditions occurring in the late summer or early fall.

Bedrock hydrogeology not characterized. The Phase I Scope of Work did not include the installation of bedrock monitoring wells. Groundwater flow characteristics and chemistry of the bedrock unit are undefined.

More data is needed to determine background values for groundwater chemistry. The Phase I sampling program did not provide adequate data to develop background values for inorganics in groundwater. Background values are needed for groundwater from each stratigraphic unit.

21.5.3 Phase IIA Activities for Filling Hydrogeological Data Gaps

The following activities are proposed for the Phase IIA hydrogeological investigation:

- install monitoring wells in the four (4) saturated stratigraphic units identified on the Site (alluvium/stratified drift, glaciolacustrine, till, and bedrock);
- collect background groundwater samples from background wells to characterize the chemical quality of groundwater in various units.
- collect additional hydrogeological data.

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Each of these activities is described below, and the specific sampling and analysis tasks associated with those activities are detailed on Table N-4 in Appendix N. Groundwater monitoring well locations are shown on Figures 20-1 and 20-2.

Groundwater samples will be collected from each of the 26 wells installed as part of the Phase IIA investigation. Specific sampling locations and analyses are discussed in the next three (3) sections.

Install monitoring wells in the four (4) saturated stratigraphic units identified on the Site. The Phase IIA hydrogeological investigation includes installation of a total of 26 monitoring wells. This includes installation of nine (9) shallow wells (designated with an "S") screened in the alluvium/stratified drift unit at a depth that intersects the water table, nine (9) intermediate wells (designated with an "I") screened in the glaciolacustrine deposits, four (4) deep wells (designated with a "D") screened in the till unit or immediately above the bedrock if no till is encountered, and three (3) wells completed in the bedrock unit (designated with a "BR").

Soil samples will be collected during advancement of the deepest boring at each location, as described in Section 21.4.3. The precise depth at which the screened interval of each well is to be set will be determined in the field by the drilling inspector based upon lithologic logging and headspace screening of samples collected from that boring. In some cases, samples may be collected from the shallower borings if samples were not collected during advancement of the deeper boring. The locations of all proposed monitoring wells are indicated in Figures 20-1 and 20-2. A description of the well location, purpose and additional objectives met by installation of each well is summarized on Table N-2 in Appendix N.

Eight (8) monitoring wells will be installed in (3) on-site background locations upgradient of Site activities. Two (2) wells will be installed adjacent to the existing well cluster formed by MW-1I and MW-25D. The remaining wells will be installed in two (2) new monitoring locations. These wells will be installed as follows:

- MW-25S, MW-27S and MW-28S will be screened in the alluvium/stratified drift unit;
- MW-27I and MW-28I will be screened in the glaciolacustrine unit
- MW-27D and MW-28D will be screened in the deep glaciolacustrine unit, or in the till, if present;
- MW-25BR will be screened in bedrock.

Groundwater samples collected from all eight (8) monitoring wells will be analyzed for selected Appendix IX analytes that were detected with significant frequency in Phase I. These analytes are listed in Section 21.7.

Six (6) monitoring wells will be installed in two (2) on-site locations, adjacent to existing wells MW-14I and MW-24S. These monitoring wells will be installed as follows:

- MW-14S will be screened into the alluvium/stratified drift unit;
- MW-24I will be screened into the glaciolacustrine unit;

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- MW-14D and MW-24D will be screened in the deep glaciolacustrine sediments, or into the till, if present;
- MW-14BR and MW-24BR will be screened in bedrock.

Twelve (12) monitoring wells will be installed in six (6) off-site locations. Well MW-22I will be installed adjacent to existing well MW-22S. Wells MW-29S/I, MW-30S/I/D, MW-31S/I, MW-32S/I, MW-33S/I will be installed in new locations (See Figure 20-2). These borings will be advanced as follows:

- MW-33S, MW-29S, MW-30S, MW-31S, and MW-32S will be screened in the alluvium/stratified drift unit;
- MW-22I, MW-29I, MW-30I, MW-31I, MW-32I and MW-33I will be screened in the glaciolacustrine unit;

Collect background groundwater samples from background wells to characterize the chemical quality of groundwater in various units.

- Groundwater samples will be collected from all background wells to be analyzed for selected Appendix IX analytes. Samples to be analyzed for metals will be collected using low flow sampling methods. The results of these analyses will be used to establish background groundwater quality.

Additional samples will be collected for analysis from the newly installed wells and selected previously installed wells. Those analyses are discussed in Section 21.7 and Section 21.9.

Collect additional hydrogeological data. Following well completion and development, a round of groundwater sampling and water table measurements will be performed. Sampling for chemical analysis is discussed in Section 21.7.

- Water levels will be measured in all wells. The data will be used to draw groundwater contours and to determine the vertical gradient in the newly installed well clusters.

21.5.4 Phase II Hydrogeological Investigation Additional Considerations

The relationship of the Phase II hydrogeological investigation to other Phase II investigations and any contingencies that could impact the proposed Phase II scope of work are discussed below.

Relationship with Other Phase II Investigations

The data obtained from the Phase IIA hydrogeological investigation will be used to refine the preliminary conceptual geological, hydrogeological, hydrological and release characterization models for the Site, and to augment risk assessment data collected for the HERA. In addition, the data will be used to develop the Phase IIB hydrogeological and hydrological investigations.

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The field activities proposed for the Phase IIA hydrogeological activities will be performed in conjunction with the field activities for all other Phase IIA investigations. Collection of soil samples for geochemical analyses will be completed in conjunction with sample collection for release characterization.

- collection of soil samples needed to complete the Phase IIA geological investigation may be completed during advancement of borings for additional monitoring wells;
- the proposed Phase IIB well locations will be re-evaluated in the context of the revised groundwater contours. Any proposed revisions to well locations based upon this analysis will be included in the Phase IIA report;
- water level data may be incorporated into the proposed plan for determining seasonal high and low water levels (Section 21.6).
- analytical data from groundwater samples collected from background wells will be used in the Phase IIA and Phase IIB release characterization for identifying the extent of Site-related groundwater contamination.
- analytical data from groundwater samples collected from background wells will be used in the Phase IIA HERA for identifying contaminants of concern.

Contingencies

Water table encountered above or below the alluvium/stratified drift unit If the water table is encountered in the eolian sands, fill, or another unit not previously identified, then the shallow well will be installed across the water table within that unit. The screen will be set to straddle the expected seasonal high and low water table , and the length of the well screen will be sufficient to allow for monitoring of water table fluctuations. If the water table is encountered in the glaciolacustrine unit, the shallow well will be screened within that unit and an intermediate well will be screened in a lower part of that unit.

Screen length must be modified for deep wells. If till is encountered with a thickness of less than fifteen feet (15'), the length of the screen will be modified to allow the bentonite seal placed above the screen sand pack to extend across the top of the till.

Seasonal high or low water levels do not coincide with Phase IIA field activities. Depending on scheduling, measurement of seasonal high and low groundwater levels may occur during both Phase IIA and Phase IIB.

21.5.5 Summary of the Phase II Hydrogeological Investigation

The purpose of the Phase IIA hydrogeological investigation is to further define the hydrogeological parameters of the bedrock and overburden aquifers, to develop groundwater chemical background values for comparison to contaminant concentration data, and to gather additional information for the HERA. In order to accomplish these goals, 26 monitoring wells will be installed in the four (4) saturated stratigraphic units on the Site. Water level measurements will be performed, and groundwater samples will be collected for chemical analysis. The data gathered will be evaluated and used to refine the preliminary conceptual

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hydrogeological, and hydrological models of the Site, to refine the Site release characterization models, and to augment analytical data collected for the HERA.

21.6 PHASE IIA HYDROLOGICAL INVESTIGATION

This section presents the scope of work for the Phase IIA hydrological investigation. The objectives of the Phase IIA hydrological investigation are as follows:

- further refine the preliminary conceptual hydrological model of the Site;
- provide additional information needed for the HERA, including proposed contaminants of concern and the ecological risk assessment hazard identification and exposure assessment;
- fill analytical data gaps identified in the Phase I investigation

21.6.1 Summary of the Phase I Hydrological Results

The Phase I hydrological investigation obtained the following information:

- The site is located in the Westfield River drainage basin. This drainage basin, which encompasses an area of approximately 517 square miles, has been subject to significant flooding (50-year flood or greater) on three (3) occasions in the twentieth century. Flooding is now controlled by dams located upstream higher within the basin. The site is located above the 100-year flood boundary identified by FEMA, and within the 500-year flood boundary.
- The site is located within approximately one-half mile of the Little River, a major tributary to the Westfield River. The Little River flows generally eastward, however the river bed meanders to the west, south and east of the site, prior to its confluence with the Westfield River approximately one-half mile to the northeast of the site.
- There is one (1) surface water body on the site that consistently holds water. That water body, the Fire Pond, is a man-made structure that is a remnant of a former canal. The water level in this surface water body was approximately 2.5 feet higher than the groundwater surface during this investigation. The Fire Pond is also an Area of Concern (AOC 34).
- The Reflecting Pond no longer holds water on a consistent basis, and did not hold water at the time of the Phase I investigation.

21.6.2 Data Gaps to be Addressed by the Phase IIA Hydrological Investigation

The Phase IIA hydrological investigation is designed to address the following data gaps identified in Phase I.

Delineation of potential wetland area needed. A delineation of the potential wetland area identified on the site has to be performed. The study should identify both the Massachusetts and the Federal wetland boundaries. The season and duration of surface water ponding in this area, if any, should be evaluated.

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Additional sediment samples are needed from the Fire Pond for physical analysis. Sediment sample SS-1 did not meet the requirements outlined in the RFI Phase I proposal. These analyses should be repeated.

Interaction between groundwater and Fire Pond surface water not determined. Additional information about groundwater and surface water elevations in the vicinity of the Fire Pond is needed to determine whether the Fire Pond is hydraulically connected to the groundwater beneath the site and the nature (recharge, discharge) of any interactions on a seasonal basis.

21.6.3 Phase IIA Activities for Filling Hydrological Data Gaps

Delineation of the potential wetland area will be incorporated into the Phase IIA HERA Proposal presented in Section 21.9. The following activities are included in the Phase IIA hydrological investigation:

- collect additional sediment samples from the Fire Pond for physical and chemical analyses;
- install a staff gauge in the Fire Pond;
- measure staff gauge and groundwater levels in all monitoring wells if a seasonal high or low groundwater period coincides with the Phase IIA activities.

Each of these activities is discussed below.

An additional sediment sample will be collected from the Fire Pond. One (1) sediment sample (SED-1) will be collected from the Fire Pond and analyzed for physical and chemical properties as outlined in the RFIP. This sample will be collected to replace sediment sample SS-1, collected during Phase I, because it did not meet the requirements outlined in the RFI Phase I proposal.
A staff gauge will be installed in the Fire Pond. A staff gauge will be installed in the Fire Pond in order to measure surface water levels and track fluctuations during high and low groundwater seasons.

Staff gauge and groundwater measurements will be collected. Water level measurements will be collected from existing and proposed monitoring wells in the vicinity of the Fire Pond and also from the staff gauge in the Fire Pond in the spring, and again during the late summer/early fall, in order to determine the interaction between groundwater and the Fire Pond. The spring and late summer/early fall correspond with the historical seasonal high and low groundwater periods in the area of the Site.

21.6.4 Phase IIA Hydrological Investigation Additional Considerations

The relationship of the Phase IIA hydrological characterization to other Phase IIA investigations and any contingencies that could impact the proposed Phase II scope of work are discussed below.

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Relationship with Other Phase IIA Investigations

The data obtained from the Phase IIA hydrological investigation will be used to refine the hydrogeological, hydrological and release characterization models for the Site, and to augment risk assessment data collected for the HERA. In addition, the data will be used to develop the Phase IIB hydrogeological and hydrological investigations.

Contingencies

Seasonal high or low water levels do not coincide with Phase IIA field activities. Depending on scheduling, measurement of seasonal high and low groundwater levels may occur during both Phase IIA and Phase IIB.

21.6.5 Summary of the Phase IIA Hydrological Investigation

The purpose of the Phase IIA hydrological investigation is to further define the interaction between groundwater and surface water at the Site and to collect additional physical and chemical analytical data for sediments. In order to accomplish these goals, data from the hydrogeological investigation will be reviewed, a staff gauge will be installed in the Fire Pond, water level measurements will taken from the staff gauge and monitoring wells, and a sediment sample will be collected and analyzed. The data gathered will be evaluated and used to refine the hydrogeological, hydrological and release characterization models for the Site, and to augment risk assessment data collected for the HERA. In addition, the results of the Phase IIA hydrological investigation will determine if additional hydrological evaluation is necessary during Phase IIB.

21.7 THE PHASE IIA RELEASE CHARACTERIZATION INVESTIGATION

The goal of the Phase IIA release characterization proposal that follows is to fill data gaps identified at the end of the Phase I investigation, allowing the refinement of the preliminary conceptual release characterization models of the site that were developed at the end of Phase I. Specifically, the following tasks will be addressed:

- perform a preliminary determination of the horizontal and vertical extent of soil and groundwater contamination from releases from AOCs on the Site;
- fill analytical data gaps identified in Phase I.

21.7.1 Summary of Phase I Release Characterization Results

The Phase I Release Characterization presented a preliminary determination of the nature and extent of contamination found at the Site.

There were no detections of PCBs or organophosphorus pesticides in any sample collected during Phase I. Two (2) chlorinated herbicides were detected in soil samples during Phase I. The herbicide 2,4-D was detected in one soil sample, collected at MW-16 from 5-7 feet (5-7'). Dichloroprop was detected in one (1) soil sample, collected at MW-24 from 25 to 27 feet (25-27'). PCBs, organophosphorus pesticides, and chlorinated herbicides were not detected in any

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groundwater sample. Analysis for these parameters was not performed on surface water and sediment samples during Phase I. Since the Phase I investigation revealed no records of prior use or disposal of these materials on the Site, additional analysis for these parameters is not proposed in Phase II except for analyses for PCBs needed at two (2) locations to fill analytical data gaps identified in Phase I.

Various chlorinated pesticides were detected in soils at relatively low concentrations in locations in the southern portion of the Site. That portion of the Site is adjacent to agricultural fields located to the southwest of the Site. According to the climatological data presented in Section 6, the prevailing winds are from the southwest during the months of June, July and August. This is also the secondary wind direction during most other months. Analysis of soil and groundwater samples from this off-site area was prohibited as a condition of allowing access for the Phase I field activities. Chlorinated pesticides were not detected in any groundwater sample. Analysis for these parameters was not performed on surface water and sediment samples during Phase I. Since the Phase I investigation revealed no records of prior use or disposal of these materials on the Site, and there is a likely off-site source upwind of areas where these analytes were reported, additional analysis for chlorinated pesticides is not proposed in Phase II.

Analytes from the following groups were detected in various locations in various environmental media at the Site: metals, VOCs, semivolatiles, cyanide and dioxins. Additional analysis for only these portions of the Appendix IX analyte list is proposed for Phase II analyses. In addition, the following metals are proposed for deletion from the list of Phase II analytes:

- beryllium - no records of site use, detected in only one (1) soil sample (MW-14, 5-7'), not detected in groundwater.
- thallium - no records of site use, detected in only four (4) soil samples, not detected in groundwater.

21.7.2 Data Gaps to be Addressed by the Phase IIA Release Characterization

Numerous data gaps were identified by the Phase I release characterization. Most of those data gaps will be addressed during the Phase IIB release characterization. The purpose of the Phase IIA release characterization is to provide data needed to refine the Scope of Work for the Phase IIB release characterization. Data from analysis of background soil samples collected for the Phase IIA geological investigation and background groundwater samples collected for the Phase IIA hydrogeological investigation will be compared to data from the Phase I and Phase IIA release characterization to identify contaminants of concern (COCs). Analysis of additional soil and groundwater samples to be collected during the Phase IIB release characterization will focus on these COCs.

The following data gaps that were identified during Phase I will be addressed in Phase IIA. A list summarizing all data gaps and the portion of the Phase II investigation in which each data gap is addressed is provided in Table N-1 in Appendix N

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Vertical extent of contaminant migration in soil and groundwater not fully delineated. The vertical extent of various analytes detected in AOC areas was not adequately delineated by Phase I activities.

The Sanitary sewer (AOC 18) needs to be evaluated as a potential source of contamination detected in MW-24 during Phase I. The sanitary sewer was identified as a potential source of elevated levels of chlorinated solvents detected in MW-24S.

Additional shallow and deep monitoring wells are needed in the waste storage yard runoff area (AOC 21). These wells are needed to determine the extent of TCE detected in MW-4I and MW-14I during Phase I. Soil samples should be collected for VOC analysis during the installation of these wells.

Additional sediment samples are needed from the Fire Pond (AOC 34) for analysis for selected Appendix IX parameters. Due to the wide variety of wastes previously generated at the site, potential disposal of wastes in the Fire Pond should be evaluated.

Additional subsurface investigation is needed to determine whether free-phase product is present in the rim room area (AOC 44) due to the observation of a petroleum sheen and odor during installation and sampling of MW-18. Use of an interface probe may be used to determine whether free-phase product is present.

21.7.3 Phase IIA Activities for Filling Release Characterization Data Gaps

The following activities are proposed for the Phase IIA release characterization:

- collecting soil samples from borings advanced into bedrock in two (2) release areas for chemical analysis.
- collecting groundwater samples from six (6) new wells installed at various depths at two (2) locations in release areas for chemical analysis.
- performing a soil gas investigation in the area to the north of Building 1.
- collecting a sediment sample from the Fire Pond for chemical analysis
- using an interface probe to check for the presence of free-phase product in MW-18 and MW-19.
- re-sampling of soil in order to fill analytical data gaps identified at the end of Phase I.

Advancement of borings and installation of groundwater monitoring wells was discussed in Sections 21.4 and 21.5. Collection and analysis of soil and groundwater samples from borings and wells located in on-site background areas is also discussed in those sections. Collection and analysis of soil and groundwater samples from borings to be advanced in two (2) release areas are discussed below, along with other activities listed above.

Collect soil samples from borings advanced into bedrock in two (2) release areas for chemical analysis. During the advancement of the soil borings for MW-14BR and MW-24BR, split-spoon soil samples will be collected at five-foot (5') intervals and analyzed for headspace

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volatiles as described in the June, 1993 RFIP. Except for the collection of samples needed to fill analytical data gaps from the Phase I investigation and geological objectives described in Section 21.4 above, soil sampling at these locations will begin at the five-foot (5') interval below the last sample collected during Phase I at each location.

Due to the high concentrations of VOCs previously detected in MW-14I and MW-24S, special drilling procedures will be employed to minimize the potential for cross-contaminating stratigraphic units. A detailed plan for the drilling will be provided to the EPA for comment and approval prior to the commencement of Phase IIA drilling.

As specified in the June, 1993 RFIP soil samples with headspace volatiles concentrations of 10 ppm or greater will be collected for laboratory analysis. The RFIP specifies analysis of those samples for full Appendix IX parameters. Based upon the data summarized in section 21.7.1 above, a reduction in the list of analytes is proposed. The following analyses are proposed for soil samples from Phase IIA borings:

- metals;
- VOCs;
- semivolatiles;
- cyanide;
- dioxins.

Collecting groundwater samples from six (6) new wells installed at various depths and two (2) previously installed wells at two (2) locations in release areas for chemical analysis. Additional wells are proposed adjacent to the two (2) wells with the highest reported concentrations of VOCs in Phase I (MW-14I and MW-24S). These wells will form clusters with individual wells monitoring each saturated stratigraphic unit identified in Phase I to allow a preliminary assessment of the vertical extent of chlorinated VOC contamination in soil and groundwater in areas most impacted by releases. The vertical distribution of other contaminants detected on the Site will also be assessed at these locations. The proposed wells are MW-14S, MW-14D, MW-14BR, MW-24I, MW-24D, and MW-24BR.

Samples will be collected from these wells in conjunction with sampling of the background wells. Collection of groundwater samples for metals analysis will be performed using low flow sampling procedures. Analysis of samples from the newly installed wells is proposed for the same list of analytes listed above for soil samples. Analysis of groundwater samples from the previously installed wells is proposed for VOCs only. This analysis is proposed so that VOC concentrations in the new wells may be compared with VOC concentrations in existing wells in samples collected at the same time.

Performing a soil gas investigation in the area to the north of Building 1. A soil gas survey is proposed to assess the sanitary sewer (AOC 18) as a potential source of TCE detected in MW-24S. The area of the proposed soil gas survey is indicated as SG2 on Figure 20-1. The proposed survey area includes areas upgradient and downgradient of the sewer line from Building 1, where a degreaser was formerly located (new AOC 50, see Site Plan in Appendix A). Soil gas samples will be collected and analyzed as outlined in the June, 1993 RFIP. The

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data from this investigation will be used to determine whether additional investigations of the sewer line are needed in Phase IIB.

Collecting a sediment sample from the Fire Pond for chemical analysis. Collection of a sediment sample from the Fire Pond at location SED-1 (previously SS-1) was proposed as part of the Phase IIA hydrological investigation to replace the sample collected during Phase I for physical analysis that did not meet the percent solids criterion in the June, 1993 RFIP. This sample will also be analyzed for the list of selected Appendix IX analytes outlined above.

Using an interface probe to check for the presence of free-phase product in MW-18S and MW-19S. An interface probe will be used in MW-18S and MW-19S to assess whether free-phase product is present in those wells. Petroleum sheens were observed during installation and sampling of those wells. No free phase product was present in those well when they were sampled in 1993. The interface probe will be used to determine whether additional evaluation of the potential for free-phase product is needed in these areas during Phase IIB.

Re-sampling of soil in order to fill analytical data gaps identified at the end of Phase I. Analytical data gaps will be filled by the collection of soil samples during boring advancement at the following well locations:

- MW-14BR (0-2'and 5-7' intervals for cadmium and lead)
- MW-24BR (5-7' interval for cadmium)

Analytical data gaps will also be filled in the following locations where additional Phase IIA monitoring wells are not being installed (borings on sediment samples only):

- MW-12I (0-2' interval for cadmium);
- MW-15I (5-7' interval for cadmium and VOCs);
- MW-17S (5-7' interval for cadmium and 15-17' interval for lead and cadmium);
- MW-21S (0-2' and 5-7' intervals for 8240 and 8270);
- MW-22S (0-2' and 5-7' intervals for 8240 and 8270);
- SED-06 (Formerly SS-6, for cadmium and lead);
- SED-08 (Formerly SS-8, for cadmium);
- BH-1 (0-1' 1-2' and 5-6' for cadmium);
- BH-2 (0-2' and 4-6' for lead);
- BH-5 (5-6' for 8240 and 8270).

21.7.4 Phase IIA Release Characterization Additional Considerations

The relationship of the Phase IIA release characterization to other Phase II investigations and any contingencies that could impact the scope of work are outlined below.

Relationship with Other Phase II Investigations

The field activities proposed for the Phase IIA release characterization will be performed in conjunction with the field activities for all other Phase IIA investigations. Sampling of soil,

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groundwater, and sediment for chemical analysis for the release characterization will be conducted in conjunction with sampling and analysis for the geological, hydrogeological and hydrological investigations. This data will be used to refine the geological, hydrogeological, and release characterization models for the Site, and to augment risk assessment data collected for the HERA. In addition, the data will be used to develop the Phase IIB and Phase IIC geological and hydrogeological investigations.

Contingencies

Contingencies identified for the Phase IIA geological and hydrogeological investigations are applicable to the Phase IIA release characterization.

21.8 THE PHASE IIA OFF-SITE INVESTIGATION

The goal of the Phase IIA off-site investigation proposal that follows is to fill data gaps identified at the end of the Phase I investigation, allowing the refinement of the preliminary conceptual geological, hydrogeological, hydrological, and release characterization models of the site that were developed at the end of Phase I. Specifically, the following tasks will be addressed:

- assess the horizontal and vertical extent of soil and groundwater contamination in off-site areas;

21.8.1 Summary of Phase IIA Off-Site Investigation Results

The Phase I characterization of Off-site areas reported the following results:

Volatile and semivolatile organic compounds were detected in one (1) surficial (0- to 2- foot interval) soil sample located off-site at well MW-21S. The source of these compounds is unknown, but two (2) compounds (ethylbenzene and toluene) are not common Site compounds and the sample was from a shallow, unsaturated depth near a tobacco barn. This suggests that the source of ethylbenzene and toluene is unrelated to releases at the site. Additional background data will be collected during Phase II to evaluate potential sources of these compounds. Copper was detected at concentrations in excess of published ranges at off-site locations (MW-21S and MW-22S). Cyanide was not detected in off-site soil samples.

Volatile organic compounds were detected in shallow groundwater monitored by off-site sampling locations. VOCs were detected in shallow, intermediate, intermediate/deep, and deep groundwater along the southeast boundary of the Site. Phase I off-site release migration sampling did not include pesticide, herbicide, or dioxin analysis of groundwater. PCB's were not detected in groundwater in off-site wells. Chromium and nickel concentrations in groundwater appear elevated in comparison with MCLs. Cyanide was not detected in groundwater from off-site release monitoring locations.

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21.8.2 Data Gaps to be Addressed by the Phase IIA Off-Site Investigation

The Phase IIA off-site release characterization investigation is designed to fill the following data gaps identified by the Phase I off-site investigation:

Horizontal extent of contaminant migration in soil and groundwater to off-site areas not fully delineated. Various potentially site-related contaminants were detected in downgradient off-site wells (MW-21S, MW-22S). Additional wells are needed to determine the horizontal extent of this contamination.

The potential presence of a vinyl chloride plume needs further investigation. The potential that a plume of vinyl chloride is present at the Site should be evaluated by analyzing samples from downgradient off-site wells for VOCs using EPA Method 524.2 to detect that analyte at the Federal MCL of 2 μg/L.

Well MW-8I should be re-sampled to confirm elevated metals concentrations reported in Phase I. A sample will be collected during Phase IIA using low flow sampling procedures.

21.8.3 Phase IIA Activities for Filling Off-Site Data Gaps

The activities outlined for filling the data gaps identified at the end of Phase I are as follows:

- collect soil samples from borings advanced in downgradient off-site areas for chemical analysis;
- collect groundwater samples from eleven (11) new wells installed in six (6) downgradient off-site locations for chemical analysis.
- collect a groundwater sample from MW-8I for metals analysis using low flow sampling methods.

Each of these activities is discussed below:

Collect soil samples from borings advanced into the glaciolacustrine unit in six (6) off-site locations for chemical analysis. During the advancement of the soil borings for MW-22S/I, MW-29S/I, MW-30S/I, MW-31S/I, MW-32S/I and MW-33S/I, split-spoon soil samples will be collected at five-foot (5') intervals and analyzed for headspace volatiles as described in the June, 1993 RFIP. As specified in the June, 1993 RFIP soil samples with headspace volatiles concentrations of 10 ppm or greater will be collected for laboratory analysis. Analysis will be performed for selected Appendix IX parameters, as outlined in Section 21.7. Details of the sampling plan for these borings are presented in Table N-4 in Appendix N.

Collect groundwater samples from eleven (11) new wells installed in six (6) downgradient off-site locations for chemical analysis. Eleven (11) additional monitoring wells are proposed to form six (6) off-site well clusters to further assess off-site hydrogeology and to assess the vertical and horizontal extent of groundwater contamination. Three (3) of the proposed off-site clusters will be located approximately one-half the distance from the Site to the Little River.

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Sampling of these wells will be performed in conjunction with proposed sampling of wells for background assessment and release characterization. Collection of groundwater samples for metals analysis will be performed using low flow sampling procedures. Analysis of samples from the newly installed wells is proposed for the same list of analytes listed above for soil samples. Analysis of groundwater samples from the previously installed wells is proposed for VOCs only. This analysis is proposed so that VOC concentrations in the new wells may be compared with VOC concentrations in existing wells from samples collected at the same time.

In order to assess the potential presence of a plume of vinyl chloride in this area as a result of degradation of chlorinated solvents, it is proposed to perform VOC analysis using EPA Method 524.2 on samples from the following wells:

- MW-29S/I
- MW-30S/I
- MW-33S/I

Collect a groundwater sample from MW-8I for metals analysis using low flow sampling methods. This sample will be collected in conjunction with other proposed field activities to confirm elevated metals concentrations reported in Phase I.

21.8.4 Phase IIA Off-Site Investigation Additional Considerations

The relationship of the Phase IIA off-site investigation to other Phase IIA investigations and any contingencies that could impact the proposed Phase II scope of work are discussed below.

Relationship with Other Phase IIA Investigations

The data obtained from the Phase IIA off-site investigation will be used to refine the hydrogeological, hydrological and release characterization models for the Site, and to augment risk assessment data collected for the HERA. In addition, the data will be used to develop the Phase IIB hydrogeological and hydrological investigations.

Groundwater samples from the newly installed monitoring wells will be analyzed to assess the vertical and horizontal extent of off-site groundwater contamination and determine its potential to impact the Little River ecosystem. This data will be used to evaluate the need for additional well clusters adjacent to the Little River in the Phase IIB off-site investigation.

Contingencies

Access to off-site areas denied or delayed Performance of the Phase IIB off-site hydrogeological investigation is contingent upon off-site access. Scheduling of the off-site investigation is also contingent upon how long it takes to obtain permission to drill at these locations.

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21.8.5 Summary of the Phase IIA Off-Site Release Characterization Investigation

The purpose of the Phase IIA off-site investigation is to further assess the limits of off-site migration of potential site-related contaminants. In order to accomplish these goals, soil and groundwater samples will be analyzed and, additional data from the Phase IIA hydrogeological investigation will be reviewed. The data gathered will be evaluated and used to refine the hydrogeological, hydrological and release characterization models for the Site, and to augment risk assessment data collected for the HERA. In addition, the results of the Phase IIA off-site investigation will determine if additional hydrological evaluation is necessary during Phase IIB.

21.9 PHASE IIA HERA PROPOSAL

This section presents the Scope of Work for the proposed Phase IIA activities to complete the Human and Environmental Risk Assessment (HERA). Two (2) HERA submittals are proposed during Phase IIA. The first submittal will present a proposed list of contaminants of concern (COCs) for EPA review and approval, and a wetlands and habitat evaluation. The second submittal will incorporate the EPA's comments on the first submittal, and present a revised evaluation of human exposure pathways and dose-response data for the approved list of COCs. This will achieve the objectives of the second interim submittal as outlined in the Consent Decree.

21.9.1 Summary of the Phase I HERA

The Phase I RCRA HERA submittal identified a preliminary risk assessment data set for use in Baseline Risk Assessment for the Site. A preliminary set of exposure scenarios for various potential receptor groups was also presented.

21.9.2 Data Gaps to be Addressed in the Phase IIA HERA

The Phase IIA HERA proposal is designed to fill the following data gaps identified by the Phase I HERA submittal:

Contaminants of Concern (COCs) not determined. Analytical data from background soil and groundwater sampling locations should be evaluated to assist in selection of contaminants of concern (COCs) for the Site.

Potential ecological receptors and endpoints not identified. Potential receptors and endpoints need to be identified to adequately evaluate the ecological risk assessment.

Additional groundwater samples need to be collected for metals analysis. Groundwater samples should be collected for metals analysis using low flow sampling methods to provide groundwater metals data for the HERA.

Dose-response evaluation is needed. A dose-response evaluation is needed for EPA approved contaminants of concern (COCs).

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21.9.3 Phase IIA Activities for Filling HERA Data Gaps

The proposed Phase IIA HERA will develop a list of COCs for the Site and provide a preliminary ecological risk assessment. This objective will be addressed by the following activities:

- develop a set of background values for the area surrounding the Site.
- compare data in the Phase I preliminary risk assessment data set to background values and toxicity data to develop a proposed list of contaminants of concern;
- perform a wetland and wildlife habitat delineation.

The activities proposed for the Phase IIA HERA are detailed below.

Develop a set of background values for the area surrounding the Site. A background data set will be developed by collection of soil samples and groundwater samples from areas unaffected by Site activities. These samples will be analyzed for the selected list of Appendix IX analytes described in Section 21.7 above.

Proposed background soil sample collection locations are:

- Borings advanced for the installation of wells MW-25BR, MW-27D and MW-28D. Samples will be collected from the shallow (0-2'), intermediate (2-15') and deep (>15') soil zones from each boring.
- Five (5) shallow soil borings to be advanced in off-site locations to be determined contingent upon access from property owners.

Samples will be collected from all background monitoring wells installed during Phase IIA to provide background groundwater quality data. Samples for metals analysis will be collected using low flow sampling methods. Proposed background groundwater sample locations are:

- MW-1I, MW-25S, MW-25D and MW-25BR. This four-point well cluster in the northwest corner of the Site the fenced portion of includes wells screened in all four (4) saturated stratigraphic units, including bedrock;
- MW-27S, MW-27I and MW-27D. This three point cluster located in the western corner of an undeveloped portion of the Site includes wells screened in all three (3) saturated overburden units;
- MW-28S, MW-28I and MW-28D. This three point cluster located in the far northern portion of the Site includes wells screened in all three (3) saturated overburden units.

Compare data in the Phase I preliminary risk assessment data set to background values and toxicity data to develop a proposed list of contaminants of concern. The background data set will be compared to the Phase I HERA data set for each of the following media:

- shallow soil;
- intermediate soil;

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- deep soil;
- groundwater.

Metals data for groundwater from the Phase I investigation were not included in the HERA data set because standard procedures used in the collection of those samples may have caused suspension of sediments in the groundwater samples, leading to apparently elevated metals concentrations. In order to select metal contaminants of concern in groundwater, groundwater samples will be collected for metals analysis, using low flow sampling methods, from ten (10) wells with apparently elevated concentrations of those metals used at the Site (cadmium, chromium, copper, nickel, zinc). Those wells are:

- MW-3;
- MW-6;
- MW-9S;
- MW-9I;
- MW-10S;
- MW-10I;
- MW-16;
- MW-17;
- MW-18;
- MW-19;
- MW-22.

Perform a wetland and wildlife habitat delineation. A wetlands and wildlife habitat assessment and delineation will be performed to identify any potential ecological receptors in the vicinity of the Site. The boundaries of any State or Federal jurisdictional wetlands on the Site will be delineated.

An interim HERA submittal consisting of a proposed list of COCs for the human and ecological risk assessments will be submitted (after background analytical data have been evaluated) and will include a description of proposed indicator species and endpoints for the ecological risk assessment.

The EPA's comments on the interim Phase IIA HERA will be used to revise the human hazard identification and exposure pathways and parameters identified in the Phase I report. A dose-response evaluation will be provided for the list of COCs approved by EPA. The Agency's comments on the ecological hazard identification provided in the interim submittal will be incorporated into a revised ecological hazard assessment, and an ecological exposure assessment will be presented. This deliverable, to be submitted with the Phase IIA interim report, will conform with the second interim deliverable identified in the Consent Decree. The dose-response evaluation is described below:

Perform a dose-response evaluation for the EPA approved list of COCs. The carcinogenic and non-carcinogenic effects of exposures to COCs selected for the Site will be presented from the following hierarchy of data sources:

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- IRIS - Agency verified toxicity data from IRIS will be used preferentially over data from other sources.
- HEAST - If data are not available from IRIS, HEAST will be consulted for interim toxicity values.
- ECAO or EPA Workgroups - With prior approval of the EPA Project Manager, data will be sought from ECAO or EPA workgroups only if data are unavailable from other sources.

21.9.4 Phase IIA HERA Additional Considerations

The relationship of the Phase IIA HERA activities to other Phase II investigations and any contingencies that could impact the Phase II scope of work are discussed below.

Relationship with Other Phase II Investigations

The Phase IIA HERA will use data produced by the geological, hydrogeological, and hydrological Phase IIA investigations to assess site hazards to potential current and future human and ecological receptors.

The data from the Phase IIA HERA will be used to select COCs, which will focus the analytical needs for future phases of investigation at the site.

Contingencies

Wetlands delineation and wildlife habitat cannot be completed due to heavy snow cover. If there is sufficient snowfall to preclude accurate delineation of wetland and other wildlife habitat areas, the submittal of the habitat assessment report will be delayed. The remaining portions of the first interim HERA deliverable will be submitted according to schedule, and the habitat assessment report will be submitted under separate cover when available.

Toxicity data unavailable or inadequate for risk assessment. The EPA Project Manager will be consulted to determine whether indicator chemicals or surrogate analytes with similar structure and activity to the COC may be substituted. The EPA Project Manager will also be consulted if route-to-route extrapolation is being considered for deriving toxicity data.

21.9.5 Summary of the Phase IIA HERA

The goals of the proposed Phase IIA HERA are to develop a list of COCs for the Site and provide a preliminary ecological risk assessment. These objectives will be addressed by developing a set of background values for various environmental media, comparing the data in the Phase I preliminary risk assessment data set to background values and toxicity data to develop a proposed list of contaminants of concern, and performing a wetland and wildlife habitat delineation.

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21.10 THE PHASE IIA REPORT

The deliverables to be submitted to the EPA while the Phase IIA investigation is in progress include monthly progress reports and an interim HERA submittal. At the conclusion of Phase IIA, a Phase IIA Report will be submitted to the EPA.

The following deliverables will be submitted to the EPA as part of Phase IIA:

- monthly progress reports;
- an interim HERA submittal consisting of a proposed list of COCs for the human and ecological risk assessments (to be submitted after background analytical data have been evaluated) and description of proposed indicator species and endpoints for the ecological risk assessment.
- a Phase IIA report.

Since the purpose of Phase IIA Investigation is to provide additional data needed to refine the scope of the Phase IIB investigation, it is not proposed to include detailed plans, cross-sections, and calculations in the Phase IIA report beyond the extent needed to justify proposed modifications to Phase IIB. The Phase IIA report will describe the results obtained from these investigations and will outline proposed changes to the Phase IIB Proposal and a proposed list of contaminants of concern. Those proposals will be based upon the following analysis:

- The laboratory analytical data from the Phase IIA Physical Characterization will be used to determine background concentrations for inorganic analytes, VOCs, semivolatile organics and dioxins.

- The boring logs from the Phase IIA Physical Characterization, Release Characterization and Off-Site Investigations will be used to refine the preliminary conceptual geological, hydrogeological and hydrological models of the site. The Phase IIB Physical Characterization proposal will be re-evaluated to determine whether tasks should be added or eliminated based upon data collected during Phase IIA.

- The laboratory analytical data from the Phase IIA Release Characterization will be evaluated to determine the vertical extent of contamination. Soil and groundwater analytical data from borings and wells advanced into the till unit (if found) and bedrock unit beneath the Site will be used to determine if these units are impacted by releases at the Site. If contamination is not detected in bedrock wells in this area, the Phase IIB proposal will be re-evaluated and a reduction in the number of bedrock wells will be proposed, and additional deep wells screened above bedrock may be proposed.

- The data from the Phase IIA Off-site Investigations will be evaluated to determine whether the horizontal extent of the release has been defined. If the extent of contamination is defined in these areas by the Phase IIA activities, the Phase IIB proposal will be re-evaluated to determine whether all of the additional off-site investigations included in the Phase IIB proposal will be needed.

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- The EPA's comments on the Phase I HERA will be used to revise the human hazard identification and exposure pathways and parameters identified in the Phase I report. A dose-response evaluation will be provided for the list of COCs approved by EPA. The Agency's comments on the ecological hazard identification provided in the interim submittal will be incorporated into a revised ecological hazard assessment, and an ecological exposure assessment will be presented. This submittal will conform with the second interim deliverable identified in the Consent Decree.

21.11 SUMMARY

In this Section, the goals and proposed work scope for the Phase IIA Investigation of the Site is presented for each of three (3) general areas of investigation; geological, hydrogeological and hydrological. Each area of investigation summarized in this section includes information regarding on-site, release, and off-site physical and chemical characterization.

Geology - The purpose of the Phase IIA geological investigations is to further define on-site stratigraphy, including the characterization of the till and bedrock units, to develop soil chemical background values for comparison to contaminant concentration data, to delineate vertical and horizontal extent of soil contamination as a result of releases from AOCs, and to gather additional information for the HERA. In order to accomplish these goals, twenty-six (26) soil borings will be advanced into the four (4) major saturated stratigraphic units on the Site and soil samples will be collected for lithological logging, field screening, and physical and chemical analysis. The data gathered will be evaluated and used to refine the geological, hydrogeological, and release characterization models for the Site, and to augment risk assessment data collected for the HERA.

Hydrogeology - The purpose of the Phase IIA hydrogeological investigations is to further define the hydrogeological parameters of the bedrock and overburden aquifers, to develop groundwater chemical background values for comparison to contaminant concentration data, delineate the vertical and horizontal extent of groundwater contamination as a result of releases from AOCs, and to gather additional information for the HERA. In order to accomplish these goals, twenty-six (26) monitoring wells will be installed in the four (4) major saturated stratigraphic units on-site, slug tests will be performed, and groundwater samples will be collected for chemical analysis. The data gathered will be evaluated and used to refine the hydrogeological, hydrological and release characterization models for the Site, and to augment risk assessment data collected for the HERA.

Hydrology - The purpose of the Phase IIA hydrological investigation is to further define the interaction between groundwater and surface water both on-site and off-site, collect additional sediment physical and chemical analytical data; delineate the extent of surface water and sediment contamination as a result of releases from AOCs, delineate a potential resource area to the northwest of the Site, and to gather additional information for the HERA. In order to accomplish these goals, data from the hydrogeological investigation will be reviewed, a staff gauge will be installed in the Fire Pond, sediment samples will be analyzed, and an investigation of the potential resource area will be performed. The data gathered will be evaluated and used to refine the hydrogeological, hydrological and release characterization models for the Site, and to augment risk assessment data collected for the HERA. In addition, the results of the Phase IIA hydrological investigation will determine if additional hydrological evaluation is necessary during Phase IIB.

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22
PRELIMINARY PHASE IIB PROPOSAL

22.1 OVERVIEW

This section presents the preliminary scope of work for the Phase IIB investigation of the Site. This scope is termed "preliminary" because it will be subject to revision following evaluation of the data generated by the Phase IIA investigation. Depending on the background concentrations established for soil and groundwater at the Site during Phase IIA, additional analytes may be added or eliminated from the proposal for the Phase IIB investigation. A proposal for Phase IIB will be provided in the Phase IIA Report. The Phase IIB Proposal will be tailored to address the data gaps remaining after completion of the Phase IIA investigation, and will include each of the three (3) investigations that were incorporated into the Phase I investigation. These were:

- a physical characterization
- a release characterization
- an off-site investigation

The activities proposed for the Phase IIB investigation are detailed in the following sections. Appendix N includes a summary table outlining the preliminary sampling plan developed for Phase IIB, based on Site information available from Phase I. Section 22.2 describes the objectives of the Phase IIB investigation. An outline summarizing the approach to the Phase IIB physical characterization proposal is presented in Section 22.2.1, the Phase IIB release characterization outline is presented in Section 22.2.2, and the Phase IIB off-site investigation outline is included in Section 22.2.3. The Phase IIB HERA proposal is presented in Section 22.2.4. A Phase IIB preliminary sampling and analysis plan is presented in Appendix N. A summary is presented in Section 22.3.

22.2 OBJECTIVES OF THE PHASE IIB INVESTIGATION

The second proposed stage of research and field activities (Phase IIB) is designed to meet the following objectives:

- fill remaining data gaps from the Phase IIA geological, hydrogeological and hydrological investigations;
- collect any additional data needed to prepare the Media Protection Standards (MPS) Proposal;
- document seasonal high or low groundwater levels;
- characterize the horizontal and vertical extent of the releases from the Site if this was not accomplished by the Phase IIA investigations to an adequate degree to perform the Corrective Measures Study (CMS);
- complete the third interim deliverable of the HERA.

22.2.1 Phase IIB Physical Characterization

The Phase IIB Physical Characterization will fill any data gaps remaining after the Phase IIA activities by:

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22.2.5 Deliverables

The following deliverables will be submitted to the EPA as part of Phase IIB:

- monthly progress reports;
- a Phase IIB report.

The Phase IIB report will provide a comprehensive summary of all data obtained from the Phase IIA and Phase IIB activities. The Phase IIB report will also outline activities to be conducted during Phase IIC. The Phase IIC proposal will be based upon the following analysis:

- the field logs and laboratory analytical data from the Phase IIA and IIB Physical Characterization will be used to further refine the conceptual geologic, hydrogeologic and hydrologic models of the site. Revised geologic cross-sections will be prepared based upon data in boring logs from Phase IIA and Phase IIB. Seasonal high or low groundwater measurements will be used to construct groundwater contours and flow nets. Interactions between groundwater and surface water will be evaluated based upon data from Phases IIA and IIB.

- the laboratory analytical data from the Phase IIB Release Characterization will be used to describe the nature and extent of the contamination in the media of concern for each AOC.

- the data from the Phase IIB Off-site Investigations will be evaluated to determine whether the horizontal and vertical extent of the releases have been defined. If the extent of contamination is defined in these areas by the Phase IIA and IIB activities, the Phase IIC proposal will be tailored to address data gaps and unresolved issues remaining after Phase IIB.

22.3 SUMMARY

The Phase IIB Proposal outlines the sampling plan associated with the second stage of the Phase II investigation. As discussed in Section 20, the Phase II investigation is designed to be completed in three (3) stages to ensure that all data gaps are addressed at the conclusion of Phase II. The scope of the Phase IIB investigation will be tailored to address data gaps remaining at the end of Phase IIA. Proposed revisions to the scope of the Phase IIB investigation will be included in the Phase IIA report. The primary goal of the Phase IIB investigation is to characterize the horizontal and vertical extent of contamination at the Site in all media of concern. In order to accomplish this, the Phase II release characterization data will be compared with the Phase IIA background data to evaluate the extent of soil and groundwater contamination. Integrating the release characterization and physical characterization data will support a HERA; integrating all these data will support the MPS proposal and the CMS Proposal. Data gaps remaining at the end of Phase IIB will be addressed by the Phase IIC investigation, as outlined in Section 23.

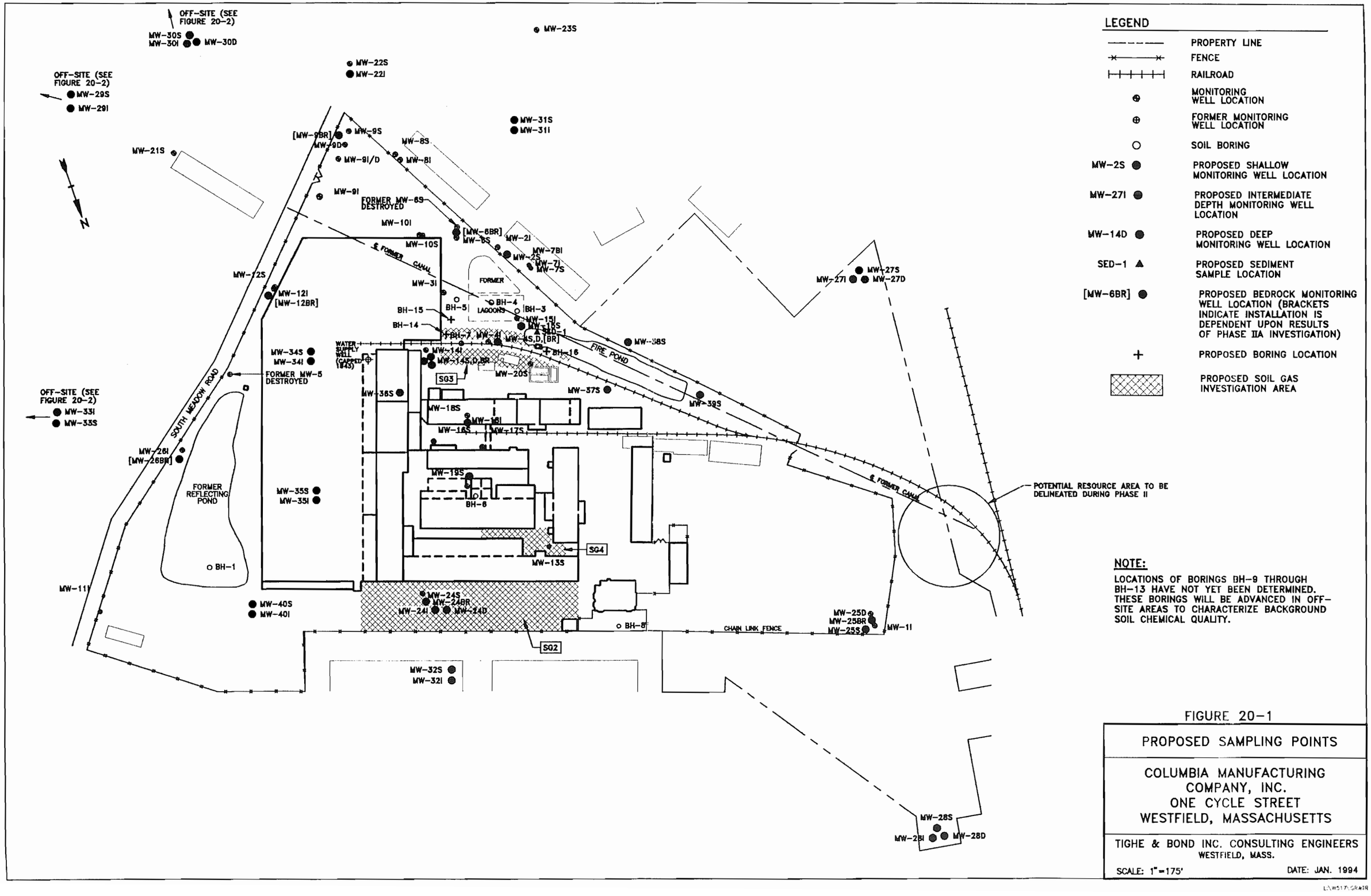

FIGURE 20-1

PROPOSED SAMPLING POINTS

COLUMBIA MANUFACTURING COMPANY, INC.
ONE CYCLE STREET
WESTFIELD, MASSACHUSETTS

TIGHE & BOND INC. CONSULTING ENGINEERS
WESTFIELD, MASS.

SCALE: 1"=175' DATE: JAN. 1994

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23
PRELIMINARY PHASE IIC PROPOSAL

23.1 OVERVIEW

This section presents an outline of the tasks anticipated in the Phase IIC RCRA Facility Investigation Proposal. Information to be detailed in each of the next three (3) sections is outlined herein. The Phase IIC preliminary proposal is designed to fill any final data gaps with respect to the Site physical characterization, on-site release characterization and off-site release characterization. It is likely that off-site characterization will involve the most activity as part of Phase IIC. The Phase IIC proposal is presented in this section in the context of data gaps which may remain following completion of the Phase IIA and IIB physical characterization, on-site release characterization, off-site release characterization and the HERA submittals. This summary is followed in Section 23.2 by a brief description of the Phase IIC strategy for filling the data gaps which may arise. The strategies will be developed into a detailed list of Phase IIC activities and final HERA and Phase II Reports will be developed. The Phase IIC report will also include a proposal for Media Protection Standards (MPS).

23.2 PHASE IIC REPORT

The Phase IIC Report will be developed based on a proposal submitted to the USEPA at the completion of Phase IIB. Upon approval of that proposal, the Phase IIC investigation will commence.

23.2.1 Contents of the Phase IIC Investigation

Objectives

The third and final proposed stage of research and field activities (Phase IIC) is designed to meet the following objectives:

- fill remaining data gaps from the Phase IIB Physical Investigation, Release Characterization and Off-Site Investigations.
- document seasonal high or low groundwater levels;
- submit the Draft Baseline Risk Assessment

Approach

The proposed Phase IIC Physical Characterization will fill any data gaps remaining after the Phase IIB activities by:

- measurement of staff gauge and groundwater levels in all monitoring wells if a seasonal high or low groundwater period coincides with the Phase IIC activities.
- collecting additional samples from locations where critical analytical data were rejected. This work will assure 95% completeness at the end of Phase II activities.

The proposed Phase IIC Release Characterization will fill any data gaps remaining after the Phase IIB activities by:

- collecting additional samples from locations where critical analytical data were rejected. This work will assure 95% completeness at the end of Phase II activities.

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- installing additional wells to further delineate the extent of contamination, if necessary.

The proposed Phase IIC Off-site Investigations will further delineate the extent of off-site release migration, if needed, by completing the following activities:

- collecting surface water and sediment samples from the Little River if Phase IIB field and analytical data indicate that contaminated groundwater attributable to releases from AOCs at the Site is discharging to that water body.

The proposed Phase IIC HERA will include preparation of the Draft Baseline Risk Assessment by completing the following activities:

- compiling information accepted by the EPA in all interim submittals into a comprehensive document incorporating any new validated data obtained during Phase IIC in a report format conforming to the outline provided in the Consent Decree.

Deliverables

The following deliverables will be submitted to the EPA as part of Phase IIC:

- monthly progress reports;
- a complete RFI Report.

The RFI report will include the following:

- a full characterization of the physical characteristics of the site and surrounding area based upon data obtained from all phases of the RFI;
- evaluation of the nature and extent of contamination of environmental media;
- a Media Protection Standards Proposal;
- a further evaluation of corrective measures;
- a Draft Baseline Risk Assessment;
- appendices containing all supporting data.

23.3 SUMMARY

The Phase IIC Preliminary Proposal is the final major deliverable of the three (3) stage Phase II investigation. This final report will be scoped to ensure that all data gaps outstanding from Phases IIA and IIB are addressed at the conclusion of Phase II. The primary goals of this final investigation are to fully characterize the physical characteristics of the site and surrounding area, to evaluate the nature and extent of contamination of environmental media, to provide proposed Media Protection Standards, to preliminarily evaluate available corrective measures, and to provide a Draft Baseline Risk Assessment. Submission of this final report will complete the Phase II process.

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24
PRELIMINARY EVALUATION OF CORRECTIVE MEASURES

24.1 OVERVIEW

This section presents a preliminary evaluation of corrective measures which may be implemented at the Site given the results of the Phase I investigation. In compliance with the RFI Guidance Document and Section 4 (Corrective Measures Screening) of the June, 1993 RFI Proposal, preliminary potential corrective measure technologies were identified. These measures are likely to contain, treat, remediate, and/or dispose of facility contamination based on data collected during preliminary investigations conducted at the Site by Tighe & Bond, EPA and other contractors. The evaluation presented here primarily utilizes the Phase I data. Although Media Protection Standards (MPS) have not yet been developed, re-evaluating potential corrective measures technologies will allow the data needs to be redefined during Phase II and determine the need for treatability investigations, if required. An extensive evaluation will be presented in the Corrective Measures Study (CMS) Proposal (after the MPS are approved by the USEPA).

24.2 OBJECTIVES

The objectives of the preliminary evaluation of corrective measures were to:

- conduct an initial screening of the likely corrective measures available for remediating facility-related contamination identified to date;
- determine whether additional data may be required, through treatability investigations; and
- identify the data required to develop, evaluate, and recommend any corrective measures necessary to achieve the MPS.

To meet these objectives, the Phase I data was reviewed to assess the various requirements and the need for additional data necessary to perform treatability studies. This review is presented in Section 24.3. Corrective measures technologies were then evaluated for potential remediation of soils, groundwater, and sediments; this preliminary evaluation is presented in Section 24.4. A summary concludes this Section.

24.3 PHASE I FINDINGS FOR SCREENING OF TREATABILITY STUDIES

This section summarizes the results of the Phase I investigation and discusses the implications of those results for treatability studies that might be appropriate at the Site. The results are discussed for on-site areas and for groundwater/soils in off-site areas, and are presented in terms of the type of a specific contaminant release (i.e. volatile organics release, semi-volatile organics release, etc.). This "release" is evaluated for the AOC grouping areas discussed in Section 7 and shown on Table 24-1, where elevated levels of the compounds which comprise these categories have come to be located. Since treatability is primarily a function of the contaminant type, the specific release has been segregated in the AOC grouping to aid in the preliminary evaluation of corrective measures. For each of the aforementioned releases, the positively identified analytical results from the various media (soils, groundwater, sediment and surface water) included in that release are summarized and a conceptual approach for treatability studies for the media within the release is evaluated.

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In Phase I, analyses of various physicochemical and geotechnical parameters were developed to provide data designed to evaluate the treatability of the Media of Concern at the Site and in the off-site groundwater/soils.

The following groups of treatability parameters were analyzed for **soil**:

- physicochemical parameters - pH, and Total Organic Carbon (TOC); Oil and Grease
- major/minor ions - antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), cadmium (Cd), calcium (Ca), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), magnesium (Mg), manganese (Mn), mercury (Hg), nickel (Ni), potassium (K), selenium (Se), silver (Ag), sodium (Na), thallium (Tl), tin (Sn), vanadium (V), zinc (Zn), chlorides (Cl), sulfates (SO_4), and bicarbonates (HCO^-_3)
- geotechnical parameters - percent solids and grain size distribution
- nutrients - ammonia (NH_3-N), nitrates (NO_3-N), phosphates (PO^-_4), Cyanide (CN), Sulfate (SO_4).
- Volatile organic compounds (VOC), Semi-volatile organic compounds (SVOC).
- Pesticides, Organophosphorus pesticides, chlorinated herbicides, dioxin and PCB's

The following treatability parameters were analyzed for **groundwater**:

- physicochemical parameters - pH, Eh, conductivity, temperature, and dissolved oxygen (DO);
- major/minor ions - As, Ba, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, V, Zn
- corrosion/encrustation parameters - alkalinity,
- POTW/NPDES - related parameters - biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), total dissolved solids (TDS), Oil and Grease, total organic carbon (TOC)
- nutrients - NH_3-N, chloride, CN, NO_3-N, PO_4, SO_4.
- volatile organic compounds (VOC) semi-volatile organic compounds (SVOC).
- dioxin

The following treatability parameters were analyzed for **surface water**:

- physicochemical parameters - pH, Eh, conductivity, temperature, and DO
- major/minor ions - Ca, Cu, Fe, Mg, Mn, K, Na, Zn
- POTW/NPDES - related parameters - BOD, COD, TSS, TDS, TOC, and alkalinity
- nutrients - NH_3-N, NO_3-N, PO_4, chlorine, SO_4.
- VOC's

The following treatability parameters were analyzed for **sediment**:

- physicochemical parameters - pH, and TOC;
- major/minor ions - Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, Sn, V, Zn, SO_4
- geotechnical parameters - bulk density, grain size distribution, and porosity
- nutrients - NH_3-N, NO_3-N, and PO_4.

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Across all four (4) media, the results for a number of these parameters were discussed in previous sections; the results for other treatability parameters (i.e. summary tables of positively identified analytes which may require treatment) are presented and discussed in this section.

The Phase I results and possible treatability studies are discussed in this section for the VOC Release, Semi-Volatile Organics Release, Metals Release and the "Other" release AOC Group Areas. Other releases include PCB's, pesticides, organophosphorus pesticides, chlorinated herbicides and dioxin. The AOC grouping areas, including the specific AOCs in that grouping, are presented in Table 24-1 below:

Table 24-1
AOC GROUPINGS

AOC No.	Item/Description
PLATING OPERATIONS	
39	Old Trenches and Sumps
41	Zinc Plating Line Trench & Sump
42	Nickel & Chrome Line Trench & Sump
WASTEWATER TREATMENT	
10	Nickel Filter
11	Former pH Adjustment Tank
12	Storage Tank 11
45	Wastewater Treatment Pipes
46	Wastewater Treatment Room Sump
ON-SITE SLUDGE DISPOSAL	
29	Former Lagoons
30	Underground Discharge Pipe
33A	Scrap Metal Fill Area
33B	Former Incinerators
WASTE STORAGE YARD	
9	Sludge Roll-off Box
14A	HW Drum Storage (current)
14B	HW Drum Storage (former)
21	Storage Yard Runoff Area

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AOC No.	Item/Description
ON-SITE SURFACE WATER BODIES	
16	Reflecting Pond
34	Fire Pond
UTILITY LINES	
17	Storm Sewer Lines
18	Sanitary Sewer Lines
STORAGE TANKS	
35	Removed UST
36	Abandoned UST
37	Fuel Storage Area
47	Gasoline UST
48	Abandoned UST
OTHER OPERATIONS	
23	Stripping Area Floor Drains
40	Pickling Room Drain and Sump
44	Rim Room
49	Rack Maintenance Area

24.3.1 Volatile Organics Release Area

Media of Concern within the category of Volatile Organics Release include soils and groundwater. The results of the investigations involving these media are discussed in this Section.

Soils/Sediment

In Phase I, soils were investigated for the Volatile Organics Releases. The Phase I analytical results for a release to soils were summarized in Sections 8 through 16. Table 24-2 presents the results for general treatability parameters for VOCs detected in surficial and subsurface soils, and sediment.

Phase I Results

Volatile Organics Release to soils and sediment. The following results were obtained from AOC groupings during Phase I soils investigations:

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- Plating Operations - Four (4) VOCs (ethylbenzene, methylene chloride, trichloroethene and total xylenes) were detected in soils in this AOC grouping. Of the 18 samples collected from this area, 13 had detectable levels of VOCs. Ethylbenzene was detected in a soil sample (MW-18S, 6-8 ft) at 3,000 μg/kg. This was the highest concentration detected of any VOC in the area. No more than two (2) VOC's were detected in any one of the 13 locations where analytes were observed.

- Wastewater Treatment - A total of four (4) samples were collected from the wastewater treatment area. Trichloroethene was the only VOC detected (in two (2) sample locations) with a maximum concentration of 65 μg/kg (MW-16S, 0-2').

- On-site Sludge Disposal - Three (3) VOC's were detected (cis-1,2-dichloroethene, methylene chloride and trichloroethene) in this AOC grouping which includes AOC's 29, 30, 33A and 33B. VOC's were detected in 13 of the 16 samples comprising this grouping. The highest individual concentration observed was 1400 μg/kg (estimated) of methylene chloride (BH-4, 4-6'). The maximum TCE concentration was in BH-7 (Former incinerator area) at 1100 μg/kg (estimated).

- Waste Storage Yard - Seven (7) soil samples were collected and analyzed for VOC's. Detected compounds included cis-1,2-dicloroethene, methylene chloride, tetrachloroethene (PCE) and TCE. An estimated concentration of 1800 μg/kg was detected at MW-14I (0-2') in the Storage Yard Runoff area (AOC 21). This was the highest concentration of VOC's in this AOC grouping. That same sample had the highest total VOC concentration in soils at 2135 μg/kg.

- On-site Surface Water Bodies - VOC's were detected in four (4) of the six (6) soil samples collected in this AOC grouping. A total of four (4) compounds (acetone, methylene chloride, TCE and 2-chloroethyl vinyl ether) were detected. Acetone and methylene chloride were detected at comparable concentrations (range 120-150 μg/kg) at each of the three (3) sample depths in BH-1. The highest individual concentration was TCE a 280 μg/kg (estimated) in MW-26I, 20-22'.

- Utility Lines - This grouping includes samples from both sediments and soil. VOC's were detected in three (3) of the four (4) sediment samples collected, although at relatively low concentrations. VOC's included acetone, ethylbenzene, methylene chloride and TCE. The highest VOC concentration was for acetone detected in SS-5 at 150 μg/kg (estimated). Only one (1) VOC, TCE, detected in the soil samples collected from this AOC grouping. TCE was detected at 110 and 270 μg/kg (estimated) from MW-24S, 15-17' and 20-22', respectively.

- Storage Tanks - VOC's were detected in 13 of the 21 samples analyzed for this AOC grouping. The VOC's that were detected include acetone, ethylbenzene, methylene chloride, PCE, TCE, and total xylenes. The compound with both the highest individual concentration and highest number of detects was ethylbenzene. This compound was detected at six (6) locations (five (5) in soils at MW-19S) including a concentration of 1350 μg/kg at 9-10' in MW-19S. The TCE and PCE was only detected in MW-20S and MW-24S.

- Other Operations - VOC's were detected in four (4) of the five (5) soil samples collected during the installation of MW-18S in the Rim Room. The detected compounds included ethylbenzene

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and a single, minor concentration of methylene chloride. A maximum estimated ethylbenzene concentration of 3000 μg/kg was detected in the 6-8' sample.

Soils and sediment with evidence of VOC releases are present on-site as a result of past site operations, and may require containment, treatment, stabilization, or removal (depending on the MPS).

Implications for Treatability Studies

Fencing is present at the Site and has been implemented to limit access to the Site. The fencing is inspected regularly and repairs are made if breaches are discovered.

Soil gas surveys have been proposed as part of Phase II B investigations to characterize more completely the extent of volatile organic compound (VOC) contamination in the soil. Based on the results of the survey, additional soil borings will be advanced at depth (also during Phase IIB) to delineate VOC contamination. The results of the survey will help determine whether there is any need, depending on MPS selection, for a vapor extraction pilot test. Additional off-site wells are proposed to track the VOC plume migrating off-site. Soil samples will be collected and analyzed for VOC's to track the levels of VOC contamination in off-site soils.

Vapor Extraction Pilot Test

If the soil gas survey results indicate recoverable levels of volatile organic contaminants in unsaturated soils in excess of contemplated MPS, a vapor extraction pilot test would then be conducted as part of the CMS to provide the data needed to design a full-scale system (e.g., the number, sizes, and locations of soil vapor recovery wells as well as the necessary flow rates of vacuum pumps). In addition, the volatile constituents and their concentrations in the extracted vapor would be measured to determine if treatment would be required prior to discharging the air. The results of such a pilot test also would help predict the length of time that the extraction system would have to be operated to achieve the desired cleanup level, if necessary.

Groundwater

In Phase I, groundwater was investigated for Volatile Organics Releases. The analytical results for groundwater were summarized in Sections 8 through 16. Table 24-3 presents the results for treatability parameters for VOCs detected in groundwater samples.

Phase I Results

Volatile Organics Release to Groundwater. This section will also address VOC release to surface water, where applicable. The following results were obtained from AOC groupings during Phase I groundwater investigation:

- Plating Operations - Three (3) VOC's (cis-1,2-dichloroethene, ethylbenzene and trichloroethene) were detected in groundwater samples around the Plating Operations area from a total of four (4) samples collected. Ethylbenzene was detected at 170 μg/l in MW-18S; the highest single

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analyte concentration. That well also has a total VOC concentration of 340 μg/l, the highest total VOC concentration in a well in this AOC grouping.

- Wastewater Treatment - VOC's were not detected in the well (MW-16S) monitoring this AOC grouping.

- On-site Sludge Disposal - VOC's were detected in each of the eight (8) groundwater samples collected in this AOC grouping. The VOC's included cis-1,2-dichloroethene and TCE, both of which were detected in the soils in this area. Cis-1,2-dichloroethene was detected in a single well (MW-2I) at 10 μg/l. TCE was detected in each of the eight (8) wells at concentrations ranging from 15 to 5200 μg/l.

- Waste Storage Yard - TCE was the only VOC detected in groundwater in this area. Identical concentrations of 5200 μg/l were observed in MW-4I and MW-14I.

- On-site Surface Water Bodies - TCE was detected in the monitoring well downgradient of the Reflecting Pond (AOC 16). TCE was detected at 1500 μg/l; no other VOC's were detected. Surface water was also analyzed for VOC's at SW-1, SW-2 and SW-3 in the Fire Pond (AOC 34). VOC's were not detected in these samples.

- Utility Lines - Three (3) monitoring wells (MW-12S, MW-12I and MW-24S) monitored groundwater quality from utility lines. Cis-1,2-dichloroethene and PCE were detected in the MW-12S and MW-12I wells. TCE was detected in each of the three (3) wells, and was the only VOC detected in either sediments or soils from this grouping. The highest TCE concentration in groundwater on or off-site was detected in MW-24S at 9000 μg/l.

- Storage Tanks - Four (4) VOC's were detected in the well network monitoring this AOC grouping; benzene, 1,1-dichloroethene, ethylbenzene and TCE. MW-24S monitors both the Utility Lines and Storage Tanks grouping. In addition to the 9000 μg/l in MW-24S, TCE was detected at 120 and 25 μg/l in MW-13S and MW-20S, respectively.

- Other Operations - Three (3) VOC's were detected in MW-18S in the Rim Room. The highest concentration of a VOC detected was ethylbenzene at 170 μg/l. This was also the predominant VOC in the soils at this AOC grouping. Cis-1,2-dichlorethene (70 μg/l) and TCE (100 μg/l) were also detected.

Implications for Treatability Studies

Pilot-Scale Pumping/Aquifer Tests

Pilot-scale pumping/aquifer tests are designed to evaluate the hydraulic parameters and boundary conditions in the vicinity of the contaminated groundwater. These tests will be performed as part of CMS activities if Phase II data indicates that a groundwater pumping alternative is warranted.

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Air Stripping Pilot Tests

Recovered groundwater may require pre-treatment before discharge to the local POTW. Metals pre-treatment is also considered necessary prior to discharge to an air stripping unit. Pilot air stripping tests may be run concurrently with aquifer testing during CMS activities to evaluate removal efficiency as the quality of the feed water changes. Samples of influent and effluent will be evaluated for engineering parameters (e.g., iron content, hardness, pH, corrosivity/encrustation potential) during the pumping.

Granular Activated Carbon (GAC) Bench Test

Water obtained from the aquifer test also would provide a representative sample for a GAC bench test. The GAC bench test would provide data needed for evaluating the removal efficiency and pretreatment requirements, as well as the projected capital and operating cost of a full-scale treatment system. Various carbon vessel volumes would be evaluated as part of this investigation.

24.3.2 Semi-Volatile Organics Release

Media of Concern within the category of Semi-Volatile Organic Release include soils, sediment and groundwater. The results of the investigation involving these media are discussed in this section.

Soils/Sediment

In Phase I, soil and sediment was investigated for Semi-Volatile Organic Releases. The analytical results for a release to soils were summarized in Sections 8 through 16. Table 24-2, presents the results for treatability parameters in soil and sediment samples from the Semi-Volatile Release Areas.

Phase I Results

Semi-Volatile Organic Release to Soils and Sediment. The following results were obtained from AOC groupings during Phase I soil/sediment investigations:

- Plating Operations - Seven (7) soil samples were analyzed in this AOC grouping, with three (3) locations having positively identified analysts. Four (4) compounds (benzo[a]anthracene, chrysene, fluoranthene, phenanthrene and pyrene) were detected. The highest single compound concentration and total soil sample concentration was 6,800 μg/kg of phenanthrene in the 5- to 7-foot soil sample collected at MW-16S.

- Wastewater Treatment - A single SVOC (phenanthrene) was detected in MW-16S at a depth of 5-7'. The concentration of this compound was 6800 μg/kg.

- On-site Sludge Disposal - SVOC's were detected in 13 of the 18 soil samples collected from this grouping. Numerous SVOC compounds were detected in BH-3 (0-2' and 2-4'), BH-4 (0-2' and 6-8') BH-7 (0-1' and 1-2') and MW-15I (0-2'). A single total VOC concentration of 486,600 μg/kg was detected in 11 of the 18 samples collected and fluoranthene was detected in 10 of the 18 samples. A total of 19 different SVOC were detected in at least one soil sample.

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- Waste Storage Yard - A total of 10 different SVOC were detected in at least one (1) soil sample in this AOC grouping. The sample collected at MW-14I, 0-2' contained each of these 10 compounds and had the highest total SVOC concentration of 47,000 μg/kg. BH-7, 1-2' also had a total SVOC concentration of 46,800 μg/kg. Fluorathene, phenanthrene and pyrene were detected in five (5) of the seven (7) total samples.

- On-Site Surface Water Bodies - Two (2) SVOCs were detected (Fluoranthene and pyrene) in a single soil sample MW-26I, 0-2'. They were detected at concentration of 220 and 210 μg/kg, respectively.

- Utility Lines - SVOC's were detected in two (2) of the four (4) soil samples collected at this grouping. 13 total SVOCs were detected, with 10 of these common to both samples. Total SVOC concentrations were 281,500 μg/kg (SS-4) and 66,600 μg/kg (SS-8).

- Storage Tanks - SVOC's were detected in only two (2) of the eight (8) soil samples collected form this grouping. A total of nine (9) SVOC compounds were detected in MW-24S, 0-2', with a total SVOC concentration of 8,150 μg/kg. Fluoranthene and pyrene were also detected (total SVOC concentration - 2700 μg/kg) in MW-20S, 0-2'.

- Other Operations - SVOC's were not monitored in soil at this AOC grouping.

Implications for Treatability Studies

Remediation technologies for SVOC's in soils are limited. Treatment methods consist of selective removal of certain SVOC's through vapor extraction, stabilization and/or immobilization, and selective degradation utilizing bioremediation with cultured bacteria. Ex-situ biodegradation (bioremediation) offers the most promise owing to the controls inherent in the ex-situ structure. Pilot studies during CMS investigations on each of these technologies would be required to determine the viability and cost effectiveness of each proposed technology.

Groundwater

In Phase I, groundwater was investigated for the Semi-Volatile Organics Release. The analytical results for groundwater were summarized in Sections 8 through 16. Table 24-3 presents the results for treatability parameter for SVOC's detected in groundwater samples.

Phase I Results

Semi-Volatile Organics Release to Groundwater. The following results were obtained from AOC groupings during Phase I groundwater investigations:

- Plating Operations - Four (4) groundwater samples were collected from this AOC area. Three (3) of the four (4) samples identified SVOC's in the groundwater and a total of seven (7) SVOC's were detected. These included dibenzofuran, fluoranthene, flourene, 2-methynapthalene, naphthalene, phenanthrene and pyrene. As in the soils, phenanthrene was detected at the highest concentration (260 μg/l in MW-18S). Elevated total petroleum

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hydrocarbons were observed in the soils collected during installation of MW-18S and elevated oil and grease was detected in the groundwater from this well.

- Wastewater Treatment - A single SVOC (phenanthrene) was detected in groundwater at 19 μg/l. This SVOC was also detected in the soil at 5-7'.

- On-site Sludge Disposal - SVOC's were not detected in the five (5) groundwater samples collected.

- Waste Storage Yard - Although 10 SVOC's were detected in the soil, SVOC's were not detected in the one (1) groundwater sample collected in this area.

- On-site Surface Water Bodies - SVOC's were not monitored in this AOC grouping.

- Utility Lines - SVOC's were not monitored in this AOC grouping.

- Storage Tanks - Two (2) groundwater samples were collected from this AOC grouping for SVOC analysis. SVOC's were not detected in MW-13S. However, six (6) SVOCs were detected in MW-19S, downgradient of the abandoned UST (AOC 48) at a total concentration of 2870 μg/l.

- Other Operations - Five (5) SVOC's were detected in groundwater in the well in the Rim Room (MW-18S). The total SVOC concentration was 682 μg/l.

Implications for Treatability Studies

The Phase I results of SVOC's in groundwater have been evaluated. Sources of SVOC contamination at the Site consist primarily of petroleum products. Measures are being maintained at the Site for preventing new releases of compounds containing SVOCs. This includes maintaining and improving the storage area for No. 6 fuels, removing UST's beyond their expected life and monitoring existing UST's.

Groundwater remediation through steam stripping is the most likely candidate for remediating groundwater contaminated with fuel oils. Pilot testing is warranted to determine the efficiency and cost-effectiveness of this treatment alternative. Additional alternatives such as oil/water separation may provide cost effective alternatives for areas where LNAPL has been identified. Separator effluent treatment may be warranted depending on POTW restrictions and effluent water quality.

24.3.3 Metals Release Areas

Media of concern within the category of Metals and Inorganic Release include soils, groundwater, sediment and surface water. The results of investigations involving these media are discussed in this section.

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Soils

In Phase I, soils were investigated for the Metals and Inorganics Releases. The Phase I analytical results for a release to soils were summarized in Sections 8 through 16. Table 24-4 presents the results for general treatability parameters for metal releases to surficial and subsurface soil samples.

Phase I Results

Metals Release to soils. The following results were obtained from AOC groupings during Phase I investigation.

- Plating Operations - Metals associated with plating operations include Cd, Cr, Cu, Ni, Sn, V, Zn, and cyanide. Cr, Cu, Ni, V and Zn were detected in all 18 of the samples collected. Cr, Cu, Ni and Zn were particularly elevated, exceeding typical published upper ranges by a factor of three (3). The highest individual concentration of a given metal was Cd at 19,000 mg/kg. Cyanide was not detected in any soil sample collected in this area.

- Wastewater Treatment - Metals associated with the Wastewater Treatment operations are similar to those in the Plating Operations and include Cd, Cr, Cu, Ni, Sn, V and Zn. Concentrations of Cr, Cu and Ni exceeded typical published values for these metals in soil. Cr, Cu and Ni were particularly elevated in the soil samples from 5-7' in MW-16S. Ni was detected at 1,005 mg/kg as compared to published maximum ranges of 43 mg/kg.

- On-site Sludge Disposal - On-site Sludge Disposal metals include those metals typical of plating operations and wastewater treatment and include Cd, Cr, Cu,Ni, Sn, V, Zn and cyanide. All compounds in this area had elevated concentrations, exceeding maximum published concentrations, where values were available. For example, the maximum concentration of Ni was 22,000 mg/kg as compared to a published maximum value in soil of 35 mg/kg. Cyanide was detected in 11 of the 18 soil samples with a maximum concentration of 440 mg/kg.

- Waste Storage Yard - Metals were observed in elevated concentrations throughout this AOC grouping. Of those metals typical of the CMC facility (Cd, Cr, Cu, Ni, Sn, V, and Zn) at least one sample exceeded the maximum published values. Cu and Ni had maximum sample values of 3,550 and 1,900 mg/kg, respectively, compared to maximum published values of 43 and 35 mg/kg, for these metals. Cyanide was not detected in the seven (7) samples collected from this area.

- On-site Surface Water Bodies - In general, metals in the soils from the surface water bodies (Reflecting Pond - AOC 16) were lower than those detected in the sediments (Fire Pond - AOC 34). However, elevated concentrations were detected for the site-related metals in both sample areas. Concentrations of metals typically decreased with depth in the soil samples (BH-1) collected in AOC 16. Concentrations of Ni were particularly high in the Fire Pond sediments at 6000 and 3000 mg/kg, in SS-1 and SS-2, respectively. Metal concentrations were typically lowest in the western Fire Pond sediments, SS-3. Surface water samples were also analyzed for Ca, Fe, K and Na at SW-1, SW-2 and SW-3. In all cases, the concentration of these analytes

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in surface water were at least one order of magnitude lower than in the groundwater samples monitored as part of this AOC grouping.

- Utility Lines - Metal concentrations in sediment and soil samples from the Utility Lines were typically lower than in the previously described AOC groupings. Very low concentrations of site related metals were detected in the Little River sediments (SS-5 and SS-6) with little appreciable difference between upstream and downstream concentrations. Elevated Metal concentrations were detected in the soils from monitoring wells MW-24. Several samples at different depth exceeded the maximum published values for metals, including Cu and Zn. Cyanide was not detected in any of the eight (8) soil samples collected.

- Storage Tanks - Numerous Cd samples were rejected across the site and will be reanalyzed in Phase II. However, a single Cd concentration of 19,000 mg/kg was detected in MW-19S, 7-9'. Concentration of Cu, Ni, and Zn were also elevated across the AOC grouping. Cyanide was not detected in the eight (8) soil samples collected in this area.

- Other Operations - Metals in this AOC grouping were typically within typical background concentration in the five (5) samples collected. One Ni sample (MW-18S, 8-10') exceeded the maximum published ranges (measured concentration of 90.5 mg/kg).

Implications of Treatability Studies

Remediation technologies for metals in soils are limited and expensive. The most likely alternatives include some form of immobilization or an ex-situ leaching process. In either case small scale pilot testing would be necessary during the CMS to determine the effectiveness of this solution. Leachability studies to determine the likelihood of continued metal migration in soils will also be considered.

Groundwater/Surface Water

In Phase I, groundwater was investigated for the Metals Releases. The Phase I analytical results for groundwater were summarized in Sections 8 through 16. Table 24-5 presented the results for general treatability parameters for metals detected in groundwater samples, respectively. This table also includes the results for surface water samples collected at the site.

Phase I Results

Metals Release to Groundwater. This section will also address metal releases to sediment and surface water, where applicable. The following results were obtained for AOC groupings during Phase I soil investigations.

- Plating Operations - The same list of metals evaluated in the soil component of this screening were examined for groundwater. Each of the seven (7) metals were detected in the four (4) groundwater samples which monitor this AOC grouping. Cyanide was not detected in any of the samples. The maximum concentration of Cd, Cr, Cu, and Ni were well above MCL's for these metals.

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- Wastewater Treatment - Elevated levels of the site related metals were detected in the well (MW-16S) monitoring this area. Concentrations of Cr (2600 μg/l) Cu (1100 μg/l) and Ni (5300 μg/l) were recorded. Cyanide was detected at a concentration of 110 μg/l.

- On-site Sludge Disposal - Relatively low levels of Cd, Cu, V and Zn were detected in this AOC grouping in groundwater. Elevated concentrations of Cr (max: 5900 μg/l) and Ni (4600 μg/l) were detected. Cyanide was detected in three (3) of the nine (9) wells monitoring this area.

- Waste Storage Yard - Elevated levels of Cr (2,900 μg/l) and Ni (2,900 μg/l) were detected, but relative to other AOC groupings, the metal concentrations were relatively low. Although Cu was detected in seven (7) soil samples at concentrations ranging from 29 to 3550 mg/l, the highest measured concentration of Cu in groundwater was 58 μg/l, well below the MCL of 1000 μg/l.

- On-site Surface Water Bodies - Elevated concentration of Ni (4,400 μg/l) were detected in groundwater monitoring this AOC grouping. All other metal concentrations in the wells monitoring this area are within low to typical ranges.

- Utility Lines - Three (3) monitoring wells (MW-12S, 12I, and 24S) monitor this AOC grouping. Of the site-related metals monitored, only Ni exceeded drinking water MCL's, with a maximum concentration of 1,700 μg/l at MW-12S. Cyanide was not detected in the three (3) samples collected.

- Storage Tanks - Four (4) monitoring wells (MW-13S, 24S, 19S and 20S) monitor this AOC grouping. Concentrations of Ni exceeded drinking water MCL's in all four (4) wells, but only MW-19S showed elevated concentrations of other metals. Elevated concentrations of each of the site related metals were detected in this sampling point. Particularly high concentrations of Cd (1,400 μg/l) and Zn (19,000 μg/l) were detected.

- Other Operations - Elevated concentrations of Cr (3100 μg/l) and Ni (1700 μg/l) were detected at this sample location.

Implications of Treatability Studies

Chemical precipitation in a viable and relatively inexpensive alternative for remediating a liquid wastestream with elevated metal concentrations. The existing wastewater treatment plant at the Site is currently treating a concentrated waste stream from plant operations. Utilizing or expanding the existing facility will be considered as a likely alternative during CMS investigations.

24.3.4 Other Releases

Media of Concern within the category of Other Releases include soils and groundwater. Other releases include PCB's, pesticides, organophosphorous pesticides, chlorinated herbicides and dioxin. Pesticides, organophosphorus pesticides and chlorinated herbicides will be eliminated from future analyses as discussed in Phase I and the Phase II Scope of Work. PCB's will be analyzed in one location and, if not detected, eliminated from future analyses. Dioxin analysis will be retained for

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Phase II. For completeness, an evaluation of each of these analytes will be included in this section. The results of the investigations involving these media are discussed in this section.

Soils

In Phase I, soils were investigated for the compounds included in the Other category. The Phase I analytical results for a release to soils was summarized in Sections 8 through 16. Tables 24-2 and 24-4 presents the results for the general treatability parameters for these compounds.

Phase I Results

Other Compounds in Soils. The following data were obtained from AOC groupings during Phase I Investigations.

- Plating Operations - PCBs and organophosphorus pesticides (O-pesticides) were analyzed in four (4) and six (6) samples, respectively. Neither compound was detected. One (1) chlorinated pesticide (C-pesticide), 2,4-D was detected at 23 μg/kg in six (6) of the samples collected. Five (5) dioxin congeners, total TCCD, total PeCD, total HxCDD, total TCDF and total PeCDF were detected in the soil samples.

- Wastewater Treatment - Pesticides and PCB's were not monitored in this AOC grouping in soils. O-pesticides and chlorinated herbicides (c-herbicides) were analyzed in three (3) samples. O-pesticides were not detected and a total concentration of c-pesticides of 15.5 μg/kg were detected. Six (6) dioxin cogeners were detected in all three (3) samples with MW-16S, 10-12' detected in all seven (7) of the cogeners monitored.

- On-site Sludge Disposal - 11 samples were analyzed for pesticides, O-pesticides and c-herbicides. O-pesticides and c-herbicides were not detected. Lindane; gamma-BHC was detected in eight (8) of the samples with a maximum estimated concentration of 1000 μg/kg. Dieldrin, endosulfan I and heptachlor were also detected. A total of eight (8) dioxin cogeners were detected. At least four (4) cogeners were detected in 10 of the 10 samples collected.

- Waste Storage Yard - PCB's were not detected in seven (7) soil samples collected in this AOC grouping. One pesticide/herbicide was detected in a total of five (5) samples collected; Lindane: gamma-BHC in BH-7 at 1-2' at a concentration of 48 μg/kg, estimated. Six (6) dioxin cogeners were detected in the two (2) dioxin samples collected.

- On-site Surface Water Bodies - Other compounds were analyzed in soil samples from BH-1 and MW-26I. PCB's were not detected in the three (3) samples collected in this area. One (1) sample was collected for pesticides/herbicides, and none were detected. Four (4) dioxin cogeners were detected in the one (1) soil sample collected for this parameter.

- Utility Lines - No samples were collected for PCB's, pesticides, herbicides or dioxin in this AOC grouping.

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- Storage Tanks - Eight (8) soil samples were analyzed for PCBs and seven (7) were analyzed for herbicides/pesticides. PCB's were not detected in any sample. One (1) 0-pesticide, dichloroprop (76 μg/kg - estimated) was detected in MW-24S, 20-22'. Five (5) of the five (5) samples had positively detected analytes for dioxin cogeners. A maximum of seven (7) cogeners were detected in MW-20S, 5-7' and a total of eight (8) cogeners were detected in the soils in this AOC grouping.

- Other Operations - No samples were collected for PCB's, pesticides, herbicides or dioxin in this AOC grouping.

Groundwater

In Phase I, groundwater was investigated for the compounds included in the Other category. The Phase I analytical results for a release to groundwater was summarized in Sections 8 through 16. Tables 24-3 and 24-5 presents the results for the general treatability parameters for these compounds.

Phase I Results

Other Compounds in Groundwater. Only selected AOC grouping contained groundwater samples analyzed for Other parameters. The following data were obtained from the AOC groupings where samples were collected during Phase I Investigations.

- Wastewater Treatment - No samples were collected for PCB's, pesticides, herbicides or dioxin in this AOC grouping.

- On-site Sludge Disposal - No samples were collected for PCB's, pesticides or herbicides in this AOC grouping. Dioxin cogeners were detected in each of the five (5) groundwater samples. Six (6) total cogeners were detected in this AOC grouping, with total TCCD and total PeCDD present in all five (5) samples.

- Waste Storage Yard - No samples were collected for PCB's, pesticides, herbicides or dioxin in this AOC grouping.

- On-site Surface Water Bodies - No samples were collected for PCB's, pesticides, herbicides or dioxin in this AOC grouping.

- Utility Lines - No samples were collected for PCB's, pesticides, herbicides or dioxin in this AOC grouping.

- Storage Tanks - No samples were collected for PCB's, pesticides, herbicides or dioxin in this AOC grouping.

- Other Operations - No samples were collected for PCB's, pesticides, herbicides or dioxin in this AOC grouping.

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24.4 POTENTIAL REMEDIAL TECHNOLOGIES TO BE EVALUATED

The Phase I results indicate that corrective measures may be needed for each of the four (4) general compound releases documented in the previous Sections. These include:

- VOC's in soil/sediment and groundwater;
- SVOC's in soil/sediment and groundwater;
- Metals in soils, groundwater, sediments and on-site surface water.
- Other Releases in soils and groundwater.

This section discusses the preliminary evaluation of potential corrective measures technologies for any necessary remediation of these four (4) categories of contaminants.

Consistent with the CMS Screening Section presented in Section 4.0 of the RFI Proposal, all potential technologies applicable to specific media were considered. Table 24-6 summarizes the results of this media technology screening. A technology was retained for further consideration so long as no information available indicated it should not be retained. Additional technologies were also considered as part of the enhanced data evaluation performed in Phase I. These technologies are discussed here, with a more detailed explanation of why they were or were not retained.

24.4.1 Remedial Technologies for Soils

Table 24-6 lists the technologies considered for any necessary on-site soil remediation. Eight (8) of these technologies (or process options within the technology) were considered in greater detail because they might require collecting additional data or conducting pilot/bench tests:

- capping;
- chemical fixation;
- solidification/stabilization;
- encapsulation/vitrification;
- vapor extraction;
- water/solvent leaching;
- biological treatment; and
- thermal treatment.

These eight (8) soil remediation technologies are discussed briefly here.

Capping

Capping is the covering of the contaminated soil with either asphalt, compacted clay or a synthetic membrane liner designed to prevent precipitation/runoff from coming in contact with the contaminated soils. The cap also isolates the soil contaminants from contact with humans or animals. Normally, a vegetated soil layer is placed on top of the impermeable covering. The cap and covering may have to be maintained in perpetuity utilizing this technology. This technology is retained for further evaluation.

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Solidification/Fixation/Stabilization; Chemical Fixation

Chemical fixation entails blending bonding agents or other additives (such as lime and fly ash) with the contaminated soil. When mixed with the soil, the agents or additives react chemically with the contaminants, forming other non-leachable materials. Fixation may be performed as either a batch or continuous process, and the treated soil is allowed to set before being excavated and replaced or disposed. Treatability tests would be needed to determine the feasibility of chemically fixing the soil contaminants. This technology is retained for further evaluation.

Solidification/Fixation/Stabilization; Solidification/Stabilization

This process is similar to chemical fixation, but differs in that the soil is stabilized physically rather than fixed chemically. Typically, stabilization/solidification uses lime, cement, or fly ash to physically bind and stabilize the waste, preventing leaching of the contaminants. This technology is retained for further evaluation.

Immobilization; Encapsulation/Vitrification

Encapsulation requires the addition of a matrix material to seal soil contaminants; the ground surface is rendered a solid with this technology. Vitrification uses electrical current to melt soil silica to glass, destroying the organics and immobilizing the inorganics. Vitrification is limited to depths to 10 to 15 feet, and is not a proven technology. Also, vitrified or encapsulated land has limited usability and this is not a cost-effective solution. Accordingly, this technology is not retained for further evaluation.

Physical Treatment; Vapor Extraction

Vapor extraction uses a vacuum to extract volatile organics (and certain Semi-volatile compounds) from the unsaturated zone for subsequent treatment. A phase shift induced across the saturated/unsaturated interface also allows for limited groundwater treatment. Vapor extraction wells are drilled to a few feet above the water table and connected to a vacuum pump. VOCs and soil moisture are drawn through the soil to the vacuum source. After removing the water vapor, the volatile organic vapors may be incinerated or adsorbed with activated carbon. Field pilot testing will be required to determine the feasibility of the process. The soil permeability and volatility and concentrations of organics in the soil will also need to be evaluated as part of this process. This technology has been shown to reduce volatile organic contamination very quickly depending upon the various physical and chemical factors cited above. This technology is retained for further evaluation.

Chemical Treatment; Water/Solvent Leaching

Water solvent leaching is a batch process. A specific volume of soil is mixed with liquid (water plus an additive, such as an acid, a surfactant, and/or a solvent). The liquid dissolves the contaminants in the soil. The liquid is then separated and treated to remove the dissolved contaminants. For heavy metals, a dilute acid is used to dissolve the metals. The dilute acid is then separated from the soil and is neutralized with alkali to precipitate the metals as hydroxides. The precipitate is then

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removed by filtration. For volatile organics, the solvent used to extract the organics is recovered by distillation. The washed soil is then dried and either replaced or disposed off-site. Pilot testing will be necessary to determine the effectiveness of this technology on soils at this site. Although this technology is more costly than other equally effective methods for reducing the primary contaminants (e.g., VOCs) at this site, this technology is retained for further evaluation due to the presence of metals in shallow soils at the site.

Biological Treatment

In biological treatment either natural biological growth is enhanced or new bacteria are added to the soil to biodegrade the volatile and, to some extent, semi-volatile compounds. Nutrients and hydrogen peroxide may be added to the soil to promote biodegradation of the contaminants depending upon the conditions of the soil. Bioremediation can be performed in-situ if sufficient natural bacteria exist at (or are added to) the site, and other chemicals and elevated concentrations of selected metals are not present in the soil. Bioremediation can be performed ex-situ by tilling to aerate and turn the soil. Since bioremediation would remove VOC's, this technology is retained for further evaluation.

Thermal Treatment

In thermal treatment, the contaminated soil is excavated and fed to a rotating thermal device such as a rotary kiln. The soil is heated to temperatures of 300° to 500°F for low-temperature treatment, or to about 1200°F for high-temperature treatment. Low-temperature volatilizes all or most of the volatile organic compounds; the vapors are then incinerated in an afterburner, and the residue is water-scrubbed. High-temperature treatment incinerates all of the organics in the kiln. The effluent gases are quenched and scrubbed to remove dust and acids. Either treatment method can be used on-site or off-site. Because thermal treatment would not remove heavy metals and is energy-intensive and most VOC's are not present in shallow soils this technology is not retained for further evaluation.

24.4.2 Groundwater Remediation Technologies

Table 24-6 lists the technologies considered for on-site and/or off-site groundwater remediation. Ten (10) of these technologies were considered in greater detail because they might require collecting additional data or conducting pilot/bench tests:

- containment;
- air stripping;
- steam stripping;
- granular activated carbon (GAC) adsorption;
- resin adsorption;
- direct discharge to POTW
- chemical precipitation;
- biological treatment
- oil/water separation
- air sparging

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These ten (10) groundwater remediation technologies are discussed briefly here. In all cases (with the exception of containment and certain forms of bioremediation) groundwater extraction will be required. As noted in Section 24.3.1 pilot scale pumping and aquifer tests would be required in the CMS investigation prior to the implementation of pilot testing for remediation.

Containment

In some cases, contaminated groundwater can be contained by isolating the site with caps, slurry walls and pumping strategies. Due to the thickness of the aquifer and the chemical characteristics of the contaminants involved, this technology is not retained for further evaluation.

Physical Treatment; Air Stripping

Air stripping removes volatile organics by forced aeration of the contaminated water in a packed tower or low profile tray unit. The process is simple and effective, and has low capital and operating costs. Pretreatment may be required to remove dissolved iron and/or manganese or high levels of suspended solids, all of which would tend to plug the packing or the perforations in the tray. Excessive $CaCO_3$ may also hinder the efficiency of remediation. Treatment of the exhaust air with vapor phase activated carbon prior to atmospheric discharge may be required. This technology is retained for further evaluation.

Physical Treatment; Steam Stripping

Steam stripping is similar to air striping, except steam is used instead of air. The advantage of steam stripping over air stripping is that steam removes some semi-volatile organics as well as volatile organics. Both the energy requirements and cost are relatively high for steam stripping. In addition, a means must be available to dispose of the stripped contaminants. Although this technology is considerably more expensive than other effective technologies, due to the presence of SVOC's in groundwater at the site, this technology is retained for further evaluation.

Physical Treatment; Granular Activated Carbon (GAC) Adsorption

GAC adsorption uses packed-bed canisters filled with granular activated carbon. Contaminated water is pumped through the columns. Organics dissolved in the water adsorb onto the carbon until the carbon approaches saturation. The spent carbon is then replaced and returned to the supplier for thermal reactivation. Pretreatment to remove suspended solids may be required. GAC may also be used as a "polishing step" in conjunction with other treatments. This technology is retained for further evaluation.

Physical Treatment; Resin Adsorption

Synthetic adsorbent resin can be used to remove organics from wastewater. Although the resins are more costly than activated carbon, they have longer regenerative life. This technology has high capital and operating costs, would require pretreatment, and has uncertain effectiveness. Pilot testing would be required to determine if this technology was to be retained. This technology is retained

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for further evaluation subject to the pilot test results. However, it is unlikely that this treatment would be selected over GAC.

Direct Discharge to POTW

Groundwater investigations in selected zones of the site would be necessary to determine the effectiveness of this solution. Significant pilot pumping tests would be necessary and the technique would be undertaken only with significant monitoring. This technology is retained for further evaluation.

Chemical Treatment; Chemical Precipitation

Typically, chemical precipitation is used to remove heavy metals from wastewater. Removal is usually accomplished by adding chemicals (caustic, lime, iron salts, or sodium sulfide) to the waste stream. The metal precipitate formed by this process is then removed by flocculation and filtration. This technology is retained for further evaluation. Because metals removal will likely precede VOC remediation, chemical precipitation may be part of a more complete life-cycle remediation design.

Biological Treatment

Biological treatment consists of aeration of the waste stream to enhance biological growth. Nutrients are added to enhance the process. Sludge or biomass is recycled and the excess biomass is dewatered and disposed off-site. Treatment may also be performed on an in-situ basis. However, distribution of contaminants and aquifer characteristics may render this an impractical alternative. Given the variable concentrations and types of VOC's present in the groundwater, this technology is retained for further evaluation.

Oil Water Separation

Groundwater contaminated with LNAPL will impact the ability to perform other remedial technologies. Therefore, pretreatment in the form of oil\water separation is performed to remove oils prior to additional groundwater treatment. The water is directed through a baffled tank allowing sufficient residence time for oils to float to the surface. The clarified liquid is subsequently discharged to the next phase of groundwater treatment. This technology is retained for further evaluation.

Air Sparging

VOC's may be preferentially forced toward the ground surface for soil vapor treatment or toward a recovery well for groundwater treatment utilizing air sparging. Sparging involves injecting air into the groundwater in a pattern designed to direct VOC's toward your target (recovery well, vapor point, etc.). Pilot testing is necessary before implementing this remedial alternative. Due to the depth of contamination and the low hydraulic conductivity values of the glacio/acustrine materials, this technique is not considered viable and is not retained for further evaluation.

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24.4.3 Remedial Technologies for Surface Water

Data from Phase I indicates that contaminated surface water consists solely of Fire Pond water. This water would be pumped to a treatment area subjected to the treatment technologies described in the groundwater section (24.4.2). Due to the nature of the contaminants (metals and inorganics) two technologies from the Groundwater Remediation category will be considered for surface water.

- direct discharge to POTW
- chemical precipitation

24.4.4 Remedial Technologies for Sediments

Contaminated sediments consist solely of the Fire Pond sediments. These sediments would be removed mechanically and subjected to four (4) technologies from the Soil Remediation category. Pilot testing may be applied to any of these methods.

- chemical fixation
- chemical precipitation
- solidification/stabilization
- water/solvent leaching

24.5 SUMMARY

This section presented a preliminary evaluation of potential corrective measures technologies for use with contaminated media detected at the Phase I investigations. The Phase I results indicate that corrective measures may be warranted in the four (4) media Release Areas described in this section.

Based on the results from Phase I, six (6) treatability investigations may be appropriate:

- a vapor extraction pilot test
- pilot-scale pumping/aquifer tests
- air stripping pilot tests
- water/solvent leaching tests
- a UV-hydrogen peroxide bench test
- a GAC bench test

Of the potential soil remediation technologies considered, eight (8) technologies were evaluated and two (2) were eliminated from further consideration:

- capping - retained for further consideration;
- chemical fixation - retained for further consideration;
- solidification/stabilization - retained for further consideration;
- encapsulation/vitrification - not retained for further consideration;
- vapor extraction - retained for further consideration;
- water/solvent leaching - retained for further consideration;
- biological treatment - retained for further consideration; and

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- thermal treatment - not retained for further consideration.

Of the potential groundwater remediation technologies considered, ten (10) technologies were evaluated and two (2) were eliminated from further consideration:

- containment - not retained for further consideration;
- air stripping - retained for further consideration;
- stream stripping - retained for further consideration;
- GAC adsorption - retained for further consideration;
- resin adsorption - retained for further consideration;
- direct discharge to POTW - retained for further consideration;
- chemical precipitation - retained for further consideration;
- biological treatment - retained for further consideration.
- oil/water separation - retained for further consideration.
- air sparging - not retained for further consideration.

Of the potential sediment remediation technologies considered, four (4) technologies were evaluated:

- chemical fixation - retained for further consideration;
- chemical precipitation - retained for further consideration;
- solidification/stabilization - retained for further consideration;
- water/solvent leaching - retained for further consideration.

Of the potential surface water remediation technologies considered, two (2) technologies were evaluated:

- direct discharge to POTW - retained for further consideration;
- chemical precipitation - retained for further consideration.

If additional technologies are suggested or indicated during Phase II activities, these will be screened during Phase II for future use in the CMS. Further, additional data may be obtained during Phase II which would warrant elimination of a technology presented above.

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	BH-1 0-1'	BH-1 1-2'	BH-1 5-6'	BH-2 S-1	BH-2 S-2	BH-2 S-3
VOLATILE ORGANICS BY 8240	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Acetone	150 J	130 J	150 J	80 U	80 U	4800 U
2-Chloroethyl vinyl ether	10 U	10 U	10 U	10 U	10 U	600 U
cis-1,2-Dichloroethene	5 U	5 U	5 U	5 U	5 U	300 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	690
Methylene chloride	120 J	130 J	140 J	13 J	10 UJ	600 UJ
Tetrachloroethene	5 U	5 U	5 U	5 U	5 U	300 U
Toluene	5 U	5 U	5 U	5 U	5 U	300 U
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	300 U
Trichloroethene	5 U	5 U	5 U	5 U	5 U	300 U
Total Xylenes	5 U	5 U	5 U	5 U	5 U	300 U
SEMIVOLATILE ORGANICS BY 8270	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.			
Acenaphthene	200 U	200 U	200 U			
Acenaphthylene	200 U	200 U	200 U			
Anthracene	200 U	200 U	200 U			
Benzo(a)anthracene	200 U	200 U	200 U			
Benzo(b)fluoranthene	200 U	200 U	200 U			
Benzo(k)fluoranthene	200 U	200 U	200 U			
Benzo(ghi)perylene	200 UJ	200 UJ	200 UJ			
Benzo(a)pyrene	200 U	200 U	200 U			
Bis(2-ethylhexyl)phthalate	200 U	200 U	200 U			
Chrysene	200 U	200 U	200 U			
Dibenzofuran	200 U	200 U	200 U			
Di-n-butylphthalate	200 U	200 U	300 U			
Fluoranthene	200 U	200 U	200 U			
Fluorene	200 U	200 U	200 U			
Indeno(1,2,3-cd)pyrene	200 UJ	200 UJ	200 UJ			
2-Methylnapthalene	200 U	200 U	200 U			
Naphthalene	200 U	200 U	200 U			
Phenanthrene	200 U	200 U	200 U			
Pyrene	200 U	200 U	200 U			
PESTICIDES & PCB'S BY 8080						
Lindane: gamma-BHC						
4,4'-DDE						
Dieldrin						
Endosulfan I						
Heptachlor						

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TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	BH-1 0-1'	BH-1 1-2'	BH-1 5-6'	BH-2 S-1	BH-2 S-2	BH-2 S-3
ORGANOPHOSPHOROUS PESTICIDES						
CHLORINATED HERBICIDES						
2,4-D						
Dichloroprop						
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)						
Dioxin - Total TCCD						
Dioxin - Total PeCDD						
Dioxin - Total HxCDD						
Dioxin - Total HpCDD						
Furan - Total TCDF						
Furan - Total PeCDF						
Furan - Total HxCDF						
Furan - Total HpCDF						

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

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TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	BH-3 0-2'	BH-3 2-4'	BH-3 4-6'	BH-3 6-8'	BH-4 0-2'	BH-4 2-4'
VOLATILE ORGANICS BY 8240	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Acetone	640 U	800 U	800 U	800 U	800 U	800 U
2-Chloroethyl vinyl ether	80 U	100 U	100 U	100 U	100 U	100 U
cis-1,2-Dichloroethene	40 U	50 U	50 U	50 U	50 U	50 U
Ethylbenzene	40 U	50 U	50 U	50 U	50 U	50 U
Methylene chloride	180 J	610 J	730 J	680 J	1100 J	1400 J
Tetrachloroethene	40 U	50 U	50 U	50 U	50 U	50 U
Toluene	40 U	50 U	50 U	50 U	50 U	50 U
1,1,1-Trichloroethane	40 U	50 U	50 U	50 U	50 U	50 U
Trichloroethene	40 U	50 U	50 U	50 U	50 U	130
Total Xylenes	40 U	50 U	50 U	50 U	50 U	50 U
SEMIVOLATILE ORGANICS BY 8270	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
Acenaphthene	1000 U	5900	1000 U	200 U	1000 U	2000 U
Acenaphthylene	1000 U	7400	1000 U	200 U	1000 U	2000 U
Anthracene	2000	24000	1000 U	200 U	2800	2000 U
Benzo(a)anthracene	4700	29000	1000 U	200 U	5400	2000 U
Benzo(b)fluoranthene	3900	24000	1000 U	200 U	4600	2000 U
Benzo(k)fluoranthene	3800	22000	1000 U	200 U	4300	2000 U
Benzo(ghi)perylene	8500 J	36000 J	1000 UJ	200 U	7400	2000 U
Benzo(a)pyrene	5800	30000	1000 U	200 U	1000 U	2000 U
Bis(2-ethylhexyl)phthalate	1000 U	4000 U	1000 U	200 U	1000 U	2000 U
Chrysene	4900	28000	1000 U	200 U	5800	2000 U
Dibenzofuran	1000 U	10000	1000 U	200 U	1000 U	2000 U
Di-n-butylphthalate	1000 U	4000 U	1000 U	200 U	1000 U	2000 U
Fluoranthene	10000	68000	1000 U	200 U	12000	2000 U
Fluorene	1000 U	11000	1000 U	200 U	1000 U	2000 U
Indeno(1,2,3-cd)pyrene	8100 J	36000 J	1000 UJ	200 U	8200	2000 U
2-Methylnapthalene	1000 U	5300	1000 U	200 U	1000 U	2000 U
Naphthalene	1000 U	4000 U	1000 U	200 U	1000 U	2000 U
Phenanthrene	6400	75000	1000 U	200 U	9900	2000 U
Pyrene	12000	75000	1000 U	200 U	13000	2200
PESTICIDES & PCB'S BY 8080	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Lindane: gamma-BHC	1000 J	710 J	55 J	40 UJ	270 J	80 J
4,4'-DDE	40 UJ	40 UJ	40 UJ	40 UJ	40 UJ	40 UJ
Dieldrin	80 J	40 UJ	40 UJ	40 UJ	40 UJ	40 UJ
Endosulfan I	40 UJ	40 UJ	40 UJ	40 UJ	40 UJ	40 UJ
Heptachlor	40 UJ	40 UJ	40 UJ	40 UJ	60 J	40 UJ

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TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	BH-3 0-2'	BH-3 2-4'	BH-3 4-6'	BH-3 6-8'	BH-4 0-2'	BH-4 2-4'
ORGANOPHOSPHOROUS PESTICIDES	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
CHLORINATED HERBICIDES	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
2,4-D	5 U	5 U	5 U	4 U	5 U	5 U
Dichloroprop	25 U	25 U	25 U	20 U	25 U	25 U
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)	0.22	0.09	0.01	0	0.02	0.06
Dioxin - Total TCCD	2.89 X	0 UU	2.58 X	2.39 X	2.58 X	2.52 X
Dioxin - Total PeCDD	0.06	0 U	0.04 U	0.26 X	0.09 X	0.32 X
Dioxin - Total HxCDD	0.58 X	0.09	0.03 U	0.03 U	0.11	0.17
Dioxin - Total HpCDD	0.46	0.92	0.07	0.06 U	0.27	0.67
Furan - Total TCDF	0.45	0.68	0.49 X	0.17 X	0.51 X	0.28
Furan - Total PeCDF	1.17	0.53	0.04 U	0.1 X	0.45 X	0.32
Furan - Total HxCDF	1.38	1.08	0.1	0.02 U	0.22	0.81
Furan - Total HpCDF	0.7	1.08	0.09	0.05 U	0.2	0.41

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

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TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	BH-4 4-6'	BH-4 6-8'	BH-5 0-1'	BH-5 1-2'	BH-5 1-2' DUPLICATE	BH-5 5-6'
VOLATILE ORGANICS BY 8240	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Acetone	800 U	80 UJ	80 UJ	80 UJ	80 UJ	R
2-Chloroethyl vinyl ether	100 U	10 U	10 U	10 U	10 U	R
cis-1,2-Dichloroethene	50 U	5 U	5 U	5 U	5 U	R
Ethylbenzene	50 U	5 UJ	5 U	5 U	5 U	R
Methylene chloride	1300 J	23 U	47 U	51 U	67	R
Tetrachloroethene	50 U	5 UJ	5 U	5 U	5 U	R
Toluene	50 U	5 UJ	5 U	5 U	5 U	R
1,1,1-Trichloroethane	50 U	5 U	5 U	5 U	5 U	R
Trichloroethene	66	67	5 U	5 U	5 U	R
Total Xylenes	50 U	5 UJ	5 U	5 U	5 U	R
SEMIVOLATILE ORGANICS BY 8270	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
Acenaphthene	2500 U	2000 U	200 U	600 U	200 U	200 U
Acenaphthylene	2500 U	2000 U	200 U	600 U	200 U	200 U
Anthracene	2500 U	2000 U	200 U	600 U	200 U	200 U
Benzo(a)anthracene	2500 U	6800	200 U	600 U	200 U	200 U
Benzo(b)fluoranthene	2500 U	6600	200 UJ	600 U	200 U	200 U
Benzo(k)fluoranthene	2500 U	6200	200 UJ	600 U	200 U	200 U
Benzo(ghi)perylene	2500 U	2000 UJ	200 UJ	600 UJ	200 UJ	200 UJ
Benzo(a)pyrene	2500 U	8300	200 UJ	600 U	200 U	200 U
Bis(2-ethylhexyl)phthalate	27000	2000 U	200 U	600 U	200 U	410
Chrysene	2500 U	7900	220	600 U	200 U	200 U
Dibenzofuran	2500 U	2000 U	200 U	600 U	200 U	200 U
Di-n-butylphthalate	2500 U	2000 U	200 U	600 U	200 U	200 U
Fluoranthene	2600	13000	420	600 U	200 U	200 U
Fluorene	2500 U	2000 U	200 U	600 U	200 U	200 U
Indeno(1,2,3-cd)pyrene	2500 U	2000 UJ	200 UJ	600 UJ	200 UJ	200 UJ
2-Methylnapthalene	2500 U	2000 U	200 U	600 U	200 U	200 U
Naphthalene	2500 U	2000 U	200 U	600 U	200 U	200 U
Phenanthrene	2500	8900	200 U	600 U	200 U	200 U
Pyrene	5700	21000	500	600 U	200 U	200 U
PESTICIDES & PCB'S BY 8080	ug/kg, Dry Wgt	ug/kg, Dry Wgt				
Lindane: gamma-BHC	210 J	590 J				
4,4'-DDE	50 UJ	40 UJ				
Dieldrin	95 J	40 UJ				
Endosulfan I	410 J	40 UJ				
Heptachlor	50 UJ	40 UJ				

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TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	BH-4 4-6'	BH-4 6-8'	BH-5 0-1'	BH-5 1-2'	BH-5 1-2' DUPLICATE	BH-5 5-6'
ORGANOPHOSPHOROUS PESTICIDES	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.				
CHLORINATED HERBICIDES	ug/kg, Dry Wgt	ug/kg, Dry Wgt				
2,4-D	6 U	5 U				
Dichloroprop	30 U	25 U				
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)	0.05	0.01				
Dioxin - Total TCCD	5.44 X	2.99 X				
Dioxin - Total PeCDD	1.27 X	0.31 U				
Dioxin - Total HxCDD	0.32 X	0.31				
Dioxin - Total HpCDD	1.36	0.52				
Furan - Total TCDF	14.3 X	2.98 X				
Furan - Total PeCDF	1.42	0.43 U				
Furan - Total HxCDF	0.96 X	0.22				
Furan - Total HpCDF	0.88 U	0.23				

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	BH-6D S-1	BH-6D S-2	BH-6D S-3	BH-7 0-1'	BH-7 1-2'	BH-7 5-6'
VOLATILE ORGANICS BY 8240	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Acetone	160 J	80 U	800 UJ	80 UJ	480 UJ	80 U
2-Chloroethyl vinyl ether	10 U	10 U	100 U	10 U	60 U	10 U
cis-1,2-Dichloroethene	5 U	5 U	50 U	5 U	46	5 U
Ethylbenzene	5 U	5 UJ	230 J	5 UJ	30 U	5 U
Methylene chloride	110 J	16	100 UJ	370	770 J	52 U
Tetrachloroethene	5 U	5 UJ	50 U	5 UJ	30 U	5 U
Toluene	5 U	5 UJ	50 U	5 UJ	30 U	5 U
1,1,1-Trichloroethane	5 U	5 U	50 U	5 U	30 U	5 U
Trichloroethene	5 U	5 U	50 U	6.7	1100 J	5 U
Total Xylenes	5 U	5 UJ	140	5 UJ	30 U	5 U
SEMIVOLATILE ORGANICS BY 8270				ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
Acenaphthene				2000 U	2000 U	1000 U
Acenaphthylene				2000 U	2000 U	1000 U
Anthracene				2000 U	2000 U	1000 U
Benzo(a)anthracene				2000 U	4100	1000 U
Benzo(b)fluoranthene				2200	4200	1000 U
Benzo(k)fluoranthene				2000 U	3800	1000 U
Benzo(ghi)perylene				2000 UJ	2000 UJ	1000 UJ
Benzo(a)pyrene				2000 U	4600	1000 U
Bis(2-ethylhexyl)phthalate				2000 U	2000 U	1000 U
Chrysene				2100	4400	1000 U
Dibenzofuran				2000 U	2000 U	1000 U
Di-n-butylphthalate				2000 U	2000 U	1000 U
Fluoranthene				4100	9400	1000 U
Fluorene				2000 U	2000 U	1000 U
Indeno(1,2,3-cd)pyrene				2000 UJ	2000 UJ	1000 UJ
2-Methylnapthalene				2000 U	2000 U	1000 U
Naphthalene				2000 U	2000 U	1000 U
Phenanthrene				2400	6300	1000 U
Pyrene				5500	10000	1000 U
PESTICIDES & PCB'S BY 8080				ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Lindane: gamma-BHC				40 U	48 J	40 U
4,4'-DDE				40 U	40 UJ	40 U
Dieldrin				40 U	40 UJ	40 U
Endosulfan I				40 U	40 UJ	40 U
Heptachlor				40 U	40 UJ	40 U

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TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	BH-6D S-1	BH-6D S-2	BH-6D S-3	BH-7 0-1'	BH-7 1-2'	BH-7 5-6'
ORGANOPHOSPHOROUS PESTICIDES				ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
CHLORINATED HERBICIDES				ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
2,4-D				8 U	8 U	7 U
Dichloroprop				40 U	40 U	35 U
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)						
Dioxin - Total TCCD						
Dioxin - Total PeCDD						
Dioxin - Total HxCDD						
Dioxin - Total HpCDD						
Furan - Total TCDF						
Furan - Total PeCDF						
Furan - Total HxCDF						
Furan - Total HpCDF						

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	BH-8	BH-9 S-3	BH-9 S-4	BH-9 S-5	BH-9 S-6	BH2 S-4
VOLATILE ORGANICS BY 8240	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Acetone	80 UJ	48000 U	40000 U	4000 U	4000 U	1600 U
2-Chloroethyl vinyl ether	10 U	6000 U	5000 U	500 U	500 U	200 U
cis-1,2-Dichloroethene	5 U	3000 U	2500 U	250 U	250 U	100 U
Ethylbenzene	5 U	3000 U	2500 U	250 U	250 U	3000 J
Methylene chloride	84	6000 UJ	5000 UJ	500 UJ	500 UJ	200 U
Tetrachloroethene	5 U	3000 U	2500 U	250 U	250 U	100 U
Toluene	5 U	3000 U	2500 U	250 U	250 U	100 U
1,1,1-Trichloroethane	5 U	3000 U	2500 U	250 U	250 U	100 U
Trichloroethene	5 U	3000 U	2500 U	250 U	250 U	100 U
Total Xylenes	5 U	3000 U	2500 U	250 U	250 U	100 U
SEMIVOLATILE ORGANICS BY 8270	ug/kg, Dry Wgt.					
Acenaphthene	1000 U					
Acenaphthylene	1000 U					
Anthracene	1000 U					
Benzo(a)anthracene	1000 U					
Benzo(b)fluoranthene	1000 U					
Benzo(k)fluoranthene	1000 U					
Benzo(ghi)perylene	1000 UJ					
Benzo(a)pyrene	1000 U					
Bis(2-ethylhexyl)phthalate	1000 U					
Chrysene	1000 U					
Dibenzofuran	1000 U					
Di-n-butylphthalate	1000 U					
Fluoranthene	1000					
Fluorene	1000 U					
Indeno(1,2,3-cd)pyrene	1000 UJ					
2-Methylnapthalene	1000 U					
Naphthalene	1000 U					
Phenanthrene	1000 U					
Pyrene	1100					
PESTICIDES & PCB'S BY 8080						
Lindane: gamma-BHC						
4,4'-DDE						
Dieldrin						
Endosulfan I						
Heptachlor						

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	BH-8	BH-9 S-3	BH-9 S-4	BH-9 S-5	BH-9 S-6	BH2 S-4
ORGANOPHOSPHOROUS PESTICIDES						
CHLORINATED HERBICIDES						
2,4-D						
Dichloroprop						
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)						
Dioxin - Total TCCD						
Dioxin - Total PeCDD						
Dioxin - Total HxCDD						
Dioxin - Total HpCDD						
Furan - Total TCDF						
Furan - Total PeCDF						
Furan - Total HxCDF						
Furan - Total HpCDF						

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	BH2 S-5	BH2 S-5 DUPLICATE	MW-12B S-1	MW-12B S-1 DUPLICAT	MW-19 S-2	MW-19 S-3
VOLATILE ORGANICS BY 8240	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Acetone	1600 U	800 U	80 UJ	80 UJ	800 UJ	800 UJ
2-Chloroethyl vinyl ether	200 U	100 U	10 U	10 U	100 U	100 U
cis-1,2-Dichloroethene	100 U	50 U	5 U	5 U	50 U	50 U
Ethylbenzene	910	700 J	5 U	5 UJ	50 U	830
Methylene chloride	200 U	100 U	10 UJ	10 UJ	100 UJ	100 UJ
Tetrachloroethene	100 U	50 UJ	5 U	5 U	50 U	50 U
Toluene	100 U	50 UJ	5 U	5 UJ	50 U	50 U
1,1,1-Trichloroethane	100 U	50 U	5 U	5 U	50 U	50 U
Trichloroethene	100 U	50 U	5 U	5 U	50 U	50 U
Total Xylenes	100 U	50 UJ	5 U	5 UJ	50 U	140
SEMIVOLATILE ORGANICS BY 8270			ug/kg, Dry Wgt.	ug/kg, Dry Wgt.		
Acenaphthene			200 U	200 U		
Acenaphthylene			200 U	200 U		
Anthracene			200 U	200 U		
Benzo(a)anthracene			200 U	200 U		
Benzo(b)fluoranthene			200 UJ	200 UJ		
Benzo(k)fluoranthene			200 U	200 U		
Benzo(ghi)perylene			200 U	200 U		
Benzo(a)pyrene			200 UJ	200 UJ		
Bis(2-ethylhexyl)phthalate			200 U	200 U		
Chrysene			200 U	200 U		
Dibenzofuran			200 U	200 U		
Di-n-butylphthalate			200 U	200 U		
Fluoranthene			350	290		
Fluorene			200 U	200 U		
Indeno(1,2,3-cd)pyrene			200 U	200 U		
2-Methylnapthalene			200 U	200 U		
Naphthalene			200 U	200 U		
Phenanthrene			200 U	200 U		
Pyrene			380	370		
PESTICIDES & PCB'S BY 8080			ug/kg, Dry Wgt	ug/kg, Dry Wgt		
Lindane: gamma-BHC						
4,4'-DDE						
Dieldrin						
Endosulfan I						
Heptachlor						

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	BH2 S-5	BH2 S-5 DUPLICATE	MW-12B S-1	MW-12B S-1 DUPLICAT	MW-19 S-2	MW-19 S-3
ORGANOPHOSPHOROUS PESTICIDES						
CHLORINATED HERBICIDES						
2,4-D						
Dichloroprop						
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)						
Dioxin - Total TCCD						
Dioxin - Total PeCDD						
Dioxin - Total HxCDD						
Dioxin - Total HpCDD						
Furan - Total TCDF						
Furan - Total PeCDF						
Furan - Total HxCDF						
Furan - Total HpCDF						

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW-19 S-4	MW-19 S-5	MW-19 S-5 DUPLICATE	MW-19 S-6A	MW-19 S-6B	MW-23 S1-1
VOLATILE ORGANICS BY 8240	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Acetone	800 UJ	800 UJ	800 UJ	800 UJ	80 UJ	80 U
2-Chloroethyl vinyl ether	100 U	100 U	100 U	100 U	10 U	10 U
cis-1,2-Dichloroethene	50 U	50 U	50 U	50 U	5 U	5 U
Ethylbenzene	760	1600	1100	580	9.5	5 U
Methylene chloride	130 J	100 UJ	100 UJ	100 UJ	10 UJ	10 UJ
Tetrachloroethene	50 U	50 U	50 U	50 U	5 U	5 U
Toluene	50 U	50 U	50 U	50 U	5 U	5 U
1,1,1-Trichloroethane	50 U	50 U	50 U	50 U	5 U	5 U
Trichloroethene	50 U	50 U	50 U	50 U	5 U	5 U
Total Xylenes	50 U	250 J	83	65	5 U	5 U
SEMIVOLATILE ORGANICS BY 8270						ug/kg, Dry Wgt.
Acenaphthene						200 U
Acenaphthylene						200 U
Anthracene						200 U
Benzo(a)anthracene						200 U
Benzo(b)fluoranthene						200 U
Benzo(k)fluoranthene						200 U
Benzo(ghi)perylene						200 U
Benzo(a)pyrene						200 U
Bis(2-ethylhexyl)phthalate						200 U
Chrysene						200 U
Dibenzofuran						200 U
Di-n-butylphthalate						200 U
Fluoranthene						200 U
Fluorene						200 U
Indeno(1,2,3-cd)pyrene						200 U
2-Methylnapthalene						200 U
Naphthalene						200 U
Phenanthrene						200 U
Pyrene						200 U
PESTICIDES & PCB'S BY 8080						ug/kg, Dry Wgt
Lindane: gamma-BHC						
4,4'-DDE						
Dieldrin						
Endosulfan I						
Heptachlor						

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW-19 S-4	MW-19 S-5	MW-19 S-5 DUPLICATE	MW-19 S-6A	MW-19 S-6B	MW-23 S1-1
ORGANOPHOSPHOROUS PESTICIDES						
CHLORINATED HERBICIDES						
2,4-D						
Dichloroprop						
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)						
Dioxin - Total TCCD						
Dioxin - Total PeCDD						
Dioxin - Total HxCDD						
Dioxin - Total HpCDD						
Furan - Total TCDF						
Furan - Total PeCDF						
Furan - Total HxCDF						
Furan - Total HpCDF						

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW-23 S2-2	MW-23 S2-3	MW-23 S2-3 DUPLICAT	MW-24 S-1	MW-24 S-2	MW-24 S-4
VOLATILE ORGANICS BY 8240	ug/kg, Dry Wgt		ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Acetone	80 UJ		80 UJ	80 U	80 U	80 U
2-Chloroethyl vinyl ether	10 U		10 U	10 UJ	10 UJ	10 UJ
cis-1,2-Dichloroethene	5 U		5 U	5 U	5 U	5 U
Ethylbenzene	5 U		5 U	5 U	5 U	5 U
Methylene chloride	10 UJ		10 UJ	23 UJ	10 UJ	10 UJ
Tetrachloroethene	5 U		5 U	5 U	5 U	5 U
Toluene	5 U		5 U	5 U	5 U	5 U
1,1,1-Trichloroethane	5 U		6	5 UJ	5 UJ	5 UJ
Trichloroethene	5 U		5 U	5 UJ	5 UJ	110 J
Total Xylenes	5 U		5 U	5 U	5 U	5 U
SEMIVOLATILE ORGANICS BY 8270		ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
Acenaphthene		200 UJ	200 U	200 U	200 U	500 U
Acenaphthylene		200 UJ	200 U	200 U	200 U	500 U
Anthracene		200 UJ	200 U	250	200 U	500 U
Benzo(a)anthracene		200 UJ	200 U	710	200 U	500 U
Benzo(b)fluoranthene		200 UJ	200 UJ	770	200 U	500 U
Benzo(k)fluoranthene		200 UJ	200 UJ	640	200 U	500 U
Benzo(ghi)perylene		200 UJ	200 U	200 UJ	200 UJ	500 UJ
Benzo(a)pyrene		200 UJ	200 UJ	670	200 U	500 U
Bis(2-ethylhexyl)phthalate		200 UJ	200 U	200 U	200 U	500 U
Chrysene		200 UJ	200 U	710 J	200 U	500 U
Dibenzofuran		200 UJ	200 U	200 U	200 U	500 U
Di-n-butylphthalate		200 J	200 U	830 U	280 U	820 U
Fluoranthene		200 UJ	200	1500	200 U	500 U
Fluorene		200 UJ	200 U	200 U	200 U	500 U
Indeno(1,2,3-cd)pyrene		200 UJ	200 U	200 UJ	200 UJ	500 UJ
2-Methylnapthalene		200 UJ	200 U	200 U	200 U	500 U
Naphthalene		200 UJ	200 U	200 U	200 U	500 U
Phenanthrene		200 UJ	200 U	1000	200 U	500 U
Pyrene		200 UJ	200 U	1900	200 U	500 U
PESTICIDES & PCB'S BY 8080		ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Lindane: gamma-BHC				40 U	40 UJ	40 UJ
4,4'-DDE				40 U	40 UJ	40 UJ
Dieldrin				40 U	40 UJ	40 UJ
Endosulfan I				40 U	40 UJ	40 UJ
Heptachlor				40 U	40 UJ	40 UJ

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW-23 S2-2	MW-23 S2-3	MW-23 S2-3 DUPLICAT	MW-24 S-1	MW-24 S-2	MW-24 S-4
ORGANOPHOSPHOROUS PESTICIDES				ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
CHLORINATED HERBICIDES				ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
2,4-D				8 U	7 U	8 U
Dichloroprop				40 U	35 U	40 U
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)						
Dioxin - Total TCCD						0.27
Dioxin - Total PeCDD						0.21 X
Dioxin - Total HxCDD						0.01 U
Dioxin - Total HpCDD						0.01 U
Furan - Total TCDF						0.32 U
Furan - Total PeCDF						0.25
Furan - Total HxCDF						0.03 X
Furan - Total HpCDF						0.21 X

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW-24 S-6	MW-25 35-37'	MW-6-S1-1	MW-6-S2-2	MW-9D S-1	MW-9D S-2
VOLATILE ORGANICS BY 8240	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Acetone	80 U	80 U	80 UJ	210 J	80 UJ	80 UJ
2-Chloroethyl vinyl ether	10 UJ	10 U	10 UJ	10 UJ	10 U	10 U
cis-1,2-Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U
Methylene chloride	10 UJ	11	15 J	10 UJ	10 UJ	10 UJ
Tetrachloroethene	10 J	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	5 U	5 U
1,1,1-Trichloroethane	5 UJ	5 U	5 U	5 U	5 U	5 U
Trichloroethene	270 J	5 U	5 U	5 U	5 U	5 U
Total Xylenes	5 U	5 U	5 U	5 U	5 U	5 U
SEMIVOLATILE ORGANICS BY 8270	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
Acenaphthene	200 U	R	200 U	200 U	200 U	200 U
Acenaphthylene	200 U	R	200 U	200 U	200 U	200 U
Anthracene	200 U	R	200 U	200 U	200 U	200 U
Benzo(a)anthracene	200 U	R	200 U	200 U	200 U	200 U
Benzo(b)fluoranthene	200 U	R	200 U	200 U	200 UJ	200 UJ
Benzo(k)fluoranthene	200 U	R	200 U	200 U	200 UJ	200 UJ
Benzo(ghi)perylene	200 UJ	R	200 U	200 U	200 UJ	200 UJ
Benzo(a)pyrene	200 U	R	200 U	200 U	200 UJ	200 UJ
Bis(2-ethylhexyl)phthalate	200 U	R	200 U	200 U	200 U	200 U
Chrysene	200 U	R	200 U	200 U	200 U	200 U
Dibenzofuran	200 U	R	200 U	200 U	200 U	200 U
Di-n-butylphthalate	200 U	590 UJ	200	200 U	200 U	200 U
Fluoranthene	200 U	R	200 U	200 U	200 U	200 U
Fluorene	200 U	R	200 U	200 U	200 U	200 U
Indeno(1,2,3-cd)pyrene	200 UJ	R	200 U	200 U	200 UJ	200 UJ
2-Methylnapthalene	200 U	R	200 U	200 U	200 U	200 U
Naphthalene	200 U	R	200 U	200 U	200 U	200 U
Phenanthrene	200 U	R	200 U	200 U	200 U	200 U
Pyrene	200 U	R	200 U	200 U	200 U	200 U
PESTICIDES & PCB'S BY 8080	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Lindane: gamma-BHC	40 U	40 U				
4,4'-DDE	40 U	40 U				
Dieldrin	40 U	40 U				
Endosulfan I	40 U	40 U				
Heptachlor	40 U	40 U				

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TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW-24 S-6	MW-25 35-37'	MW-6-S1-1	MW-6-S2-2	MW-9D S-1	MW-9D S-2
ORGANOPHOSPHOROUS PESTICIDES	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.				
CHLORINATED HERBICIDES	ug/kg, Dry Wgt	ug/kg, Dry Wgt				
2,4-D	8 U	10 U				
Dichloroprop	76 J	50 U				
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)						
Dioxin - Total TCCD	3.37 X					
Dioxin - Total PeCDD	0.11					
Dioxin - Total HxCDD	0.07 X					
Dioxin - Total HpCDD	0.01 U					
Furan - Total TCDF	0.54 U					
Furan - Total PeCDF	0.98					
Furan - Total HxCDF	0.01 U					
Furan - Total HpCDF	0.14 X					

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW12, S-1	MW12, S-2	MW12, S-5	MW12A, S-1	MW12A, S-2	MW12B-S2-1
VOLATILE ORGANICS BY 8240	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Acetone	80 U	80 U	80 UJ	80 UJ	80 U	80 UJ
2-Chloroethyl vinyl ether	10 U	10 U	10 J	10 UJ	10 U	10 U
cis-1,2-Dichloroethene	5 U	5 U	5 UJ	5 UJ	5 U	5 U
Ethylbenzene	5 U	5 U	5 UJ	5 UJ	5 U	5 U
Methylene chloride	10 U	10 U	10 J	10 UJ	10 U	10 UJ
Tetrachloroethene	5 U	5 U	5 UJ	5 UJ	5 U	5 U
Toluene	5 U	5 U	5 UJ	5 UJ	5 U	5 U
1,1,1-Trichloroethane	5 U	5 U	5 UJ	5 UJ	5 U	5 U
Trichloroethene	5 U	5 U	280 J	5 UJ	5 U	5 U
Total Xylenes	5 U	5 U	5 UJ	5 UJ	5 U	5 U
SEMIVOLATILE ORGANICS BY 8270	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
Acenaphthene	200 U	200 U	200 U	200 U	200 U	200 U
Acenaphthylene	200 U	200 U	200 U	200 U	200 U	200 U
Anthracene	200 U	200 U	200 U	200 U	200 U	200 U
Benzo(a)anthracene	200 U	200 U	200 U	430	200 U	200 U
Benzo(b)fluoranthene	200 U	200 U	200 U	200 UJ	200 U	200 U
Benzo(k)fluoranthene	200 U	200 U	200 U	200 U	200 U	200 U
Benzo(ghi)perylene	200 UJ	200 UJ	200 UJ	200 U	200 UJ	200 U
Benzo(a)pyrene	200 U	200 U	200 U	200 UJ	200 U	200 U
Bis(2-ethylhexyl)phthalate	200 U	200 U	200 U	200 U	200 U	200 U
Chrysene	200 U	200 U	200 U	500	200 U	200 U
Dibenzofuran	200 U	200 U	200 U	200 U	200 U	200 U
Di-n-butylphthalate	200 U	200 U	200 U	200 U	200 U	400 U
Fluoranthene	220	200 U	200 U	1100	200 U	200 U
Fluorene	200 U	200 U	200 U	200 U	200 U	200 U
Indeno(1,2,3-cd)pyrene	200 UJ	200 UJ	200 UJ	200 U	200 UJ	200 U
2-Methylnapthalene	200 U	200 U	200 U	200 U	200 U	200 U
Naphthalene	200 U	200 U	200 U	200 U	200 U	200 U
Phenanthrene	200 U	200 U	200 U	680	200 U	200 U
Pyrene	210	200 U	200 U	970	200 U	200 U
PESTICIDES & PCB'S BY 8080	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Lindane: gamma-BHC			40 U	40 U	40 U	
4,4'-DDE			40 U	740 J	40 U	
Dieldrin			40 U	40 U	40 U	
Endosulfan I			40 U	40 U	40 U	
Heptachlor			40 U	40 U	40 U	

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW12, S-1	MW12, S-2	MW12, S-5	MW12A, S-1	MW12A, S-2	MW12B-S2-1
ORGANOPHOSPHOROUS PESTICIDES			ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	
CHLORINATED HERBICIDES			ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	
2,4-D			8 U	8 U	8 U	
Dichloroprop			40 U	40 U	40 U	
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)			0			
Dioxin - Total TCCD			2.27 X			
Dioxin - Total PeCDD			0.15 X			
Dioxin - Total HxCDD			0.01 U			
Dioxin - Total HpCDD			0.01 U			
Furan - Total TCDF			0.32 U			
Furan - Total PeCDF			0.46			
Furan - Total HxCDF			0.01 U			
Furan - Total HpCDF			0.1 X			

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW14-DUPE-1	MW14-S1-1	MW14-S2-2	MW14-S4-1	MW14-S5-2	MW15-DUPE-2
VOLATILE ORGANICS BY 8240	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Acetone	1200 U	800 U	800 U	800 U	400 U	210 UJ
2-Chloroethyl vinyl ether	150 UJ	100 UJ	100 UJ	100 UJ	50 UJ	10 U
cis-1,2-Dichloroethene	75 U	50 U	50 U	50 U	58 J	5 U
Ethylbenzene	75 U	50 U	50 U	50 U	25 U	5 U
Methylene chloride	150 UJ	100 UJ	120 J	100 UJ	50 UJ	10 UJ
Tetrachloroethene	460 J	210 J	50 UJ	50 UJ	25 UJ	5 U
Toluene	75 U	50 U	50 U	50 U	25 U	5 U
1,1,1-Trichloroethane	75 UJ	50 UJ	50 UJ	50 UJ	25 UJ	5 U
Trichloroethene	2300 J	1300 J	82 J	50 UJ	510 J	9.2
Total Xylenes	75 U	50 U	50 U	50 U	25 U	5 U
SEMIVOLATILE ORGANICS BY 8270	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
Acenaphthene	1000 U	1000 U	200 U	1000 U	250 U	1900
Acenaphthylene	1000 U	1000 U	200 U	1000 U	250 U	6600
Anthracene	1900	1700	200 U	1000 U	250 U	11000
Benzo(a)anthracene	4400	3200	380	1000 U	250 U	10000
Benzo(b)fluoranthene	5300 J	3400 J	390	1000 U	250 UJ	6400
Benzo(k)fluoranthene	4100 J	3800 J	330	1000 U	250 UJ	5900
Benzo(ghi)perylene	1000 UJ	1000 UJ	200 U	1000 UJ	250 UJ	1000 U
Benzo(a)pyrene	5700 J	4600 J	200 U	1000 U	250 UJ	8800
Bis(2-ethylhexyl)phthalate	1200	1200	200 U	1000 U	250 U	1000 U
Chrysene	4800	3700	430	1000 U	250 U	9600
Dibenzofuran	1000 U	1000 U	200 U	1000 U	250 U	6700
Di-n-butylphthalate	1000 U	1000 U	350 U	1000 U	250 U	1000 U
Fluoranthene	7800	6500	1100	1800	250 U	24000
Fluorene	1000 U	1000 U	200 U	1000 U	250 U	5800
Indeno(1,2,3-cd)pyrene	1000 UJ	1000 UJ	200 U	1000 U	250 U	1000 U
2-Methylnapthalene	1000 U	1000 U	200 U	1000 U	250 U	4200
Naphthalene	1000 U	1000 U	200 U	1000 U	250 U	8400
Phenanthrene	5600	4900	970	1400	250 U	32000
Pyrene	12000	8200	880	1700	250 U	24000
PESTICIDES & PCB'S BY 8080	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Lindane: gamma-BHC				40 U	40 U	
4,4'-DDE				40 U	40 U	
Dieldrin				40 U	40 U	
Endosulfan I				40 UJ	40 UJ	
Heptachlor				40 U	40 U	

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TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW14-DUPE-1	MW14-S1-1	MW14-S2-2	MW14-S4-1	MW14-S5-2	MW15-DUPE-2
ORGANOPHOSPHOROUS PESTICIDES				ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	
CHLORINATED HERBICIDES				ug/kg, Dry Wgt	ug/kg, Dry Wgt	
2,4-D				8 UJ	9 UJ	
Dichloroprop				40 UJ	45 UJ	
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)				0	0	
Dioxin - Total TCCD				0.04	3.58 X	
Dioxin - Total PeCDD				0.43 X	0.27 X	
Dioxin - Total HxCDD				0.02 U	0.02 U	
Dioxin - Total HpCDD				0.04 U	1.14 X	
Furan - Total TCDF				0.2 X	0.44 X	
Furan - Total PeCDF				0.06 X	0.03 U	
Furan - Total HxCDF				0.01 U	0.02 U	
Furan - Total HpCDF				0.03 X	0.13 X	

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW15-S1-1	MW15-S1-2	MW15-S2-1	MW15-S2-3	MW16-DUPE-1	MW16-S1-1
VOLATILE ORGANICS BY 8240	ug/kg, Dry Wgt		ug/kg, Dry Wgt		ug/kg, Dry Wgt	ug/kg, Dry Wgt
Acetone	80 UJ		R		800 UJ	80 UJ
2-Chloroethyl vinyl ether	10 U		R		100 UJ	10 UJ
cis-1,2-Dichloroethene	5 U		R		50 U	5 U
Ethylbenzene	5 U		R		50 U	5 U
Methylene chloride	10 UJ		R		100 UJ	10 UJ
Tetrachloroethene	5 U		R		50 U	5 U
Toluene	5 U		R		50 U	5 U
1,1,1-Trichloroethane	5 U		R		50 U	5 U
Trichloroethene	11		R		50 U	65
Total Xylenes	5 U		R		50 U	5 U
SEMIVOLATILE ORGANICS BY 8270	ug/kg, Dry Wgt.		ug/kg, Dry Wgt.		ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
Acenaphthene	1000 U		200 U		1000 U	200 U
Acenaphthylene	1000 U		200 U		1000 U	200 U
Anthracene	1000 U		200 U		1000 U	200 U
Benzo(a)anthracene	1300 J		200		1000 U	200 U
Benzo(b)fluoranthene	1000 U		200 U		1000 U	200 U
Benzo(k)fluoranthene	1000 U		200 U		1000 U	200 U
Benzo(ghi)perylene	1000 U		200 U		1000 U	200 U
Benzo(a)pyrene	1000 U		200 U		1000 U	200 U
Bis(2-ethylhexyl)phthalate	1000 U		200 U		1000 U	200 U
Chrysene	1600 J		210		1000 U	200 U
Dibenzofuran	1000 U		200 U		1000 U	200 U
Di-n-butylphthalate	1000 U		260 U		1000 U	200 U
Fluoranthene	3000 J		480		1000 U	200 U
Fluorene	1000 U		200 U		1000 U	200 U
Indeno(1,2,3-cd)pyrene	1000 U		200 U		1000 U	200 U
2-Methylnapthalene	1000 U		200 U		1000 U	200 U
Naphthalene	1000 U		200 U		1000 U	200 U
Phenanthrene	1800 J		450		1000 U	200 U
Pyrene	3000 J		480		1000 U	200 U
PESTICIDES & PCB'S BY 8080	ug/kg, Dry Wgt		ug/kg, Dry Wgt		ug/kg, Dry Wgt	ug/kg, Dry Wgt
Lindane: gamma-BHC					R	
4,4'-DDE					R	
Dieldrin					R	
Endosulfan I					R	
Heptachlor					R	

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TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW15-S1-1	MW15-S1-2	MW15-S2-1	MW15-S2-3	MW16-DUPE-1	MW16-S1-1
ORGANOPHOSPHOROUS PESTICIDES					ug/kg, Dry Wgt.	
CHLORINATED HERBICIDES					ug/kg, Dry Wgt	
2,4-D					23 J	
Dichloroprop					40 UJ	
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)		0.09		0.26	0	
Dioxin - Total TCCD		3.08 X		3.13 X	2.63 X	
Dioxin - Total PeCDD		0.01 X		0.26 X	0.08 X	
Dioxin - Total HxCDD		0.33		0.17	0.02 U	
Dioxin - Total HpCDD		1.61		0.16	1.18 X	
Furan - Total TCDF		0.23		0.98	0.48 X	
Furan - Total PeCDF		0.43		2.4	0.02 X	
Furan - Total HxCDF		0.54		2.03	0.02 U	
Furan - Total HpCDF		0.82 X		0.58	0.22 X	

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J
X
U

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TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW16-S2-2	MW16-S3-3	MW16-S4-4	MW17-S1-1	MW17-S2-2	MW17-S4-3
VOLATILE ORGANICS BY 8240	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Acetone	800 UJ	80 UJ	80 UJ	80 U	800 U	80 U
2-Chloroethyl vinyl ether	100 UJ	10 UJ	10 UJ	10 UJ	100 UJ	10 UJ
cis-1,2-Dichloroethene	50 U	5 U	5 U	5 U	50 U	5 U
Ethylbenzene	50 U	5 U	5 U	5 U	50 U	5 U
Methylene chloride	100 UJ	10 UJ	10 UJ	10 UJ	100 UJ	10 UJ
Tetrachloroethene	50 U	5 U	5 U	5 U	50 U	25
Toluene	50 U	5 U	5 U	5 U	50 U	5 U
1,1,1-Trichloroethane	50 U	5 U	5 U	5 U	50 U	5 U
Trichloroethene	50 U	5 U	22	51	50 U	15
Total Xylenes	50 U	5 U	5 U	5 U	50 U	5 U
SEMIVOLATILE ORGANICS BY 8270	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
Acenaphthene	4000 U	200 U	200 U	200 U	200 UJ	200 U
Acenaphthylene	4000 U	200 U	200 U	200 U	200 UJ	200 U
Anthracene	4000 U	200 U	200 U	200 U	200 UJ	200 U
Benzo(a)anthracene	4000 U	200 U	200 U	230	200 UJ	200 U
Benzo(b)fluoranthene	4000 U	200 UJ	200 U	200 U	200 UJ	200 UJ
Benzo(k)fluoranthene	4000 U	200 UJ	200 U	200 U	200 UJ	200 UJ
Benzo(ghi)perylene	4000 U	200 UJ	200 U	200 UJ	200 UJ	200 UJ
Benzo(a)pyrene	4000 U	200 UJ	200 U	200 U	200 UJ	200 UJ
Bis(2-ethylhexyl)phthalate	4000 U	200 U	200 U	200 U	200 UJ	200 U
Chrysene	4000 U	200 U	200 U	230	270 J	200 U
Dibenzofuran	4000 U	200 U	200 U	200 U	200 UJ	200 U
Di-n-butylphthalate	4000 U	200 U	200 U	300 U	200 UJ	200 U
Fluoranthene	4000 U	200 U	200 U	580	690 J	200 U
Fluorene	4000 U	200 U	200 U	200 U	200 UJ	200 U
Indeno(1,2,3-cd)pyrene	4000 U	200 UJ	200 U	200 U	200 U	200 U
2-Methylnapthalene	4000 U	200 U	200 U	200 U	200 UJ	200 U
Naphthalene	4000 U	200 U	200 U	200 U	200 UJ	200 U
Phenanthrene	6800	200 U	200 U	430	490 J	200 U
Pyrene	4000 U	200 U	200 U	550	1000 J	200 U
PESTICIDES & PCB'S BY 8080	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Lindane: gamma-BHC	R	R	R		40 U	40 U
4,4'-DDE	R	R	R		40 U	40 U
Dieldrin	R	R	R		40 U	40 U
Endosulfan I	R	R	R		40 UJ	40 UJ
Heptachlor	R	R	R		40 U	40 U

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TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW16-S2-2	MW16-S3-3	MW16-S4-4	MW17-S1-1	MW17-S2-2	MW17-S4-3
ORGANOPHOSPHOROUS PESTICIDES	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.		ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
CHLORINATED HERBICIDES	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt		ug/kg, Dry Wgt	ug/kg, Dry Wgt
2,4-D	8 UJ	8 UJ	8 UJ		9 U	8 U
Dichloroprop	40 UJ	40 UJ	40 UJ		45 U	40 U
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)	0	0	0		0	0
Dioxin - Total TCCD	2.49 X	2.59 X	2.48 X		3.1 X	2.54 X
Dioxin - Total PeCDD	0.66 X	0.25 X	0.08 X		0.08 X	0.1 X
Dioxin - Total HxCDD	0.03 U	0.02 X	0.01 U		0.03 U	0.01 U
Dioxin - Total HpCDD	0.84 X	1.2 X	0.74 X		0.1 U	1 X
Furan - Total TCDF	0.07	0.03	0.07		0.32 X	0.27 X
Furan - Total PeCDF	0.12 X	0.03 X	0.01 X		0.14 X	0.06 X
Furan - Total HxCDF	0.02 U	0.01 U	0.01 U		0.02 U	0.01 U
Furan - Total HpCDF	0.06 U	0.26 X	0.13 X		0.08 U	0.19 X

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW20-DUPE-1	MW20-S1-1	MW20-S2-2	MW20-S3-3	MW20-S4-4	MW21-S1-1
VOLATILE ORGANICS BY 8240	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Acetone	80 U	800 U	1200 U	80 U	1200 U	80 U
2-Chloroethyl vinyl ether	10 UJ	100 UJ	150 UJ	10 UJ	150 UJ	10 U
cis-1,2-Dichloroethene	5 UJ	50 U	75 U	5 U	350 J	5 U
Ethylbenzene	5 UJ	50 U	75 U	5 U	75 U	5 U
Methylene chloride	21 JB	230 J	150 UJ	10 UJ	150 UJ	12 J
Tetrachloroethene	5 UJ	50 U	75 U	5 UJ	75 UJ	5 U
Toluene	5 UJ	50 UJ	75 U	5 U	75 U	5 U
1,1,1-Trichloroethane	5 U	50 UJ	75 U	5 UJ	75 UJ	5 U
Trichloroethene	6.8 J	220 J	75 U	5 UJ	1200 J	5 U
Total Xylenes	5 UJ	50 U	75 U	5 U	75 U	5 U
SEMIVOLATILE ORGANICS BY 8270	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
Acenaphthene	200 U	1000 U	2500 U	1000 U	250 U	R
Acenaphthylene	200 U	1000 U	2500 U	1000 U	250 U	R
Anthracene	200 U	1000 U	2500 U	1000 U	250 U	R
Benzo(a)anthracene	200 U	1000 U	2500 U	1000 U	250 U	R
Benzo(b)fluoranthene	200 U	1000 U	2500 UJ	1000 U	250 UJ	R
Benzo(k)fluoranthene	200 U	1000 U	2500 UJ	1000 U	250 UJ	R
Benzo(ghi)perylene	200 U	1000 U	2500 UJ	1000 U	250 UJ	R
Benzo(a)pyrene	200 U	1000 U	2500 UJ	1000 U	250 UJ	R
Bis(2-ethylhexyl)phthalate	200 U	1000 U	2500 U	1000 U	250 U	R
Chrysene	200 U	1000 U	2500 U	1000 U	250 U	R
Dibenzofuran	200 U	1000 U	2500 U	1000 U	250 U	R
Di-n-butylphthalate	300 U	1000 U	2500 U	1000 U	250 U	360 J
Fluoranthene	200 U	1200	2500 U	1000 U	250 U	300 J
Fluorene	200 U	1000 U	2500 U	1000 U	250 U	R
Indeno(1,2,3-cd)pyrene	200 U	1000 U	2500 UJ	1000 U	250 U	R
2-Methylnapthalene	200 U	1000 U	2500 U	1000 U	250 U	R
Naphthalene	200 U	1000 U	2500 U	1000 U	250 U	R
Phenanthrene	200 U	1000 U	2500 U	1000 U	250 U	R
Pyrene	200 U	1500	2500 U	1000 U	250 U	200 J
PESTICIDES & PCB'S BY 8080	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Lindane: gamma-BHC	40 U		40 U	40 U	50 U	
4,4'-DDE	40 U		40 U	40 U	50 U	
Dieldrin	40 U		40 U	40 U	50 U	
Endosulfan I	40 UJ		40 UJ	40 UJ	50 UJ	
Heptachlor	40 U		40 U	40 U	50 U	

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW20-DUPE-1	MW20-S1-1	MW20-S2-2	MW20-S3-3	MW20-S4-4	MW21-S1-1
ORGANOPHOSPHOROUS PESTICIDES	ug/kg, Dry Wgt.		ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	
CHLORINATED HERBICIDES	ug/kg, Dry Wgt		ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	
2,4-D	8 UJ		80 U	80 U	10 UJ	
Dichloroprop	40 UJ		400 U	400 U	50 UJ	
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)	0		0	0	0	
Dioxin - Total TCCD	2.91 X		5.75 X	2.96 X	3.25 X	
Dioxin - Total PeCDD	0.07 X		0.13 X	0.27 X	0.19 X	
Dioxin - Total HxCDD	0.02 U		0.04 U	0.03 U	0.02 U	
Dioxin - Total HpCDD	0.03 U		0.74 X	0.07 U	0.78 X	
Furan - Total TCDF	0.31 X		1.88 X	0.69 X	0.34 X	
Furan - Total PeCDF	0.02 U		0.06 X	0.04 X	0.03 U	
Furan - Total HxCDF	0.02 X		0.23 X	0.02 U	0.01 U	
Furan - Total HpCDF	0.11 X		0.14 X	0.06 U	0.18 X	

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW21-S1-DUP E	MW21-S2-2	MW22-S1-1	MW22-S2-2	MW25 0-2'	MW25 5-7 DUPLICATE
VOLATILE ORGANICS BY 8240	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Acetone	80 U	80 U	80 U	80 U	140 J	150 J
2-Chloroethyl vinyl ether	10 U	10 U	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5.9	5 U	5 U	5 U	5 U	5 U
Methylene chloride	14 J	10 UJ	10 UJ	10 UJ	84 J	110 J
Tetrachloroethene	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	26	5 U	5 U	5 U	5 U	5 U
1,1,1-Trichloroethane	29	5 U	5 U	5 U	5 U	5 U
Trichloroethene	5 U	5 U	5 U	5 U	5 U	5 U
Total Xylenes	5 U	5 U	5 U	5 U	5 U	5 U
SEMIVOLATILE ORGANICS BY 8270	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
Acenaphthene	200 U	R	R	R	2000 U	NA
Acenaphthylene	200 U	R	R	R	16000	NA
Anthracene	200 U	R	R	R	13000	NA
Benzo(a)anthracene	200 U	R	R	R	26000	NA
Benzo(b)fluoranthene	200 UJ	R	R	R	43000 J	NA
Benzo(k)fluoranthene	200 UJ	R	R	R	33000 J	NA
Benzo(ghi)perylene	200 UJ	R	R	R	67000 J	NA
Benzo(a)pyrene	200 UJ	R	R	R	43000 J	NA
Bis(2-ethylhexyl)phthalate	200 U	R	R	R	2000 U	NA
Chrysene	200 U	R	R	R	28000	NA
Dibenzofuran	200 U	R	R	R	2000 U	NA
Di-n-butylphthalate	330	R	R	R	2000 U	NA
Fluoranthene	200 U	R	R	R	36000	NA
Fluorene	200 U	R	R	R	2000 U	NA
Indeno(1,2,3-cd)pyrene	200 UJ	R	R	R	73000 J	NA
2-Methylnapthalene	200 U	R	R	R	2000 U	NA
Naphthalene	200 U	R	R	R	2000 U	NA
Phenanthrene	200 U	R	R	R	9900	NA
Pyrene	200 U	R	R	R	65000	NA
PESTICIDES & PCB'S BY 8080	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Lindane: gamma-BHC					40 U	40 UJ
4,4'-DDE					40 U	40 UJ
Dieldrin					40 U	40 UJ
Endosulfan I					40 U	40 UJ
Heptachlor					40 U	40 UJ

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW21-S1-DUPE	MW21-S2-2	MW22-S1-1	MW22-S2-2	MW25 0-2'	MW25 5-7 DUPLICATE
ORGANOPHOSPHOROUS PESTICIDES						
CHLORINATED HERBICIDES						
2,4-D						
Dichloroprop						
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)						
Dioxin - Total TCCD						
Dioxin - Total PeCDD						
Dioxin - Total HxCDD						
Dioxin - Total HpCDD						
Furan - Total TCDF						
Furan - Total PeCDF						
Furan - Total HxCDF						
Furan - Total HpCDF						

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW25 5-7'
VOLATILE ORGANICS BY 8240	ug/kg, Dry Wgt
Acetone	120 J
2-Chloroethyl vinyl ether	10 U
cis-1,2-Dichloroethene	5 U
Ethylbenzene	5 U
Methylene chloride	71 J
Tetrachloroethene	5 U
Toluene	5 U
1,1,1-Trichloroethane	5 U
Trichloroethene	5 U
Total Xylenes	5 U
SEMIVOLATILE ORGANICS BY 8270	ug/kg, Dry Wgt.
Acenaphthene	200 U
Acenaphthylene	200 U
Anthracene	200 U
Benzo(a)anthracene	300
Benzo(b)fluoranthene	310
Benzo(k)fluoranthene	250
Benzo(ghi)perylene	200 UJ
Benzo(a)pyrene	330
Bis(2-ethylhexyl)phthalate	200 U
Chrysene	300
Dibenzofuran	200 U
Di-n-butylphthalate	440 U
Fluoranthene	580
Fluorene	200 U
Indeno(1,2,3-cd)pyrene	200 UJ
2-Methylnapthalene	200 U
Naphthalene	200 U
Phenanthrene	420
Pyrene	640
PESTICIDES & PCB'S BY 8080	ug/kg, Dry Wgt
Lindane: gamma-BHC	40 U
4,4'-DDE	40 U
Dieldrin	40 U
Endosulfan I	65 J
Heptachlor	40 U

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	MW25 5-7'
ORGANOPHOSPHOROUS PESTICIDES	
CHLORINATED HERBICIDES	
2,4-D	
Dichloroprop	
DIOXIN	
2,3,7,8-TCCD (TEF adjusted)	
Dioxin - Total TCCD	
Dioxin - Total PeCDD	
Dioxin - Total HxCDD	
Dioxin - Total HpCDD	
Furan - Total TCDF	
Furan - Total PeCDF	
Furan - Total HxCDF	
Furan - Total HpCDF	

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
VOC, SVOC, AND OTHER COMPOUNDS

	SS-4	SS-5	SS-8
VOLATILE ORGANICS BY 8240	ug/kg, Dry Wgt	ug/kg, Dry Wgt	ug/kg, Dry Wgt
Acetone		150 J	
Ethylbenzene	10		
Methylene chloride	44		24
Trichloroethene	11		
SEMIVOLATILE ORGANICS BY 8270	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
Acenaphthylene			1300
Anthracene	10000		1800
Benzo(a)anthracene	19000		3700
Benzo(b)fluoranthene	17000		4600
Benzo(k)fluoranthene	16000		3600
Benzo(ghi)perylene			7700 J
Benzo(a)pyrene	20000		4900
Bis(2-ethylhexyl)phthalate	9500		
Chrysene	20000		5100
Fluoranthene	44000		8800
Indeno(1,2,3-cd)pyrene	31000 J		7300 J
Phenanthrene	41000		5800
Pyrene	54000		12000
PESTICIDES & PCB'S BY 8080			
ORGANOPHOSPHOROUS PESTICIDES			
CHLORINATED HERBICIDES			
DIOXIN			

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-3
TREATABILITY PARAMETERS FOR GROUNDWATER
VOC, SVOC, AND OTHER COMPOUNDS

	MW-10A	MW-10B	MW-10B DUPLICATE	MW-12	MW-12A	MW-12B
VOLATILE ORGANICS BY 8240	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Benzene						
1,1-Dichloroethane						
cis-1,2-Dichloroethene					43	43
Ethylbenzene						
Tetrachloroethene					8	11
Trichloroethene	150	140	130	1500	26	43
SEMIVOLATILE ORGANICS BY 8270	ug/L	ug/L	ug/L			
Anthracene						
Dibenzofuran						
Fluoranthene						
Fluorene						
2-Methylnapthalene						
Naphthalene						
Phenanthrene						
Pyrene						
PESTICIDES & PCB'S BY 8080	ug/L	ug/L	ug/L			
ORGANOPHOSPHOROUS PESTICIDES	ug/L	ug/L	ug/L			
CHLORINATED HERBICIDES	ug/L	ug/L	ug/L			
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)	0	0	0			
Dioxin - Total TCCD	23.7 X	23.6 X	22.1 X			
Dioxin - Total PeCDD	0.6 X	1.11 X	2.33 X			
Dioxin - Total HxCDD						
Dioxin - Total HpCDD	4.8 X	7.81 X				
Furan - Total TCDF			4.64 X			
Furan - Total PeCDF			0.51 X			
Furan - Total HpCDF						

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-3
TREATABILITY PARAMETERS FOR GROUNDWATER
VOC, SVOC, AND OTHER COMPOUNDS

	MW-13	MW-14	MW-15	MW-15 DUPLICATE	MW-16	MW-17
VOLATILE ORGANICS BY 8240	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Benzene						
1,1-Dichloroethane						
cis-1,2-Dichloroethene						
Ethylbenzene						
Tetrachloroethene						
Trichloroethene	120	5200	200			15
SEMIVOLATILE ORGANICS BY 8270	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Anthracene						
Dibenzofuran						
Fluoranthene						
Fluorene						
2-Methylnapthalene						
Naphthalene						
Phenanthrene					19	
Pyrene						
PESTICIDES & PCB'S BY 8080			ug/L	ug/L		
ORGANOPHOSPHOROUS PESTICIDES			ug/L	ug/L		
CHLORINATED HERBICIDES			ug/L	ug/L		
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)			0	0.01		
Dioxin - Total TCCD			23.3 X	27.2 X		
Dioxin - Total PeCDD			17.1 X			
Dioxin - Total HxCDD						
Dioxin - Total HpCDD				1.14		
Furan - Total TCDF			3.64 X			
Furan - Total PeCDF			9.39 X			
Furan - Total HpCDF						

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-3
TREATABILITY PARAMETERS FOR GROUNDWATER
VOC, SVOC, AND OTHER COMPOUNDS

	MW-18	MW-19	MW-2	MW-20	MW-21	MW-22
VOLATILE ORGANICS BY 8240	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Benzene				6		
1,1-Dichloroethane				17		
cis-1,2-Dichloroethene	70		10			330
Ethylbenzene	170	150				
Tetrachloroethene						120
Trichloroethene	100		25	25	190	370
SEMIVOLATILE ORGANICS BY 8270	ug/L	ug/L				
Anthracene		60				
Dibenzofuran	140	150				
Fluoranthene	53					
Fluorene	160	270				
2-Methylnapthalene		1500				
Naphthalene		470				
Phenanthrene	260	420				
Pyrene	69 J					
PESTICIDES & PCB'S BY 8080					ug/L	ug/L
ORGANOPHOSPHOROUS PESTICIDES						
CHLORINATED HERBICIDES						
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)						
Dioxin - Total TCCD						
Dioxin - Total PeCDD						
Dioxin - Total HxCDD						
Dioxin - Total HpCDD						
Furan - Total TCDF						
Furan - Total PeCDF						
Furan - Total HpCDF						

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-3
TREATABILITY PARAMETERS FOR GROUNDWATER
VOC, SVOC, AND OTHER COMPOUNDS

	MW-22 DUPE	MW-24	MW-3	MW-3 DUPLICATE	MW-4	MW-6
VOLATILE ORGANICS BY 8240	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Benzene						
1,1-Dichloroethane						
cis-1,2-Dichloroethene	280					
Ethylbenzene						
Tetrachloroethene	97					
Trichloroethene	290	9000	280	300	5200	94
SEMIVOLATILE ORGANICS BY 8270			ug/L	ug/L		ug/L
Anthracene						
Dibenzofuran						
Fluoranthene						
Fluorene						
2-Methylnapthalene						
Naphthalene						
Phenanthrene						
Pyrene						
PESTICIDES & PCB'S BY 8080	ug/L		ug/L	ug/L		ug/L
ORGANOPHOSPHOROUS PESTICIDES			ug/L	ug/L		ug/L
CHLORINATED HERBICIDES			ug/L	ug/L		ug/L
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)			0	0		0
Dioxin - Total TCCD			22.4 X	23.2 X		22.8 X
Dioxin - Total PeCDD			2.1 X	0.92 X		
Dioxin - Total HxCDD						
Dioxin - Total HpCDD			10.9 X	13.7 X		
Furan - Total TCDF			4 X	3.5 X		4.15 X
Furan - Total PeCDF			1.41 X			
Furan - Total HpCDF						

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-3
TREATABILITY PARAMETERS FOR GROUNDWATER
VOC, SVOC, AND OTHER COMPOUNDS

	MW-6 DUPLICATE	MW-7A	MW-8A	MW-9A	MW-9C	MW-9D
VOLATILE ORGANICS BY 8240	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Benzene						
1,1-Dichloroethane						
cis-1,2-Dichloroethene				96		18
Ethylbenzene						
Tetrachloroethene						
Trichloroethene	110	15	18	280	81	41
SEMIVOLATILE ORGANICS BY 8270	ug/L					
Anthracene						
Dibenzofuran						
Fluoranthene						
Fluorene						
2-Methylnapthalene						
Naphthalene						
Phenanthrene						
Pyrene						
PESTICIDES & PCB'S BY 8080	ug/L					
ORGANOPHOSPHOROUS PESTICIDES	ug/L					
CHLORINATED HERBICIDES	ug/L					
DIOXIN						
2,3,7,8-TCCD (TEF adjusted)	0					
Dioxin - Total TCCD	25 X					
Dioxin - Total PeCDD	0.57 X					
Dioxin - Total HxCDD	0.4 X					
Dioxin - Total HpCDD						
Furan - Total TCDF	6.06 X					
Furan - Total PeCDF						
Furan - Total HpCDF	0.76 X					

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-3
TREATABILITY PARAMETERS FOR GROUNDWATER
VOC, SVOC, AND OTHER COMPOUNDS

	MW9B
VOLATILE ORGANICS BY 8240	ug/L
Benzene	
1,1-Dichloroethane	
cis-1,2-Dichloroethene	190
Ethylbenzene	
Tetrachloroethene	
Trichloroethene	270
SEMIVOLATILE ORGANICS BY 8270	
Anthracene	
Dibenzofuran	
Fluoranthene	
Fluorene	
2-Methylnapthalene	
Naphthalene	
Phenanthrene	
Pyrene	
PESTICIDES & PCB'S BY 8080	
ORGANOPHOSPHOROUS PESTICIDES	
CHLORINATED HERBICIDES	
DIOXIN	
2,3,7,8-TCCD (TEF adjusted)	
Dioxin - Total TCCD	
Dioxin - Total PeCDD	
Dioxin - Total HxCDD	
Dioxin - Total HpCDD	
Furan - Total TCDF	
Furan - Total PeCDF	
Furan - Total HpCDF	

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc
includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-4
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
METALS

METALS	BH-1 0-1' ug/kg, Dry Wgt.	BH-1 1-2' ug/kg, Dry Wgt.	BH-1 5-6' ug/kg, Dry Wgt.	BH-2 S-1 ug/kg, Dry Wgt.	BH-2 S-2 ug/kg, Dry Wgt.	BH-2 S-3 ug/kg, Dry Wgt.
Antimony	300 U	300 U	300 U	300 U	300 U	300 U
Arsenic	980	1100	610	650	1000	1400
Barium	53000	31000	25000	53000	22000	16000
Beryllium	3000 U	3000 U	3000 U	3000 U	3000 U	3000 U
Cadmium	R	R	R	600 U	600 U	600 U
Calcium	320000	520000	1300000	320000	230000	330000
Chromium	280000	58000	15000	14000	17000	16000
Cobalt	5600	4100	3300	5000	7100	4700
Copper	34000	13000	4300 UJ	8000 J	11000 J	9100 J
Iron	15000000	20000000	12000000	19000000	21000	16000
Lead	12000 UJ	6000 U	6000 U	R	9400 J	R
Magnesium	2600000	2800000	2000000	2200000	2800000	2300000
Manganese	81000	140000	330000	380000	260000	180000
Mercury	300 U	300 U	300 U	300 U	300 U	300 U
Nickel	490000	170000	36000	20000	22000	17000
Potassium	1100000	1400000	1900000	990000	1500000	940000
Selenium	300 U	300 U	300 U	300 U	300 U	300 U
Silver	810	600 U	600 U	600	600 U	600 U
Sodium	110000 U	110000 U	110000 U	120000 U	160000 U	160000 U
Thallium	300 U	300 U	300 U	300 U	300 U	300 U
Tin	6000 U	6000 U	6000 U	6000 U	6000 U	6000 U
Vanadium	18000	19000	9000	17000	27000	18000
Zinc	280000	95000	64000	39000 J	33000 J	26000 J
Cyanide (total)	10000 U	10000 U	10000 U			

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-4
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
METALS

METALS	BH-3 0-2' ug/kg, Dry Wgt.	BH-3 2-4' ug/kg, Dry Wgt.	BH-3 4-6' ug/kg, Dry Wgt.	BH-3 6-8' ug/kg, Dry Wgt.	BH-4 0-2' ug/kg, Dry Wgt.	BH-4 2-4' ug/kg, Dry Wgt.
Antimony	25000	14000	700	300 U	9000	20000
Arsenic	20000	11000	1800	840	16000	14000
Barium	730000	2100000	61000	34000	520000	2000000
Beryllium	3000 U	3000 U	3000 U	3000 U	3000 U	3000 U
Cadmium	300000	330000	2400 J	1100 J	50000 J	140000
Calcium	17000000	54000000	1400000	960000	16000000	21000
Chromium	600000	880000	3400000	1000000	210000	1700000
Cobalt	13000	12000	12000	7700	12000	13000
Copper	3400000	7500000	330000	77000	7500000	3700000
Iron	41000000	52000000	15000000	12000000	94000000	64000000
Lead	850000	1300000	73000 J	15000 J	860000	1500000
Magnesium	2200000	2500000	3000000	2700000	2500000	2700000
Manganese	410000	360000	170000	170000	510000	640000
Mercury	890	1500	300 U	300 U	650	630
Nickel	670000	1100000	4900000	1700000	1300000	2300000
Potassium	730000	900000	1400000	1700000	790000	930000
Selenium	15000	25000	2100	570 U	6000	5300
Silver	24000	23000	870 U	530 U	19000	59000
Sodium	180000	350000	99000	69000 U	270000	400000
Thallium	420	300 U	300 U	300 U	300 U	300 U
Tin	200000	240000	11000	5000 U	450000	460000
Vanadium	38000	16000 J	4400 J	9600	37000 J	32000 J
Zinc	3000000	6300000	290000	120000	6100000	8400000
Cyanide (total)	23000	50000	12000 U	10000 U	86000	15000

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-4
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
METALS

METALS	BH-4 4-6' ug/kg, Dry Wgt.	BH-4 6-8' ug/kg, Dry Wgt.	BH-5 0-1' ug/kg, Dry Wgt.	BH-5 1-2' ug/kg, Dry Wgt.	BH-5 1-2' DUPLICATE ug/kg, Dry Wgt.	BH-5 5-6' ug/kg, Dry Wgt.
Antimony	11000	6900	2200	300 U	300 U	570
Arsenic	4700	16000	2700	900	530	560
Barium	1300000	580000	120000	22000	26000	34000
Beryllium	3000 U	3000 U	3000 U	3000 U	3000 U	3000 U
Cadmium	200000	110000	6800 J	600 U	600 U	1600 J
Calcium	13000000	9700000	1600000	750000	800000	6700000
Chromium	18000000	2500000	190000	11000	13000	100000
Cobalt	39000	19000	7100	5700	4700	3200
Copper	24000000	2700000	320000	11000 J	12000 J	57000
Iron	88000000	75000000	15000	12000000	13000000	11000
Lead	890000	790000	100000 J	6000 U	6000 U	33000 J
Magnesium	6000000	2500000	3000000	2600000	3300000	5600000
Manganese	470000	380000	230000	180000	200000	190000
Mercury	400 U	430	300 U	300 U	300 U	300 U
Nickel	22000000	5800000	320000	16000	19000	180000
Potassium	1700000	340000	1300000	1500000	1700000	1300000
Selenium	3100	3500	940	300 U	300 U	300 U
Silver	360000	140000	2100	600 U	930 U	600 U
Sodium	460000	370000	91000 U	60000 U	70000 U	84000 U
Thallium	300 U	300 U	300 U	300 U	300 U	300 U
Tin	380000	250000	28000	6000 U	6700 U	6000 U
Vanadium	3000 U	23000	18000	14000	15000	11000
Zinc	21000	2200000	400000	29000 J	31000 J	93000
Cyanide (total)	440000	61000	10000 U	10000 U	10000 U	10000 U

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-4
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
METALS

METALS	BH-6D S-1 ug/kg, Dry Wgt.	BH-6D S-2 ug/kg, Dry Wgt.	BH-6D S-3 ug/kg, Dry Wgt.	BH-7 0-1' ug/kg, Dry Wgt.	BH-7 1-2' ug/kg, Dry Wgt.	BH-7 5-6' ug/kg, Dry Wgt.
Antimony	3700	1300	3100	1400	910	300 U
Arsenic	7500	6000	6500	6100	3500	460
Barium	150000	86000	100000	130000	73000	31000
Beryllium	3000 U	3000 U	3000 U	3000 U	3000 U	30000 U
Cadmium	4700 J	4300 J	5700 J	16000 J	9600 J	1800 J
Calcium	38000000	15000000	12000000	5200000	2400000	750000
Chromium	23000	99000	65000	460000	99000	56000
Cobalt	5800	5000	9800	15000	6500	2000
Copper	140000	120000	140000	620000	310000	49000
Iron	17000000	34000000	32000000	80000000	29000000	14000000
Lead	220000 J	85000	280000	200000 J	150000 J	13000 UJ
Magnesium	7700000	38000000	7000000	2500000	1900000	1700000
Manganese	430000	280000	400000	380000	170000	130000
Mercury	910	600	6100	300 U	470	240
Nickel	68000	320000	120000	1900000	330000	53000
Potassium	1400000	600000	1100000	920000	1400000	1600000
Selenium	1000	740 U	1100	660 U	1000	300 U
Silver	600 U	600 U	700 U	11000	5000	630 U
Sodium	570000	380000	570000	160000 U	120000 U	68000 U
Thallium	300 U	300 U	300 U	300 U	300 U	300 U
Tin	36000	6000 U	7500 U	35000	39000	5000 U
Vanadium	28000 J	17000	18000 J	16000 J	14000 J	9000 J
Zinc	1100000	640000	640000	1100000	360000	90000
Cyanide (total)				10000 U	10000 U	10000 U

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-4
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
METALS

METALS	BH-8 ug/kg, Dry Wgt.	BH-9 S-3 ug/kg, Dry Wgt.	BH-9 S-4 ug/kg, Dry Wgt.	BH-9 S-5 ug/kg, Dry Wgt.	BH-9 S-6 ug/kg, Dry Wgt.	BH2 S-4 ug/kg, Dry Wgt.
Antimony	710	300 U	300 U	300 U	300 U	300 U
Arsenic	3200	780	2000	1100	1200	590
Barium	92000	11000	16000	23000	17000	22000
Beryllium	3000 U	3000 U	3000 U	3000 U	3000 U	3000 U
Cadmium	R	600 U	500 U	600 U	500 U	500 U
Calcium	2900000	350000	490000	250000	690000	270000
Chromium	17000	7800	10000	13000	14000	11000
Cobalt	6500	3300	6900	3800	3800	4300
Copper	57000	6500 J	13000 J	11000 J	20000	10000 J
Iron	18000000	10000000	12000	14000000	10000	16000
Lead	68000 J	6000 U	5000 U	6000 U	5000 U	5000 U
Magnesium	2600000	1500000	2100 U	1700000	1400000	2200000
Manganese	370000	75000	110000	110000	110000	130000
Mercury	300 U	300 U	300 U	300 U	300 U	200 U
Nickel	26000	89000	620000	110000	160000	23000
Potassium	1000000	770000	1200000	1200000	1200000	1600000
Selenium	790	300 U	300 U	300 U	300 U	300 U
Silver	710	600	500 U	600 U	500 U	500 U
Sodium	82000 U	110000 U	120000 U	140000 U	130000 U	120000 U
Thallium	300 U	300 U	300 U	300 U	300 U	300 U
Tin	6000 U	6000 U	5000 U	6000 U	5000 U	5000 U
Vanadium	20000	11000	10000	13000	8600	15000
Zinc	340000	20000 J	39000	63000	50000	29000 J
Cyanide (total)	10000 U					

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-4
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
METALS

METALS	BH2 S-5 ug/kg, Dry Wgt.	BH2 S-5 DUPLICATE ug/kg, Dry Wgt.	MW-12B S-1 ug/kg, Dry Wgt.	MW-12B S-1 DUPLICAT ug/kg, Dry Wgt.	MW-19 S-2 ug/kg, Dry Wgt.	MW-19 S-3 ug/kg, Dry Wgt.
Antimony	300 U	300 U	300 U	300 U	400 U	300 U
Arsenic	910	620	3500	3300	1700	960
Barium	18000	18000	87000	86000	80000	45000
Beryllium	3000 U	3000 U	3000 U	3000 U	4000 U	3000 U
Cadmium	500 U	500 U	1200 UJ	R	R	R
Calcium	400000	360000	870000	870000	1300	640000
Chromium	15000	13000	20000	20000	27000	17000
Cobalt	4100	3200	6700	7300	8200	5800
Copper	11000 J	10000 J	56000	52000	24000	14000 J
Iron	15000000	13000000	16000000	17000000	20000000	19000000
Lead	5000 U	5000 U	29000 J	30000 J	12000 UJ	11000 UJ
Magnesium	2600000	1900000	2500000	2800000	3000000	3300000
Manganese	140000 J	79000	420000	450000	240000	190000
Mercury	300 U	300 U	300 U	300 U	360	300 U
Nickel	88000	93000	28000	28000	790000	44000
Potassium	1300000	1300000	1000000	1100000	1300000	1500000
Selenium	300 U	300 U	300 U	300 U	550	470
Silver	500 U	500 U	660	590	700 U	700 U
Sodium	150000 U	150000 U	60000 U	60000 U	960000	640000
Thallium	300 U	300 U	300 U	300 U	400 U	300 U
Tin	5000 U	5000 U	6000 U	6000 U	7400 U	7700 U
Vanadium	14000	10000	24000	26000	27000	26000
Zinc	62000	69000	67000	67000	68000 J	87000
Cyanide (total)			20000 U	20000 U		

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-4
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
METALS

METALS	MW-19 S-4 ug/kg, Dry Wgt.	MW-19 S-5 ug/kg, Dry Wgt.	MW-19 S-5 DUPLICATE ug/kg, Dry Wgt.	MW-19 S-6A ug/kg, Dry Wgt.	MW-19 S-6B ug/kg, Dry Wgt.	MW-23 S1-1 ug/kg, Dry Wgt.
Antimony	330 U	300 U	300 U	300 U	300 U	300 U
Arsenic	1700	640	570 U	580	510	8000
Barium	40000	15000	13000	19000	20000	57000
Beryllium	3000 U	3000 U	3000 U	3000 U	3000 U	3000 U
Cadmium	19000000	17000	16000	8500	2100 J	600 U
Calcium	850000	680000	340000	680000	330000	570000
Chromium	20000	22000	15000	13000	3800	18000
Cobalt	8000	3200	3800	3100	1600	5700
Copper	75000	90000	59000	58000	38000	63000
Iron	19000000	8400000	6100000	8400000	9400000	18000000
Lead	12000 UJ	5900 UJ	5500 UJ	8000 UJ	5000 U	17000 J
Magnesium	2600	1200000	1100000	1400000	1200000	3300000
Manganese	180000	87000	60000	71000	120000	400000
Mercury	300 U	300 U	300 U	300 U	200 U	300 U
Nickel	220000	120000	77000	97000	95000	21000
Potassium	1700000	1000000	870000	1100000	860000	1800000
Selenium	440	300 U	300 U	300 U	300 U	300 U
Silver	600 U	500 U	500 U	500 U	500 U	600 U
Sodium	340000	150000	100000	120000	67000	64000
Thallium	300 U	300 U	300 U	300 U	300 U	300 U
Tin	6000 U	5000 U	5000 U	5000 U	7400 U	56000
Vanadium	17000 J	8000 J	5600 J	7900 J	7400 J	24000
Zinc	800000	210000	150000	170000	85000	56000 J
Cyanide (total)						20000 U

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-4
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
METALS

METALS	MW-23 S2-3 ug/kg, Dry Wgt.	MW-23 S2-3 DUPLICAT ug/kg, Dry Wgt.	MW-24 S-1 ug/kg, Dry Wgt.	MW-24 S-2 ug/kg, Dry Wgt.	MW-24 S-4 ug/kg, Dry Wgt.	MW-24 S-6 ug/kg, Dry Wgt.
Antimony	300 U	300 U	480 U	200 U	5000 U	300 U
Arsenic	4800	3900	2700	670	590	510
Barium	42000	36000	52000	15000	35000	15000
Beryllium	3000 U	3000 U	3000 U	2000 U	3000 U	3000 U
Cadmium	570	500 U	4900 J	R	R	600 U
Calcium	360000 J	440000	830000	230000	990000	410000
Chromium	16000	11000	18000	8400	8900	8700
Cobalt	4600	3300	6800	2100	1900	2400
Copper	49000	32000	270000	19000	15000	9000
Iron	16000	17000	15000000	10000	14000000	7800000
Lead	15000 J	10000 J	87000	13000 UJ	5000 U	6000 U
Magnesium	2200000	2200000	2200000	1300000	1900000	1600000
Manganese	360000	330000	220000	130000	130000	79000
Mercury	300 U	300 U	300 U	300 U	300 U	300 U
Nickel	16000	16000	36000	16000	14000	14000
Potassium	1300000	1300000	1200000	710000	2200000	1000000
Selenium	300 U	300 U	490 U	300 U	300 U	300 U
Silver	600 U	500 U	2600	1100	500 U	600 U
Sodium	60000 U	55000	60000 U	50000 U	130000	91000
Thallium	300 U	300 U	300 U	300 U	300 U	300 U
Tin	6000 U	5000 U	6200	5300 U	5000 U	6000 U
Vanadium	18000	16000	17000	9900 J	11000 J	7800 J
Zinc	43000 J	39000 J	210000	36000	51000	28000
Cyanide (total)	20000 U	20000 U	10000 U	8000 U	10000 U	9000 U

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-4
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
METALS

METALS	MW-25 35-37' ug/kg, Dry Wgt.	MW-6-S1-1 ug/kg, Dry Wgt.	MW-6-S2-2 ug/kg, Dry Wgt.	MW-9D S-1 ug/kg, Dry Wgt.	MW-9D S-2 ug/kg, Dry Wgt.	MW12, S-1 ug/kg, Dry Wgt.
Antimony	400 U	300 U	300 U	300 U	300 U	500 U
Arsenic	1800	670	550	1100	560	3300
Barium	88000	20000	20000	27000	19000	110000
Beryllium	4000 U	3000 U	3000 U	3000 U	300 U	3000 U
Cadmium	R	600 U	600 U	500 U	500 U	1900 J
Calcium	4800000	470000	620000	760000	340000	1500000
Chromium	22000	12000	8800	14000	10000	24000
Cobalt	9100	5600	2500	5000	2900	7600
Copper	24000 J	14000 J	8100 J	16000 U	6300 U	59000 J
Iron	24000000	14000000	12000000	13000000	11000000	20000000
Lead	R	6000 U	6400 J	8100 J	5000 U	33000
Magnesium	7900000	3200000	1900000	2700000	1800000	3300000
Manganese	410000	220000	190000	190000	180000	560000
Mercury	400 U	300 U	300 U	300 U	300 U	300 U
Nickel	31000	20000	14000	24000	14000	33000
Potassium	4100000	1600000	1500000	1300000	1100000	1200000
Selenium	400 U	300 U	300 U	300 U	3000 U	380 U
Silver	700 U	600 U	600 U	500 U	500 U	1200
Sodium	170000 U	65000	86000	57000	50000	70000
Thallium	400 U	300 U	300 U	300 U	300 U	320
Tin	7000 U	6200	6000 U	5000 U	5000 U	6000 U
Vanadium	28000	16000	11000	17000	11000	29000
Zinc	55000 J	33000 J	27000 J	32000 J	21000 UJ	82000
Cyanide (total)	3000 U	9000 U	10000 U	20000 U	20000 U	

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-4
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
METALS

METALS	MW12, S-2 ug/kg, Dry Wgt.	MW12, S-5 ug/kg, Dry Wgt.	MW12A, S-1 ug/kg, Dry Wgt.	MW12A, S-2 ug/kg, Dry Wgt.	MW12B-S2-1 ug/kg, Dry Wgt.	MW14-DUPE-1 ug/kg, Dry Wgt.
Antimony	300 U	300 U	300 U	300 U	300 U	5100
Arsenic	900	1400	3500	790	1100	9200
Barium	12000	48000	81000	14000	29000	500000
Beryllium	3000 U	3000 U	3000 U	3000 U	3000 U	3000 U
Cadmium	500 U	600 U	1200 J	600 U	600 U	25000 J
Calcium	220000	810000	740000	220000	1900000	3100000
Chromium	12000	11000	23000	13000	8700	350000
Cobalt	4200	6300	6200	4400	2600	11000
Copper	8500 U	12000 U	43000	9000 U	21000	3900000
Iron	12000000	14000000	17000000	13000000	9600000	68000000
Lead	5000 U	6700 J	27000 J	6000 U	15000 J	5400000
Magnesium	1900000	2700000	2700000	2200000	1600000	4100000
Manganese	250000	240000	380000	280000	310000	630000
Mercury	300 U	300 U	300 U	300 U	300 U	1700
Nickel	19000	22000	26000	17000	14000	1600000
Potassium	840000	1900000	1100000	920000	720000	750000
Selenium	300 U	300 U	300 U	300 U	300 U	300 U
Silver	500 U	600 U	580 U	600 U	600 U	18000
Sodium	50000 U	70000	60000 U	60000 U	60000 U	170000
Thallium	300 U	300 U	300 U	300 U	300 U	300 U
Tin	5000 U	6000 U	6000 U	6000 U	6000 U	450000
Vanadium	14000	14000	24000	15000	11000	27000 J
Zinc	20000 UJ	58000	63000	22000 J	31000 J	5100000
Cyanide (total)	10000 U	10000 U	10000 U	10000 U	20000 U	10000 U

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-4
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
METALS

METALS	MW14-S1-1 ug/kg, Dry Wgt.	MW14-S2-2 ug/kg, Dry Wgt.	MW14-S4-1 ug/kg, Dry Wgt.	MW14-S5-2 ug/kg, Dry Wgt.	MW15-DUPE-2 ug/kg, Dry Wgt.	MW15-S1-1 ug/kg, Dry Wgt.
Antimony	7500	300 U	300 U	300 U	13000	6100
Arsenic	8000	980	37000	1300	8000	9700
Barium	420000	43000	26000	120000	810000	730000
Beryllium	3000 U	2700	3000 U	3000 U	3000 U	3000 U
Cadmium	22000 J	1600 J	R	R	210000	140000
Calcium	1800000 J	1000000	1000000	1600000	45000000	40000000
Chromium	320000	220000	17000	39000	530000	260000 J
Cobalt	11000	11000	2600	14000	8800	9600
Copper	3200000	52000	62000	29000	6400000	4800000
Iron	40000000 J	9200000	27000000	32000000	48000000	48000000
Lead	1800000 J	49000	R	R	860000	790000
Magnesium	2700000	1800000	1900000	8400000	3500000	3500000
Manganese	370000 J	430000	67000	650000	380000	360000
Mercury	820 J	300 U	300 U	300 U	810	680
Nickel	1000000	110000	280000	69000	980000	980000
Potassium	670000	1300000	980000	5900000	1200000	960000
Selenium	300 U	300 U	700	300 U	14000	5600 J
Silver	26000	970	600 U	700 U	43000	54000
Sodium	91000	70000	110000	400000	390000	250000
Thallium	300 U	300 U	300 U	400 U	300 U	300 U
Tin	750000 J	9400 U	6000 U	7000 U	150000	300000 J
Vanadium	28000 J	6400 J	24000 J	36000	60000	37000 J
Zinc	3100000	170000	42000 J	150000	6700000	4400000
Cyanide (total)	10000 U	10000 U	10000 U	10000 U	20000 U	25000 J

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-4
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
METALS

METALS	MW15-S2-1 ug/kg, Dry Wgt.	MW16-DUPE-1 ug/kg, Dry Wgt.	MW16-S1-1 ug/kg, Dry Wgt.	MW16-S2-2 ug/kg, Dry Wgt.	MW16-S3-3 ug/kg, Dry Wgt.	MW16-S4-4 ug/kg, Dry Wgt.
Antimony	300 U	300 U	300 U	300 U	300 U	300 U
Arsenic	510	890	1500	810	530	460
Barium	21000	13000	31000	16000	10000	10000
Beryllium	3000 U	3000 U	3000 U	3000 U	300 U	3000 U
Cadmium	R	3400	1400 J	4100	500 U	600 U
Calcium	770000	460000	520000	420000	260000	840000
Chromium	1100000	92000	18000	770000 J	90000	70000
Cobalt	3700	4800	5600	5400	2400	1500
Copper	39000	59000	38000	86000	18000	14000
Iron	10000000	9400000	13000000	12000000	5200000	4500000
Lead	5000 U	8600 J	19000 J	15000 J	5000 U	6000 U
Magnesium	2700000	1400000	2600000	2000000	1000000	980000
Manganese	78000	140000	120000	94000	75000	47000
Mercury	300 U	300 U	300 U	300 U	200 U	200 U
Nickel	650000	910000	330000	1100000	52000	910000
Potassium	1500000	750000	1200000	960000	580000	790000
Selenium	370	300 U	300 U	300 U	300 U	300 U
Silver	500 U	600 U	990	600 U	500 U	600 U
Sodium	50000 U	110000	77000	150000	160000	110000
Thallium	300 U	300 U	300 U	300 U	300 U	300 U
Tin	5000 U	7800	6800	13000	5000 U	6700
Vanadium	8300	11000	16000	11000	5900	5100
Zinc	57000	75000	58000	61000	20000	20000
Cyanide (total)	10000 U	10000 U	10000 U	10000 U	10000 U	9000 U

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-4
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
METALS

METALS	MW17-S1-1 ug/kg, Dry Wgt.	MW17-S2-2 ug/kg, Dry Wgt.	MW17-S4-3 ug/kg, Dry Wgt.	MW20-DUPE-1 ug/kg, Dry Wgt.	MW20-S1-1 ug/kg, Dry Wgt.	MW20-S2-2 ug/kg, Dry Wgt.
Antimony	450 U	300 U	300 U	300 U	500	300 U
Arsenic	1200	880	530	1500	11000	22000 J
Barium	37000	21000	21000	26000	65000	27000
Beryliium	3000 U	3000 U	3000 U	3000 U	3000 U	3000 U
Cadmium	45000	3400 J	R	R	5800 J	R
Calcium	750000	340000	460000	1100000	1700000	220000 J
Chromium	240000	590000	200000	15000	61000	12000
Cobalt	5700	6500	2600	4500	7000	1700
Copper	130000	51000	30000	22000	360000	37000 J
Iron	15000000	18000000	11000000	14000000	16000000	24000000 J
Lead	36000 J	R	R	6000 U	170000	R
Magnesium	240000	2400000	1500000	2900000	1600000	2200000
Manganese	120000	120000	110000	130000	150000	52000 J
Mercury	300 U	300 U	300 U	300 U	8800	300 U
Nickel	270000	560000	82000	29000	1700000	59000 J
Potassium	1100000	1100000	1300000	1700000	660000	920000
Selenium	300 U	300 U	300 U	300 U	920	390
Silver	600 U	600 U	600 U	600 U	1200	600 U
Sodium	120000	230000	100000	80000	100000	60000 U
Thallium	300 U	300 U	300 U	300 U	280 U	300 U
Tin	6000 U	6000 U	5000 U	6000 U	6400 U	6500 U
Vanadium	16000	16000 J	8200 J	12000 J	290000	16000 J
Zinc	130000	98000	37000 J	37000 J	350000	30000 J
Cyanide (total)	10000 U	10000 U	10000 U	10000 U	10000 U	10000 U

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-4
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
METALS

METALS	MW20-S3-3 ug/kg, Dry Wgt.	MW20-S4-4 ug/kg, Dry Wgt.	MW21-S1-1 ug/kg, Dry Wgt.	MW21-S1-DUP E ug/kg, Dry Wgt.	MW21-S2-2 ug/kg, Dry Wgt.	MW22-S1-1 ug/kg, Dry Wgt.
Antimony	300 U	300 U	300 U	300 U	300 U	300 U
Arsenic	2100	1800	7000	6300	890	3400
Barium	23000	84000	65000	54000	19000	37000
Beryllium	3000 U	3000 U	3000 U	3000 U	3000 U	3000 U
Cadmium	600 U	R	600 U	600 U	500 U	600 U
Calcium	510000	4700000	970000	790000	470000	610000
Chromium	9300	23000	14000	14000	7900	13000
Cobalt	3300	13000	4700 J	4500 J	2600 J	5100 J
Copper	37000	24000	53000	58000	6800 J	37000
Iron	12000	26000000	15000000	14000000	7500000	13000
Lead	6000 U	R	16000 J	15000	5000 J	15000 J
Magnesium	1800000	9400000	2700000	3000000	2000000	2900000
Manganese	90000	450000	240000	290000	110000	300000
Mercury	300 U	300 U	300 U	300 U	200 U	300 U
Nickel	22000	34000	21000	18000	9800	16000
Potassium	1400000	4700000	1500000	1500000	1200000	1500000
Selenium	300 U	300 U	300 U	300 U	300 U	300 U
Silver	600 U	700 U	600 U	600 U	500 U	600 U
Sodium	57000	290000	95000	100000	57000	92000
Thallium	300 U	510	300 U	300 U	300 U	300 U
Tin	6000 U	6000 U	6400	6000 U	6500	6000 U
Vanadium	9200 J	29000	20000	20000	11000	18000
Zinc	30000 J	66000 J	62000	46000	17000 J	50000
Cyanide (total)	10000 U	10000 U	20000 U	20000 U	20000 U	20000 U

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-4
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
METALS

METALS	MW22-S2-2 ug/kg, Dry Wgt.	MW25 0-2' ug/kg, Dry Wgt.	MW25 5-7 DUPLICATE ug/kg, Dry Wgt.	MW25 5-7' ug/kg, Dry Wgt.
Antimony	300 U	300 U	300 U	300 U
Arsenic	230 U	1200	800	700
Barium	35000	22000	21000	20000
Beryllium	3000 U	3000 U	3000 U	3000 U
Cadmium	6000 U	1100 J	1500 J	1600 J
Calcium	540000	1800000	530000	590000
Chromium	15000	13000	13000	13000
Cobalt	4500 J	7500	4200	4200
Copper	28000	33000 U	10000 U	12000 U
Iron	16000000	16000	14000000	15000000
Lead	11000 J	43000 J	8800 J	6500 UJ
Magnesium	3000	4000000	2300000	2400000
Manganese	320000	140000	87000	97000
Mercury	300 U	300 U	300 U	300 U
Nickel	18000	23000	19000	21000
Potassium	1300000	1100000	1300000	1300000
Selenium	300 U	300 U	1300	1100
Silver	600 U	500 U	600 U	600 U
Sodium	82000	200000	110000 U	120000 U
Thallium	300	300 U	300 U	300 U
Tin	6000 U	5000 U	6000 U	6000 U
Vanadium	19000	25000	17000	16000
Zinc	49000 J	45000	48000	50000
Cyanide (total)	20000 U	10000 U	10000 U	10000 U

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
METALS

	SS-1	SS-2	SS-2 DUPLICATE	SS-3	SS-4	SS-5
METALS	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
Antimony	8100	1700	1100	530	2200	400 U
Arsenic	13000	7900	6900	2500	2300	430
Barium	570000	740000	500000	320000	200000	21000
Cadmium	33000	9400	7200	2600	R	700 U
Calcium					1000000	680000
Chromium	810000	300000	200000	64000	2000000	5700
Cobalt	33000	26000	21000	9300	4500	2100
Copper	1600000	490000	440000	130000	300000	6300
Iron					34000000	6600000
Lead	420000	140000	110000	58000	2500000	10000
Magnesium					1500000	1300000
Manganese					140000	80000
Mercury	550	420	440	140	660	300 U
Nickel	6000000	3300000	2700000	590000	3900000	11000
Potassium					400000	610000
Selenium	3900	1500	1300	600 U	860	400 U
Silver	9200	4400	4700	1600	8800	700
Sodium					320000	78000 U
Tin	55000	20000 U	10000 U	9000 U	34000	7000 U
Vanadium	130000	70000	52000	32000	20000 J	9200
Zinc	1900000	720000	490000	190000	890000	33000

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Parameter was not detected. Value is the detection limit.

Close File

TABLE 24-2
TREATABILITY PARAMETERS FOR SOIL AND SEDIMENTS
METALS

	SS-6	SS-8
METALS	ug/kg, Dry Wgt.	ug/kg, Dry Wgt.
Antimony	300 U	300 U
Arsenic	400	2700
Barium	11000	16000
Cadmium	R	R
Calcium	370000	1000000
Chromium	6700	10000
Cobalt	1600	5500
Copper	5500 J	49000
Iron	38000000	12000000
Lead	R	53000 J
Magnesium	730000	2900000
Manganese	36000 J	66000
Mercury	310	300 U
Nickel	15000	25000
Potassium	390000	370000
Selenium	300 U	300 U
Silver	600 U	660
Sodium	60000 U	120000 U
Tin	6000 U	6000 U
Vanadium	4100 J	20000
Zinc	23000	67000

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Parameter was not detected. Value is the detection limit.

Close File

TABLE 24-5
TREATABILITY PARAMETERS FOR GROUNDWATER & SURFACE WATER
METALS

	MW-10A	MW-10B	MW-10B DUPLICATE	MW-12	MW-12A	MW-12B
METALS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Arsenic					7.2	5.4
Barium				550	570	310
Cadmium						
Calcium	16000	20000	19000	39000	14000	54000
Chromium	1700	1800	1800		57	82
Cobalt		16	15	29	59	51
Copper	170			120		
Iron	83000	13000 J	6600	85000	39000	55000
Lead	16	10	7.8	24	54	30
Magnesium	6100	8100	7300	33000	9300	
Manganese	490	700	700	450	8300	2100
Mercury						
Nickel	3800	4100	4100	4400	1700	100
Potassium	10000	12000	11000	20000	9000	14000
Selenium	22	20	20			
Sodium	18000	22000	22000	25000	9000	6900
Vanadium				86		
Zinc	250	250	230	420 J	310	260
Cyanide (total)						

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-5
TREATABILITY PARAMETERS FOR GROUNDWATER & SURFACE WATER
METALS

	MW-13	MW-14	MW-15	MW-15 DUPLICATE	MW-16	MW-17
METALS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Arsenic					7.4	
Barium						350
Cadmium					23 J	100
Calcium	26000	25000	26000	23000	26000	34000
Chromium		2900			2600	5000
Cobalt		17			58	26
Copper	40	58	66 J	34	1100	490
Iron	11000	17000	18000	4500	140000	150000
Lead	5	39			120	27
Magnesium		8000	8700		31000	27000
Manganese	2800	190	2000	1900	3600	3500
Mercury						
Nickel	470	2900	180		5300	6100
Potassium	9900	22000	5600	2900	23000	39000
Selenium						
Sodium	24000	180000	29000	30000	180000	100000
Vanadium					150	96
Zinc	140	330	130 J	68	690	570
Cyanide (total)					110	

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-5
TREATABILITY PARAMETERS FOR GROUNDWATER & SURFACE WATER
METALS

	MW-18	MW-19	MW-2	MW-20	MW-21	MW-22
METALS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Arsenic		6.5		17		5.1
Barium	660	1300	120	460	580	180
Cadmium	27	1400				
Calcium	46000	66000	24000	40000	27000	26000
Chromium	3100	1500				1100
Cobalt	58	87	13	24	68	17
Copper	350	4100	130	250	59	39
Iron	200000	390000	18000	200000	51000	30000 J
Lead	59	190	22	39	55	19
Magnesium	48000	57000	11000	28000		8200
Manganese	3700	7100	6500	2600	3800	190 J
Mercury		1.2				
Nickel	1700	5800	3800	750	110	5200
Potassium	29000	36000	16300	31000	12000	11000
Selenium			22			
Sodium	77000	73000	110000	15000	7700	61000
Vanadium	220	460		190	56	
Zinc	1200	19000	250	310	180	140
Cyanide (total)			2300 J			

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-5
TREATABILITY PARAMETERS FOR GROUNDWATER & SURFACE WATER
METALS

METALS	MW-22 DUPE	MW-23	MW-24	MW-25	MW-3	MW-3 DUPLICATE
	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Arsenic						
Barium	150	270	170			
Cadmium						
Calcium	26000	14000	25000	18000	20000	21000
Chromium	1100				5600	6200
Cobalt	14	19	15	54	12	14
Copper	27	47	71	64		
Iron	18000	42000	49000	15000	990 J	4700
Lead	14	22	16	22		7.8
Magnesium	7300	11000	17000		5300	5800
Manganese	130	2000	4000	390	1100	1000
Mercury						
Nickel	5400	110	400		1600	1700
Potassium	10000	10000	15000	5700	11000	12000
Selenium						
Sodium	62000	11000	79000	8600	33000	32000
Vanadium						
Zinc	150	170	270	150	160	260
Cyanide (total)						21 J

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-5
TREATABILITY PARAMETERS FOR GROUNDWATER & SURFACE WATER
METALS

	MW-4	MW-6	MW-6 DUPLICATE	MW-7A	MW-8A	MW-9A
METALS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Arsenic	7.7					
Barium		560	500		250	
Cadmium		19 J	18 J			
Calcium	120000	28000	27000	15000	9400	15000
Chromium		2700	2500	260	140	2600
Cobalt		46	38	17	40	
Copper		180 J	170 J			
Iron	11000	130000	120000	10000	29000	1300
Lead	11	37 J	27	6	23	
Magnesium	36000	40000	40000	6600	9000	
Manganese	790	3500	3100	4200	2200	240
Mercury						
Nickel	60	4700	4500	970	3400	3600
Potassium	3800	35000	34000	5600	9200	7200
Selenium		72			47	
Sodium	18000	32000	30000	16000	19000	48000
Vanadium		140	160			
Zinc	110	670	560	310	190	180
Cyanide (total)		55	51			

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-5
TREATABILITY PARAMETERS FOR GROUNDWATER & SURFACE WATER
METALS

	MW-9C	MW-9D	MW9B
METALS	ug/L	ug/L	ug/L
Arsenic			
Barium			160
Cadmium			
Calcium	30000	4900	17000
Chromium		2300	2100
Cobalt			15
Copper			
Iron	740	620	32000
Lead			22
Magnesium	9100		8700
Manganese	210	200	2100
Mercury			
Nickel		100	4100
Potassium	3900	20000	10800
Selenium		19	
Sodium	42000	45000	49000
Vanadium			
Zinc			220
Cyanide (total)			

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
R Datum was rejected.
U Analyte was not detected. Value is the detection limit.

Close File

TABLE 24-5
TREATABILITY PARAMETERS FOR GROUNDWATER & SURFACE WATER
METALS

	SW-1	SW-2	SW-2 DUPLICATE	SW-3
METALS				
Calcium	5600	5100	5000	5100
Iron	1200	1200	1300	2100
Potassium	710	760	710	700
Sodium	8600	9200	8500	8300

Note : This table includes only those parameters that were positively identified.
If a parameter heading (VOLATILE ORGANICS BY 8240, CHLORINATED HERBICIDES, etc.) includes a unit heading (e.g. ug/L), this indicates that samples were analyzed.
Columns without unit headings indicate no sample collected / analyzed for this parameter.

Qualifiers : J Value is the estimated concentration.
X Value is the estimated maximum possible concentration.

Close File

Table 24-6
MEDIA REMEDIATION TECHNOLOGY SCREENING

Remedial Technology Types (for general response actions)	Process Options	Screening Comments
POTENTIAL SOIL REMEDIATION TECHNOLOGIES:		
NO ACTION/INSTITUTIONAL OPTIONS: Fencing	Site Fencing	Currently in place
TECHNOLOGIES:		
Capping	clay cap	Potentially applicable
	synthetic membrane	Potentially applicable
	multi-layer	Potentially applicable
	asphalt	Potentially applicable
Chemical Fixation	batch process	Treatability studies necessary
	continuous process	Treatability studies necessary
Solidification/Stabilization	batch process	Treatability studies necessary
	continuous process	Treatability studies necessary
Encapsulation/Vitrification	In-situ Treatment	Costly and unproven; not retained for consideration
Vapor Extraction	Post Treatment Alternatives	Limited to relatively shallow soil contamination with VOC
	Incineration	
	GAC	

Close File

Remedial Technology Types (for general response actions)	Process Options	Screening Comments
Water/Solvent Leaching	Numerous additives depending upon contaminant Disposal on-site or off-site	Expensive alternative; treatability studies necessary.
Biological Treatment	Natural or imported bacteria In-situ or ex-situ processes.	Treatability studies necessary.
Thermal Treatment	High-temp or low-temp applications	Expensive Alternative, but retained
POTENTIAL GROUNDWATER REMEDIATION TECHNOLOGIES:		
Containment	Caps Slurry Walls Pumping Strategies	Problematic contaminants and aquifer conditions; alternative not required. Not retained for consideration.
Air Stripping	Packed Tower Low profile tray	Pretreatment may be required; treatability studies possible; post treatment of gases likely.
Steam Stripping	Can be used in tandem with air stripping	Necessary technology due to presence of SVOC in waste stream.
GAC	Canister size Carbon Type Polishing step for other treatment	Easily designed and modeled due to wealth of available data. Carbon disposal costs must be evaluated.
Resin Adsorption	Multiple synthetic reasons available.	High capital and operating costs; pretreatment likely.
Direct Discharge to POTW	------	Significant monitoring; permit required.
Chemical Precipitation	Multiple chemical additives	Filtrate disposal required; suitable for metal/CN treatment.
Biological Treatment	In-situ Ex-situ	Proven technology, suitable for VOCs and selected SVOC's; In-situ treatment will require treatability studies.

Close File

Remedial Technology Types (for general response actions)	Process Options	Screening Comments
Oil/Water Separation	------	Appropriate only for LNAPL contamination, post-treatment of effluent likely required.
Air Sparging	Enhances soil vapor and groundwater remediation	Depth to contaminants/soil conductivity prohibitive. Not retained for consideration
POTENTIAL SEDIMENT REMEDIATION TECHNOLOGIES		
Chemical Fixation	Batch Process Continuous Process	Treatability Studies necessary
Chemical Precipitation	Multiple Chemical Additives	Filtrate disposal required; suitable for metal/CN treatment
Solidification/Stabilization	Batch Process Continuous Process	Treatability Studies Necessary
Water/Solvent Leaching	Numerous Additives depending upon contaminant Disposal on-site or off-site	Expensive alternatives; treatability studies necessary.
POTENTIAL SURFACE WATER REMEDIATION TECHNOLOGIES		
Direct Discharge to POTW	------	Significant monitoring permit required
Chemical Precipitation	Multiple Chemical Additives	Filtrate disposal required; suitable for metal/CN treatment

Close File

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25
PROJECT MANAGEMENT PLAN

25.1 OVERVIEW

A carefully developed and implemented project management plan is necessary to complete Phase II of the Facility Investigation in accordance with the Scope of Work (SOW). A project management plan was developed as part of the RFI Proposal. The plan described the organization of the project and identified the tasks to be accomplished (including deliverable reports) as well as the schedule for those tasks. The project management plan for Phase II has changed markedly from the plan developed for the RFI Proposal; this section identifies the major changes and modifies the original project management plan. In addition to staffing changes at Tighe & Bond that are designed to more efficiently and effectively ensure completion of the Phase II SOW, this modified SOW incorporates a new Quality Assurance (QA) Officer from an independent consulting firm to review and comment during the preparation of Phase II deliverables, the review of field and analytical data and other key project tasks. This section addresses project management issues only for Phase II including the organization of the project in Phase II (Section 25.2), the Phase II schedule (Section 25.3), and contingency plans and other considerations for Phase II (Section 25.4). A summary concludes this section (Section 25.5).

25.2 ORGANIZATION

The organization of this project centers on the Tighe & Bond Project manager who is responsible for coordinating the interaction among all project team members, ensuring that the objectives of the Facility Investigation are met and coordinating the input of the QA Officer. The organizational structure for this project is shown on Figure 25.1. This organizational structure has changed since the RFI Proposal, including replacement of personnel and the institution of the QA Officer position.

25.3 SCHEDULE

Phase II for this project is schedule-driven, however, as described in Sections 20 through 23, several interim USEPA approval steps have been implemented throughout the process. These include approval of the development of background concentrations for selected Site contaminants and other Phase IIA deliverables, the approval of Phase IIB data and the Phase IIC SOW, and the approval of interim risk assessment milestones as mandated in the RCRA Facility Investigation guidance. USEPA review times have been estimated in order to establish an overall schedule for completion of Phase II. Based on these review time estimates, the completion of the Phase IIA field work is scheduled for 5 months after USEPA approval of the Phase II Proposal, the Phase IIB field work and interim report months after approval of the Phase IIA deliverables and delivery of the final RFI Report will occur 28 months after the completion of Phase IIC field work. The Phase II schedule (shown in Figure 25.2) meets these requirements. If USEPA review periods extend beyond the time frames estimated, completion of the major tasks will be extended by an equivalent time period. A proposed schedule for Phase II is presented in Table 25-2.

This section discusses the Phase II schedule in four (4) segments:

- the Phase II physical characterization;

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- the Phase II release characterization;
- the Phase II off-site investigation; and
- report preparation for Phase II.

25.3.1 Phase II Physical Characterization

The Phase II physical characterization involves five (5) tasks:

- Mobilization
- Geological Investigation
- Hydrogeological Investigation
- Hydrological Investigation
- Data Analyses

The Phase II physical characterization will begin with USEPA approval of the Phase II Proposal. The schedule shown in Figure 25-2 highlights the completion dates for these tasks. Physical Characterization will occur, when possible, during Release characterization described in Section 25.3.2. However, certain tasks (e.g. Hydrogeological Investigation) may be delayed during Interim Report reviews by the USEPA.

25.3.2 Phase II Release Characterization

The Phase II release characterization involves the following:

Phase IIA

- Subsurface Gas Sampling;
- Soil Sampling;
- Well Installation (including bedrock wells);
- Off-Site Sampling;
- Groundwater Sampling;
- Surveying for Phase IIA sampling;
- Refine existing models;
- Document seasonal water table elevations
- HERA modifications/ interim report submittal
- Analysis of the Phase IIA Data;
- Data Validation;
- Data Interpretation;
- Monthly Progress Reports;
- Interim Phase IIA Report;
- EPA Review

Phase IIB

- Well Installation
- Soil Sampling;
- Off-Site Sampling;
- Bedrock well installation;
- Conduct Subsurface Gas Sampling;

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- Groundwater Sampling;
- Surveying for Phase IIB sampling;
- Analysis of Phase IIB data;
- HERA evaluation/interim report submittal
- Data Validation; and
- Monthly Progress Reports;
- Interim Phase IIB Report;
- EPA Review.

Phase IIC

Actual Phase IIC tasks will be dependent upon the results of Phase IIA and IIB findings. Individual components of this Phase may be deleted or added depending on the findings. The proposed tasks currently include:

- Soil Sampling;
- Groundwater Samples;
- Collect Surface Water/Sediment, where necessary;
- Fill remaining data gaps;
- Complete HERA/Baseline Risk Assessment;
- Analysis of Data;
- Data Validation;
- Monthly Progress Reports;
- Phase II Report.

The Phase IIA release characterization also will begin upon USEPA approval of the Phase II Proposal. The schedule presented in Figure 25-2 identifies the completion dates for these tasks.

25.3.3 Phase II Report Preparation

In Phase II, information will be delivered formally to the USEPA via three (3) reporting mechanisms:

- in the continuing development of Monthly Progress Reports (throughout Phase II);
- in interim reports at the completion of Phases IIA and IIB; and
- in major reports at the end of Phase II (including the RFI Report and the MPS Proposal).

This section briefly discusses the deliverables for each of these reporting mechanisms.

Monthly Progress Reports

Monthly Progress Reports have been submitted to the USEPA since September of 1993, although they were briefly terminated during USEPA review of the Phase I Report submitted in February of 1994. Monthly reports were issued again in August of 1994 and will continue until completion of the project. These reports (due on the 11th of each month) summarize:

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- the significant achievements during the month;
- the sampling and other activities completed;
- any tasks, not completed on schedule during the reporting period;
- tasks currently underway;
- data obtained during the reporting period;
- problem areas that were resolved, as well as problem areas that are new, potential (i.e., may possibly arise), and outstanding (i.e., existing and not yet resolved);
- the schedule of tasks for the upcoming months;
- changes to the work plan; and
- other comments.

Interim Reports

Interim reports will be submitted at the completion of tasks in Phases IIA and IIB. These reports will include:

- Proposal for work in the subsequent Phase
- HERA interim deliverables
- Results of the tasks accomplished in the previous Phase
- New data gaps, if identified
- Proposed background values (Phase IIA only)

Major Reports

The preparation of reports in Phase II will involve the following tasks:

- Preparing the RFI Report;
- Preparing the three (3) HERA deliverables as required prior to submitting Revised Draft Baseline Risk Assessment;
- Preparing the MPS Proposal;
- QA Officer Review of these reports;
- MTD/CMC Review of these reports;
- Report Modification as required based on the reviews; and
- Final Preparation and Production of the reports.

Overall, Phase II report preparation is expected to take about 6 months following completion of the last Phase II field activity. As previously noted, the actual schedule will be contingent upon USEPA review and approval of interim reports. Phase II will conclude upon submission of the RFI Report and MPS Proposal.

25.4 CONTINGENCIES AND CONSIDERATIONS

Successful management and timely completion of Phase II depend on identifying:

- the contingencies that may arise in the interim Phase II steps and outlining plans to counter them; and

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- receiving approval from USEPA for interim reports (background data information interim data results and HERA deliverables).

25.4.1 Contingencies

Although many contingencies are not foreseeable, the following Phase II contingencies have been identified at this point:

- obtaining access to perform work on off-site properties;
- the extent of contamination may not be fully delineated at certain SWMUs or AOC's;
- receiving approval for interim submittals to USEPA.

These contingencies, and the plans for managing each, are discussed in this section.

Access to Off-Site Properties

Access to the adjacent tobacco fields led to significant delays during the Phase I field work. Planting schedules, legal issues and other related problems must be addressed in the early stages of the project to ensure that approval is granted. Collection of background samples will also involve access to off-site properties. The Project Manager and the Site Attorneys will be responsible for making these contacts.

Extent of Contamination Not Fully Delineated

It is possible the work currently planned for Phase II may fail to delineate the full extent of contamination at one or more SWMUs or AOC groupings. In this event, additional delineation sampling will need to be designed and performed, either as part of an existing task (extending the schedule for that task) or as a new task in Phase II. However, the interim Phase II steps are designed to reduce the likelihood that this contingency is encountered.

USEPA Approval for Interim Reports

"Background" concentrations for site related contaminants, particularly metals in soils and groundwater, will be developed as an initial task during Phase II (Phase IIA). Prior to proceeding with the more detailed Phase IIB tasks, this information will be forwarded to USEPA for concurrence as a Phase IIA interim submittal. If additional data collection is warranted to confirm these findings, a plan will be developed in the Interim Report and the schedule will be adjusted to reflect this change in the Phase II SOW.

25.4.2 Keys to Project Success

In order successfully complete Phase II several key goals must be achieved. These goals are outlined below:

- Delivery of acceptable laboratory data in accordance with the schedule developed.

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- Interim deliverables (background data, HERA interim reports) must be complete and maintain schedule parameters.

These key goals are described in this section.

Laboratory Deliverables

During preparation of the Phase I Report, analytical results underwent revisions following submittal of the Phase I Report. The revisions necessarily impacted the conclusions/evaluations that were presented in the Phase I report. Valuable information was gleaned from this process to improve the quality and format of the results in Phase II. However, in order to avoid these shortcomings in Phase II, the Quality Assurance Project Plan (QAPP) which was included in the RFIP (Volume II, Appendix H) has been revised to reflect these changes and improvements. A copy of the revised QAPP is included at the end of this section. The Phase II schedule is designed to complete the RFI as efficiently as possible. Therefore, it is essential that the Phase II laboratory analyses be reliable and precise. Coordination will be conducted with those laboratories performing analyses in Phase II to minimize potential problems.

Interim Deliverables

As described in Section 20, three (3) major deliverables beyond laboratory reports are key to the success of the project. These deliverables are interim, that is they will be submitted to USEPA at the completion of Phase IIA and IIB. The Phase IIC deliverables include the Phase II final report the development of Media Protection Standards (MPS Proposal) and the final HERA submittal for approval. Significant progress on the project will be on hold awaiting response to these submittals. The specific interim deliverables include:

Background Approval: Initial survey sampling will be designed to develop background concentrations of contaminants in critical site media. Concentrations and justifications must be approved by USEPA.

Interim Approval: Additional release characterization will be chronicled in Phases IIA and IIB and submitted for USEPA approval. This approval will consist of data collected as part of the previous phase and the SOW for the subsequent phase.

HERA Interim Deliverables: Section 18 of the Phase I RFI provides the first deliverable required as part of the Health and Environmental Risk Assessment. Subsequent interim deliverables include the (1) Second Interim Deliverable, (2) Third Interim Deliverable and (3) Draft Baseline Risk Assessment. Once these documents have been reviewed and approved by USEPA the Revised Draft Baseline Risk Assessment will be submitted with the Phase II RFI.

25.5 SUMMARY

This section addressed project management issues for Phase II of this investigation. The level of detail for this Project Management Plan has been greatly enhanced for the Phase II Scope of Work.

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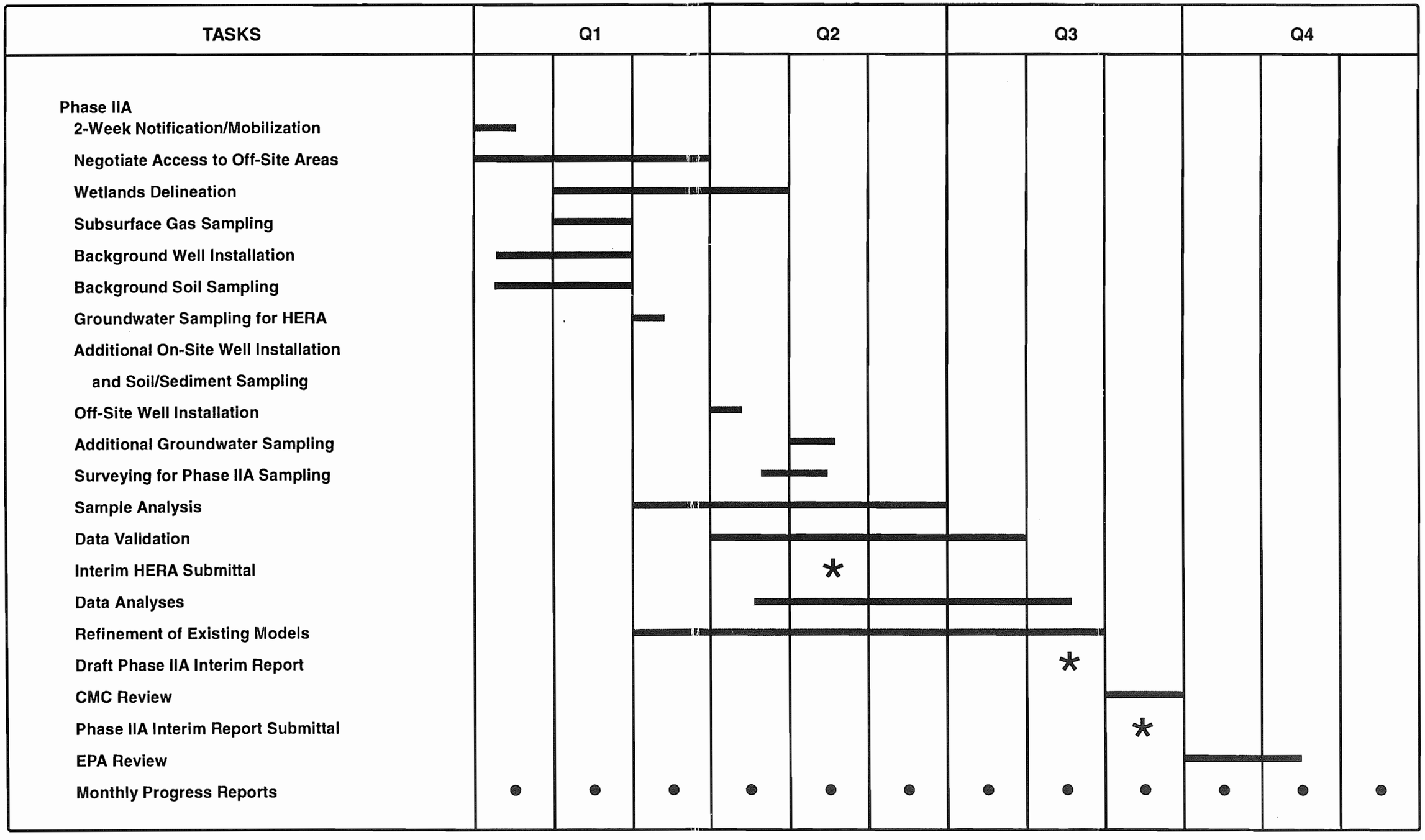
In addition to the level of detail presented, two (2) key features have been included. These include the creation of an independent QA Officer to provide review and comment throughout Phase II and the implementation of interim deliverables to USEPA during the course of the Phase II. These two features will improve the quality of the Phase II Report and efficiency of the implementation of this Phase.

TABLE 25-2
PROPOSED SCHEDULE FOR PHASE IIA
COLUMBIA MANUFACTURING COMPANY, WESTFIELD, MA

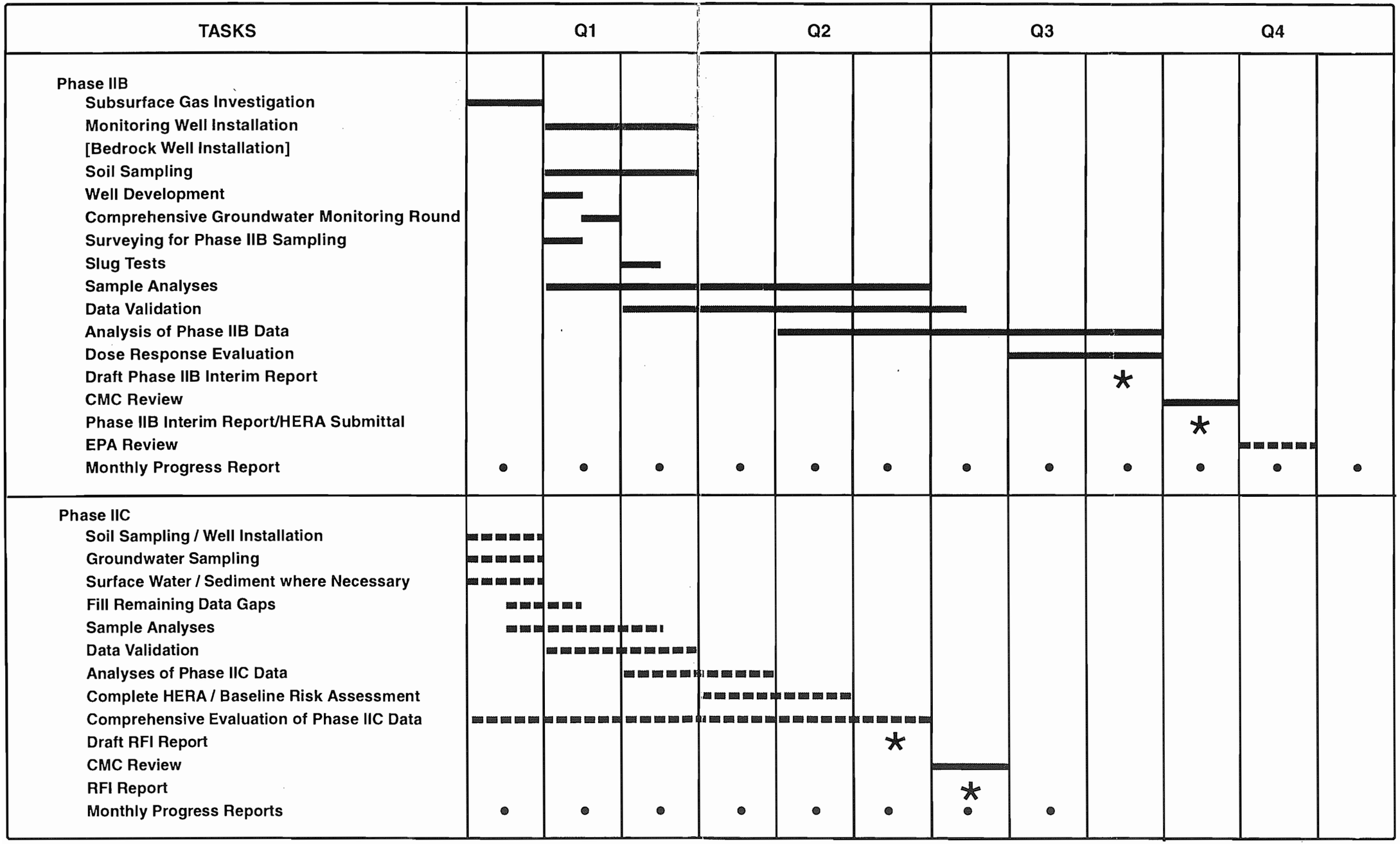


● Progress Report

* Major Submittal

Task in Progress

TABLE 25-2 (cont.)
PROPOSED SCHEDULE FOR PHASE IIB & IIC
COLUMBIA MANUFACTURING COMPANY, WESTFIELD, MA



● Progress Report

* Major Submittal

▬ Task in Progress

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LABORATORY

QUALITY ASSURANCE PROJECT PLAN

RCRA Facilities Investigation (RFI)
Columbia Manufacturing Company

August 1992

Revised
September 1994

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ATTACHMENT 1 = Example of Quality Assurance Summary Report for Laboratory Analyses

ATTACHMENT 2 = Example of In-House Data Validation Checklist

ATTACHMENT 3 = Internal Laboratory Audit Checklist

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1.0 INTRODUCTION

This plan applies to the RCRA Facilities Investigation (RFI) to be completed at the Columbia Manufacturing Company, Westfield, Massachusetts. The general objective of the RFI is to define the nature and extent of any hazardous waste and/or hazardous constituent releases on site and collect sufficient information to propose appropriate corrective actions. The goal of this Quality Assurance Project Plan (QAPP) is to establish protocols to ensure that data generated in the field or in the laboratory is of a known and acceptable quality. The quality of this data is critical in that it will provide the basis for the preparation of a Risk Assessment study, as well as enhance overall site characterization and aide in the determination of possible engineering alternatives for site remediation. This QAPP has been revised since the performance of the Phase II investigation in order to reflect improvements in the analytical approach and reflect comments received during Phase I activities. The QAPP also reflects changes in personnel since the June, 1993 RFI Proposal.

2.0 PROJECT DESCRIPTION

2.1 General - The Columbia Manufacturing Company (CMC) is required by the U.S. Environmental Protection Agency to complete a RCRA Facilities Investigation (RFI). The reader is directed to the RFI proposal for a more detailed description.

2.2 Location - The CMC facility is located on Cycle Street in Westfield, Massachusetts. The specific sampling locations, which include soil, soil gas, air, groundwater and surface water matrices are located on and adjacent to the parcel owned by CMC. Plans C and D of the RFI Proposal show the general location of the site, as well as sampling locations.

2.3 Potential Sources of Pollutants - A review of the manufacturing operations, as well as interviews with current key employees at CMC, reveal the following processes, which may be potential sources of pollutants:

- Metal finishing wastes
- Oil wastes from degreasing
- Alkaline cleaners from metal cleaning procedures
- Chlorinated solvents from degreasing
- Spent acids
- Metal sludges
- Chemical and fuel storage

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

3.1 General - The following page presents a QA/QC organizational chart that applies to this project. It identifies the key personnel selected to work on the project and their corresponding QA assignments.

Responsibility for all aspects of quality assurance for this project lie with the Project Manager (Evan T. Johnson, P.E.) and the Principal-in-Charge (Thomas C. Couture, P.E.). The actual audits of performance are to be conducted by specialists within Tighe & Bond who have no direct responsibilities for other aspects of this investigation. In addition, all aspects of this investigation will be subject to review by Mr. John W. Powers, P.E., Tighe & Bond's President, who will provide overall Quality Review for the project.

3.2 Geophysics and Field Activities - Geophysics, monitoring well installation and field screening analyses (i.e. PID Screening) will be audited by Abigail Kingman, hydrogeologist. The

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audit is to ensure that procedures outlined in the Field Sampling Plan are adhered to. Copies of the inspection log will be provided to the Project Manager and inserted in the project file.

In addition, during the initial stages of well installation, the Project Manager will conduct and document a field audit to assess compliance with the Work Plan, FSP, and H&SP.

3.3 Health and Safety - A qualified inspector with proper OSHA health and safety training will oversee the well installation activities to ensure and document compliance with the approved RFI Proposal and Health and Safety Plan. Copies of the inspection log will be provided to the Project Manager and the project file.

3.4 Sampling Activities - All soil, sediment, surface water, air and groundwater sampling activities will be monitored by Tighe & Bond's Assistant Laboratory Director, Stephen L. Knollmeyer. This individual will review Protocols with the sample technicians prior to field deployment. Additionally, the sampling coordinator will, during the first week of field sampling, conduct a field audit to ensure that the technicians are following the appropriate protocols. The results of this audit will be documented and submitted to the project manager with an additional copy placed in the project file.

3.5 Laboratory Analyses - The Tighe & Bond laboratory is responsible for adhering to the methods of analyses required to perform any or all EPA Appendix IX analyses as outlined in 40 CFR 264, plus the additional non-Appendix IX analyses as specified in Table 5-5, Section 5 of the RFI Proposal. All analyses are to adhere to the required QC protocols outlined by the referenced method, EPA Region 1 Functional Guidelines, and the project specific requirements outlined throughout this document. Mr. Peter Bowser will be responsible for ensuring auditing of all data generated by the laboratory.

3.6 Project Quality Assurance Officer - An independent contractor will serve as the Quality Assurance Officer for the project. He will review all QA/QC audits and laboratory data. His advice and recommendations will be sought throughout the project to improve the quality of all aspects of data collection. The Project Quality Assistance Officer's sole involvement in the project will be QA/QC review.

4.0 QA OBJECTIVES

4.1 General - The Data Quality Objectives (DQO's) for this project are designed to ensure data is generated, which are suitable for the intended end-use, as follows:

- Identify areas of concern with regard to hazardous waste generation, storage or handling.
- Determine any releases of hazardous wastes/constituents to groundwater, surface water, soils, sediments or air.
- To identify potential abatement measures.
- To conduct a Risk Assessment study relative to EPA Supplemental Risk Assessment Guidance.
- To identify background levels of compounds associated with Site contamination.

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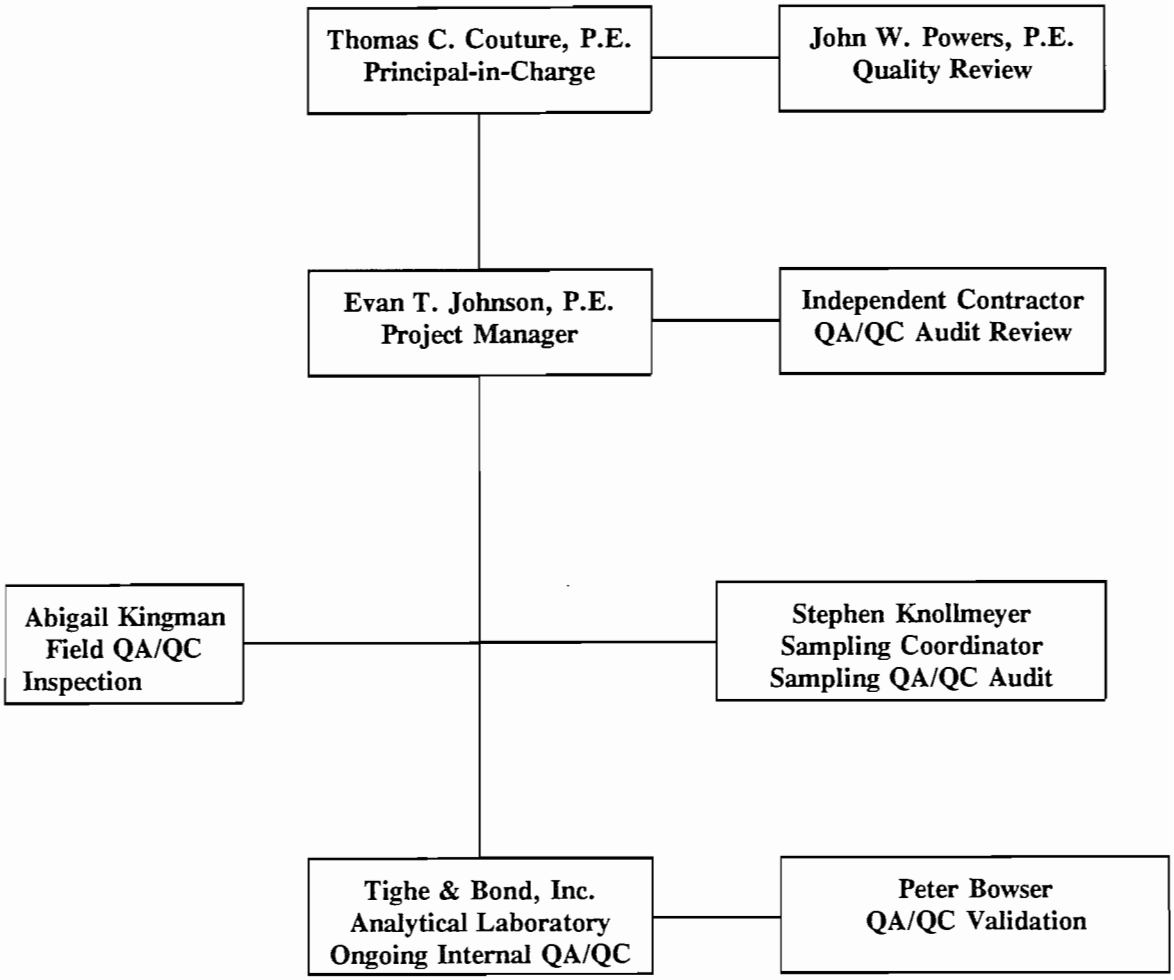
QA/QC ORGANIZATIONAL CHART



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4.2 Objectives - Project specific data quality objectives (DQO's) are designed to specify the quality and quantity of data required to support the overall objectives of the site investigation. The initial objective for this project is to identify Solid Waste Management Units (SWMU's), determine whether those SWMUs qualify as Areas of Concern (AOCs) and to investigate any releases of hazardous materials to the surrounding media. The ultimate data use for this project is to determine the possible presence and concentration of contaminants of concern for a Risk Assessment study, as well as to further overall site characterization and to assist with the determination of engineering activities designed for site remediation. In addition to actual sample data, physical site information such as geology, soils and meteorological data will be used in determining the potential for migration of any identified compounds.

Several analytical and sampling criteria will be utilized to assess adherence to the overall project QA/QC objectives. Precision, Accuracy and Completeness for all measurement parameters will be calculated and compared to the objectives outlined below.

4.2.1 Precision - Precision is a measure of how reproducible an analysis is. It is measured by calculating the relative percent difference (RPD) between the amount of analyte in the matrix spike (MS) sample and the amount of analyte in the matrix spike duplicate (MSD) sample.

RPD is calculated as follows:

$$RPD = \frac{|MS - MSD| \times 100}{\bar{x}}$$

where: MS = analyte amount in MS sample(g)
MSD = analyte amount in MSD sample(g)
$\bar{x}$ = mean of MS and MSD

For this project, RPD values will be calculated on 5% of all samples taken. The RPD values obtained will be compared to method and/or laboratory derived limits and plotted on a control chart.

Phase I had RPD values calculated on 10% of all samples taken. This has been changed to 5% in order to adhere to the methodology and increase analytical efficiency.

If the RPD value lies above the upper control limit (highest acceptable QC value), then the analysis is out of control. At this point, the analytical department Group Leader will immediately be notified, and working with the QA Coordinator and Lab Director, will decide the proper corrective action, i.e., reanalysis, dilution, qualification, etc., whichever is most appropriate.

The objective for this project is to have a minimum of 95% of all RPD values falling within acceptable criteria.

4.2.2 Accuracy - Accuracy is a measure of how close a result is to the true value. It is measured by calculating percent recovery (%R) for matrix spike (MS) samples, surrogates and for performance evaluation (PE) samples.

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% R is calculated as follows:

$$\% \ R = \frac{(S-A)}{So} \times 100$$

where: S = measured analyte amount in MS sample(g)
A = measured analyte amount in matrix sample(g)
So = amount of analyte spiked onto matrix sample(g)

For this project, % R values will be calculated on 5-10% of all samples taken in accordance with the specific methodology. The % R values obtained will be compared to method and/or laboratory derived limits and plotted on a control chart. Phase I had % R values calculated on 10% of all samples. This has been changed in order to provide QC in accordance with the methodology.

If the % R value lies outside the acceptable control limits (maximum acceptable QC values), then the analysis is out of control. At this point, the analytical department Group Leader will immediately be notified, and working with the QA Coordinator and Lab Director will decide the proper corrective action, i.e, reanalysis, dilution, qualification, etc., whichever is most appropriate.

The objective for this project is to have a minimum of 95% of all % R values fall within acceptable criteria.

4.2.3 Completeness - Completeness is a measure of the amount of valid data obtained compared to the amount that could be expected to be obtained under routine sampling and analytical conditions.

Completeness criteria for this project will be assessed by comparing the proposed number of samples to be taken and analyzed versus the actual number completed. The objective for this project is to properly complete analysis on at least 95% of the proposed samples.

Tables 1 and 2 (following pages) further outline the analytical quality control criteria which must be met for this project.

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TABLE 1
QUALITY CONTROL CRITERIA

Procedure	Method 8240	Method 8270	Method 8080	Method 8150	Method 8140	Metals	Inorganics
Tuning	50 ng BFB every 12 hours	50 ng DFTPP every 12 hours	N/A	N/A	N/A	N/A	N/A
Initial Calibration	Use all target analytes 5 concs. from near DL to upper end RRF: 5 SPCC to be ≥0.300 all other TCL ≥0.050 %RSD: all TCL ≤30%	Use all target analytes 5 concs. from near DL to upper end RRF: All TCL ≥0.050 %RSD: all TCL ≤30%	Use all target analytes At least 3 concs. from near DL to upper end % RSD: All TCL ≤10%	Use all target analytes 5 concs. from near DL to upper end All TCL <20% comparing calibration factors.	Use all target analytes 5 concs. from near DL to upper end All TCL <20% comparing calibration factors	Use all target analytes ICP: Two standards and blank for analytical batch GFAA: 4 stds. with blank Flame: 2 stds. with blank	Use all target analytes 5 concs. from near DL to upper end Correlation coefficient to be at least 0.9900 (0.9950 for CN)
Continuing Calibration	Use one midpoint standard with all target analytes every 12 hrs. RRF: 5 SPCC to be >0.300 Bromoform to be >0.250 All other TCL ≥0.050 % D: all TCL to be ± 25% IS Area -50% to +100% of most recent CC IS RT to be ±30 sec. of most recent CC	Use one midpoint standard with all target analytes every 12 hrs. Re: all TCL ≥0.050 % D: all TCL to be ±25% IS Area -50% to +100% of most recent CC IS RT to be ±30 sec. of most recent CC	Midpoint calibration with calibration factor of ± 15% for quantitation and ±20% for confirmation	Calibration factor ±15%. If not met, new initial calibration required.	Calibration factor ±15%. If not met, new initial calibration required.	Midpoint and blank every 10 samples Standard % Rec is to be ±10% of true value Hg Standard % Rec is to be ±20% of true value Blank is to be ±[DL]	Mid-range standard at end of analytical batch Std. to be ±10% of true value Cyanide Standard Recovery is to be ±15% of true value.
Surrogates	1,2-Dichloroethane-d4, Toluene-d8, Bromofluorobenzene % Rec. to be within QC limits	Phenol-d5, 2-Fluorophenol, 2,4,6-Tribromophenol, Nitrobenzene-d5, 2-Fluorobiphenyl, and p-Terphenyl-d14 % Rec. to be within QC limits	2,4,5,6-tetrachloro-m-xylene and decachlorobiphenyl % Rec. to be within QC limits	2,4-dichlorophenyl acetic acid % Rec. to be within QC limits	Non Target Analyte	N/A	N/A
Internal Standards	Bromochloromethane, 1,4-Difluorobenzene, Chlorobenzene-d5	1,4-Dichlorobenzene-d4, Naphthalene-d8, Acenapthene-d10, Phenanthrene-d10, Chrysene-d12 and Perylene-d12	dibutylchloroendate as a retention time marker (not a true internal standard).	Non target analyte	Non Target Analyte	N/A	N/A
Method Blank	Required every 12 hrs. to be interference free	Each extraction batch to be interference free	Each extraction batch to be interference free	Each extraction batch to be interference free	Each extraction batch to be interference free	Digestion blank per every 10 samples	One digestion/distillation blank per batch Result <D.L.
Spike	Matrix on 5% basis To meet method % recovery limits	Matrix on 5% basis To meet method % recovery limits	Matrix on 5% basis To meet method % recovery limits	Matrix on 5% basis To meet method % recovery limits	Matrix on 5% basis To meet method % recovery limits	Matrix on 5% basis % Rec to be minimum of 75% to 125%	Matrix on 5% basis % Rec to meet laboratory control limits
Duplicate	Matrix on 5% basis Must meet method QC limits	Matrix on 5% basis Must meet method QC limits	Matrix on 5% basis Must meet method QC limits	Matrix on 5% basis Must meet method QC limits	Matrix on 5% basis Must meet method QC limits	Matrix on 5% basis Must meet method QC limits RPD to be ≤20%	Matrix on 5% basis RPD to meet laboratory control limits
Qualitative Identification	RRT to be within ±0.06 RRT of Standard RRT	RRT to be within ±0.06 RRT of Standard RRT	RT to be within method calculated RT window Use second column for compound identification confirmation	RT to be within method calculated RT window	RT to be within method calculated RT window	N/A	N/A
QC Check Sample	Laboratory control sample with each analytical batch	Laboratory control sample with each analytical batch	Laboratory control sample with each analytical batch	Laboratory control sample with each analytical batch	Laboratory control sample with each analytical batch	Laboratory control sample with each analytical batch	Laboratory control sample with each analytical batch

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TABLE 2 TUNING CRITERIA	
Method 8240 BFB Relative Ion Abundance	
Ion abundance criteria	
50 of mass 95	15-40
75 of mass 95	30-60
95	100
96 of mass 95	5-9
173 of mass 174	<2
174 of mass 95	>50
175 of mass 174	5-9
176 of mass 174	95-101
177 of mass 176	5-9
Method 8270 DFTPP Relative Ion Abundance	
Ion abundance criteria	
51 of mass 198	30-60
68 of mass 69	<2
70 of mass 69	<2
127 of mass 198	40-60
197 of mass 198	<1
198	100
199 of mass 198	5-9
275 of mass 198	10-30
365 of mass 198	>1
441	<mass 443
442 of mass 198	>40
443 of mass 442	17-23

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4.3 Existing Data

Although historical data is available for this facility via previous soil and groundwater monitoring activities, records and files, no historical data will be utilized in the development of the health Risk Assessment study other than that data prepared by the US EPA Region I study completed in November 1991 (see Appendix I of the RFI Proposal) and data prepared by Tighe & Bond laboratory as part of Phase I of the RFI in 1993. Previous data will be omitted due to our concerns that we are unable to properly validate this data for a Risk Assessment study as its intended purpose at the time was generally for site monitoring only.

We believe the data generated by the US EPA in November 1991 can be viewed as valid for Risk Assessment usage, and it will be incorporated into the eventual Risk Assessment study completed for this project.

4.4 Data Quality Levels

For the initial phase of site investigation and all subsequent analyses, the following Levels of Data Quality will be employed.

Level I analytical level will be utilized for on-site monitoring for each analysis as total organic vapors, pH, dissolved oxygen, ORP, and temperature.

This data quality level requires proper calibration and documentation thereof, for field instruments designed to provide for low-level site characterization and ambient monitoring activities.

For all soil gas analyses, Level II data quality requirements will be implemented. This level requires additional QA/QC procedures as well as on increased level of documentation. The soil gas survey will provide for rapid on-site data collection to further enhance overall site characterization. Section 4.4.2 of this submittal further describes the QA/QC protocols to be implemented for the soil gas survey.

For all base lab analyses, an enhanced Level III data quality level will be used for all soil and groundwater samples obtained. This level of QA will provide for data of a known quality, although complete CLP-type documentation will not be required. All analyses will be completed adhering to a strict QA/QC protocol, and all data will be available to the US EPA in such a format which will allow for data validation commensurate with the overall Risk Assessment study and according to US EPA Region I Data Validation Guidelines.

Further discussion of each of these data quality analytical levels can be found in subsequent sections of this Quality Assurance Project Plan.

4.4.1 Air Screening - To collect general information on the presence of air pollution hazards on the site that may adversely affect workers, a Level I field screening of the air will be performed. No blanks or duplicates will be required. Daily calibration of the instruments will be in accordance with manufacturer's instructions.

4.4.2 Subsurface Gas Survey - Subsurface gas investigations are scheduled for at least two general areas during Phase II of this project. The actual number of investigation is yet undetermined. Soil gas samples will be obtained following the procedure outlined in Appendix E of the RFI Proposal. A Level II analyses will be employed.

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The soil gas analyses utilize a dual-detector gas chromatograph, designed to provide on-site data for a wide range of volatile organic compounds. The following QC steps will be utilized at the frequency specified:

- Instrument Blank and Equipment Blank; minimum of 1X/day
- Initial Calibration
- Duplicate; 10% of samples
- Performance Evaluation Standard obtained from outside source; 1X/day
- Base lab confirmation; 10% of samples
- Final calibrations; 1 x/day
- Mid range calibration - every 10 sample analyses

During the course of any field volatile organic compound (VOC) analysis on soil gas samples, standard quality control procedures are followed to ensure the integrity of the data generated. The following QC sample analyses are conducted either on a daily basis or 5-10% of the samples, as indicated.

Phase I of the RFI had mid range calibration for every 5 samples analyses. This has been changed to 5% in accordance with the methodology.

Prior to mobilizing to the site, the mobile laboratory GC system is checked out through instrument operation and calibration. This calibration is stored in the internal memory of the integrators.

- **Initial Calibrations** for Target Compounds are run after instrument startup and equilibration by injecting a mixed VOC standard. Individual compound concentrations are calculated using the standard stored in the integrator internal memory. These concentrations are compared to the true concentrations using percent recoveries calculated for each analyte. If the measured value is between 80 and 120% of the true value then a new calibration is created by averaging the old response factors with the new response factors. If the new standard concentrations are less than 80% or greater than 120% of the true value then a new calibration is created by replacing old response factors with the new response factors and a PE standard is run to verify proper instrument function.

- **Blank analyses** are conducted either after the calibration standard or after a highly contaminated sample run. The target level for acceptable blank data has been established as at or below the detection limit. If the value of any target compound in the blank is greater than one-half the method detection limit, instrument and syringe cleaning will be conducted and a second blank analyzed. If the second blank contains any analyte at a concentration greater than one-half the method detection limit, the data will be flagged when reported.

- **Performance Evaluation (PE) standards** are run daily following instrument calibration to verify the accuracy of the calibration. The PE is a standard prepared from a source independent of that used for the calibration standards. For this project, the PE standard will at a minimum contain the following compounds: vinyl chloride, methylene chloride, 1,1-dichloroethene, 1,1-

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dichloroethane, 1,2-dichloroethene (both cis and trans isomers), 1,1,1-trichloroethane, trichloroethene, benzene, tetrachloroethene and o- and p-xylenes.

Acceptance criteria of 80-120% recovery will be used for each PE compound. If the percent recovery of a compound falls outside the acceptable limits, a new calibration will be created by analyzing a second series of calibration standards. Once the new calibration is established, the PE is once again analyzed to verify the accuracy of the new calibration.

- **Mid-Range calibration standards** for Target Compounds will be analyzed after every ten sample analyses to monitor any potential instrument drift. Percent recoveries will be compared to the acceptance limits of 80-120% recovery. If the percent recovery falls outside the acceptable limits, a new calibration will be created.

  Phase I of the RFI had mid-range calibration standards for target compounds after every five (5) samples. This has been changed to after every 10 samples. This was done to reflect our standard practice which has been adequate on other projects to monitor any potential instrument drift.

- **Duplicate analyses** are conducted on a daily basis to verify the precision of the analyses. Acceptance limit of 30% relative percent difference (RPD) is used in evaluating the duplicates. If the RPD falls outside the control limit, a second duplicate will be analyzed. If the second duplicate is still outside the control limit, the data will be flagged when reported.

- **Final calibrations** for Target Compounds are analyzed at the end of each day to check for instrument drift. Acceptance criteria of 80 - 120% of the initial value will be used. If the percent recovery is outside of these acceptable limits, the results will be flagged when reported and the project manager notified immediately.

- **Confirmation analyses** are conducted on 10% of the samples analyzed in the field by running duplicate samples at the Tighe & Bond Laboratory (Westfield, MA) using EPA methods and GC/MS or GC analyses of volatile organics. The results of the base laboratory analyses will be compared to the field analyses. If the results differ by a factor greater than ten, the field results will be flagged when reported.

4.4.3 Groundwater, Surface Water and Soil Samples - An undetermined number of groundwater, surface water and soil samples will be taken for a wide variety of inorganic and organic analyses. A Level III analytical level will be utilized for these analyses. The Level III analytical level will include:

- Base laboratory analyses.

- Standard EPA Methodologies, or equivalent (see Table 5-5).

- Built-in methodology QA/QC; i.e., initial and continuing calibrations, surrogate and internal standards, blanks, tuning requirements, spikes,

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duplicates, Quality Control Check samples, trip blanks and field blanks (see Table 1, page 8 for acceptance criteria).

- Possible Tentative Identification for non-target compounds. Given that analyses are to include all Appendix IX compounds, additional compounds requiring tentative identification may be limited.

In addition, for this project we will be assembling data validation checklists, QC summary and narrative for submission to the Project Manager and the QA Officer at the time of the final report submittal. All instrument print outs, raw benchsheets, chromotograms, target and library analyte ion spectra will be maintained in order to allow for data validation per USEPA Region I Functional Guidelines.

The goal of this level of analysis is to provide for data of a known quality to be used for Risk Assessment, site characterization and evaluation of engineering alternatives.

For each sampling event, the following QC samples will be obtained:

- Equipment Rinse Blanks; 1X/day, at the end of the day, for each piece of equipment.
- Field Blanks; 1/20 samples
- Field Duplicates; 1/20 samples
- Trip Blanks for VOCs only; 1X/day
- Split samples; frequency unknown

The data package submittal was modified in order to provide for more efficient data review at the appropriate level.

For laboratory analyses, the following QC activities will be performed as applicable to specific method requirements:

- Blanks; daily or with each analytical batch, whichever is most frequent.
- Continuing Blank Verification
- Initial Calibration
- Continuing Calibration
- Matrix Spikes (MS); 1/20 samples
- Matrix Spike Duplicate (MSD); 1/20 samples
- Internal Standards
- Surrogate Standards
- Quality Control Check Samples

See Table 1, Page 8 for specific QC criteria requirements.

4.5 Data Quality Level of Previous Sampling

As no data other than that prepared by the US EPA in November 1991 and the Phase I investigation in 1993-94 will be utilized for any aspect of this study, no characterization of previous data relative to the level of quality is deemed necessary.

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4.6 Characterization of Quantitation Limits

For this project, every attempt will be made to achieve sample quantitation limits which will meet or exceed the standards established by the Safe Drinking Water Act (SDWA) (Table 3)

Table 3

CURRENT PRIMARY DRINKING WATER PARAMETERS		
Compound	MCL (ug/L)	QL (ug/L)
Arsenic	50	5
Barium	1000	50
Cadmium	10	10
Chromium	50	50
Lead	15 (action level)	5
Mercury	2	1
Selenium	10	5
Silver	50	10
Nitrate	10,000	20
Nitrite	1,000	20
2,4-D	100	0.5
2,4,5-TP (Silvex)	10	0.5
Endrin	0.2	0.1
Lindane	0.2	0.1
Methoxychlor	100	2
Toxaphene	5	2
Benzene	5	5
Carbon Tetrachloride	5	5
p-Dichlorobenzene	75	5
1,2-Dichloroethane	5	5
1,1-Dichloroethylene	7	5
1,1,1-Trichloroethane	200	5
Trichloroethylene	5	5
Vinyl Chloride	2	5
Total Trihalomethanes (4)	100	5 (individual components)
PROPOSED PHASE II PRIMARY DRINKING WATER PARAMETERS (as applicable)		
Chlordane	2	0.5
1,2-Dibromo-3-chloropropene	0.2	5
Ethylene dibromide	0.05	5
Heptachlor	0.4	0.1
Heptachlor epoxide	0.2	0.1
Polychlorinated biphenyls	0.5	0.5
Pentachlorophenol	1	25

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as they currently exist. The following table lists our estimated quantitation limits achievable for groundwater samples relative to existing Maximum Containment Levels established by the SDWA.

Due to the fact that many of the compounds which will be analyzed during this second phase of site investigation are not regulated by the US EPA for drinking water purposes, actual comparisons of expected quality data limits to regulatory limits is not possible. However, every attempt will be made to achieve the lowest quantitation limit possible given matrix characteristics.

4.7 Data Validation

The data validation process in the Tighe & Bond Laboratory is used to verify that all sample analyses were conducted according to and within the guidelines established by the EPA Method and the Quality Control (QC) program. The data validation process does not begin until the analysis and the data package have been deemed complete by the analyst and their data books have been checked by the Group Leader. When the data packages have been assembled, the person responsible for the data validation can then systematically review the data to verify that all procedures were followed and all QC criteria met.

For this project, two types of data validation will be conducted on the data packages:

1. An in-house data validation on all data packages by the QA/QC Officer.

2. An outside data validation by an experienced firm on 10% of the data packages.

4.7.1 In-House Data Validation - The Tighe & Bond QA Coordinator assigned to this project will ensure review of 100% of the data generated using the guidelines established in this document and the EPA Region I documents, "Laboratory Data Validation, Functional Guidelines for Evaluating Organic Analyses" February, 1988 and "Laboratory Data Validation, Functional Guidelines for Evaluating Inorganic Analyses" June 1988. Data review checklists (see Attachment 2) will be utilized for each type of analysis, i.e, metals, organics and inorganics. These checklists have been generated using the guidelines established in the above EPA documents and the individual methods. They will be used to record the in-house data validation process through comparison of the method's prescribed QC criteria and the actual QC results. Compliance with the requirements will be noted and any and all qualifiers and comments will be recorded. After the data validator has reviewed each data package for each method, they will prepare a summary of the data package and describe the data review process for that package including all deviations from the prescribed criteria. This package will then be forwarded to the project manager.

4.7.2 Outside Data Validation - Ten percent (10%) of all the data packages generated from this project will be submitted to an independent data validator who has experience in reviewing data packages of the type generated in the EPA Level III analyses being conducted. As in the in-house data validation process, Tighe & Bond will require this data validator to utilize the guidelines established in the EPA Region I documents, "Laboratory Data Validation, Functional Guidelines for Evaluating Organic Analyses" and "Laboratory Data Validation, Functional Guidelines for Evaluating Inorganic Analyses" February 1988. The results of the outside data validator will be compared to the in-house data validation results and a summary of the correlation between the two will

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be prepared. Discrepancies between the two will be investigated to determine if further review is required on the other data packages not submitted for outside data validation.

In addition to the above specific QC steps, control charts for Percent Recovery (accuracy) and Relative Percent Difference (precision) will be maintained for all analyses. The laboratory also performs routine system audits and use of double blind check samples. Quality Assessment reports are provided to laboratory management on a monthly basis. Ultimately, the Laboratory Director will be responsible for any corrective actions taken.

5.0 SAMPLING PROCEDURES

Appendix E of RFI Proposal details methods for sample collection for all types of samples. All samples will be delivered directly to the analytical laboratory. In no case will samples arrive greater than 24 hours after sample acquisition.

6.0 SAMPLE CUSTODY

Strict chain-of-custody procedures will be followed for all samples. Complete documentation of sample possession is critical to ensuring valid results. It is the responsibility of both the analytical laboratory and the sample collection team to maintain the chain-of-custody forms.

Copies of the form (Appendix E of the RFI Proposal) will be provided by the analytical laboratory. The documentation will accompany the sample throughout collection, transportation and analysis.

In all cases, sample containers that are not in use or in transport will be stored in sealed boxes in locked storage at the project site.

Transport of samples will be made directly by the sampling team. The sampling team will pack the samples in coolers, complete the chain-of-custody record in the appropriate columns, seal the cooler with strapping tape that completely encircles the cooler, and sign over the tape where the two ends overlap.

Upon receipt at the laboratory, the Tighe & Bond sample custodian will ensure that the cooler seal is unbroken. That individual will then open the cooler, review all samples and accompanying documentation, and sign the enclosed chain-of-custody record.

Once in the possession of the laboratory, all samples and extracts will remain refrigerated under lock and key except for when required to perform a given analysis. Internal chain-of-custody procedures will be adhered to. Only Tighe & Bond laboratory personnel have access to the laboratory facility.

7.0 CALIBRATION PROCEDURES

Operation and Calibration instructions for all field sampling and analytical equipment are included in the FSP.

Laboratory calibration procedures will be in accordance with analytical methods. Instrument calibration criteria for organic and metals analyses can be found in Table 1, Page 8 of this Appendix.

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8.0 ANALYTICAL PROCEDURES

Table 5-5 of the RFI Proposal provides an outline of the methods to be employed for Appendix IX and non-Appendix IX analytes. All methods are taken from SW-846, 3rd edition, "Test Methods for Chemical Analyses of Water and Wastes", Standard Methods, 16th edition, or equivalent sources. Specific test references can be found in Table 4. Appendix E of the RFI Proposal also contains a copy of the proper sample container and the type and quantity of preservative to be added, if so required.

Specific analyses will be performed utilizing the following instrumentation and/or close substitutes:

Analysis	Instrumentation
8240	H.P 5890 Series II Gas Chromatograph with 5971A MSD and OI MPM16 with 4560 sample concentrator purge & trap. OR H.P 5890 Gas Chromatograph with 5970 MSD and OI MPM 16 with 4560 sample concentrator purge & trap.
8270	H.P 5890 Gas Chromatograph with 5970 MSD and 7673A auto injector.
8080	H.P 5890 Series II Gas Chromatograph with dual ECD and dual 7673A auto injectors.
8140	H.P 5890 Gas Chromatograph with NPD and 7673A auto injector.
8150	H.P 5890 Gas Chromatograph with ECD and 7673A auto injector.
8280 (sub-contracted)	Low resolution magnetic sector MS - exact instrumentation not available as sub-contractor not yet determined.
Metals:	
ICP/AES	Leeman Labs PS1000 ICP with Echelle grating and auto sampler.
AA/Graphite Furnace	Perkin Elmer Zeeman 5100 PC atomic absorption spectrophotometer with L'Vol platform and AS-60 auto sampler.
AA/Flame	Perkin Elmer 2380 atomic absorption spectrophotometer
pH	Accumet model 20
Specific conductance	Accumet model 20
BOD (probe)	Orion model 407A with Orion probe
Sulfate	Bausch & Lomb Spectronic 1001 dual beam spectrophotometer
TPH	Perkin Elmer 1420 Infrared spectrophotometer
NH_3, NO_2/NO_3 and Total Phosphorus	Alpkem (Technicon) Auto Analyzer II

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Full Standard Operating Procedures (SOPs) for all analyses to be performed for this project are on file at the Tighe & Bond laboratory.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

Data reduction will be performed by the laboratory performing the analyses in accordance with the methods outlined by Appendix IX, plus additional analytes and those described in the laboratory's Quality Assurance Manual (Appendix G of the RFI Proposal). The laboratory will provide a Quality Assurance Summary report included with every analytical report. An example of this summary is included in Appendix A of this plan.

Some typical analyte concentration calculations are listed below for organic and inorganic compounds in both solid and aqueous sample matrices.

- Method 8080 - Pesticides and PCB's:

$$\text{Aqueous} = \frac{C \times V}{B} \times \frac{Vi}{Di} = \text{Concentration (ug/L)}$$

where:

C	=	sample extract analyte concentration (ng/uL)
V	=	sample extract volume (uL)
B	=	sample volume (mL)
Vi	=	volume of diluted extract (uL)
Di	=	volume of extract taken for dilution (uL)

$$\text{Solids} = \frac{C \times V}{B} \times \frac{Vi}{Di} = \text{Concentration (ug/kg, dry weight)}$$

where:

C	=	sample extract analyte concentration (ng/uL)
V	=	sample extract volume (uL)
B	=	sample dry weight (g)
Vi	=	Volume of diluted extract (uL)
Di	=	volume of extract taken for dilution (uL)

- Metals - ICP:

$$\text{Aqueous} = \frac{A \times B}{100} = \text{Concentration (mg/L)}$$

where:

A	=	Instrument Reading for digested sample in 100 mL
B	=	Final volume of digested sample (mL)

$$\text{Solids} = \frac{A \times V}{B} = \text{Concentration (mg/kg, dryweight)}$$

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where:

A	=	Instrument Readout (mg/L)
V	=	Volume of digested sample (ml)
B	=	Dry weight of sample (g)

10.0 INTERNAL QUALITY CONTROL

The general Tighe & Bond Laboratory QA Manual (Appendix G of the RFI Proposal) describes the overall structure and foundation of the Quality Assurance Program, including but not limited to the use of blanks, spikes, duplicates, instrument calibration and documentation requirements for general analyses.

As described in earlier sections of this QAPP, a detailed internal quality control procedure will be implemented for this project. Table 1, page 5 of RFI Proposal Appendix G outlines many of the analytical QC criteria.

In addition to strict adherence to the methodology QC, the laboratory utilizes standardized notebooks for all field and lab activities, follows strict chain-of-custody procedures and utilizes trip blanks, equipment blanks and field duplicates. Control charts are maintained for precision and accuracy data and only proper grade and traceable standards and chemicals are utilized.

It is the responsibility of each analyst to ensure adherence to the laboratory's standard operating procedures. Actual compliance with the QC requirements is then maintained by departmental Group Leaders, QA personnel and ultimately by the Laboratory Director. As outlined earlier, for this project, 100% of the data will go through internal validation and an additional 10% will be forwarded to an independent data validator for review.

11.0 PERFORMANCE AND SYSTEMS AUDITS

Responsibility for all aspects of quality control for the project lie with the project manager. The actual audits of performance are conducted by specialists within Tighe & Bond. Routine laboratory audits are performed by the Quality Assurance Coordinator and results summarized and reported to laboratory management. An example of our internal audit form can be found in Attachment 3 of this section of the RFI Proposal. The QA personnel also perform double-blind sample submission to the laboratory, with all results reported to management. In addition to these internal system reviews, we are also audited by several state agencies where we currently hold certification, namely Massachusetts, New Hampshire, New Jersey, and New York. All audit results are maintained on file at Tighe & Bond. For this project, we propose to have 10% of base laboratory analyses reviewed by an independent data validator.

12.0 PREVENTIVE MAINTENANCE

Field and laboratory instruments will be maintained and serviced according to manufacturer's instructions and recommendations. Full service contracts are maintained on all major pieces of analytical instrumentation. A listing of these major service contracts is provided below:

- Hewlett Packard Service Agreements, coverage for:
  - 1 - H.P. 5971 Gas Chromatograph/Mass Spectrometer/Data Systems
  - 2 - H.P. 5970 Gas Chromatograph/Mass Spectrometer/Data Systems
  - 5 - H.P. 5890 Gas Chromatographs and Data Systems

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- Perkin-Elmer Maintenance Plan - Warranty Extensions for:
  - P.E. Z5100 PC, Zeeman corrected Graphite Furnace Atomic Spectrophotometer
  - P.E. 2380 Atomic Absorption Spectrophotometer
  - P.E. 1420 Infrared Spectrometer

- Leeman Labs, Inc., "Total Maintenance Agreement"
  - Leeman PS1000, Inductively Coupled Argon Plasma Spectrometer

- Fisher Scientific, Warranty Extension
  - Scientific Systems High Performance Liquid Chromatograph

- New England Balance Service
  - Semi-annual service and calibration of all scales and balances to NIST standards.

All of these service contracts cover both parts and labor, and provide for immediate response from the manufacturer.

In addition to manufacturer service contracts, a large inventory of spare parts are maintained for all lab and field instruments. Certain analysts have been trained in proper maintenance and service activities such as cleaning GM/MS sources, servicing GC detectors, ICAP auto samplers and nebulizers, computer systems and a wide range of field instruments.

13.0 CORRECTIVE ACTIONS

If data validation proves that some results are outside acceptable quality assurance standards, the engineer, in cooperation with the USEPA project manager, will determine whether resampling or re-analysis will be required.

14.0 QUALITY ASSURANCE REPORTS

A quality assurance report will be prepared at the conclusion of the investigation. The report will detail results of audits and any QA problems encountered. This report will be summarized into the final RFI report.

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TABLE 4
SUMMARY OF ANALYTICAL METHODS
APPENDIX IX ANALYSIS AND MISCELLANEOUS PARAMETERS (H)

CAS #	COMPOUND	METHOD	QUANTITATION LIMITS[A]	
			AQUEOUS (ug/l)	SOLID[B] (ug/kg)
83-32-9	Acenaphthene	8270	5	170
208-96-8	Acenaphthylene	8270	5	170
67-64-1	Acetone	8240	80	2000
98-86-2	Acetophenone	8270	5	1700
75-05-8	Acetonitrile	8240	100	2500
53-96-3	2-Acetylaminofluorene	8270	10	350
107-02-8	Acrolein	8240	100	2500
107-13-1	Acrylonitrile	8240	100	2500
309-00-2	Aldrin	8080	0.10	5
107-05-1	Allyl Chloride (3-Chloro-1-propene)	8240	100	2500
92-67-1	4-Aminobiphenyl	8270	10	350
62-53-3	Aniline	8270	5	170
120-12-7	Anthracene	8270	5	170
(Total)	Antimony	7041	5	2000
140-57-8	Aramite	8270	20	700
(Total)	Arsenic	7060	5	1000
(Total)	Barium	6010	50	3000
71-43-2	Benzene	8240	5	130
56-55-3	Benzo(a)anthracene	8270	5	170
205-99-2	Benzo(b)fluoranthene	8270	5	170
207-08-9	Benzo(k)fluoranthene	8270	5	170
191-24-2	Benzo(ghi)perylene	8270	5	170
50-32-8	Benzo(a)pyrene	8270	5	170
100-51-6	Benzyl Alcohol	8270	10	350
(Total)	Beryllium	6010	50	3000
319-84-6	alpha-BHC	8080	0.10	5
319-85-7	beta-BHC	8080	0.10	5
319-86-8	delta-BHC	8080	0.10	5
58-89-9	gamma-BHC (lindane)	8080	0.10	5
111-91-1	Bis (2-chloroethoxy)methane	8270	5	170
111-44-4	Bis (2-chloroethyl)ether	8270	5	170

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108-60-1	Bis (2-chloroisopropyl)ether	8270	5	170
117-81-7	Bis (2-ethylhexyl)phthalate	8270	5	170
75-27-4	Bromodichloromethane	8240	5	130
75-25-2	Bromoform	8240	5	130
101-56-3	4-Bromophenyl phenyl ether	8270	5	170
85-68-7	Benzyl butyl phthalate	8270	5	170
(Total)	Cadmium	6010	10	500
75-15-0	Carbon Disulfide	8240	5	130
56-23-5	Carbon Tetrachloride	8240	5	130
57-74-9	Chlordane	8080	0.5	5
106-47-8	p-Chloroaniline	8270	10	350
108-90-7	Chlorobenzene	8240	5	130
510-15-6	Chlorobenzilate	8270	5	170
59-50-7	p-Chloro-m-cresol	8270	10	350
75-00-3	Chloroethane	8240	10	250
67-66-3	Chloroform	8240	5	130
91-58-7	2-Chloronaphthalene	8270	5	170
95-57-8	2-Chlorophenol	8270	5	170
7005-72-3	4-Chlorophenyl phenyl ether	8270	5	170
126-99-8	2-Chloro-1,3-butadiene	8240	5	130
(Total)	Chromium	6010	50	3000
218-01-9	Chrysene	8270	5	170
(Total)	Cobalt	6010	5	1000
(Total)	Copper	6010	10	500
108-39-4, 106-44-9	m-Cresol, p-Cresol	8270	5	170
95-48-7	o-Cresol	8270	5	170
57-12-5	Cyanide, Total	9010	20	20,000
94-75-7	2,4-D	8150	0.50	20
72-54-8	4,4′-DDD	8080	0.10	5
72-55-9	4,4′-DDE	8080	0.10	5
50-29-3	4,4′-DDT	8080	0.10	5
2303-16-4	Dillate	8270	5	120
53-70-3	Dibenz(a,h)anthracene	8270	5	170
132-64-9	Dibenzofuran	8270	5	170
124-48-1	Dibromochloromethane	8240	5	130
96-12-8	1,2-Dibromo-3-chloropropane	8240	5	130

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106-93-4	1,2-Dibromoethane	8240	5	130
84-74-2	Di-n-butyl phthalate	8270	5	170
95-50-1	o-Dichlorobenzene	8240	5	130
541-73-1	m-Dichlorobenzene	8240	5	130
106-46-7	p-Dichlorobenzene	8240	5	130
91-94-1	3,3′-dichlorobenzidine	8270	10	350
110-57-6	trans-1,4-Dichloro-2-butene	8240	5	130
75-71-8	Dichlorodifluoromethane	8240	100	2500
75-34-3	1,1-Dichloroethane	8240	5	130
107-06-2	1,2-Dichloroethane	8240	5	130
75-35-4	1,1-Dichloroethene	8240	5	130
156-59-4	Cis-1,2-Dichloroethene	8240	5	130
156-60-5	trans-1,2-Dichloroethene	8240	5	130
120-83-2	2,4-Dichlorophenol	8270	5	170
87-65-0	2,6-Dichlorophenol	8270	5	170
78-87-5	1,2-Dichloropropane	8240	5	130
10061-01-5	cis-1,3-Dichloropropene	8240	5	130
10061-02-6	trans-1,3-Dichloropropene	8240	5	130
60-57-1	Dieldrin	8080	0.10	5
84-66-2	Diethyl phthalate	8270	5	170
297-97-2	Thionazin	8270	20	700
60-51-5	Dimethoate	8270	20	700
60-11-7	p-(Dimethyllamino)azobenzene	8270	5	170
57-97-6	7,12-Dimethylbenz(a)anthracene	8270	5	170
119-93-7	3,3′-Dimethylbenzidine	8270	5	170
122-09-08	a,a-Dimethylphenethylamine	8270	5	170
105-67-9	2,4-Dimethylphenol	8270	5	170
131-11-3	Dimethyl phthalate	8270	5	170
99-65-0	m-Dinitrobenzene	8270	5	170
534-52-1	4,6-Dinitro-o-cresol	8270	25	900
51-28-5	2,4-Dinitrophenol	8270	25	900
121-14-2	2,4-Dinitrotoluene	8270	5	170
606-20-2	2,6-Dinitrotoluene	8270	5	170
88-85-7	Dinoseb	8150, mod	0.50	20
117-84-0	Di-n-octyl phthalate	8270	5	170
123-91-1	1,4-dioxane	8240, mod (F)	500	12,500

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122-39-4	Diphenylamine	8270	5	170
298-04-4	Disulfoton	8140	10	350
959-98-8	Endosulfan I	8080	0.10	5
33213-65-9	Endosulfan II	8080	0.10	5
1031-07-8	Endosulfan Sulfate	8080	0.10	5
72-20-8	Endrin	8080	0.10	5
7421-93-4	Endrin Aldehyde	8080	0.10	5
100-41-4	Ethylbenzene	8240	5	130
97-63-2	Ethyl methacrylate	8240	20	500
62-50-0	Ethyl methanesulfonate	8270	20	700
52-85-7	Famphur	8270	20	700
206-44-0	Fluoranthene	8270	5	170
86-73-7	Fluorene	8270	5	170
76-44-8	Heptachlor	8080	0.10	5
1024-57-3	Heptachlor Epoxide	8080	0.10	5
118-74-1	Hexachlorobenzene	8270	5	170
87-68-3	Hexachlorobutadiene	8270	5	170
77-47-4	Hexachlorocyclopentadiene	8270	5	170
67-72-1	Hexachloroethane	8270	5	170
70-30-4	Hexachlorophene	8270	10	350
1888-71-7	Hexachloropropene	8270	10	350
591-78-6	2-Hexanone	8240	20	500
196-39-5	Indeno(1,2,3-cd)pyrene	8270	5	170
78-83-1	Isobutyl alcohol	8015 mod (G)	1000	30000
465-73-6	Isodrin	8270	20	700
78-59-1	Isophorone	8270	5	170
120-58-1	Isosafrole	8270	20	700
143-50-0	Kepone	8080	2.0	70
(Total)	Lead	6010	5	5000
(Total)	Mercury	7470	1	300
126-98-7	Methacrylonitrile	8240	200	5000
91-80-5	Methapyrilene	8270	20	70
72-43-5	Methoxchlor	8080	2	70
74-83-9	Bromomethane	8240	5	130
74-87-3	Chloromethane	8240	5	130
56-49-5	3-Methylcholanthrene	8270	5	170

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74-95-3	Dibromomethane	8240	5	130
75-09-2	Methylene chloride	8240	10	250
78-93-3	Methyl ethyl ketone	8240	20	500
74-88-4	Methyl iodide	8240	5	130
80-62-6	Methyl methacrylate	8240	20	500
66-27-3	Methyl methanesulfonate	8270	20	700
91-57-6	2-Methylnaphthalene	8270	5	170
296-00-0	Methyl parathion	8140	1.0	35
108-10-1	4-Methyl-2-pentanone	8240	20	500
91-20-3	Naphthalene	8270	5	170
130-15-4	1,4-Naphthoquinone	8270	70	700
134-32-7	1-Naphthylamine	8270	5	170
91-59-8	2-Naphthylamine	8270	5	170
(Total)	Nickel	7520	50	3000
88-74-4	o-Nitroaniline	8270	25	850
99-09-2	m-Nitroaniline	8270	25	850
100-01-6	p-Nitroaniline	8270	25	850
98-95-3	Nitrobenzene	8270	5	170
88-75-5	o-Nitrophenol	8270	5	170
100-02-7	p-Nitrophenol	8270	25	850
56-57-5	4-Nitroquinoline 1-oxide	8270	20	700
924-16-3	N-Nitrosodi-n-butylamine	8270	5	170
55-18-5	N-Nitrosodiethylamine	8270	20	700
62-75-9	N-Nitrosodimethylamine	8270	5	170
86-30-6	N-Nitrosodiphenylamine	8270	5	170
621-64-7	N-Nitrosodipropylamine	8270	5	170
10595-95-6	N-Nitrosomethylethylamine	8270	20	700
59-89-2	N-Nitrosomorpholine	8270	20	700
100-75-4	N-Nitrosopiperidine	8270	5	170
930-55-2	N-Nitrosopyrrolidine	8270	20	700
99-55-8	5-Nitro-o-toluidine	8270	20	700
56-38-2	Parathion	8140	1.0	35
1336-36-3	Polychlorinated Biphenyls; Peraroclor	8080	0.5	20
	Polychlorinated dibenzo-p-dioxins; PCDDs • tetrachloro cogenens • pentachloro cogeners • hexachloro cogeners	DFL-M01.0[E]	 0.4 ppt 2 ppt 2 ppt	 40 ppt 200 ppt 200 ppt

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	Polychlorinated dibenzofurans; PCDFs • tetrachloro cogeners • pentachloro cogeners • hexachloro cogenes	8280	0.4 ppt 2 ppt 2 ppt	40 ppt 200 ppt 200 ppt
603-93-5	Pentachlorobenzene	8270	5	170
76-01-7	Pentachloroethane	8240	10	250
82-68-8	Pentachloronitrobenzene	8270	5	170
87-86-5	Pentachlorophenol	8270	25	850
62-44-2	Phenacetin	8270	5	170
85-01-8	Phenanthrene	8270	5	170
108-95-2	Phenol	8270	5	170
106-50-3	p-Phenylenediamine	8270	20	700
298-02-2	Phorate	8140	20	700
109-6-8	2-Picoline	8270	5	170
23950-58-5	Pronamide	8270	20	700
107-12-0	Propionitrile	8240	200	5000
129-00-0	Pyrene	8270	5	170
110-86-1	Pyridine	8270	10	350
94-59-7	Safrole	8270	20	700
(Total)	Selenium	7740	5	
(Total)	Silver	7760	10	500
93-72-1	Silvex, 2,4,5-TP	8150, mod	0.5	20
100-42-5	Styrene	8240	5	130
18496-25-8	Sulfide	9030	500	50,000
93-76-5	2,4,5-T	8150, mod	0.5	20
95-94-3	1,2,4,5-Tetrachlorobenzene	8270	5	170
630-20-6	1,1,1,2-Tetrachloroethane	8240	5	130
79-34-5	1,1,2,2-Tetrachloroethane	8240	5	130
127-18-4	Tetrachloroethene	8240	5	130
58-90-2	2,3,4,6-Tetrachlorophenol	8270	5	130
3689-24-5	Tetraethyl dithiopyrophosphate	8140	20	700
(Total)	Thallium	7841	5	1000
(Total)	Tin	7041	100	5000
108-88-3	Toluene	8240	5	130
95-53-4	o-Toluidine	8270	20	700
8001-35-2	Toxaphene	8080	2	70
120-82-1	1,2,4-Trichlorobenzene	8270	5	170

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71-55-6	1,1,1-Trichloroethane	8240	5	130
79-00-5	1,1,2-Trichloroethane	8240	5	130
79-01-6	Trichloroethene	8240	5	130
75-69-4	Trichlorofluoromethane	8240	5	130
95-95-4	2,4,5-Trichlorophenol	8270	5	170
88-06-2	2,4,6-Trichlorophenol	8270	5	170
96-18-4	1,2,3-Trichloropropane	8240	5	130
126-68-1	0,0,0-Triethyl phosphorotioate	8140	20	700
99-35-4	1,3,5-Trinitrobenzene	8270	20	700
(Total)	Vanadium	7911	50	3000
108-05-4	Vinyl Acetate	8240	100	2500
75-01-4	Vinyl Chloride	8240	5	1302
1330-20-7	Xylene (total)	8240	5	130
(Total)	Zinc	6010	50	3000

	METHOD NUMBER		
Miscellaneous Parameters	Aqueous	Solids	Method or Reference Number
pH	9040	9045	1
Alkalinity	310.1	NA	2
Specific conductance	9050	NA	1
Total dissolved solids	160.1	NA	2
Total suspended solids	160.2	NA	2
Dissolved oxygen (profile)	4500-0	NA	3
BOD	405.1	NA	2
COD	410	NA	2
Oil & Grease	9070	9071	1
Total petroleum hydrocarbons	418.1	USEPA Modified 418.1[D]	2
Ammonia nitrogen	350.1	350.1; w/digestion, following Soxhlet Extraction	2
Nitrate/nitrite nitrogen	353.2	9200; w/digestion	2,1
Total phosphorous	365.4	365.4; w/digestion	2
Cl	4500-CL	NA	3
Fe	6010	6010	1
Mn	6010	6010	1
Na	7770	7770	1
Sulfate	9038	9038; Slurry	1

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Mg	6010	6010	1
K	7610	7610	1
Volatile organics[C]	8240	8240	1
Total Organic Carbon	9060	Lloyd Kahn TOC	1/5
Semi-volatile organics	8270	8270	1
Pesticides & PCBs	8080	8080	1
Ca	7140	7140	1
Oxidation - Reduction Potential	D1498	NA	4
Grain Size	NA	D422	4
Bulk Density	NA	D5057-90	4
Cation Exchange Capacity	NA	9081	1
Porosity	NA	1110-2-1906	6

SAMPLE PREPARATION METHOD NUMBERS			
Parameter	Aqueous	Solids	Reference Number
Semivolatile Organics (8270)	3520	3550	1
Pesticides/PCB's (8080)	3520	3550	1
Organophosphorus Pesticides (8140)	3510	3550	1
Chlorophenoxy herbicides (8150)	within 8150 methodology		1
Metals: ICP	3010	3050	1
GFAA	3020	3050	1
Flame	3010	3050	1
Cold Vapor	7470	7471	1

REFERENCES:

[1] "Test Methods for Evaluating Solid Wastes, "EPA SW-846, Third Ed., Nov. 1986.
[2] "Methods for Chemical Analysis of Waters and Wastes", EPA-600/4-79-0202, Rev. 1983.
[3] "Standard Methods for the Examination of Water and Wastewaters", 17th Edition, 1989.
[4] "1991 Annual Book of ASTM Standards", ASTM, Philadelphia, PA.
[5] "Determination of Total Organic Carbon in Sediment", Lloyd Kahn, USEPA, 1988.
[6] "Laboratory Soil Engineering Manual", U.S. Army Corps of Engineers, Nov. 1970.

NOTES:

(A) All quantitation limits given are estimates. Actual reported values will vary depending on sample matrix effects and quality control data.

(B) Quantitation limits for solid samples are given on a wet weight basis. Actual results will be reported on a dry weight basis.

(C) Other SW-846 methods may be substituted for those listed above provided that all listed compounds are reported.

(D) Subsequent sampling rounds may require analysis utilizing low-level methodologies (i.e. EPA Method 524) for volatile organic compounds, subject to USEPA approval. (Personal communication Joanna Hall, TRC-Alliance, July 17, 1992.)

(E) TPH will be analyzed in accordance with technical instructions provided in Attachment B of a letter report provided by Charles Porfert dated May 13, 1992.

(F) 1,4-dioxane method has been changed from 8240 to 8240 mod. The modification is the application of heat to the sample in order to more efficiently bring out the compound.

(G) Isobutyl alcohol method has been changed from 8240 to 8015 mod. Although this results in elevated detection limits, due to previous experience analyzing this compound, this is a more appropriate methodology.

(H) Changes reflected in Table 4 were made to apply method QC criteria to the project. These changes are in accordance with QC criteria as found in EPA Region I Functional Guidelines. The criteria previously applied did not reflect EPA Region I guidance documents.

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REFERENCES

A.T. Kearney, Inc., RCRA Facility Assessment, Preliminary Review/Visual Site Inspection Report of the Columbia Manufacturing Facility, Westfield, Massachusetts, May 1989 (Alexandria, Virginia, 1989).

Boston Society of Civil Engineers, Journal of the Boston Society of Civil Engineers, Report of the Boston Society of Civil Engineers Committee on Floods, Volume 48, Number 4, Section 2 BSCE, (Boston Massachuetss, October 1961).

Bouwer, H., and R.C. Rice, A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells, U.S. Water Conservation Laboratory, Agricultural Research Service, U.S. Department of Agriculture (Pheonix, Arizona, 1976).

Camp Dresser & Mckee, Technical Report, Interim Report, Fate and Transport of Substance Leaking from Underground Storage Tanks, Volume I - Technical Report (USEPA, 1986).

Chin, S.D., Report, Second Draft, Industrial Survey Report on Columbia Manufacturing Company (USEPA, 1990).

Colton, R.B., and J.H. Hartshorn, Geologic Quadrangle Map, Surficial Geology, West Springfield Quadrangle, Massachusetts-Connecticut (USGS, 1971) GQ-892.

Colton, R.B., and J.H. Hartshorn, Geologic Quadrangle Map, Bedrock Geology, West Springfield Quadrangle, Massachusetts-Connecticut (USGS, 1966) GQ-537.

DEQE, Water Supply Protection Atlas Handbook, Commonwealth of Massachusetts Department of Environmental Quality Engineering, Office of Planning and Program Management, Division of Water Supply (1982).

Dragun, J., The Soil Chemistry of Hazardous Materials (Hazardous Materials Control Research Institute, Silver Spring, Maryland, 1988).

Factory Mutual Insurance Company, Modern Tool and Dye Company, The Columbia Manufacturing Co. Div. Westfield, MA. (August 18, 1970).

Freeze, R.A., and J.A. Cherry, Groundwater (Prentice Hall, Englewood Cliffs, N.J., 1979).

Geraghty & Miller, Inc., Environmental Services, AQTESOLV™, Groundwater Modelling Software (Reston, Virginia, 1991).

Hall, N., Dictionary of Metal Finishing Chemicals, Second Edition, Metals and Plastics Publications, Inc., (Westwood, N.J., 1963).

Higgins, G.R., Hydrology Studies in Massachusetts, A Preliminary Report for the Massachusetts Water Resources Commission (1964).

Close File

HMM Associates, Inc., Phase I - Limited Site Investigation, Columbia Manufacturing Company, 1 Cycle Street, Westfield, Massachusetts, Site No. 1-232, May 8, 1989, prepared for the Massachusetts Department of Environmental Quality Engineering (Concord, Massachusetts, 1989).

Maevsky, A., and D.G. Johnson, Water Resources of the Westfield and Farmington River Basins, Massachusetts, Department of the Interior, U.S. Geological Survey, Hydrologic Investigations Atlas, HA-716 (1990).

Merck & Co., Inc., The Merck Index, Eleventh Edition (Rahway, N.J., 1989).

Peterson, R.G., Groundwater Favorability of Westfield River Basin, Massachusetts Water Resources Commission, Prepared in cooperation with the United States Department of the Interior, Geological Survey, MP-60 (1964).

Pioneer Valley Planning Commission, Aquifer Characteristics Map, City of Westfield (July 1984).

Puls, Robert W., and Powell, Robert M., Acquisition of Representative Groundwater Quality Samples for Metals, Groundwater Monitoring Review, Summer, 1992.

Schnabel, R.W., Geologic Quadrangle Map, Surficial Geology, Southwick Quadrangle, Massachusetts - Connecticut (USGS, 1971) GQ-891.

Schnabel, R.W., Geologic Quadrangle Map, Bedrock Geology, Southwick Quadrangle, Massachusetts - Connecticut (USGS, 1974) GQ-1170.

Shacklette, H.T., and J.C. Boerngen, Element Concentrations in Soils and Other Surficial Materials in Conterminous United States, U.S. Geological Survey Professional Paper 1270 (U.S. Government Printing Office, Washington, 1984).

Tighe & Bond, Inc., Consulting Engineers, Technical Report, Interim Progress Report on Remedial Investigations, Columbia Manufacturing Company, May 1986 (Westfield, Massachusetts, 1986).

Tighe & Bond, Inc., Consulting Engineers, Technical Report, RCRA Facility Investigation Proposal, Columbia Manufacturing Co., Inc., Westfield, Massachusetts, Volume I and II (Westfield, Massachusetts, June 1993).

Tighe & Bond, Inc., Consulting Engineers, Technical Report, Columbia Manufacturing Company, Inc., Facility Design Report (Westfield, Massachusetts, November 10, 1993).

U.S. Department of Agriculture, Soil Survey of Hampden County, Massachusetts Central Part, United States Department of Agriculture Soil Conservation Service (in cooperation with Massachusetts Agricultural Experiment Station, May 1978).

U.S. Department of Housing and Urban Development, Flood Insurance Rate Maps, City of Westfield, Hampden County Community Panel Number 250153 0001-0020, May 1, 1978.

Close File

U.S. Department of the Interior, Fish and Wildlife Service, National Wetlands Inventory Map, West Springfield Quadrangle (USFWS, Newton Corner, Massachusetts) No Date.

U.S. Environmental Protection Agency, Letter to MTD regarding Part B filing and a corrective action information request, May 9, 1985.

U.S. Environmental Protection Agency, RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (TEGD) (USEPA, 1986).

U.S. Environmental Protection Agency, Interim Final RCRA Facility Investigation (RFI) Guidance, volumes I through IV, Waste Management Division, Office of Solid Waste (USEPA, 1989).

U.S. Environmental Protection Agency, Risk Assessment Guidance for Superfund (RAGS), Volume I - Human Health Evaluation Manual (Part A, 1989).

U.S. Environmental Protection Agency, Risk Assessment Guidance for Superfund (RAGS), Volume II - Environmental Evaluation Manual, Interim Final (March, 1989).

U.S. Environmental Protection Agency, EPA Region I Supplemental Risk Assessment Guidance for Superfund Program (June 1989).

U.S. Environmental Protection Agency, Handbook of RCRA Ground-Water Monitoring Constituents Chemical Physical Properties (40 CFR Part 264, Appendix 9) (USEPA, Washington, D.C., September 1992).

USEPA Risk Reduction Engineering Laboratory, RREL Chemical Data Base for Physical and Chemical Properties, (USEPA, Cincinnati, Ohio, 1992).

United States Geological Survey, personal communication with Thomas Shepard on September 28, 1994 regarding statistical flood flows for 50 year through 500 year events.

United States Geological Survey, Environmental Geologic and Hydrologic studies, Contribution 182, Map of Flood-Prone Areas, West Springfield Quadrangle, Massachusetts-Connecticut, Connecticut Valley Urban Area Project (USGS Open-File Map, 1976).

Veneman, Peter L.M., Laboratory Data and Descriptions for Selected Soils in Massachusetts I (Massachusetts Agricultural Experiment Station, College of Food and Natural Resources, University of Massachusetts at Amherst, Research Bulletin Number 706, October 1985).

Verschueren, K., Handbook of Environmental Data on Organic Chemicals, 2nd edition, (Van Nostrand Reinhold, New York, 1983).

Weston Geophysical Engineers, Inc. Compilation of Geophysical Studies Conducted by Weston Geophysical Engineers, Inc. Throughout Massachusetts, for Massachusetts Water Resources Commission, Part I (Westborough, Massachusetts, 1967).