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April 1, 2011

Mr. Joseph LeMay, P.E.
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Mail Code: OSSR07-4
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Subject: Industri-plex Superfund Site, Operable Unit 2, Woburn, Massachusetts Submission of Remedial Design Work Plan

Dear Mr. LeMay:

Pursuant to Section VI, paragraph 11(a) of the Consent Decree for Remedial Design / Remedial Action (Civil Action No. 1:08-cv-10325) (the RD/RA CD), and Section V.B.2 and Attachment A of the Statement of Work (SOW) attached to the RD/RA CD for the above-referenced site and on behalf of Pharmacia Corporation by its attorney-in-fact Monsanto Company, and Stauffer Management Company LLC as litigation agent for Bayer CropScience Inc. (collectively, the "Settling Defendants"), enclosed please find two copies of the draft final Remedial Design Work Plan (RDWP), along with one electronic copy.

Hard copies and / or electronic versions of the RDWP will be sent directly to the following:

- Mr. Gordon Bullard – Twin Light Associates
- Mr. Paul Dombrowski - AECOM
- Dr. Robert Ford – US EPA
- Woburn Town Library
- Ms. Linda Raymond – Aberjona Study Coalition, Inc.

SDMS DocID 482806

Sincerely,

Bruce R. Thompson
Project Coordinator

Encl: Remedial Design Work Plan

cc: Jennifer McWeeney, MassDEP
David Peterson, Esq., US EPA
Donald Frankel, Esq., US DOJ
Randall Cooper, Monsanto Company
Carol Dickerson, Stauffer Management Company LLC

DRAFT

REMEDIAL DESIGN WORK PLAN

Industri-plex Operable Unit 2
(including Wells G&H Operable Unit 3) Superfund Site
Woburn, Massachusetts

Prepared by:

Haley & Aldrich, Inc.
465 Medford Street
Boston, Massachusetts 02129

March 2011

DRAFT

Disclaimer: This document is a DRAFT document prepared by the Settling Defendants under a government Consent Decree. This document has not undergone formal review by the U.S. Environmental Protection Agency or the Massachusetts Department of Environmental Protection. The opinions, findings, and conclusions, expressed are those of the author and not those of the U.S. Environmental Protection Agency or the Massachusetts Department of Environmental Protection.

EXECUTIVE SUMMARY

Haley & Aldrich has prepared this Remedial Design Work Plan (RDWP) for the Industri-plex Superfund Site Operable Unit No. 2, Woburn, Massachusetts (hereinafter the "Site" or "Industri-plex OU2") on behalf of Pharmacia Corporation by its Attorney-in-Fact Monsanto Company and Stauffer Management Company LLC, as litigation agent for Bayer CropScience Inc. (collectively, the Settling Defendants). This RDWP describes the processes for collecting design data and developing a remedial design (RD) in accordance with the Consent Decree that was lodged on February 27, 2008 with the United States District Court for the District of Massachusetts in connection with Civil Action No. 1:08-cv-10325 (the CD), and with the Remedial Design/Remedial Action (RD/RA) Statement of Work (SOW) that is attached as Appendix D to the CD.

The RD process will place a significant focus on the Halls Brook Holding Area (HBHA). The HBHA consists of a surface water body (the HBHA Pond) and a downstream wetland originally designed and constructed to serve as a storm water management facility. The HBHA Pond is 4.6 acres in size. Immediately south of the HBHA Pond is the HBHA wetland, which covers approximately 10.6 acres. Surface water discharges into the HBHA Pond from three main sources: Halls Brook (primary contributor under base flow), Atlantic Avenue Drainway (AAD), and Right of Way Number 9 (ROW No. 9) outfall. Water exits the HBHA Pond from one outlet at its south end.

The RD process also will focus on the New Boston Street Drainway (NBSD), West Hide Pile (WHP) Area, Former Lake Mishawum (FLM), Wells G&H wetland, and Cranberry Bog Conservation Area (CBCA). Figure ES-1 (attached at the end of this RDWP along with other tables and figures referenced in the main body of the RDWP) is a Site plan highlighting these areas of interest.

EPA's selected remedy, presented as alternative HBHA-4 in the Record of Decision[1] (ROD), consists of the following components:

- Dredging and off-site disposal of contaminated sediments in the southern portion of the HBHA Pond[2]; dredging and off-site disposal of contaminated near shore sediments at the Wells G&H Wetland and CBCA; and restoration of all disturbed areas.

- Use of the northern portion of HBHA Pond as a sediment retention area that will intercept contaminated groundwater plumes from Industri-plex OU1, treat/sequester contaminants of concern (COCs) including arsenic, benzene and ammonia, and minimize downstream migration of COCs. To intercept contaminated groundwater and treat/sequester COCs present in surface water, the HBHA-4 remedy concept described in the ROD utilizes two cofferdams, a treatment chamber between the cofferdams, and a storm water bypass structure to route storm flows to the south of the cofferdams. This remediation design concept uses the two cofferdams to divide the HBAH Pond into three sections: a primary treatment cell, a secondary treatment cell, and a tertiary or southern cell. The primary treatment cell will be located to intercept contaminated groundwater discharging into the HBHA Pond. Water retained behind the first cofferdam in the primary treatment cell is assumed to remain stratified and sequester arsenic below the chemocline. To address COCs that may be present above the chemocline and that may flow out of the primary treatment cell into the secondary treatment cell, the HBHA-4 remedy as described in the ROD, aerates water in the secondary treatment cell for further treatment/polishing between

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[1] Industri-plex OU2 ROD dated January 2006.
[2] To the extent there is a defined southern cell in the final remedy design.

the cofferdams. Aerated water then passes over the second cofferdam into the restored southern cell and then discharges from the HBHA Pond. The compliance point for the HBHA-4 remedy is the outlet of the secondary treatment cell. Storm flows that may mix water across the chemocline would be re-routed around the primary and secondary treatment cells, to the extent necessary.

The remedy described in the ROD also includes the following components:

- If necessary, in situ enhanced bioremediation of contaminated groundwater plumes (e.g., benzene) at the WHP
- Construction of an impermeable cap to line stream channels as needed to prevent the discharge of contaminated groundwater plumes, contamination of stream sediments, downstream migration of COCs, and potential impacts to other components of the selected remedy
- Construction of a permeable cap as needed to prevent contaminated soil erosion , downstream migration of COCs, and potential impacts to other components of the selected remedy
- Establishing Institutional Controls (ICs) to restrict contact with soils, groundwater, or deeper interior wetland sediments with concentrations above Performance Standards and protect the remedy
- Wetlands mitigation of appropriate scope and location to mitigate for any loss of wetland functions and values that may occur as a result of the implementation of the remedy
- Long-term monitoring of the groundwater, surface water, and sediments, and periodic five-year reviews of the remedy

The SOW describes the Performance Standards related to each of the remedy elements noted above. In general, the Performance Standards are numerical cleanup standards or operational standards related to the work, all intended to satisfy the remediation objectives summarized in the ROD.

Pursuant to the SOW, the final design of HBHA Pond component of the selected remedy may differ from the conceptual layout in the ROD, including but not limited to one design option that uses the entire HBHA Pond to serve as the sediment retention area and perform the treatment functions assigned in the ROD to the primary and secondary treatment cells. Consequently, the specific details of the design and implementation of the selected remedy will be finalized during the RD phase, and will be based on the results of various pre-design investigations. Thus, it is possible that the remedy for the HBHA Pond will differ to some degree from the conceptual layout described in the ROD.

To lay the foundation for the Industri-plex OU2 RD process, this RDWP encompasses two main topics: pre-design investigations[3] (PDIs) and the overall RD framework. The PDIs necessary to support the RD for the Industri-plex OU2 remedy can be grouped in two categories: those relating to the use of the Pond for treatment and others relating to more or less stand-alone elements of the Industri-plex OU2 remedy.

The RD framework and engineering design process as described in this RDWP involves three sequential steps.

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[3] While PDIs described in the Field Sampling Plan (FSP) appended to this RDWP are generally focused on field-related investigations, a few of the design studies involve the development of models with limited field investigation components. These “modeling focused” studies are included alongside other PDIs for completeness and because of their inter-related nature.

- **Planning (RDWP) -** The RD planning process involves scoping the PDIs and preparation of this RDWP. The PDIs, which are contemplated in the ROD and SOW as a fundamental part of the RD/RA process, will take the conceptual design presented in the ROD and SOW to greater levels of definition through the subsequent 30%, 95%, and 100% design stages. The RD/RA Project Operations Plan (POP), which includes the Site Management Plan (SMP), Sampling and Analysis Plan (SAP), Quality Assurance Project Plan (QAPP), Field Sampling Plan (FSP), Site-specific Health & Safety Plan (HASP), and Community Relations Support Plan (CRSP) are integral to this RDWP.

- **Design Data Collection and Project Development (through 30% Design) -** The design data collection and project development step builds on the planning elements described in this RDWP to bring the project from a conceptual design (as presented in the ROD/SOW) to a schematic design stage (in the 30% design submittal).

- **Design Development (30% to 100%) -** When the 30% design is submitted, the scope of the remedy (particularly the Pond remedy elements) should be established, based on the outcome of the PDIs and project development process. Several PDIs, due to their duration, seasonal test requirements, or other timing/sequencing issues, may continue past the submittal of the 30% design. As the remedial design progresses, the design development process will advance from a conceptual to a fully developed state (i.e., 95% design milestone), and then to a final state (100% design milestone), that will include contract documents providing sufficiently detailed plans and specifications to procure contractors and implement the remedy.

Figure ES-2 is a RD process flowchart summarizing the sequential steps described above.

TABLE OF CONTENTS

		Page
EXECUTIVE SUMMARY		**i**
LIST OF TABLES		**vi**
LIST OF FIGURES		**vi**
1.0	**INTRODUCTION**	**1**
1.1	Background	1
1.1.1	Project Setting	1
1.1.2	Fate and Transport Summary	2
1.2	Remedial Design and Remedial Action	3
1.2.1	Remedial Action Objectives	4
1.2.2	Cleanup Standards	4
1.2.3	Remedy Components	4
1.3	Remedial Design Work Plan	6
1.3.1	Pre-design Investigations/Studies	7
1.3.2	Remedial Design Process	7
1.3.3	Remedial Design Considerations	8
2.0	**HBHA POND CONDITIONS**	**15**
2.1	Background	15
2.2	Chemocline and Fate and Transport	15
2.3	Role of Mixing in Downstream Migration	17
3.0	**REMEDIAL DESIGN SUPPORT ACTIVITIES**	**18**
3.1	HBHA Pond	18
3.1.1	PDI-1: HBHA Pond Sediment Dredging	19
3.1.2	PDI-3: Groundwater Investigation	20
3.1.3	PDI-4: HBHA Pond COC Transformation Processes & Studies	22
3.1.4	PDI-5: Tank Treatability Studies	27
3.1.5	PDI-6: Geotechnical Investigations	29
3.1.6	PDI-7: HBHA Flood-routing Modeling Analysis	32
3.1.7	PDI-8: HBHA Pond Hydrodynamic Modeling	33
3.1.8	PDI-10: Impermeable Caps	33
3.1.9	PDI-11: Permeable Caps	34
3.1.10	PDI-13: Studies to Locate Property(ies) for Construction of Compensatory Wetlands	34
3.1.11	PDI-14: Ammonia Background Investigation	35
3.1.12	PDI-15: HBHA Pond Aeration Pilot Test	36
3.1.13	PDI-16: Cofferdam Simulation Pilot Test	38
3.2	WHP In-situ Enhanced Bioremediation	39
3.2.1	PDI-9: West Hide Pile Investigations and Assessment	39
3.3	Removal and Restoration of Near Shore Sediments from the Wells G&H Wetland and CBCA	41
3.3.1	PDI-2: Wells G&H and CBCA Wetlands Sediment Dredging/Excavation	41
3.4	Institutional Controls	43
3.4.1	PDI-12 Soil and Groundwater Institutional Controls	43
3.5	Sequence and Key Decision Framework of PDIs	46

TABLE OF CONTENTS
(continued)

4.0 ENGINEERING DESIGN PROCESS 47

4.1 Design Elements 47
4.1.1 Land Surveying and Base Map Development 47
4.1.2 Staging and Site Preparation 48
4.1.3 Material & Equipment Availability, and Material Durability, Testing and Handling 48
4.1.4 Waste Disposal 48
4.1.5 Environmental Controls and Monitoring 49
4.1.6 Sequencing and Scheduling 49
4.2 Remedy Engineering Design Components 50
4.3 Design Considerations for Engineering Design Components 50

5.0 PROJECT ORGANIZATION 51

5.1 EPA Project Personnel 51
5.1.1 Roles and Responsibilities 51
5.2 EPA Oversight Contractor 51
5.3 MassDEP Involvement 51
5.4 Settling Defendants 51
5.4.1 Roles and Responsibilities 51
5.5 Project Coordinator / Supervising Contractor 51
5.6 Project Design Team 52
5.6.1 Haley & Aldrich – Remedial Design Contractor 52
5.6.2 Roux Associates – Surface Water Monitoring Program Implementing Contractor 52
5.6.3 Geosyntec Consultants – Surface Water Modeling, Peer Review, and Technical Support Consultant 53

6.0 PROJECT SCHEDULE 54

REFERENCES 55

TABLES
FIGURES
ATTACHMENT 1 - Microbiological Monitoring Supplement

APPENDICES (BOUND SEPARATELY AND INDIVIDUALLY)
APPENDIX A - Site Management Plan
APPENDIX B - Sampling Analysis Plan - Quality Assurance Project Plan
APPENDIX C - Sampling Analysis Plan - Field Sampling Plan
APPENDIX D - Site-Specific Health and Safety Plan
APPENDIX E - Community Relations Support Plan
APPENDIX F - Surface Water Monitoring Plan (Submitted Separately by Roux Associates, Inc.)

LIST OF TABLES

Table No.	Title
1.2.2-1	Performance Standards
2.3-1	Arsenic Concentrations Under Baseflow and Storm flow Conditions
3.1.6-1	SWMM5 Model Input Information

LIST OF FIGURES

Figure No.	Title
ES-1	Industri-plex OU2 Site Plan
ES-2	Remedial Design Work Plan: Design Process Flowchart
1.1.2-1	Locus
1.2.2-1	Ammonia NRWQC – Chronic Criterion Fish Early Life Stages Present
2.2-1	Stratification Measured at the North Monitoring Station in HBHA Pond
3.1-1	Pre-Design Investigation CPM Schedule
3.1.1-1	PDI-1: Proposed HBHA Pond Dredging Delineation Sample Locations
3.1.2.1-1	Interpreted Extent of Groundwater Plumes
3.1.2.1-2	Interpreted Extent of Ammonia Groundwater Plume
3.1.2.1-3	PDI-3A: Groundwater Plume Discharge Area Delineation
3.1.2.2-1	PDI-3B: Proposed Groundwater Sampling Transects
3.1.3.2-1	Conceptual Profile, Fate and Transformation Pathway Diagrams
3.1.3.3-1	PDI-4C: Monitoring Stations and Related Locations
3.1.3.3-2	PDI-4C: CTD Sensor Station Configuration
3.1.4-1	Free Ammonia vs. pH Chart and pH Histogram

LIST OF FIGURES
(continued)

Figure No.	Title
3.1.5-1	PDI-6: HBHA Pond Geotechnical Borings
3.1.5.1-1	PDI-6: Exposed Sewer Lines
3.1.5.1-2	PDI-6: Location of Sewer Easements Adjacent to HBHA Pond
3.1.8-1	PDI-10: Impermeable Cap Investigations
3.1.9-1	PDI-11: Permeable Cap Investigation
3.1.11-1	PDI-14: Ammonia Background Sampling Locations
3.1.13-1	PDI-16: Cofferdam Simulation Pilot Test Layout Plan
3.1.13-2	PDI-16: Cofferdam Simulation Flexible Curtain Schematic Detail
3.2.1-1	PDI-9: West and East Hide Pile Investigation
3.3.1-1	PDI-2: Wells G and H Wetland Proposed Sampling Locations
3.3.1-2	PDI-2: Cranberry Bog Conservation Area Wetland Sampling Locations
3.4.1.1-1	PDI-12A: Former Lake Mishawum Soil & Groundwater Investigation
3.4.1.2-1	PDI-12B: Groundwater Institutional Control Delineation Proposed Groundwater Sampling Locations
5.1-1	Project Organization Chart
6-1	Remedial Design CPM Schedule

LIST OF ACRONYMS

Acronym	Agency/Organization/Definition
AAD	Atlantic Avenue Drainway
AOB	Ammonia-Oxidizing Bacteria
ARAR	Applicable or Relevant and Appropriate Requirement
CBCA	Cranberry Bog Conservation Area
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC	Contaminant of Concern
CPM	Critical Path Method
CQA	Construction Quality Assurance
CRSP	Community Relations Support Plan
CSM	Conceptual Site Model
DO	Dissolved Oxygen
DC	Design Considerations
EDC	Engineering Design Components
EHP	East Hide Pile
EMP	Environmental Monitoring Plan
EPA	United States Environmental Protection Agency
FDT	Fluorescent Dye Tracer
FEMA	Federal Emergency Management Agency
FLM	Former Lake Mishawum
FML	Flexible Membrane Liner
FSP	Field Sampling Plan
GSIP	Groundwater/Surface Water Investigation Plan
HASP	Site-specific Health & Safety Plan
HBHA	Halls Brook Holding Area
IC	Institutional Control
MassDEP	Massachusetts Department of Environmental Protection
MBTA	Massachusetts Bay Transportation Authority
NBSD	New Boston Street Drainway
NOB	Nitrite-Oxidizing Bacteria
NRWQC-CCC	National Recommended Water Quality Criterion
O&M	Operations and Maintenance
OU1	Operable Unit 1 (Industri-plex Site)
OU2	Operable Unit 2 (Industri-plex Site)

LIST OF ACRONYMS
(continued)

Acronym	Agency/Organization/Definition
PDI	Pre-Design Investigation
POP	Project Operations Plan
QAPP	Quality Assurance Project Plan
RAO	Response Action Objective
RD/RA	Remedial Design/Remedial Action
RDC	Remedial Design Contractor
RDWP	Remedial Design Work Plan
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
ROW	Right of Way
S.U.	Standard pH Units
SAP	Sampling and Analysis Plan
SC	Supervising Contractor
SMP	Site Management Plan
SOW	Statement of Work
SWMP	Surface Water Monitoring Plan
TKN	Total Kjeldahl Nitrogen
VOC	Volatile Organic Compound
WHP	West Hide Pile

1.0 INTRODUCTION

Haley & Aldrich, Inc. has prepared this Remedial Design Work Plan (RDWP) on behalf of Pharmacia Corporation by its Attorney-in-Fact Monsanto Company and Stauffer Management Company LLC, as litigation agent for Bayer CropScience, Inc. (Settling Defendants). This RDWP describes the processes for the collection of design data and development of a remedial design (RD) for the Industri-plex Superfund Site Operable Unit No. 2, Woburn, Massachusetts (hereinafter "Industri-plex OU2" or "Site"). This RDWP was prepared in accordance with the Consent Decree that was entered on November 24, 2008 by the United States District Court for the District of Massachusetts in connection with Civil Action No. 1:08-cv-10325 (CD), and with the Remedial Design/Remedial Action (RD/RA) Statement of Work (SOW) that is attached as Appendix D to the CD.

1.1 Background

On January 31, 2006, the United States Environmental Protection Agency (EPA) issued a Record of Decision (ROD) documenting the cleanup decision for Industri-plex OU2. The cleanup actions are outlined under "Section L, The Selected Remedy" of the ROD (p. 86 – 104) and referred to as the "Selected Remedy". A summary of the project setting and fate and transport mechanisms is provided below.

1.1.1 Project Setting

As described in Part 2 of the ROD, in 1983, EPA identified two Superfund sites along the Aberjona River in Woburn, Massachusetts: the Industri-plex Site and Wells G&H Site. Situated in northern Woburn, Massachusetts, the Operable Unit No. 1 (OU1 or OU-1) portion of the Industri-plex Superfund Site is primarily contaminated with metals (e.g., arsenic, lead, and chromium) and buried animal hide wastes. Wells G&H Operable Unit No. 3 (OU3 or OU-3) portion of the Wells G&H Superfund Site is referred to as the Aberjona River Study and investigates surface water and sediment contamination along the river and its associated wetlands. As a result of the similar sediment contamination (e.g., metals such as arsenic) at the two Superfund sites, EPA merged the Wells G&H OU3 into Industri-plex OU2 to establish one comprehensive cleanup plan for the Aberjona River and associated wetlands.

"Heavy metals are the principal contaminants of concern throughout Industri-plex OU-2, with arsenic representing the most significant metal present at elevated concentrations throughout the system. The most significant source of metals contamination has been from Industri-plex OU-1. Although the contaminated soils have been capped as part of the Industri-plex OU-1 remedy, they continue to impact groundwater at OU-1 and discharge inorganics (including dissolved arsenic) to the HBHA Pond, the HBHA Wetlands and the Aberjona River. Once contaminants are discharged from groundwater to the surface water bodies, sediments and surface water are impacted and the contaminants are transported further downstream.

"Several organic contaminants (including benzene) were also detected in soils and groundwater in the Northern Study Area. Benzene was the most frequently detected VOC at concentrations exceeding state standards for groundwater. In addition to the inorganic and organic groundwater plumes, these plumes also include high concentrations of ammonia. The ammonia is primarily generated from the buried organic waste at Industri-plex OU-1 (e.g., animal hide waste). The ammonia, along with the inorganic and organic plumes, primarily discharges into the HBHA Pond, and contribute to sediment and surface water impacts in the pond." (ROD, p. 12)

A more extensive description of the Site and its history is provided in Part 2 of the ROD, as well as supporting documentation such as the March 2005 Comprehensive MSGRP RI, and October 2005

Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data (October 2005 Technical Memorandum). The approximate boundaries of Industri-plex OU2 are shown on the Site locus, Figure 1-1.

1.1.2 Fate and Transport Summary

"The fate and transport of contaminants involve complicated and interdependent processes that affect the mobilization of contaminants between various media and areas. The principal source of contamination within Industri-plex OU-2 is the capped soils underlying Industri-plex OU-1. These contaminated soils are impacting groundwater, which in turn discharges to the HBHA Pond and wetlands and northern portions of the Aberjona River, subsequently impacting surface water and sediment. The surface water flows from the HBHA and Aberjona River combine at Mishawum Road and represents the primary contaminant transport vehicle for downgradient receptors." (ROD, p. 32)

"The most significant ongoing transport process for metals in soils underlying Industri-plex OU-1 is leaching to groundwater. Once in groundwater, contaminants continue to migrate. The contaminants most widely detected in groundwater include arsenic, benzene, toluene, ammonia and to a lesser degree, lead and zinc. Contaminants are then transported through groundwater flow paths where they predominantly discharge in the northern portions of the HBHA Pond and migrate downstream impacting sediments and surface water." (ROD, p. 33)

"Available data indicate that the biological activity occurring primarily from the degradation of buried animal hide waste materials, as well as soils contaminated with aromatic hydrocarbons [benzene and toluene], help produce a reducing environment in groundwater. The abundance of buried animal hide waste at Industri-plex OU-1 significantly contributes to these reducing conditions. In turn, metals, such as arsenic and iron, are being reduced, rendered more soluble, and therefore much more mobile in groundwater. … Also, … the reducing conditions assist in the migration of ammonia." (ROD, p. 33)

"A fraction of the dissolved arsenic being discharged from groundwater into the HBHA Pond sediments becomes bound to ferric oxides and is effectively removed from the water column and becomes part of the sediment load in the pond. However, a portion of the sediment-bound arsenic is released and migrates through the sediments up into the water column. This arsenic can either be further sequestered from solution or transported downstream. These reactions are dependent upon a fairly stable chemocline that is present at about the mid-water depth." (ROD, p. 34)

"The chemocline is the result of the difference in density between oxic surface water and anoxic contaminated groundwater and steady inputs of oxygen, iron, sulfates, and organic carbon.[4] … Below the chemocline in deep surface water, high concentrations of dissolved arsenic (up to 5,043 µg/L), benzene (up to 2,530 µg/L), and ammonia (up to 1,270 mg/L) are present in the HBHA Pond. Sudden increases in flows, as seen during storm conditions, mix the water column and destabilize the chemocline thus allowing more arsenic to be 'flushed' downstream.

"Once in the surface water column, as either dissolved or associated with the suspended solid load, arsenic will continue to migrate downstream with the flow of water. Depending on the geochemical and flow conditions, dissolved metals in the water column may adsorb to suspended solids, such as fine

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[4] This description of a "chemocline" is quoted from the ROD. A "chemocline" is more accurately defined as a boundary between different *chemical* conditions in the surface water column. A *density* gradient should be referred to as a "pycnocline." A *salinity* gradient is a "halocline." Except where embedded within quotes from the ROD, the term "chemocline" as used in this document refers to the chemical boundary separating oxic shallow waters from anoxic deeper waters in the surface water column of the HBHA Pond.

grained soil particles or other metal complexes and either settle out and become part of the sediment bed load or be transported within the water column as part of the suspended solid load and be deposited at locations downstream." (ROD, p. 34)

"Industri-plex OU-1 has a very large source of organic nitrogen in the form of buried animal hide wastes. As bacteria decompose the waste, some of the nitrogen that was bound up in complex organic molecules can be released to the soil as ammonia. Through leaching processes, the ammonia is converted to ammonium by reacting with water. … However, ammonium is a reduced compound, so if there is no oxygen present, it will not transform or be converted to a more soluble form. Under these reduced conditions, ammonium will be transported conservatively through the aquifer. In the case of Industri-plex OU-2, reduced groundwater conditions have been documented at Industri-plex OU-1 south to Interstate 95 within the Northern Study Area (MSGRP, 2005a). These reduced and anoxic groundwater conditions at Industri-plex OU-2 allow the ammonium to remain in groundwater (up to 2,710 mg/L), migrate with the groundwater flow towards the south, and discharge into the HBHA Pond.

"High concentrations of ammonia, as part of the contaminated groundwater plumes from Industri-plex OU-1, are discharged into HBHA Pond resulting in high concentrations of ammonia in surface water. The presence of the chemocline in the HBHA Pond helps sequester the highest ammonia concentrations at depth (up to 1,762 mg/L) by limiting vertical transport and assisting natural processes available to convert some of the ammonia to nitrates, nitrites, and nitrogen gas. … The shallow surface water (0 – 100 cm) ammonia concentrations were elevated up to 31.1 mg/L. Hence, as described earlier, the chemocline within the HBHA Pond helps keep high concentrations of contaminants, including ammonia, below the chemocline in deeper surface water." (ROD, p. 35)

"Based on the surface water data, surface water clearly is the transport mechanism that is facilitating the transport of arsenic (and other metals) through the river system downstream of Industri-plex OU-1. This fate and transport mechanism is demonstrated by the baseflow and stormflow surface water sample data collected during the 18-month investigation and is also evidenced by sediment data collected throughout the Aberjona River. Based on these data, the highest concentrations of arsenic are within Industri-plex OU-2 and steadily decrease as the river flows south to the Mystic Lakes. The highest concentrations of arsenic at Industri-plex OU-2 were found at the HBHA with the highest storm flow concentrations observed at HBHA Pond outlet (MSGRP RI surface water Station 2) and highest baseflow observed at HBHA Wetland outlet (MSGRP RI surface water Station 4). Concentrations of arsenic and other metals in surface water at the furthest downstream monitoring stations, located at the Mystic Lakes, show further reductions in metals concentrations, as well as TSS concentrations, during both baseflow and stormflow conditions." (ROD, p. 37)

A more extensive description of the Site and its history is provided in Part 2 of the ROD, as well as supporting documentation such as the March 2005 Comprehensive MSGRP RI, and October 2005 Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data (October 2005 Technical Memorandum).

1.2 Remedial Design and Remedial Action

On 31 January 2006, EPA issued a ROD selecting the remedy for Industri-plex OU2. The ROD identified areas of concern warranting remediation and evaluated remedial alternatives to address those identified concerns. The following sections summarize the Response Action Objectives (RAOs), Performance Standards, and components of the Selected Remedy.

1.2.1 Remedial Action Objectives

"Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, response action objectives (RAOs) were developed to aid in the development and screening of alternatives. These RAOs were developed to mitigate, restore and/or prevent existing and future potential threats to human health and the environment." (ROD, p. 55) The RAOs for the Selected Remedy for Industri-plex OU-2 are provided in Section H of the ROD (p. 55-56), and include the objective of "[minimizing], to the extent practicable, the migration of soluble and particulate arsenic during storm events to downstream depositional areas." In addition, "Expected Outcomes of the Selected Remedy" are presented in Section L.4 of the ROD (p. 98 - 104), and includes the statement that "[b]ased upon the June 2005 Draft Technical Memorandum – Model Simulation of Flow, Suspended Sediment, and Heavy Metal Transport for the Aberjona Watershed, it is anticipated that the contaminant migration from the northern portion of the HBHA Pond will be reduced by 90%" as a result of the implementation of the Selected Remedy. (ROD, pp. 98-99).[5]

1.2.2 Cleanup Standards

The Selected Remedy involves several media and areas of concern within Industri-plex OU2 and along the Aberjona River. The cleanup standards for groundwater, surface water, soil, and sediment media and their respective compliance points are set forth in Section L.4a. of the ROD (pgs. 99-104) and Section IV.A of the SOW. The Consent Decree defines "Performance Standards" as "the cleanup standards and other measures of achievement of the goals of the Remedial Action, set forth in Section L of the ROD and Section IV of the SOW." These cleanup standards are shown on Table 1.2.2-1 of this document. Figure 1.2.2-1 presents a graph of the ammonia NRWQC as a function of temperature for a variety of pH values.
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1.2.3 Remedy Components

As detailed in the ROD (p. 86-87) and SOW (p. 6-7), the major components of the Selected Remedy include the following:

1. Halls Brook Holding Area (HBHA) Pond

    a. "Use of the northern portion of HBHA Pond as a sediment retention area (primary and secondary treatment cells) that will intercept contaminated groundwater plumes (including arsenic, benzene, ammonia, 1,2-dichloroethane, trichloroethene and naphthalene) . . ., treat/sequester contaminants of concern (including arsenic, benzene and ammonia) and minimize downstream migration of contaminants (including arsenic, benzene and ammonia). The primary treatment cell shall intercept the contaminated groundwater plumes discharging into the HBHA Pond. The secondary treatment cell shall further treat contaminants of concern, and address any episodic releases from the primary treatment cell. The effluent from the northern portion of the HBHA Pond (secondary treatment cell outlet) shall serve as the surface water compliance boundary and achieve National Recommended Water Quality Criteria (NRWQC). Sediments which accumulate in the northern portion of the HBHA Pond shall be periodically dredged and sent off-site for disposal. Portions of storm water from Halls Brook, which may interfere with the natural treatment processes occurring within the northern portion

[5] The cited "June 2005 Draft Technical Memorandum" on page 98 of the ROD modeled the "Optimum Cofferdam scenario" and is the source of the "90%" (Table 8-4) reduction for total arsenic flux. The specific percentage of "90%" reduction is simulated in the model, and will serve as a benchmark during the RD process to determine the maximum extent practicable of total arsenic flux reduction that can be achieved.

of the HBHA Pond, shall be diverted to the southern portion of HBHA Pond." (SOW, p. 5-6)

b. "Dredging and off-site disposal of contaminated sediments in the southern portion of the HBHA Pond; … and restoration of all disturbed areas." (SOW, p. 5)

c. "Construction of an impermeable cap to line stream channels (e.g. New Boston Street Drainway), and to prevent the discharge of contaminated groundwater plumes, contamination of stream sediments, downstream migration of contaminants of concern, and potential impacts to other components of the selected remedy." (SOW, p. 6)

d. "Construction of a permeable cap to prevent contaminated soil erosion (e.g. Area A6), downstream migration of contaminants of concern, and potential impacts to other components of the selected remedy." (SOW, p. 6)

2. West Hide Pile

a. "[C]ollect additional groundwater, surface water and sediment data at/near the WHP area (including the East Hide Pile (EHP)) and nearby wetlands to further understand contaminated groundwater migration and impacts. The data must also be sufficient for EPA to determine if additional unacceptable human health and/or ecological risks exists at the WHP and nearby wetlands." (SOW, p 7)

b. "If selected by EPA, In-situ Enhanced Bioremediation of contaminated groundwater plumes (e.g., benzene) at the West Hide Pile (WHP)." (SOW, P. 6) [6]

3. Near Shore Sediments

a. "Dredging and off-site disposal of contaminated near shore sediments at the Wells G&H Wetland and Cranberry Bog Conservation Area; and restoration of all disturbed areas." (SOW, p. 5)

4. Institutional Controls (ICs)

a. "Establishing Institutional Controls to restrict contact with soils, groundwater, or deeper interior wetland sediments with concentrations above cleanup standards and protect the remedy. The controls shall be consistent with EPA's "Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups" (OSWER 9355.0-74 FS-P, cited in EPA's Administrative Record Compendium of Guidance Documents)." (SOW, p. 6)

5. Wetlands

a. "Construction of compensatory wetlands for any loss of wetland functions and values associated with the selected remedy (e.g. northern portion of the HBHA Pond, Halls Brook storm water by-pass, capped stream channels) nearby in the watershed. (SOW, p.6) [7]

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[6] Section III of the SOW (page 7) also notes that "[i]f Institutional Controls have been properly established on the properties restricting human health exposures to contaminated groundwater, and EPA determines that there are no other unacceptable human health and/or ecological risks, then it may not be necessary to implement this enhanced bioremediation component of the remedy at the WHP."

[7] Section IV of the SOW (page 15) also notes that "Wetland and water function and value losses resulting from the selected remedy (e.g. northern portion of the HBHA Pond, stormwater by-pass system, capped areas) shall be

6. Long-Term Monitoring

   a. "Long-term monitoring of the groundwater, surface water, and sediments, periodic monitoring and inspection of the Institutional Controls, and periodic Five-year Reviews of the remedy." (SOW, p. 7)

The first five major components listed above will require specific engineering designs and were further consolidated into four engineering design components (HBHA Pond, West Hide Pile, Near Shore Sediments, and Institutional Controls), where Wetlands were incorporated under the HBHA Pond remedy component. These engineering design components will be further described under section 1.3.3.

"The specific details of the design and implementation of the selected remedy will be finalized during the Remedial Design phase, and will depend on the results of the various pre-design investigations. The final design of the HBHA Pond component of the selected remedy may differ somewhat from the conceptual layout of the two low-head cofferdam system described in the ROD for the HBHA Pond component. The HBHA Pond component, for example, has many sub-components which are inter-dependent: The location of the first low-head cofferdam and size of the primary treatment cell will greatly depend upon pre-design investigations to further delineate the extent of the contaminated groundwater plumes' discharge into the HBHA Pond so that the primary treatment cell captures all of the contaminated groundwater plumes. The locations of the first low-head cofferdam, the size of the primary treatment cell and the design of the secondary treatment cell will directly affect other remedy components such as the length/size of the Halls Brook storm water by-pass system, the size of the southern portion of the HBHA Pond requiring dredging and restoration, and the amount of wetlands compensation. During the pre-design investigations and Remedial Design phase, efforts will be made to design the cofferdams to be the same height as the HBHA pond outlet invert level in order to further minimize flood storage losses, without diminishing the effectiveness and objectives of the primary and secondary treatment cells in conformance with the ROD. Depending upon the final design of the HBHA Pond component, one design option may be using the entire HBHA Pond as the sediment retention area which includes the primary and secondary treatment cells. The final design will comply with all applicable or relevant and appropriate ('ARAR') standards identified in the ROD, including, but not limited to, the Massachusetts Wetlands Protection Act, and Federal Statement of Procedures on Floodplain Management and Wetlands Protection (including Executive Order on Floodplain Management and Executive Order on Protection of Wetlands)." (SOW, p. 7)

1.3 Remedial Design Work Plan

The Remedial Design Work Plan (RDWP) requirements are outlined in the RD/RA SOW. The RDWP describes the RD process required to produce a final contract document package suitable for bidding and construction in the subsequent Remedial Action (RA) phase. To achieve this outcome and manage the design development process, the SOW organizes the RD into 30%, 95%, and 100% design stages. These design milestones are intended to progressively build the necessary detail from a schematic state through final construction documents. Each sequential design milestone document will be submitted to EPA for review and approval in accordance with the SOW and as discussed below.

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compensated nearby in the watershed in conformance with the ROD and all ARARs, including, but not limited to, the Massachusetts Wetlands Protection Act and Federal Clean Water Act."

1.3.1 Pre-design Investigations/Studies

Building upon existing data, sixteen (16) pre-design investigations (PDIs) are outlined below to support the final remedial design. Most of the PDIs relate to the HBHA Pond component of the remedy (PDI-1, 3 thru 8, 10, 11, 13 - 16), and some of the design features and their configuration will be determined based on the outcome of various studies to be conducted. Information gathered during these PDIs, as well as historical data, will be considered as the remedial design progresses through the 30%, 95% and 100% designs. As the remedial design progresses, this RDWP shall be flexible to accommodate additional EPA-approved investigations that may be necessary to further support the 30%, 95% and/or 100% designs.

PDI Designation
PDI-1: HBHA Pond Sediment Dredging
PDI-2: Wells G&H and CBCA Wetlands Sediment Dredging/Excavation
PDI-3: Groundwater Investigation
PDI-3A: Groundwater Discharge Evaluation to HBHA Pond
PDI-3B: Sitewide Groundwater Plume Investigation
PDI-4: HBHA Pond COC Transformation Processes & Studies PDI-4A: Estimating Residence Times PDI-4B: COC Transformation Processes PDI-4C: Surface Water Profiling
PDI-5: Tank Treatability Studies
PDI-6: Geotechnical Investigations PDI-6A: HBHA-4 Cofferdam and Storm Flow Bypass PDI-6B: Halls Brook Storm Bypass / Holding & Dissipation Systems PDI-6C: Atlantic Avenue Drainway and BECO Drainway Storm Energy Dissipation Systems
PDI-7: HBHA Flood-routing Modeling Analysis
PDI-8: HBHA Pond Hydrodynamic Modeling
PDI-9: West Hide Pile Investigations and Assessment
PDI-9A: WHP & EHP Investigations and Assessment
PDI-9B: WHP Enhanced Bioremediation Studies
PDI-9C: Additional Actions to Address Unacceptable Risk(s)
PDI-10: Impermeable Caps
PDI-11: Permeable Caps
PDI-12: Soil & Groundwater Institutional Controls PDI-12A: Soil IC Delineation PDI-12B: Groundwater IC Delineation
PDI-12C: Remedy Monitoring, Protection and Permanent Access
PDI-12D: IC Studies
PDI-13: Studies to Locate Property(ies) for Construction of Compensatory Wetlands
PDI-14: Ammonia Background Investigations
PDI-15: HBHA Pond Aeration Pilot Test
PDI-16: Cofferdam Simulation Pilot Test

1.3.2 Remedial Design Process

The remedy components described in the SOW and listed above involve one or more of the following: site preparation, excavation, sediment removal, filling, armoring, geosynthetic membrane/fabric installation, cofferdam construction, aeration equipment installation, construction of compensatory

wetlands, surface restoration, and other activities/features. In addition, ICs are also required by the Selected Remedy and drive the need for certain design data collection (i.e., sampling, survey, and title data) described in this RDWP. Administrative measures including ICs will be considered through the design process as the final design configuration of the remedy unfolds and supporting data collection described herein is completed.

Many of the construction activities and features of the Selected Remedy will be designed using well-established engineering design practices. However, the assembly of several of these activities and features, particularly the construction of cofferdams and treatment process design, are highly dependent upon one another. Considering this and the volume of design data that remains to be collected, it is necessary to follow a robust, yet flexible, design process that allows for adjustments to and refinement of the remedy concept presented in the ROD and SOW as additional design data are collected, interpreted, and documented in the 30% and subsequent design milestone submittals. The requirements for the 30%, 95% and 100% design milestones are presented in detail in the SOW (p. 27-35). The components of the three design submissions are summarized in the table below.

30% RD	95% RD	100% RD
▪ Summary of the pre-design study results ▪ ARAR Attainment Plan ▪ Design Criteria ▪ Project Delivery Strategy ▪ Preliminary Plans, Drawings, Sketches, and Calculations ▪ Outline of Technical Specifications ▪ Preliminary Construction Schedule and Cost Estimate ▪ IC Recommendation and Plan	▪ Construction Design Documentation (Drawings, Plans, Specifications, etc.) ▪ Design Basis ▪ Draft Contingency Plan (Note 2) ▪ Draft Constructability Review Report ▪ Draft Performance Standard/ARAR Attainment Plan ▪ Draft RA Work Plan ▪ Draft RA POP (Note 1), including Construction Quality Assurance (CQA) Plan ▪ Draft IC Plan ▪ Draft Operations and Maintenance (O&M) Plan ▪ Draft Environmental Monitoring Plan (EMP), including associated POP update	▪ Final Construction Design Documentation (Plans, Specifications, etc.) ▪ Final Bid Documents ▪ Final Contingency Plan (Note 2) ▪ Final Constructability Review Report ▪ Final Performance Standard/ARAR Attainment Plan ▪ Draft Final RA Work Plan ▪ Draft Final RA POP ▪ Draft Final Institutional Controls Plan ▪ Draft Final O&M Plan ▪ Draft Final EMP, including associated POP update
Notes: 1. POP includes: SMP, SAP, QAPP, FSP, HSP, and CRSP (updates as necessary through the project). 2. Emergency/accident planning.		

1.3.3 Remedial Design Considerations

The engineering design process will consider data collected from historic (i.e., pre-ROD) investigations and more recent data collected by the Settling Defendants through the implementation of the approved Surface Water Monitoring Plan (SWMP), the performance of "early action" tasks and PDIs (i.e., investigations performed prior to approval of the RDWP), PDI data (applicable PDIs are noted above for each component, and further described in Section 3), as well as any other appropriate data obtained during the design process, and the various design considerations outlined in this section, to complete the design associated with each of the Remedy Components described in Section 1.2.3.

Of the six major components of the remedy outlined in Section 1.2.3, five of the components will require engineering designs consistent with the ROD and SOW requirements (HBHA Pond, West Hide Pile, Near Shore Sediments, Institutional Controls, and Wetlands). These five components are further organized into four engineering design components, where Wetlands is incorporated under the HBHA Pond component.

If any other engineering design component impacts surface water and wetland function and value losses, then these impacts will be considered under the HBHA Pond component. The four engineering design components are as follows:

ENGINEERING DESIGN COMPONENTS

1) HBHA Pond
    a. Northern Portion of HBHA Pond Remedy (PDI 1, 3, 4, 5, 6, 7, 8, 10, 11, 13, 14, 15 and 16)
        i. Primary Treatment Cell
        ii. Secondary Treatment Cell, including outlet construction and compliance monitoring
        iii. Halls Brook Storm By-Pass/Halls Brook Storm Holding and Dissipation System
        iv. Need for dissipation Systems for Atlantic Avenue Drainway (AAD) and Boston Edison Company (BECO) inlets to HBHA Pond
        v. Permeable Cap for areas with soils above Performance Standards
        vi. Impermeable Cap for drainage channels receiving contaminated groundwater above Performance Standards
        vii. Location and design for Construction of Compensatory Wetlands considering size of engineering design component 1.a, and any other wetland functions and values losses associated with other components of the remedy
        viii. Long-Term Periodic Partial Dredging (e.g. sediment accumulation) and associated dredging and disposal activities (dewatering, etc.)
    a. Southern Portion of HBHA Pond Remedy (PDI 1):
        i. Removal of Contaminated Sediments and Surface Water, and in-pond restoration of wetland function and values south of the downstream cofferdam
2) WHP In-situ Enhanced Bioremediation, as necessary (PDI 9)
    a. Groundwater, surface water, and sediment investigations by the WHP, EHP and adjacent wetlands to evaluate contaminant migration and unacceptable human health and ecological risks
    b. Pilot and Design WHP In-situ Enhanced Bioremediation, as necessary
    c. Additional response actions to address unacceptable risk determined by EPA under 2.a., as necessary.
3) Removal and Restoration of Near Shore Sediments from the Wells G&H Wetland and Cranberry Bog Conservation Area (PDI 2)
4) Institutional Controls (PDI 3, 9, 12, 14):
    a. Soils
    b. Deeper Interior Wetland Sediments
    c. Groundwater
    d. Remedy Protection and Access for O&M

The information gathered during the design process will support the preparation of adequate 30%, 95% and 100% remedial designs as outlined in Section 1, ROD and SOW, including among other things, Draft Final Institutional Control Plan(s), Draft Final O&M Plan, Draft Final Environmental Monitoring Plan.

A number of design considerations shall be applied under each of these engineering design components of the Selected Remedy consistent with the ROD and SOW. These design considerations are presented below. Where appropriate, the design considerations have been coordinated with PDIs. Investigations for several of these design considerations have begun and are ongoing as part of early action activities that the Settling Defendants have been performing, with EPA's consent, prior to approval of the RDWP.

DRAFT

DESIGN CONSIDERATIONS

1) HBHA Pond

a. Northern Portion of HBHA Pond (*PDI-1, PDI-3, PDI-4, PDI-5, PDI-6, PDI-7, PDI-8, PDI-10, PDI-11, PDI-12, PDI-14, PDI-15, PDI-16*):

i. Assess Primary and Secondary Treatment Cells dredging design and frequency **(*PDI-1, PDI-3*):**

1. Delineate zones (i.e. area and depth) exceeding cleanup goals (273 mg/kg arsenic) that require removal
2. Conduct a waste characterization evaluation of the dewatered sediment for evaluation of off-site disposal options
3. Monitoring and assessment of sediment accumulation within primary and secondary treatment cells within HBHA Pond
4. Evaluate trigger for dredging when chemocline rises within 100 cm below the primary treatment cell outlet elevation, in accordance with ROD/SOW
5. Evaluation of potential interim measures that may defer/postpone sediment dredging within the primary and secondary treatment cells
6. Evaluate and potentially modify estimated dredging frequency within the primary and secondary treatment cells
7. Evaluate periodic, partial sediment accumulation removal methods
8. Evaluate sediment dewatering management and treatment, including dewatering/staging location(s), characterization of effluent and dewatered sediment, and appropriate location(s) for off-site disposal

ii. Determine extent of contaminated groundwater plume discharge into HBHA Pond *(PDI-3*)

iii. Further understand the impact of Industri-plex Superfund Site Operable Unit 1 (OU1) groundwater plumes on surface water and/or sediments and contributions to COCs at the HBHA Pond (e.g. west of railroad tracks along NBSD and Landfill Creek, east of rail road track north/central RTC, West Hide Pile, East Hide Pile and adjacent wetlands, AAD, BECO drainway) **(*PDI-3, PDI-10, PDI-12, PDI-14*)**

iv. Further delineate Industri-plex OU1 groundwater plumes and differentiate them from other potential upgradient groundwater or surface water sources **(*PDI-3, PDI-12, PDI-14*)**

v. Monitor and evaluate multiple, multi-level groundwater monitoring well locations for evaluating gradients and potentiometric data **(*PDI-3, PDI-9, PDI-12, PDI-14*)**

vi. Monitor and evaluate multiple surface water monitoring locations **(*PDI-4, PDI-15*)**

vii. Monitor and evaluate both baseflow and storm flow conditions in and around HBHA Pond

viii. Establish further understanding of ammonia background conditions (surface water and groundwater) as it relates to other potential sources and contributions to the HBHA Pond (e.g. upgradient of Industri-Plex OU1 boundaries) **(*PDI-3, PDI-12, PDI-14*)**

ix. Determine location of cofferdams **(*PDI-3, PDI-4, PDI-5, PDI-16*)**

x. Establish further understanding of surface water COC transformation processes within the HBHA Pond (above, below and at the chemocline) and how these processes may be enhanced to achieve further treatment of COCs under the final

design and consistent with the HBHA Pond component of the Selected Remedy as described at ROD pp. 88-92 **(*PDI-4, PDI-5*)**

xi. Evaluate reaction rates and residence times required to achieve treatment and reduction of COCs year-round in the final design **(*PDI-4, PDI-5*)**

xii. Perform initial tank aeration studies to evaluate the enhancement of various natural treatment processes within the HBHA Pond to reduce COCs **(*PDI-5*):**

1. increased oxygen (precipitation and aerobic degradation)
2. volatilization (stripping)
3. biological degradation (aerobic/anaerobic) to further promote treatment and contaminant reduction (including the deployment of bacteria media/films to enhance ammonia biological degradation)
4. further investigations within the HBHA Pond regarding the presence of existing microorganisms and approaches to enhance the use of existing microorganisms to further biologically degrade ammonia year-round in the final design

xiii. Evaluate shallow horizontal surface water aeration to further stabilize the chemocline depth at or deeper than 100 cm below the top of the cofferdam of the primary treatment cell outlet elevation. **(*PDI-15*)**

xiv. Implement and evaluate various HBHA Pond aeration pilot tests (e.g. fine bubble diffusers, vertical/horizontal mixing devices), considering initial information from tank aeration studies, to further treat COCs through transformation processes such as precipitation, biological degradation and volatilization in the secondary treatment cell and shallow surface water of the primary treatment cell **(*PDI-4, PDI-5, PDI-15*)**

xv. Continue to measure the current concentrations of total and dissolved arsenic in flow from HBHA Pond as described in the SWMP, and assess current arsenic flux from the HBHA Pond during storm events and base flow conditions

xvi. Evaluate potential arsenic precipitation/settling within the primary and secondary treatment cells, and means for enhancing arsenic precipitation and settling to the maximum extent practicable consistent with the Northern Portion of the HBHA Pond component of the Selected Remedy as described at ROD pp. 88-92 **(*PDI-4, PDI-5, PDI-15, PDI-16*)**

xvii. Implement and evaluate biological treatment studies within HBHA Pond using biological media to further enhance biological transformation and reduction of ammonia in surface water for the secondary treatment cell **(*PDI-4, PDI-5*)**

xviii. Evaluate materials for cofferdams considering the need to restrict diffusion and migration of Site COCs, permanence, ease of implementation and constructability

xix. Consider inclement weather and relevant significant storm conditions (e.g. winter/hurricane) on the final design of remedy components to ensure durability, permanence, and long-term performance **(*PDI-6, PDI-7, PDI-8, PDI-15, PDI-16*)**

xx. Evaluate flooding effects on the HBHA Pond relative to the design of the primary and secondary treatment cells, as well as impacts on surrounding properties, through flood modeling of HBHA (HBHA Wetland and HBHA Pond) and Aberjona River (north of Mishawum Road) including BECO drainway, AAD and Halls Brook; Design HBHA Pond remedy to minimize flood storage losses **(*PDI-7*)**

xxi. Evaluate potential effects of cofferdam on hydrodynamics within the HBHA Pond and potential to cause the chemocline to rise within the Primary Treatment Cell by deployment of cofferdam simulation **(*PDI-8, PDI-16*)**

xxii. Evaluate surface water flow velocities within HBHA Pond and design forces on cofferdams **(*PDI-8, PDI-16*)**

xxiii. Evaluate potential for storm flows from AAD and BECO drainways to contribute to mixing and potential chemocline destabilization within the HBHA Pond **(*PDI-6, PDI-7, PDI-8*)**

xxiv. Evaluate appropriate configuration and size of surface water flow diversions to reduce the possibility of storm mixing and potential chemocline disturbance within the HBHA Pond, as well as the discharge associated with the Halls Brook by-pass, including discharge location and appropriate flow dissipation measures **(*PDI-6*)**

xxv. Evaluate and where appropriate design energy dissipation system for AAD and BECO to slow velocities/calm storm flows and prevent potential disturbance of the chemocline within the primary treatment cell **(*PDI-6, PDI-8*)**

xxvi. Evaluate (and where appropriate design) a storm water holding and velocity dissipation system as a potential alternative to the Halls Brook storm flow by-pass, where storm flow would be slowly conveyed to the primary treatment cell to eliminate storm flow mixing of the chemocline, or the secondary treatment cell **(*PDI-4, PDI-6, PDI-7, PDI-8*)**

xxvii. Evaluate possible sediment accumulation, removal and maintenance of the Halls Brook By-Pass or Halls Brook Holding and Dissipation System **(*PDI-6*)**;

xxviii. Determine appropriate size of primary treatment cell to ensure plume capture, and maintain chemocline structure and in-pond treatment processes **(*PDI-3, PDI-4, PDI-5, PDI-7, PDI-8, PDI-15, PDI-16*)**

xxix. Determine appropriate size of secondary treatment cell within the HBHA Pond to further treat and reduce contaminants, as well as address any episodic releases from the primary treatment cell **(*PDI-4, PDI-5, PDI-15*)**

xxx. Determine appropriate size of Halls Brook By-Pass or Halls Brook Holding and Dissipation System **(*PDI-6, PDI-7, PDI-8)***

xxxi. Determine extent of permeable cap on soils contaminated with arsenic above HBHA Pond sediment cleanup standards (e.g., Area A6), and may erode and migrate downstream impacting components of the Selected Remedy (including the Northern Portion of HBHA Pond) **(*PDI-11*)**

xxxii. Determine the location and extent of impermeable caps preventing groundwater contamination discharge into surface water drainage channels (e.g. NBSD, BECO drainway, and other surface drainage within the Site) considering results of groundwater and surface water sampling data **(*PDI-10, PDI-3, PDI-12, PDI-14*)**

b. Southern Portion of HBHA Pond (*PDI-1*):

i. Assess sediment and associated surface water contaminant removal and restoration processes:

1. Evaluate dredging and surface water removal methods.
2. Evaluate dewatering management and treatment, including sediment dewatering/staging location(s), characterization of effluent and dewatered sediment, and appropriate location(s) for off-site sediment disposal.
3. Evaluate sediment restoration materials and amendments, as well as plantings necessary to replace lost wetland functions and values.

ii. Plan and estimate post-excavation confirmation samples to document sediment cleanup levels have been achieved.

c. Studies to Locate Property(ies) for Construction of Compensatory Wetlands (*PDI-13 and 1a PDIs*):

- Assess the area of the HBHA Pond component of the selected remedy causing any wetland functions and values losses.
- Assess any other components of the selected remedy and their areas causing any wetland functions and values losses.
- Locate property(ies) nearby in the watershed for the 'Construction of Compensatory Wetlands' for these areas causing any wetland functions and values losses.
- Select property(ies) and design the "construction of compensatory wetlands" under the selected remedy.
    - Coordinate with various local, state, and federal agencies regarding the design of the "construction of compensatory wetlands" under the selected remedy.

2) West Hide Pile (*PDI-9*):

- Conduct sufficient groundwater, surface water and sediment investigations to "evaluate the West Hide Pile (WHP) area (including the East Hide Pile (EHP)) contaminated groundwater plumes potential impact on the nearby wetlands (surface water and sediments) and downgradient groundwater plumes. The investigations shall produce sufficient data for EPA to further assess potential unacceptable human health and ecological risks near the WHP area and nearby wetlands." (SOW, p. 26-27).
- Evaluate the adequacy of existing institutional controls to restrict human health exposures to contaminated groundwater near the WHP area and adjacent wetlands
- Evaluate and design in-situ enhanced bioremediation system for the West Hide Pile, if necessary as determined by EPA

3) Near Shore Sediments at the Wells G&H Wetland and Cranberry Bog Conservation Area (*PDI-2*):

- Determine the horizontal and vertical extent of accessible near shore sediments requiring removal and restoration at the Wells G&H Wetlands and CBCA consistent with those sediment areas previously identified as accessible in the baseline risk assessment
- Sample collection to fill data gaps associated with the west side of Wells G&H Wetland
- Consider need for and determine type and design of "a transition zone permeable barrier separating contaminated sediments from clean/restored sediments and minimizing potential for recontamination above relevant wetland sediment Performance Standards during storm events" (FS, p. 4-36)[8]
- Plan and estimate post-excavation confirmation samples to document that the sediment cleanup levels have been achieved;
- Assess sediment removal and restoration processes:
    a. Evaluate dredging methods
    b. Evaluate dewatering management and treatment, including sediment dewatering/staging location(s), characterization of effluent and dewatered sediment, and appropriate location(s) for off-site disposal of sediments
    c. Evaluate sediment restoration materials and amendments, as well as plantings necessary to restore lost wetland functions and values

[8] This "transition zone" is not mentioned in the ROD, but, without otherwise waiving their rights with respect to remedial actions not mentioned in the ROD, Settling Defendants are prepared to consider the appropriateness of a transition zone and to designing and constructing it if found appropriate.

d. Various sediment locations downgradient of the CBCA Wetlands between CBCA Wetlands and Lower Mystic Lakes (e.g. upstream of station 7 (Davidson Park) and station 8, Upper Forebay of Upper Mystic, and Upper Mystic Lake

- Establish long-term sample stations to evaluate post Remedial Action conditions in sediments downstream of Northern Portion of HBHA Pond remedy component to allow assessment of post-Remedial Action sediment accumulation. Assessment should include the following areas:
  a. Restored Southern Portion of HBHA Pond
  b. Various sediment locations within the restored Near Shore Wells G&H Wetlands and CBCA
  c. Various sediment locations in Deeper Interior Wetland Sediments with institutional controls at the HBHA Wetlands, Wells G&H wetlands

4) **Institutional Controls (*PDI-2, PDI-3, PDI-9, PDI-10, PDI-12, PDI-14*):**

a. Groundwater
b. Soils
c. Deeper Interior Wetland Sediments
d. Remedy Protection and Access for O&M

- Evaluate existing and proposed institutional controls at OU1, and the extent to which these OU1 controls potentially satisfy the OU2 institutional controls within the OU1 boundaries.
- Evaluate and refine area extent of groundwater, soils, and wetland sediments where institutional controls will be implemented, including:
  - additional groundwater sampling west of railroad tracks along upper NBSD and Landfill Creek, east of railroad track north/central RTC, WHP, EHP and adjacent wetlands, and near the southeastern BECO ROW (boundaries of isolated groundwater plume)
  - implement and sample a network of groundwater monitoring wells in the area of soils requiring institutional controls by the Former Mishawum Lake
  - additional soil sampling to fill RI data gaps and refine the extent of surface soils by Area 6, and surface soils and subsurface soils by former Mishawum Lake Area
- Evaluate various institutional controls and potential applications:
  - Evaluate potentially applicable institutional controls for soils, sediment and groundwater as part of overall remedy protection. If multiple media apply to an area requiring institutional controls, then the most conservative controls would apply
  - Coordinate with various local (e.g. city solicitor, city engineer), state (MassDEP) and federal (EPA) agencies, landowner representatives (2-3 representatives from various properties), and Settling Defendant representatives regarding most appropriate forms of IC for each media of concern
  - Design institutional controls consistent with EPA's "Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups."

2.0 HBHA POND CONDITIONS

An important aspect of the remedy for the Site is to further understanding the natural treatment processes occurring within the HBHA Pond and enhancing them through the Northern Portion of HBHA Pond engineering design component. The following discussion includes a brief background summary, discussion of factors causing water column stratification and the role of mixing in downstream contaminant migration.

2.1 Background

"The most significant water bodies located in the northern part of the MSGRP RI Study Area include: Halls Brook, Halls Brook Holding Area (HBHA), and the Aberjona River. With the exception of Halls Brook, all of these water bodies were either modified or created for flood storage capacity during development of the area. Fed primarily by Halls Brook, the Halls Brook Holding Area (HBHA) was created as a storm water management area following the filling of Mishawum Lake. The northern portion of the HBHA consists of a large rectangular shallow pond (approximately 175 feet x 900 feet and depth up to 20 feet), referred to as the HBHA Pond. Downstream of the HBHA Pond, the southern portion of the HBHA consists of wetlands containing three smaller ponds. When the HBHA was constructed, the Aberjona River was diverted from Mishawum Lake to its current course which follows a series of culverts and drainage channels in the middle of Commerce Way roadway that parallels the HBHA approximately 1,500 feet to the east. Flows from the Aberjona River and the HBHA converge at the outlet of the HBHA at Mishawum Road." (RI, p. ES-5 and Figure ES-1).

Sediment texture in the HBHA Pond consists of loose, floc-like sediment overlying dense sand deposits. This dense sand is native material which was exposed when the HBHA Pond was constructed. The existing data indicates that the HBHA Pond morphology includes two main basins located in the northern and southern ends of the HBHA Pond. These basins are separated by a bathymetric high that extends from west to east approximately where Halls Brook discharges into the HBHA Pond.

2.2 Chemocline and Fate and Transport

As described in Section E and F of the ROD, "[a] chemocline is present within the HBHA Pond, which generally divides shallow water in the pond from deeper water. The chemocline is created and maintained by the continuing discharges of higher conductivity, greater density, and low oxygen content (anoxic) contaminated groundwater (e.g. arsenic, ammonia, benzene, etc.) at the deeper portions of the HBHA Pond while the upper layer of the water column in the pond has a lower conductivity, lower density, and higher oxygen content (oxic) sustained by contributions of non-contaminated surface water from Halls Brook."[9] (ROD, p. 31) "Below the chemocline in deep surface water, high concentrations of dissolved arsenic (up to 5,043 µg/L), benzene (up to 2,530 µg/L), ammonia (up to 1,270 mg/L) are present in the HBHA Pond." (ROD, p. 34) "The chemocline within the HBHA Pond becomes unstable during large storm events causing high contaminant concentrations in the deep surface water to mix with

[9]The ROD generally describes the surface water quality from Halls Brook surface water discharge to HBHA Pond as "non-contaminated" (ROD, p.31) when comparing surface water quality with significant surface water contamination in deeper portions of the HBHA Pond. Surface water data pre and post ROD have detected concentrations of arsenic, ammonia and other compounds in Halls Brook surface water discharge.

shallow water, and higher concentrations of arsenic to be released at the outlet of the pond."[10] (ROD, p. 31)

"A fraction of the dissolved arsenic being discharged from groundwater into the HBHA Pond sediments becomes bound to ferric oxides and is effectively removed from the water column and becomes part of the sediment load in the pond. However, a portion of the sediment-bound arsenic is released and migrates through the sediments up into the water column. This arsenic can either be further sequestered from solution or transported downstream. These reactions are dependent upon a fairly stable chemocline that is present at about the mid-water depth. … Once in the surface water column, as either dissolved or associated with the suspended solid load, arsenic will continue to migrate downstream with the flow of water. Depending on the geochemical and flow conditions, dissolved metals in the water column may adsorb to suspended solids, such as fine grained soil particles or other metal complexes and either settle out and become part of the sediment bed load or be transported within the water column as part of the suspended solid load and be deposited at locations downstream. … As part of the sediment bed load and depending on the geochemical conditions, metals may dissolve from the sediment particles back into the surface water, whereby the cycle of dissolution and precipitation would continue. This cycling was mostly observed within portions of the HBHA that exhibited significant anoxic/reduced conditions, specifically, within the HBHA Pond." (ROD, p 34)

"Organic compounds in groundwater, such as benzene, discharging into the sediment and deeper portions of the HBHA Pond are generally attenuating to very low concentrations or are not detected in shallow portions of the HBHA Pond surface water. The VOCs in sediments may be biodegraded, partitioned to surface water, or remain bound to the organic matter present in stream sediments. VOCs that enter into surface water can volatilize into the ambient air where they are degraded by photolysis or hydrolysis; they can remain in surface water and undergo degradation processes such as biodegradation, hydrolysis, or reduction-oxidation reactions; or they can become attenuated through dilution, diffusion, and advection." (ROD, p. 34-35)

"High concentrations of ammonia, as part of the contaminated groundwater plumes from Industri-plex OU-1, are discharged into HBHA Pond resulting in high concentrations of ammonia in surface water. The presence of the chemocline in the HBHA Pond helps sequester the highest ammonia concentrations at depth (up to 1,762 mg/L) by limiting vertical transport and assisting natural processes available to convert some of the ammonia to nitrates, nitrites, and nitrogen gas. As ammonia migrates to the chemocline, aerobic bacteria can convert the ammonia to nitrite. Through diffusion, the nitrite comes into contact with the more oxygenated zone of the chemocline where it can be partially oxidized to nitrate. Further reductions can also occur through facultative anaerobic bacteria where the nitrate can be reduced to nitrite and nitrogen gas can be released."[11] (ROD, p. 35)

Figure 2.2-1 provides profiling graphs that illustrate the temperature, specific conductance, and DO (as relative percent of saturation corrected for temperature) profiles in the Pond.

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[10] Based upon storm surface water data collected after SWMP approval, the Settling Defendants believe that mixing across the chemocline in the northern portion of the HBHA Pond does not occur, that mixing in the southern basin of the HBHA Pond has been observed, and that the mixing in the southern basin occurs because the weaker chemical stratification in the southern basin makes this area more susceptible to mixing during high flow conditions.
[11] Early action activities performed by the Settling Defendants have also identified bacteria in the Pond that may be degrading ammonia directly to nitrogen gas via an anaerobic process.

Arsenic, ammonia, and benzene are influenced by the following mechanisms:

- Stratification caused by oxygen or density differences due to contaminated groundwater plume discharges
- Advection, diffusion, dilution, sorption, dissolution, and other similar processes
- Reaction, (e.g., transformation due to oxidation or reduction, biodegradation, precipitation or volatilization)

The HBHA Pond processes/mechanisms for arsenic, ammonia, and benzene were discussed in the RI and ROD, and will be further evaluated during the Remedial Design in order to enhance naturally occurring processes for treatment of these contaminants of concern.

2.3 Role of Mixing in Downstream Migration

During storm events, the water column may become mixed and destratified, potentially resulting in increased discharge of arsenic, ammonia, and benzene from the HBHA Pond. Ford (2005a) reported that a precipitation event with a three to four year recurrence interval was sufficient to mix the water column.[12] To illustrate the role of mixing, Table 2.3-1 summarizes the baseflow and stormflow arsenic results obtained during the RI/FS (TtNUS, 2005) at surface water monitoring station 2 (outlet of HBHA Pond). Additional PDI data will improve the baseline database for baseflow and stormflow contaminant discharge conditions, and storm-event-induced mixing and outflow conditions.

[12] See footnote 9 above.

3.0 REMEDIAL DESIGN SUPPORT ACTIVITIES

As stated above, a number of PDIs are needed as input for design completion. Section 3 provides the context for and the intent of the PDIs described herein and in the FSP (Appendix C). The PDI's are organized pursuant to the EDC (Engineering Design Component) structure. More specifically, PDIs are described as follows:

Section 3.1 HBHA Pond: Use of HBHA Pond for treatment

Section 3.2 WHP In-situ Enhanced Bioremediation, as necessary

Section 3.3 Removal and Restoration of Near Shore Sediments from the Wells G&H Wetland and CBCA

Section 3.4 Institutional Controls

To the extent there is overlap (i.e., PDI's described in one EDC that apply to another) a note is included in the associated PDI description if appropriate.

3.1 HBHA Pond

The following sections present the background and goals of PDIs related to using the HBHA Pond for treatment. This section also discusses the relationship between PDIs for the HBHA Pond and their correlation to DCs (Design Considerations), key decision points, issues, and the schedule presented above. Where applicable, the PDI summary also refers to the investigation requirements outlined in the SOW Section V.B.2(f) that are addressed by a particular investigation or study. Appendix C contains the FSP, which provides a detailed description of the data collection scope and field activities. The following PDIs are discussed in this section:

- PDI-1: HBHA Pond Sediment Dredging
- PDI-3: Groundwater Investigation
- PDI-4: HBHA Pond COC Transformation Processes & Studies (Parts A through C)
- PDI-5: Tank Treatability Studies
- PDI-6: Geotechnical Investigations (Parts A through C)
- PDI-7: HBHA Flood-Routing Modeling Analysis
- PDI-8: HBHA Pond Hydrodynamic Modeling
- PDI-10: Impermeable Caps
- PDI-11: Permeable Caps
- PDI-13: Studies to Locate Property(ies) for Construction of Compensatory Wetlands
- PDI-14: Ammonia Background Investigation
- PDI-15: HBHA Pond Aeration Pilot Test
- PDI-16: Cofferdam Simulation Pilot Test

A number of the PDIs described below are seasonally dependent or have a particular timeframe when the work should be completed to facilitate the schedule and deadlines outlined in the SOW. Additionally, particular PDIs have to be performed later in the remedial design process because they may alter the HBHA Pond hydrodynamics, which will confound the results of PDIs that require ambient conditions. Figure 3.1-1 is a Critical Path Method (CPM) chart presenting the preliminary sequence, duration, and timing of each of the PDIs presented herein.

3.1.1 PDI-1: HBHA Pond Sediment Dredging

The SOW specifies that the sediment in the southern portion of the HBHA Pond that exceeds the arsenic Performance Standard of 273 mg/kg shall be dredged and disposed off-site at a permitted facility. PDI-1 is designed to delineate the horizontal and vertical extent of sediments exceeding the Performance Standards and to conduct dewatering treatability studies on these materials for the design of the sediment removal, dewatering and disposal system.

The design path forward regarding sediment removal will be based primarily on the outcome of PDIs and relate generally to the southern portion of the HBHA Pond, if that is a component of the final remedy. Whether the Additional Performance Standards outlined in Section IV.B.1(a) of the SOW apply will not be known until the system is operating.

Based on existing data, the majority of the HBHA Pond bottom consists of soft sediments overlying natural sand deposits consisting primarily of a flocculent layer with very low solids content (less than 10 percent). The recent sediment layer varies in thickness, with a maximum thickness ranging from 2 to 4 ft (Roux Associates, personal communication). An efficient design will require accurate delineation of the area and volume of sediments to be dredged and the associated dewatering requirements for such sediment.

PDI-1 is designed to collect data to evaluate the dredging and dewatering methods for further consideration in the RD. The engineering design will also include a civil component for constructing a staging area for handling materials, dewatering sediments, and water reintroduction to the pond. Finally, the engineering design will include waste characterization procedures for use in the RA phase for selecting the most suitable off-site disposal option(s) for dewatered sediment.

The goals of PDI-1 are to address the following data needs:

- Delineate laterally and vertically areas with arsenic concentration in sediment exceeding 273 mg/kg that may require dredging
- Identify debris requiring removal prior to sediment dredging
- Document HBHA Pond bathymetry prior to dredging
- Measure sediment thickness to estimate sediment dredging volume
- Monitor sediment accumulation to evaluate and if possible modify the estimated dredging frequency proposed in the ROD
- Determine geotechnical properties to support design for handling of dredged material
- Determine the most cost-effective means of dewatering dredge spoils
- Determine waste characteristics of sediment for preliminary evaluation of disposal option(s). Final waste characterization sampling and analysis will be established as part of the RA during/following dewatering activities)

PDI-1 will include aerial photos, existing land survey information, and field reconnaissance of the areas surrounding HBHA Pond to assess space availability for dredging operations, including roadway access, equipment laydown, and sediment processing operations. The selection of suitable space for dredging operations will consider the requirements of (1) other HBHA Pond PDIs that involve equipment mobilization and staging, (2) construction of structures required for the HBHA Pond remedy, (3) recommendations of affected property owners, (4) logistical constraints such as power, access to roadways and the potential impacts from noise and smell, if there is the potential for them to rise to the level of causing a potential significant nuisance to nearby landowners.

A hydrographic survey will be performed to identify debris, document bathymetry, and measure soft sediment layer thickness for estimating dredging volume.

Sediment will be sampled to delineate arsenic performance standard exceedances laterally and vertically within the sediment. Samples will also be analyzed for total iron to assist in the evaluation of the fate and transformation of COCs. Sediment samples will be collected at 23 locations as shown in Figure 3.1.1-1. Additional samples may be added if necessary based on the initial sediment data. The sediment sampling locations shown on Figure 3.1.1-1 will be adjusted based on the results of the groundwater plume discharge evaluation (PDI-3) and other studies that will determine where the primary and secondary treatment cells of the proposed HBHA-4 remedy would be located, as dredging will only be required within and to the south of the secondary treatment cell during initial remedy implementation.

Once the preliminary location of the cofferdams is determined, three additional bulk composite samples will be collected from the portion of the HBHA Pond to be dredged. These samples will be submitted for bench-scale treatability studies. Aliquots of the dewatered sediments from the initial three composite samples will also be analyzed for waste disposal characterization.

An array of sediment traps will be installed at three locations within HBHA Pond; each array will consist of 4 traps. One array will be placed in each of the northern, central and southern portions of the pond as shown in Figure 3.1.1-1, each array to be located at the areas where the soft layer thickness is greatest, based on the probing conducted as part of this PDI.

Additional information regarding the field sampling and laboratory methods for PDI-1 is presented in the FSP (Appendix C).

3.1.2 PDI-3: Groundwater Investigation

PDI-3 was developed to evaluate groundwater contamination related to the design of the primary and secondary treatment cells, to evaluate plume stability over time, to assist in the development of the environmental monitoring plan, and to assist in determining the extent of the surface area potentially subject to groundwater ICs (PDI-12). The data collected under this PDI will also assist in the design of impermeable caps (PDI-10) and in the ammonia background evaluation (PDI-14).

As this PDI includes a focused (smaller scale) assessment of groundwater discharge in the vicinity of HBHA Pond as well as a larger scale groundwater investigation, PDI-3 is subdivided into 2 parts: PDI-3A Groundwater Discharge to HBHA Pond, and PDI-3B Sitewide Groundwater Plume Investigation as described below.

3.1.2.1 PDI-3A: Groundwater Discharge to HBHA Pond

The goal of this PDI will be to:

- Delineate the horizontal and vertical extent of the contaminated groundwater plume discharging into the Pond above surface water Performance Standards for site COCs
- Help define the location of the cofferdams for the purpose of containing and treating the COCs within the Pond

In accordance with the SOW, PDI-3A is proposed to assess the location and extent of the groundwater contaminant plume where it discharges into the Pond at levels that could cause exceedances, in the Pond, of the surface water Performance Standards (see Table 1.2.2-1 and Figure 1.2.2-1). The groundwater plume extent exceeding these criteria in the vicinity of the HBHA Pond was preliminarily defined in the MSGRP RI as shown on Figure 3.1.2.1-1.

To evaluate the area of current contaminated groundwater discharge, a groundwater investigation will be conducted along both the eastern and western shoreline and along the centerline of HBHA Pond in three phases. The sample locations and frequency of sampling are discussed in the FSP. Phase I consists of groundwater profiling at thirteen locations along the eastern and western shoreline of the HBHA Pond as shown on Figure 3.1.2.1-3. As part of the Early Action Remedial Design Activities conducted in accordance with the 13 August 2008 letter submitted by ***de maximis inc.*** to EPA, six groundwater profiling locations have been completed along the eastern shore of HBHA Pond. Therefore, seven additional profiling locations are proposed in this workplan to complete Phase I of PDI-3. Groundwater profiling on the eastern and western shoreline will be completed using direct push technology (DPT) driving a groundwater sampling tool (e.g., GeoProbe™ groundwater profiler or Waterloo Profiler™) and low-flow sampling methods to the extent feasible. Samples will be collected from the water table to the top of bedrock or to a total depth of approximately 30 ft, whichever is less, at 10-ft increments with 4 to 5-ft screens. Therefore at each location, groundwater samples will be collected at approximately 5-10 ft (water table), 15-20 ft (near the depth of the bottom of HBHA Pond) and 25-30 ft (below the Pond) or refusal, whichever is encountered first.

Phase II will involve installation and sampling of approximately nine temporary drive point piezometers along the centerline of HBHA Pond as shown on Figure 3.1.2.1-3. Drive point piezometers will consist of a drive-point device (e.g., Solinst Model 615 Drive-Point Piezometer) with a 1-ft screen driven a minimum of 2 ft into the sand underlying the sediments in the Pond. Groundwater samples will be collected from each piezometer and submitted for analysis of arsenic (total and dissolved), ammonia, ammonia by-products including nitrates, nitrites, and total nitrogen (including TKN), benzene, 1,2-dichloroethane, trichloroethene, naphthalene and total iron (unfiltered). Groundwater elevations and surface water elevations will be measured at each of the piezometers to evaluate vertical groundwater gradients. Groundwater samples will also analyzed in the field for ferrous iron using a Hach Spectrophotometer. Based on the groundwater analytical results it is anticipated that up to four piezometers will remain in place up to one year after installation to help evaluate gradients between the groundwater and surface water along the centerline of HBHA Pond. The drive point will be fixed with HDPE tubing that is attached to buoys at the water surface. The tubing will be sealed with a sampling port at the surface. The vertical groundwater elevation data will be considered in the design of the primary and secondary treatment cells (e.g. location of cofferdams, ensure contaminants do not migrate downstream/downgradient from the treatment cells above performance standards and potentially impact downgradient surface water or groundwater).

Phase III will involve the installation of five monitoring well pairs along the eastern shore, western shore, and northern portions of the HBHA Pond to evaluate seasonal fluctuations in groundwater discharge and determine vertical gradients. The data collected during Phase I and II will determine the number required, locations, and the depth of the screened intervals of these monitoring wells. The monitoring wells installed along the shoreline will be 1-inch diameter wells with either a 5 or 10-ft screen depending on depth, installed with a DPT rig.

3.1.2.2 PDI-3B: Sitewide Groundwater Plume Investigation

The various hide piles located in Industri-plex OU1 represent a significant source of the groundwater plumes observed at the Site; however, there are no permanent monitoring wells to evaluate how the plumes may be changing over time. As groundwater discharge is the most significant known contribution of contaminants to HBHA Pond, the design of the final remedy needs to contemplate potential changes in the strength and location of the groundwater plumes over time. The goal of this PDI will be to address the following:

- Time-series data for the COC's at select locations to assist in the design of the final remedy for the Pond

- Define portions of the Site requiring ICs to prevent exposures to groundwater
- The design of a long-term groundwater monitoring network

These goals will be achieved by conducting an initial snap-shot groundwater profiling program and followed by the installation of several permanent monitoring wells at the site considering historical and PDI data. Snap-shot groundwater profiling will be conducted along five transects between the northern limits of OU-1 and the Pond, as shown on Figure 3.1.2.2-1. Also shown on this figure are the proposed locations of six additional monitoring well pairs to be installed; three of these are in the vicinity of the West Hide Pile, and three are between the hide piles and HBHA where elevated COC concentrations were identified in the MSGRP. Groundwater data generated during this PDI will be compared to the Groundwater Performance Standards shown on Table 1.2.3-1. Groundwater COC concentrations will be compared to historic data (e.g., MSGRP RI) from similar locations to evaluate changes in COC concentrations over time. This data will also be used to identify areas requiring ICs to prevent exposure to contaminated groundwater and to develop a long term groundwater monitoring network to support the Environmental Monitoring Plan.

Additional information regarding the field sampling and laboratory methods for PDI-3 is presented in the FSP (Appendix C).

3.1.3 PDI-4: HBHA Pond COC Transformation Processes & Studies

This PDI further evaluates the COC transformation processes within the HBHA Pond and investigates how these processes may be enhanced in the primary and secondary treatment cells. The primary goals of PDI-4 include:

- Improve understanding of the COC (ammonia, arsenic, and benzene) contribution, distribution, and mixing in the water column in HBHA Pond (particularly above, below and across the chemocline) caused by groundwater and surface water discharges, as well as sediment diffusion
- Estimate COC transfer from deep to shallow surface water in the HBHA Pond and COC contribution and transfer from shallow surface water which may require treatment in the secondary treatment cell (and where appropriate the shallow surface water above the chemocline in the primary treatment cell)
- Estimate hydraulic residence time information under various flow and/or weather conditions for remedy design
- Identify COC transformation processes and rates of reaction which may be enhanced in the final design of the primary and secondary treatment cell
- Collect multi-depth water quality profiling data throughout the HBHA Pond to support this PDI and others such as PDI-8, -15 and -16
- Collect data to further understand the potential impact of various surface flows, temperature, wind, sun, etc., on the chemocline relative to the final design of the remedy
- Evaluate potential field monitoring equipment and accuracy (e.g. temperature, pH, conductivity, DO, and ammonia)

The data generated under this PDI will be considered in the Northern Portion of HBHA Pond (e.g., primary and secondary treatment cells) component design of the selected remedy, including the design and location of any surface water flow controls to adjust (as appropriate) residence time within the primary and/or secondary treatment cells.

3.1.3.1 PDI-4A: Estimating Residence Times

A rhodamine dye tracer study was conducted for the HBHA Pond and Wetland in 1997 (Roux Supplemental Site Investigation Report, 1997) to determine the residence time of water from Halls Brook in the HBHA Pond and wetlands. This study involved releasing dye in Halls Brook and observing it at

the Mishawum Road culvert. The study was qualitative in nature as the discharge rates were not quantitatively measured, but nonetheless provided helpful information on flow patterns in the Pond and residence time of water in the Pond. The purpose of the PDI described herein is to obtain quantitative data relative to hydraulic residence times in the HBHA Pond.

The objectives of this PDI are to:

- Estimate residence times of water from Halls Brook and from AAD (if flowing)[13] to the outlet of the Pond, and estimate the relative contribution of surface water from each of the inlets at the outlet (i.e., dilution)
- Estimate the diffusion rate of a conservative Fluorescent Dye Tracer (FDT) from below the chemocline to above the chemocline (mass transfer across the chemocline boundary)
- Collect data suitable to verify the hydrodynamic model (see PDI-8) by the measurement of FDTs in selected areas of the HBHA Pond and the HBHA Wetland

Three separate dyes will be injected at Halls Brook, AAD, if flowing, and within the deepest point of the surface water column. The ability of three dyes to be detected within the HBHA Pond was evaluated by Ozark Underground Laboratories (OUL) during a bench test conducted during 1 through 15 April 2009 using source water collected from Halls Brook, the HBHA Pond above the chemocline and the HBHA Pond below the chemocline. The three dyes tested include eosine, fluorescein, and rhodamine WT. During the field test, one of the three dyes will be injected at each location indicated above, and as the dyes migrate across the Pond, they will be absorbed by GAC packets located at three locations along six east-to-west transects across the HBHA Pond and at three depths at each location (select locations in deeper water have an additional GAC packet, i.e., four depths). Once the test is complete, the packets will be retrieved and submitted for analysis to determine the amount of each dye absorbed onto each packet. Surface water samples will also be collected at three locations (Halls Brook Inlet, the Pond outlet and HBHA Wetland outlet) following the release of the fluorescent dyes. Data collected during the FDT study will include the flow rate at each inlet and the outlet to the Pond, wind speed and direction that can be input into the hydrodynamic model for calibration and sensitivity analyses as summarized in PDI-8. Additional information including the results of the OUL bench test is presented in the FSP (Appendix C).

3.1.3.2 PDI-4B: COC Transformation Processes

Ammonia is one of three COCs which the selected remedy requires to be removed or reduced in concentration in the Pond. As summarized in Section 2.3, the fate and transport mechanism for arsenic is established and benzene transformation is rapid based on the low benzene concentrations observed in the surface water above the chemocline. Ammonia transformation pathways and rates of reaction in the Pond are not currently fully understood; a clear understanding of ammonia processes is necessary to optimize and enhance ammonia removal in the Pond and designing a remedy that does not have a deleterious affect on ongoing remedial (i.e., biodegradation) processes. To this end, PDI-4B is designed to achieve the following two objectives:

- Identify the dominant ammonia fate and transformation pathway(s)
- Derive an empirical estimate of the ammonia transformation rates [14]

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[13] ROW No. 9 drainage culvert is excluded since it does not exhibit significant flows due to Pond backwater effects. If in the future a better understanding of the discharge from ROW No. 9 becomes necessary, ROW No. 9 could be included in the tracer tests or a subsequent test.

[14] Ammonia transformation rates will be evaluated to the extent ammonia is being transformed rather than diluted (Note: other PDIs collect data to support mass balance estimates and verification of the magnitude of ammonia loss through mixing and outflow [dilution] rather than reaction).

The data collection needs in PDI-4B are dependent on the results of other PDIs as well as the different phases of this PDI. PDI-4B consists of sediment and surface water samples for microbial analysis, and bench-scale microcosms. Additional information on sample numbers, locations, and frequencies is discussed in the FSP (Appendix C).

Data for this PDI will be collected to elucidate biological COC transformation processes for ammonia within the HBHA Pond and how they may potentially be enhanced in the Northern Portion of the HBHA Pond component design (e.g., primary and secondary treatment cells) of the selected remedy. This PDI will collect biological data from the surface water and locations identified in PDI-4, and analyze the samples for various microbial tests relative to ammonia degradation. This information will be considered further in the design process relative to (1) improved oxygenation or other treatment of surface water, (2) improved microbial ammonia treatment through enhanced microbial assimilation, (3) application of microbial films for further treatment, or (4) other means for enhancing ammonia biodegradation, as part of the design of the Northern Portion of the HBHA Pond component of the remedy.

The northern basin of the Pond contains two distinct compartments. The lower anoxic zone below the chemocline consistently has a higher ammonia concentration than the overlying oxic zone above the chemocline. Data also show that as the ammonia moves through the Pond, concentrations decrease. The best understood ammonia transformation mechanism is aerobic nitrification. However, as noted in the "Proposal to Study the Ammonia Removal Processes Occurring in the HBHA Pond" that was submitted to EPA on January 26, 2010 and responded to by EPA on 24 February 2010, the role of anammox bacteria in ammonia transformation through anaerobic oxidation to nitrogen gas is becoming better understood in general by scientific researchers and practitioners, and may be an important element of ammonia transformation in the HBHA Pond along with other processes. The outcome of PDI-4B will determine if anammox bacteria are present and active below the chemocline of the HBHA Pond. The design for PDI-4B consists of several sequential steps to be completed on an as needed basis to establish the ammonia transformation pathway(s) and rates.

- **Surface Water Monitoring and Microbial Testing:** In the first step, nitrogen species data from surface water sampling at the inlets, outlet, and within the Pond that is gathered in various other PDIs and studies (PDI-4C and the SWMP) will be evaluated. In addition to these data, the microbiological populations present at several locations in the Pond will be assessed to reveal the dominant ammonia transformation pathway(s). This assessment will be accomplished by collecting and identifying bacteria (by genetic testing) to determine which bacteria involved in the nitrogen cycle are present (refer to Figure 3.1.3.2-1). For example, this portion of the testing will investigate the presence of ammonia-oxidizing bacteria (AOB) that oxidize NH_3 or NH_4^+ to NO_2^-, and nitrite-oxidizing bacteria (NOB) that oxidize NO_2^- to NO_3^-, and anammox (bacteria that anaerobically oxidize NH_3 or NH_4^+ to N_2 gas).[15] In addition, denitrifying bacteria will be performed if a method becomes available. To evaluate which pathway(s) (if any) dominate below or above the chemocline, samples will be collected and analyzed to quantitatively measure the response of the total bacterial community and the nitrogen cycling bacteria. Refer to Attachment 1 for additional information about this microbiological testing.

- **Screening Level Bench-Scale Microcosm Study:** We anticipate completion of a screening level bench-scale microcosm study that will provide additional information on the dominant ammonia

[15] The relative abundance of the different ammonia-degrading bacteria will be assessed using real-time quantitative polymerase chain reaction (qPCR) target assays developed for ammonia-oxidizing bacteria using both DNA and RNA.

transformation processes in the Pond. The Screening Level Microcosm Work Plan is included in the Field Sampling Plan as Attachment C6.

Data collected during PDI-4B will be assessed and integrated with data collected through other PDIs (e.g., fluorescent dye study [PDI-4A], tank treatability study [PDI-5], and other work) to improve the understanding of ammonia transformation within the Pond and to facilitate the remedial design. In addition, the data collected in PDI-4B and other PDIs will be evaluated to assess whether ammonia transformation rates in the Pond can be estimated.

The ammonia transformation pathway determination and reaction rate estimates obtained in PDI-4B are anticipated to benefit the understanding with respect to potential removal options for ammonia in the HBHA Pond. For example, if the ammonia removal efficiency in the Pond is low, then additional enhancements may be necessary (such as increasing the amount of biological growth substrate, and/or adding oxygen or nutrients) to improve performance.

In addition, as part of various studies described herein, sediment (PDI-1), groundwater (PDI-3), and surface water (PDI-4C and SWMP) may provide further understanding of the contaminant contribution from sediment diffusion.

3.1.3.3 PDI-4C: Surface Water Profiling

Pond stratification plays an important role in the fate, transport, and transformation of arsenic and other COCs. Density stratification leads to the formation of two distinct compartments in the north basin of the Pond (water above and below the chemocline, or technically, the pycnocline with respect to density driven stratification). The formation and the stability of this chemocline influences the fate and transport of ammonia and benzene. PDI-4C is designed to collect a more robust database to facilitate greater understanding of the variability and sensitivity of the chemocline.

The primary objective of PDI-4C is to develop a greater understanding of the stability of the chemocline on a daily, monthly, and seasonal basis, considering storm-induced impacts to the extent they occur in portions of the Pond. To fulfill this objective, a combination of four different types of information will be obtained: 1) field water quality data from at three key locations in the Pond (RM-1, RM-2, and RM-3; see Figure 3.1.3.3-1) using submerged, computerized conductivity-temperature-depth (CTD) sensors to identify any changes at preselected depths ; 2) surface water samples at the field water quality monitoring stations to evaluate chemical trends in profile and confirm/supplement the field water quality data collected from CTD sensors; 3) stream discharge data at the inlets and the outlet of the Pond (obtained as part of the SWMP which is being conducted under a separate work plan); and 4) weather data collected from a station located near the Pond (e.g., storm and/or wind events), so meteorological data can be correlated to changes in the water quality above and below the chemocline. Additional information regarding the field tasks included in this PDI is presented in the FSP (Appendix C).

COC transformation processes will be further evaluated by obtaining chemical data from deep surface water (below the chemocline), intermediate (at the chemocline) and shallow surface water (above chemocline) within the HBHA Pond. The data will help further understand 1) transformation process which may be applicable to enhancing the primary and secondary treatment cell designs, and 2) surface water flow and weather conditions which may contribute to chemocline fluctuations or instability and how these data may be considered further for the final design of the primary treatment cell (e.g., promote chemocline stability).

This PDI involves installing and collecting monitoring data from three fixed surface water, vertical monitoring stations configured with CTD probe stations[16] within the Pond. These locations include RM-1 at the north, RM-2 at the south, and RM-3 in the middle of the Pond (see Figure 3.1.3.3-1). These locations may be adjusted to further support PDI-15 and -16. The three fixed CTD stations will be established as vertical monitoring stations within the HBHA Pond, the depth configuration of which is described in more detail below. Field data collected with the CTD sensors will be supplemented with sampling and analytical data and a more extensive field parameter list (DO, ORP, pH, etc.) during an additional six monthly base flow events (coordinated with the SWMP) and two storm flow events[17]); These data will be used to supplement the vertical water quality data collected to date (17 base flow events and 7 storm flow events as of 3/15/10) as part of the Early Action activities completed at the Site (see discussion below on which locations will be sampled for fixed laboratory analysis).

The depth configuration or vertical intervals at each of the three monitoring stations (RM-1, -2, and -3) have been established based on the approximate chemocline depth measured during the Early Action data collection phase. Generally, the chemocline depth and water quality differences (above and below the chemocline at a given location) measured below water surface varies by location (e.g., the chemocline at RM-1 is typically shallower and more abrupt in the transition compared to RM-2). To capture sufficient vertical data density proximal to the chemocline, we propose arranging the CTD sensors at 25 cm vertical intervals in the vicinity of the chemocline, with CTD sensors approximately every 50 cm above and below the interval where more dense CTD placement is proposed. Figure 3.1.3.3-2 has been developed to show the chemocline depth variability and the proposed layout of the CTD sensors for each of the three CTD stations.

As noted above, surface water sampling will be conducted on a periodic basis to augment field data collected with the CTD sensor array. Given the large database of existing data to correlate field measurements with fixed laboratory data in the Pond, sampling and analytical work will only be performed at RM-1 and RM-2 (RM-3 will have CTD data to correlate water quality). Surface water samples from RM-1 and RM-2 will be analyzed for the following parameters:

- Arsenic (total and dissolved)
- Nitrogen suite (ammonia, nitrate, nitrite, and TKN, which, when combined with ammonia result for a given sample, allows for total organic nitrogen [TON] via calculation)[18]
- Benzene
- Total suspended solids (TSS)
- Ferrous iron (filtered) and total iron (unfiltered)
- General chemical parameters including temperature, specific conductance, dissolved oxygen, pH, ORP, turbidity

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[16] Based on field observations to date, biofouling may occur on the sensors and is thus a consideration for deployment and maintenance of the CTD sensors. The initial portion of the deployment period for the CTD sensors may include a single location (e.g., at RM-1) to test and evaluate performance prior to purchasing and installing the full complement of CTD sensors for all three locations.

[17] The trigger for a storm flow monitoring event will consider the types of storm events previously monitored. The intent of the storm flow monitoring in PDI-4 is to collect profiling data during events of varying magnitude to establish a baseline for a range of storms. Because the Settling Defendants have already collected several storms in the range of 2.5 inches or more of precipitation, the storm-based sample event trigger under this PDI will be storms of magnitude greater than approximately 2.5 inches, considering such factors as rainfall intensity, snowmelt, etc.

[18] Unless specifically stated otherwise, the standard nitrogen analytical suite (ammonia, nitrate, nitrite, and TKN (to obtain TON)) excludes dissolved nitrogen gas (fixed nitrogen) and is assumed to represent the "total nitrogen" concentration when the applicable species are summed (nitrate + nitrite + ammonia + TON = total nitrogen).

In addition to these standard parameters, select Pond monitoring events will include the additional parameters of salinity and water density (note, conductivity and temperature are routinely collected during each monitoring event). Density and salinity data (along with other relevant input data) will support hydrodynamic modeling (PID-8) and the overall remedy design.

The data collected from the CTD sensors will be compared to laboratory data and considered in the environmental monitoring plan. As indicated above, some of the CTD locations may be adjusted to support other PDIs, such as PDI-15 and 16.

In addition, a meteorological station was installed on site as part of Early Action activities. This station is located in an upland area just north of the Pond and has been collecting weather data including wind direction and speed, temperature, and precipitation since July 2009. In addition, weather stations that monitor temperature and precipitation are located throughout the site as described in the SWMP.

Data collected during PDI-4C will support nearly all other PDIs. The surface water sampling portion of PDI-4C performed to date has been conducted during the same sampling events as are covered by the SWMP, thereby allowing correlations between the water quality entering, within, and leaving the Pond. Additional surface water sampling under PDI-4C is described in the FSP (Appendix C).

3.1.4 PDI-5: Tank Treatability Studies

PDI-5 is primarily designed to gather data to assess the performance, evaluate the feasibility, and facilitate full-scale design of the secondary treatment cell of the HBHA-4 remedy described in the ROD and SOW. The HBHA-4 remedy design concept uses two cofferdams to create three sections in the pond (a primary treatment cell, secondary treatment cell, and the restored southern cell).

The primary treatment cell's main function is to capture the groundwater plumes discharging into the HBHA Pond and maintain the chemocline below the outlet of the primary treatment cell cofferdam to allow treatment/sequestering of surface water contaminants of concern. A chemocline has been observed that stratifies the pond and significantly reduces the surface water COC migrating from depth to the shallow surface water. The intent of the primary treatment cell is to preserve the mechanisms within the chemocline contributing to these COC reductions.

In addition, the SOW permits various shallow horizontal aeration studies within the primary treatment cell to further enhance the removal of surface water COCs, and potentially contribute to stabilizing the chemocline position at 100 cm below the primary treatment cell outlet elevation.

The design approach for the Pond and secondary treatment cell must consider both flow management and removal efficiencies for all three surface water COCs: arsenic, ammonia, and benzene. Because typical treatment processes for these three COCs differ, PDI-5 describes three main types of treatability studies to assess the potential ammonia removal mechanisms:

- Aeration to test volatilization pathways of ammonia and/or benzene, as well as aerobic biological degradation of these COCs
- Biologically-mediated pathways, both aerobic and anaerobic
- Precipitation, as a by-product of aeration for the mitigation of arsenic transfer out of the treatment cells

Ammonia, arsenic, and benzene will be analyzed as part of this PDI to identify treatment performance with respect to all COCs.

The removal of ammonia through a stripping/aeration process, as described in the ROD, has substantial limitations based on the water conditions in the Pond and the characteristics of ammonia/water solutions. Firstly, the volatility of ammonia at circum-neutral pH is low (Peavy, 1985; Tchobanoglous and Schroeder, 1987). Data on pH levels in the Pond are readily available and are graphically summarized on Figure 3.1.4-1 (pH data compiled from Ford, 2004; and GSIP (Roux), 2002). These data indicate that the predominant pH of the Pond is between 6.5 and 7.0 standard pH units (S.U.). The distribution between ammonium (NH_4^+) and ammonia (NH_3) species in solution is strongly affected by pH, and to a lesser degree, by temperature. Since the ammonium ion is fully miscible in water, only the "free" ammonia (NH_3) can be removed from the water through an aeration/stripping process (i.e., only NH_3 is volatile). Figure 3.1.4-1 shows the percentage of free ammonia theoretically present in water at various pH and temperatures[19] (Peavy, 1985) along with a histogram of the measured pH values in the Pond. As Figure 3.1.4-1 indicates, ammonium predominates when pH is below 8.75; ammonia predominates when pH rises above 9.75, and the free ammonia decreases as temperature decreases. For the discussion in this document, the term ammonia is generally used to refer to both NH_3 and NH_4^+, although the term "free ammonia" is sometimes used to describe non-ionic ammonia (i.e., NH_3) that has the potential to be air-stripped from the water. At the pH levels observed in the Pond, less than 1% of the total ammonia present in the Pond will be in the form of "free ammonia". In other words, at the ambient pH of the Pond, less than 1% of the total ammonia is volatile and treatable through the stripping technology identified in the ROD.[20] Ammonia volatility could be increased by raising the pH in the Pond to approximately 10 standard units (i.e., at a pH of approximately 9.5 about half of the total ammonia is volatile) and then readjusted back to its original range (6.5 – 7.0 units), but this may significantly increase health and safety and ecological concerns and complicate long-term Operations and Maintenance.

Testing will be conducted with two different concentrations of COCs:

- Low COC concentrations - representative of water above the chemocline
- High COC concentrations - a mixture of water from above and below the chemocline

Pending results from the microcosm study (performed under a separate submittal to EPA), we will identify the relevant ammonia removal pathways to focus on, and attempt to integrate the lessons learned in the microcosm to define the need for testing even higher ammonia concentrations more representative of water in the vicinity or below the chemocline and the approach to such a test.

Existing site data indicate that there is a deficiency of biologically-available phosphorus in the HBHA Pond. Phosphorus, along with nitrogen, is a key nutrient to biological activity. The need for and effects of phosphorus addition to the system will also be evaluated. The phosphorus addition rate will be controlled so that there is an ortho-phosphate concentration of less than 0.025 mg/L at the tank effluent to limit the potential for noxious algae and other growth which can occur when too much nutrients enter surface water. See FSP (Appendix C) for more detailed description of the test setup and methodologies.

The tank studies identified in PDI-5 will utilize surface water drawn directly from the HBHA Pond and be implemented during summer/warm and winter/cold temperature conditions (sequencing depends on the approval date for this PDI) to evaluate removal of COCs under varying temperature conditions. The

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[19] http://cobweb.ecn.purdue.edu/~piwc/w3-research/free-ammonia/nh3.html is a calculator for the proportions of NH_3 and NH_4^+ in water as a function of pH and temperature.

[20] Given the likelihood that volatilization alone will prove insufficient in providing a level of treatment necessary to achieve Performance Standards, additional testing has been included in this PDI to test the effects of biological degradation on ammonia present in the Pond. The use of biological degradation to treat ammonia is common in municipal and industrial wastewater systems. The additional tests proposed in this PDI will give insight into biological mechanisms (e.g., nitrification/denitrification and anammox) that are at work in the Pond, and how these mechanisms may be enhanced to increase COC removal.

testing program performed second may be modified or streamlined based on the results of the first stage of tank testing. In addition, pending the sequencing of PDI-5 and the microcosm study described in PDI-4B, PDI-5 may be modified or streamlined, taking the results of preceding studies into consideration.

During the tank studies, samples will be collected from air and/or water to evaluate the distribution and extent of conversion of COCs, as well as COC removal processes such as those occurring due to increased:

- Volatilization through aeration
- Precipitation with increased dissolved oxygen through aeration
- Biological degradation via aeration and/or nutrient enhancement
- Degradation via biological films/media
- Settling via natural processes

It may be difficult, however, to conduct tank studies in both winter and summer, process and analyze the results, and use these results in the development of a 30% design, all within the span of 360 days. As mentioned above, the second study may need to be modified tailored in light of the results of the first study in order to complete it on time, as well as to incorporate lessons learned from the initial test stage. If a winter test cannot be performed during the 360-day timeframe, it will be performed when the schedule allows, with results submitted to EPA through monthly status reports, and any design changes based on the results of the winter test incorporated as part of the next scheduled design submittal.

The above studies, as well as results from other PDIs, will be considered in the final design. PDI-5 collects data necessary for removal process design, primarily associated with the secondary treatment cell, but may also produce data that improves our overall understanding of the natural processes occurring in the Pond that could be enhanced. Additional information regarding the experimental design, procedure and apparatus is presented in the FSP.

The goal of this PDI is to provide the following design information:

- Ability of volatilization alone to remove ammonia to meet the Performance Standards, (e.g., assessment of the viability of the ammonia removal mechanism proposed in the ROD)
- Contribution of aerobic biological degradation to ammonia removal
- Estimate, where concentrations are above detection limits, the removal efficiency for benzene via aeration from both volatilization and biological degradation pathways
- Assessment of the need for substrate to support microbial growth and nutrient requirements for biological growth in the Pond if dispersed growth alone is not sufficient to meet Performance Standards
- Volatilization or biological attenuation rates to allow sizing of the secondary treatment cell
- Settling rates for arsenic

3.1.5 PDI-6: Geotechnical Investigations

PDI-6 is subdivided into three discrete PDIs. Each involves subsurface explorations in distinct areas to support the design of structures which may be integrated into the final remedy. PDI-6A includes explorations along the HBHA Pond for cofferdams (dividing the Pond) and bypass structure (at Halls Brook) as described in the ROD**.** PDI-6B includes explorations conducted along the western shoreline of the HBHA Pond for a possible storm flow bypass or holding and dissipation system. Depending on where cofferdams are constructed, a longer flow bypass structure (or holding and dissipation system) may be needed and the required exploration scope will likely be a combination of Scopes PDI-6A and PDI-6B. PDI-6C includes geotechnical explorations to assess subsurface conditions near the AAD and BECO inlets to HBHA Pond in the event energy dissipation structures is needed to mitigate storm flows at either

of these inlets. Preliminary geotechnical exploration locations described in PDI-6 are shown on Figure 3.1.5-1.

The goal of the geotechnical PDIs will be to address the following data needs:

- **Scope PDI-6A (HBHA-4 Cofferdam and Storm Flow Bypass) -** Provide geotechnical information for design of structures identified in relation to HBHA-4. The location of the cofferdams may be farther south than shown in the ROD and, if so, the exploration locations will be moved to the actual proposed alignment and additional explorations will be required as described below.
- **Scope PDI-6B (Halls Brook Storm Flow Bypass/ Holding & Dissipation System) -** If studies determine that the cofferdams are to be located to the south of Halls Brook, either a storm flow bypass and/or holding and dissipation system may be constructed to maintain the chemocline in the Pond during storm flows. These structures would be constructed along the western shoreline of the Pond and partially in the water.
- **Scope PDI-6C (AAD and BECO Storm Energy Dissipation Systems) -** If studies identify that water entering the north end of the Pond by AAD or the BECO drainway could disrupt the chemocline in the primary treatment cell, energy dissipation structures may be needed at either or both of these inlets. PDI-6C will collect geotechnical data to support the design of such structures.

Additional geotechnical subsurface explorations may be indicated depending on the need for and final location of structures. The proposed explorations listed above under PDI-6A and PDI-6Bwill not be completed until the approximate location of cofferdams is determined as part of PDI-3.

The sub-components of PDI-6 are presented below.

3.1.5.1 PDI-6A: HBHA-4 Cofferdam and Storm Flow Bypass

The HBHA-4 cofferdam would be comprised of two parallel cofferdams constructed across the Pond at approximately the location where Halls Brook enters the Pond. The secondary treatment cell would be located between these two cofferdams. As part of the HBHA-4 approach, a storm water bypass would be constructed to direct most of the flow from Halls Brook to the south side of the cofferdams during storm events.

A survey map by Meridian Land Services, Inc. entitled “Topographic Worksheet, Groundwater/Surface Water Investigation Plan (GSIP) Sediment Transport, Investigation Sampling Locations, SW-1, Woburn MA,” shows the invert of the Halls Brook stone box culvert at El. 54.71 at the west side of the railroad embankment and the top of the embankment at El. 66 ft. Other drawings by Meridian show that the Pond outlet is at approximately El. 50. The 100-year flood elevation was recently determined to be El. 56.8 by Vanasse Hangen Brustlin, Inc. (VHB, 2003).

Subsequent to ROD issuance, EPA indicated that the crest elevation of the cofferdam system contemplated in the ROD may be at about El. 50 ft (the approximate invert of the Pond outlet) to minimize the remedy’s flooding effects. During storms, a cofferdam of this elevation would be submerged perhaps 5 ft or more. While it remains to be determined what storm scenario is the realistic design basis, the cofferdams may have to be constructed at various elevations (invert at El. 50 ft to avoid impounding water, and higher elevations elsewhere) to control and direct flow to the treatment elements. This variable cofferdam elevation will likely influence the design configuration and elevation of the storm flow bypass structure as well.

Significant erosion of Halls Brook has occurred and two sewer lines have been exposed in the streambed (Figure 3.1.5.1-1). A detail of City of Woburn Tax Map 15 (Figure 3.1.5.1-2), shows that there are two parallel 20-ft-wide sewer easements between the Boston & Maine Rail-Road ROW and the HBHA Pond. The horizontal distance from the edge of the sewer easement on the tax map to the El. 50 contour appears to be approximately 40 ft from where Halls Brook enters the Pond and is as close as 5 ft further to the south. The land available for the proposed storm flow bypass is relatively small and some of this bypass structure may have to be built within the limits of the Pond.

Depending on the results of hydraulic studies, it may be necessary to construct parts of the storm flow bypass in the streambed within the sewer ROWs, which would require the permission and cooperation of the owner(s) of the sewers. Construction of the proposed structures could consequently impact the railroad tracks or the sewers. For this reason, we have included a boring close to the embankment and within the sewer ROW to assess subsurface conditions in the vicinity of these structures and potential future bypass.

PDI-6A consists of two main elements, an exploration program at the Halls Brook inlet to the Pond where a surface water diversion structure may be necessary, as well as the geotechnical borings in the Pond as input to the design of cofferdams across the Pond. It is anticipated that two land and four water based borings will be advanced with one additional boring near the rail road tracks. Environmental samples will be collected at four of the soil borings to assess health and safety, and soil disposal considerations for the remedial design. Standard penetration test samples will be collected at approximately 5-ft depth intervals, with additional samples as necessary, and three test pits will be dug in the storm flow bypass area. Additional details on the geotechnical investigation to be conducted under PDI-6A are presented in the FSP (Appendix C).

Other PDIs will contribute to further understanding the surface water flows and elevations to assist in design and placement of the cofferdams for the constructed remedy, including PDI-7 HBHA Flood-routing Modeling Analysis, PDI-3 Groundwater Discharge Evaluations, PDI-14 Ammonia Background Investigations, PDI-10 Impermeable Caps, and the PDI-16 Cofferdam/Barrier Simulation Test.

3.1.5.2 PDI-6B: Halls Brook Storm Flow Bypass/ Holding & Dissipation System

The data collected during historical and Early Action storm events suggests that the chemocline is disrupted to varying extents in portions of the pond under certain conditions. The data to be collected under various PDIs will help to determine the magnitude and extent of storm impacts on the chemocline. This concern arises regardless of whether only a portion of the Pond, or the entire Pond, is used for treatment. To address this concern, a storm flow bypass that will route storm flows to the south of the cofferdams may be needed to minimize chemocline disruption. Alternatively, the structure may be modified and function as a storm water holding and dissipation system that will reduce velocities of water entering from Halls. PDI-6B has been developed to collect geotechnical data to support the design of a bypass extension or a holding and dissipation system.

The holding and dissipation system approach would include an energy dissipation system, stilling basin, and an overflow weir installed along the western edge of the Pond. Redirecting and distributing Halls Brook flow with this structure will be intended to maintain the integrity of the chemocline during high flow situations. The work scope discussed below assumes that a structure with an energy dissipation system and a 300- to 400-ft long overflow weir may be necessary. Conceptually, the energy dissipation system and stilling basin would be constructed on land where Halls Brook currently enters the.

PDI-6B is a geotechnical exploration program along the west side of the Pond where a surface water bypass or holding and dissipation structure may be constructed.

If other PDI data (e.g., PDI-3) indicates that bypass or holding and dissipation structure are appropriate the remedy design, one soil boring at the water's edge and three soil borings within the Pond along the holding and dissipation system alignment will be advanced. Additionally one boring is also proposed between Halls Brook and the Massachusetts Bay Transportation Authority (MBTA) ROW, and one located between the railroad and the sewer line easements. Seven test pits will also be excavated along the stilling basin and holding and dissipation system investigation area. Additional information regarding the geotechnical investigation conducted under PDI-6B is presented in the FSP (Appendix C). In the event other PDI data indicates that the cofferdam location presented in the ROD (Halls Brook inlet) should not be utilized, the scope of PDI-6B may be modified.

3.1.5.3 PDI-6C: AAD and BECO Drainway Storm Energy Dissipation Systems

Surface water flows in AAD and BECO, are observed primarily during and following storm events, and not during dry weather. Both AAD and BECO discharge in the north end of the Pond. Concern exists as to the potential disruption of the chemocline in this area during storm events when flows may be high in AAD and BECO. Therefore, some form of structure may be needed at each inlet to moderate and/or distribute inflows to the Pond to mitigate potential disruption of the chemocline. If it is determined that velocity/energy dissipation systems are required at these locations to maintain the chemocline, geotechnical investigations will be performed along the ADD and BECO drainway inlets. Of the two drainways, storms flows are greatest along the ADD and may require a more robust storm energy dissipation system. Three soil borings will be advanced in the area of the AAD inlet, and two borings in the area of the BECO drainway inlet. Standard penetration test (SPT) samples will be collected at approximately 5-ft depth intervals, with additional samples taken for geotechnical strength testing as necessary. Additional information regarding the geotechnical investigation conducted under PDI-6C is presented in the FSP (Appendix C).

Additional information from other PDIs will be considered in the design of ADD and BECO drainway storm energy dissipation system, including PDI-7 Hydraulic Flood-routing Modeling Analysis and PDI-11 Permeable Cap.

3.1.6 PDI-7: HBHA Flood-routing Modeling Analysis

PDI-7 will utilize existing data and obtain additional information/data regarding current base and storm surface water flows around Industri-plex OU2, with particular emphasis on surface water flows north of Route 128 (e.g., HBHA, Aberjona River [including north and south branches upstream of the Marshall warehouse along Commerce Way], Halls Brook, NBSD, AAD, Phillips Pond). This information will be used to create a more detailed model of existing storm water flows impacts on the HBHA Pond. This model will be considered further with the design of the HBHA Pond remedial component of the remedy and for minimizing flood storage losses. Storm flows with 2-, 10-, 25-, 50- and 100-year recurrence intervals will be modeled. The selected flood-routing model for use in PDI-7 is EPA's Storm Water Management Model Version 5.0.018 (SWMM5) with no proprietary user interface. Following calibration, the model will be used for predictive simulations to assist with the design of remedy components. This is expected to include simulation of a bypass structure at Halls Brook as well as other elements of the remedy identified during formulation of the 30% design. The calibrated model, including backup, will be provided electronically to EPA for review.

Existing data will be used in addition to new data to be collected for this PDI to 1) create a more detailed model of existing storm water flow in the vicinity of the HBHA Pond, 2) be used in design of HBHA Pond remedial components, and (3) to predict flood storage losses, as needed.

Information relevant to the flood-routing modeling analysis and remediation design includes reviewing:

- Existing information (e.g., maps, aerial photos, reports, permits and past filings with various agencies, past engineering designs and analyses) to develop inputs for the model of the HBHA Pond and surrounding areas
- Details on the stormwater infrastructure in the HBHA subwatershed and adjacent Aberjona River subwatershed (upstream of Mishawum Road), including locations, sizes, materials, and other characteristics of storm drains, pipes, and culverts. To the extent possible, data from existing models by project team member, VHB and ENSR (through their work for others in establishing new FEMA flood zones) will be used for the analysis. As needed, additional field survey data will be collected to verify and supplement data collected from past studies.
- Streamflow and stage/flood level within HBHA and at upstream and downstream locations, under both baseflow and flood conditions
- Meteorological data from the on-site weather station and local weather stations in Reading, MA

Table 3.1.6-1 summarizes data to be used for model calibration, including station, data type, recording interval, dates recorded and data sources.

3.1.7 PDI-8: HBHA Pond Hydrodynamic Modeling

PDI-8 involves the development of a three-dimensional hydrodynamic model for the Pond. This model is intended to be used to evaluate the potential for chemocline disruption under various design scenarios for the selection and scoping of various mitigation measures (e.g., surface water energy dissipation structure or cofferdams in the Pond). Hydraulic controls being considered for surface water inlets include a storm flow diversion, or a velocity dissipation weir, each as described in PDI-6, whereas cofferdam(s) will subdivide the Pond into treatment cells. The goal of this PDI will be to develop a model to better understand the impacts of the selected hydraulic control devices proposed for HBHA Pond inlets as well as to evaluate the potential impact of cofferdams on mixing in the Pond. The selected hydrodynamic model for PDI-8 is Estuary Lake and Coastal Ocean Model (ELCOM), which was originally developed by Centre for Water Research at the University of Western Australia and is now commercially available. ELCOM is a three dimensional computational fluid dynamics program designed for practical numerical simulation of hydrodynamics and thermodynamics for inland and coastal waters. ELCOM will be used to simulate the impacts of the proposed stormwater diversion or velocity dissipater structure(s) on the hydrodynamics of HBHA Pond. A comprehensive description of the equations and methods used in the models is provided in the “Estuary Lake and Coastal Ocean Model: ELCOM v2.2 Science Manual” by Hodges and Dallimore (2006), and the “Estuary Lake and Coastal Ocean Model: ELCOM v2.2 User Manual” by Hodges and Dallimore (2007).

The portion of PDI-8 work involving scenario evaluations that rely on flow estimates from PDI-7 and greater definition of the design concept cannot be completed until after a certain amount of other PDI/SWMP data has been collected (e.g., PDI-3 and PDI-4). As a result, PDI-8 is scheduled near the end of the pre-design data collection phase following PDI-7, although the initial model setup may begin well before this point in time.

3.1.8 PDI-10: Impermeable Caps

PDI-10 is designed to collect data to identify the location and extent of surface water channels (e.g. New Boston Street Drainway) along which impermeable cap(s) need to be designed and installed to mitigate contaminated groundwater discharge. Groundwater and surface water collected under this PDI and other PDIs (e.g., PDI-3, PDI-12, and PDI-14) will be used in determining the extent of areas requiring impermeable caps.

PDI-10 includes installation of sixteen temporary drive point piezometers along surface water channels upstream of HBHA Pond as shown on Figure 3.1.8-1. Groundwater samples will be collected from each piezometer and surface water samples will be collected adjacent to the piezometers. Refer to the FSP (Appendix C) for additional information regarding the groundwater and surface water sampling for this PDI.

3.1.9 PDI-11: Permeable Caps

Consistent with the ROD and SOW, a permeable cap will be designed and installed where arsenic concentrations in soil in the vicinity of the northern portion of the HBHA Pond are higher than the HBHA Pond sediment cleanup standard for arsenic and may erode and migrate downstream, potentially impacting components of the selected remedy (including the Northern Portion of the HBHA Pond). This PDI will utilize existing RI data and collect additional soil data to fill data gaps regarding the extent that arsenic concentrations in soils are greater than the HBHA Pond sediment cleanup standard of 273 mg/kg, thereby requiring a permeable cap. Geotechnical information collected in the vicinity of the locations where permeable caps are required (e.g., PDI-6C: AAD and BECO drainway storm energy dissipation systems) may also be considered in the final design of these permeable caps. The permeable caps, as described in the ROD, are consistent with the permeable cap designs approved under the Industri-plex OU1 100% Design Report, dated April 25, 1991. Specific design details, monitoring and maintenance requirements of the permeable caps will be established during the final design. See Figure 3.1.9-1 for initial sampling locations. The figure depicts sampling locations outside RI sampled areas to help determine the extent of the permeable caps. Soil samples will be collected from 0 to 6, 6-18, and 18-36 inches bgs a**t** the fifteen (15) locations shown in the figure.

3.1.10 PDI-13: Studies to Locate Property(ies) for Construction of Compensatory Wetlands

The selected remedy documented unacceptable ecological risk at the HBHA Pond. Specifically, the ROD states, “The analysis of the selected indicators/endpoints indicates the only area of unacceptable ecological risk is in the HBHA Pond, where the potential risk to aquatic receptors is due to arsenic, benzene, and ammonia in surface water. The potential risk to the benthic invertebrate community is due to inorganic COPCs, especially arsenic.” (ROD, p. 54) The “aquatic receptors” and “benthic invertebrate community” occupy habitats within the HBHA Pond and this habitat is considered a function associated with the pond. The selected remedy uses “the northern portion of HBHA Pond as a sediment retention area (primary and secondary treatment cells) that will intercept contaminated groundwater plumes (including arsenic, benzene, ammonia, 1,2-dichloroethane, trichloroethene, naphthalene) from Industri-plex OU-1, treat/sequester contaminants of concern (including arsenic, benzene, ammonia), and minimize downstream migration of contaminants (including arsenic, benzene, ammonia).” (ROD, p. 86) “Since the northern portion of the pond would be incorporated into the cleanup remedy and used to treat contaminated groundwater discharges, this area would not provide protection to the benthic organisms in the short-term. However, an alternative wetland would be constructed in its place.” (ROD, p. 76)

As stated in the ROD (p. 87),one of the major components of the remedy involves “[c]onstruction of compensatory wetlands for any loss of wetland functions and values associated with the selected remedy (e.g. Northern Portion of HBHA Pond, Halls Brook Storm Water By-Pass, capped stream channels) nearby in the watershed.” These functions and values losses include the “aquatic receptors” and “benthic invertebrate community” losses associated with HBHA Pond, as well as any other losses associated with the selected remedy. The goal of this PDI is “to locate property suitable for the construction of a compensatory wetlands [sic] to mitigate wetland and water function and value losses.” (ROD, p. 93)

Construction of the compensatory wetlands is an integral subcomponent to the Northern Portion of the HBHA Pond remedy component of the selected remedy. As reflected in the ROD (p. 91), “The details of

this component of the selected remedy will be established during pre-design investigations and remedial design, and many of the components are inter-dependent. For example: The location of the first low-head cofferdam and size of the primary treatment cell will greatly depend upon pre-design investigations to further delineate the extent of the contaminated groundwater plumes discharge into the HBHA Pond so that the primary treatment cell captures all of the contaminated groundwater plumes. The locations of the first low-head cofferdam, the size of the primary treatment cell and the design of the secondary treatment cell will directly affect other remedy components such as the length/size of the Halls Brook storm water by-pass system, the size of the southern portion of the HBHA Pond requiring dredging and restoration, and the amount of wetland compensation. Also, the wetland function losses associated with the construction of impermeable and permeable caps will affect the amount of wetlands compensation."

The size of the required compensatory wetlands is related to the size of the habitat that the selected remedy impacts (e.g. Northern Portion of HBHA Pond, Halls Brook Storm Water By-Pass, capped stream channels). As such, the PDIs associated with the Northern Portion of the HBHA Pond remedy component (e.g. PDI-3, PDI-4, PDI-5, PDI-6, PDI-7, PDI-8, PDI-10, PDI-11, PDI-15, PDI-16), may influence the size of suitable property(ies) for PDI-13.

The initial scoping of property nearby within the watershed will begin early in the RD process and be refined as the size of the Northern Portion of the HBHA Pond remedy component progresses with the final design (after the 30% design stage). The design of the construction of compensatory wetlands should consider the results of the Flood-routing Modeling Analysis and further minimizing potential impacts to the HBHA Pond remedy during storm events. Appropriate local, state and federal agencies will be coordinated with during the design process.

3.1.11 PDI-14: Ammonia Background Investigation

Consistent with the ROD and SOW, groundwater and surface water investigations are necessary to 1) further evaluate ammonia background conditions, and 2) identify the extent of the groundwater plumes requiring institutional controls. This PDI will also fill groundwater and surface water data gaps regarding Industri-plex ammonia contributions to help understand other potential sources upgradient/upstream of Industri-plex OU-1 which may contribute to surface water ammonia at HBHA Pond. As discussed in PDI-10, the results of PDIs investigating the extent of Site groundwater plumes and their discharge to surface water will also help determine the extent of the impermeable caps to further prevent the discharge of contaminated groundwater plumes into surface water (e.g., New Boston Street Drainway), downstream migration of contaminants of concern and potential impacts to other components of the selected remedy.

PDI-14 involves a study to locate potential sources of ammonia contamination outside Industri-plex OU2 that contribute to the Pond. The general sequence for PDI-14 involves: 1) historical data review; 2) screening reconnaissance (e.g., surface water sampling); 3) groundwater investigation; and 4) groundwater monitoring. As part of the Early Action activities conducted to date, the historical data review and surface water sampling was completed. Surface water sampling to support PDI-14 has been completed at thirteen locations (on multiple events) upstream of HBHA Pond to date. The results of the surface water sampling indicate potential offsite, non-Industri-plex related sources of ammonia in surface water (e.g., Olin Chemical, Woburn Landfill.). Numerous surface water and groundwater investigations are proposed in PDI-3B, PDI-9, PDI-10, and PDI-12B and groundwater and surface water data are available from the Olin Chemical Superfund Site and the Woburn Landfill to further evaluate ammonia background. Therefore no additional surface water or groundwater sampling locations are proposed for PDI-14. Figure 3.1.11-1 provides a comprehensive view of both the types and locations of existing and proposed sampling locations to be used for PDI-14. This sampling network will provide data on ammonia (as well as benzene and arsenic) from sources that may be migrating into OU2 (e.g., Olin Chemical, Woburn Landfill, active New Boston Street facilities). The FSP (Appendix C) provides additional information regarding the scope and approach to this step-wise process.

3.1.12 PDI-15: HBHA Pond Aeration Pilot Test

The HBHA Pond Aeration Pilot Test is designed to gather data to assess the performance and, if found effective, prepare the full-scale design of a surface water aeration device to increase oxygen mass flux in the water column. Increasing dissolved oxygen in the water column is anticipated to enhance treatment of arsenic, ammonia, and possibly benzene. Consistent with the ROD and SOW, investigations regarding the design and construction of the primary and/or secondary treatment cells in the HBHA Pond, including various vertical (e.g. secondary treatment cell) and shallow horizontal (e.g. primary treatment cell) aeration studies to enhance treatment of contaminants of concern (including methods for increasing oxygen levels in surface water) are warranted for the Remedial Design effort.

To mitigate potential deleterious water quality impacts during these tests, PDI-15 incorporates several contingency measures, including a silt curtain and detailed water quality monitoring to reduce the risk and/or magnitude of potential contaminant outflow. While the volatilization and biological portions of the tank tests conducted under PDI-5 and the COC transformation work conducted under PDI-4B will provide information regarding the natural processes occurring in the Pond and the effects of aeration on these processes, the pilot tests conducted under PDI-15 will help in the assessment of the performance at pilot scale of two different aeration technologies (low-speed surface aerator and surface aspirating aerator) for enhancing the removal of ammonia, arsenic and benzene.

PDI-15 is designed to produce a more thorough understanding of the following general processes and system performance characteristics:

- Underlying geochemical behavior and mixing characteristics in the Pond
- Effect of increasing dissolved oxygen at depth on surface water/Pond effluent quality
- Surface water quality before, during, and immediately after the test
- Performance characteristics of the aeration device(s)
- System operating parameters and monitoring requirements
- Maintenance requirements and operating costs for aeration devices
- Technology applicability

This PDI will consider information gathered from other PDIs, including PDI-4 (HBHA Pond COC Transformation Processes & Studies, particularly PDI-4C), PDI-5 (Tank Treatability Studies), and PDI-16 (Cofferdam Simulation Pilot Test). This PDI will pilot test two aeration techniques to consider further in the final design of the secondary treatment cell, and, where appropriate, the shallow horizontal surface water in the primary treatment cell. The aeration pilot tests for the secondary treatment cell will focus on aerating the vertical surface water column to treat the surface water contamination which may migrate from the primary treatment cell. A portion of PDI-5 includes the use of a bubble diffuser to aerate the influent water in the applicable test tanks to assess vertical aeration in the secondary treatment cell (to test both ammonia “stripping” (e.g., intentional volatilization) as well as aeration to support aerobic microbial growth for contaminant transformation). Under PDI-15, low speed surface aerator and surface aspirator will be applied and monitored during the pilot test for the HBHA Pond. Pending the results of PDI-5, the approach to this PDI may be modified or other studies may be proposed with EPA approval including aeration pilot tests with fine bubble diffusers and deployment of biological media/films to further biologically degrade surface water COCs.

The aeration pilot tests for the primary treatment cell will focus on aerating the shallow horizontal surface water for possible stabilization of the chemocline at (or just below) 100 cm below the primary treatment cell cofferdam outlet elevation (potentially equivalent to the HBHA Pond outlet elevation). The potential to further remove contaminants by aeration above the chemocline in the shallow horizontal surface water in the primary treatment cell prior to discharge to the secondary treatment cell will also be evaluated. The

following aeration methods will be evaluated for the primary and/or secondary treatment cells at the northern portion of the HBHA Pond: low speed surface aerator and surface aspirating aerator. This pilot test in the northern portion of the HBHA Pond is not intended to mix deep surface water below the chemocline. The following aeration method will be evaluated for the secondary treatment cell: fine bubble diffuser aerator. Note, as described in FSP Section 3.2.7.4.B (Setup Locations), the intent of PDI-15 is to test the low speed surface aerator in both the northern and southern portion of the pond, whereas the surface aspirating aerator will be tested only in the northern portion of the pond. This PDI requires detailed surface water monitoring throughout the surface water column and will be implemented in areas where permanent surface water monitoring stations are situated in the Pond. Both portions of the pond where pilot testing will occur will evaluate the removal of surface water COCs from the shallow surface water, while the northern aeration pilot tests will monitor the chemocline to assess whether operation of the aeration device(s) are effective and appropriate to preserve the stability of the chemocline.

Schedule and seasonal considerations permitting, it may be possible to overlap portions of PDI-16 with PDI-15 to separately, as well as simultaneously, evaluate the effects of the cofferdam simulation (PDI-16) and aeration (PDI-15) in the northern portion of the Pond (i.e., primary cell). For example, operatePDI-16 first, followed immediately by PDI-15 startup while leaving the curtain used for the cofferdam simulation in place (weather permitting) may be carried out. More specifically, the sequenced series of test phases may involve:

1. No aeration / Cofferdam simulation in Pond (PDI-16)
2. Cofferdam simulation in Pond with mixing inside northern “primary cell” and the southern cell to attempt to see the net effect of both test types (shallow mixing in the primary cell and full vertical water column profile in the southern portion of the Pond)
3. Removal of the cofferdam simulation curtain, or portions of the curtain, and continued operation of aeration equipment only, if necessary (PDI-15)

PDI-15 draws on the results of other studies, including PDI-5, results of the proposed microcosm study proposed as part of PDI-4B, as summarized in the January 26, 2010 submittal to EPA, and the cofferdam simulation study (PDI-16). If it appears feasible and advantageous to overlap PDI-15 and -16, the duration of various test phases will be adjusted accordingly. To mitigate interferences associated with operating multiple PDIs concurrently, it may be necessary to sequence PDI-15 with other PDIs unless it is possible to maintain the general water quality anticipated in another PDI.

PDI-15 will not be conducted in the wintertime due to safety concerns associated with monitoring and sampling activities in the Pond during such period unless concerns can be properly addressed and prior testing results from other PDIs identify a need to test wintertime performance. Performing this test during winter depends on, among other things, safety considerations[21], the RDWP approval date, prior test results of other PDIs, and PDI schedules. Furthermore, based on the data collected to date, the summer represents the most challenging season for compliance relative to the ammonia Performance Standard[22], and thus winter testing for pilot test purposes may not be a necessary first step in the technology evaluation process unless schedule permits and adequate safety precautions are integrated into the test.

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[21] Safety is paramount; operating a mixing device will reduce or eliminate the ice adjacent to the mixing equipment, thus making performance monitoring and system maintenance more challenging and unsafe.

[22] While ammonia is referenced, it is also acknowledged that arsenic and benzene also represent surface water COCs. The focus on ammonia and winter condition stems from the hypothesis that ammonia transformation and removal processes, being biological in nature, may be influenced by temperature extremes, whereas arsenic transformation is more oxygen-dependent, and is not anticipated to be as temperature dependent.

Additional details on the technical approach to PDI-15 including experimental sequence, duration, and associated rationale for the main tasks associated with this PDI are provided in the FSP (Appendix C).

The CTD sensors/stations installed and operated as part of PDI-4C, as well as periodic sampling of the water column for fixed lab analysis per PDI-4C, will be utilized to evaluate water quality during PDI-15. In addition, a mobile profiling sonde will be used to monitor aeration performance at varying locations to assess the performance of the aeration devices.

3.1.13 PDI-16: Cofferdam Simulation Pilot Test

The primary purpose of PDI-16: Cofferdam Simulation Pilot Test will be to evaluate the hydrodynamic effects of a cofferdam on the chemocline and surface water flows within the HBHA Pond. Particular interest will be on whether or not a cofferdam for the primary treatment cell may potentially cause the chemocline to rise and how this may be considered in the final design.

An additional purpose of this PDI will be to evaluate likely surface water forces on flexible curtain-style cofferdams[23]. The final design of the cofferdams to be constructed must be sufficiently durable and robust to withstand periodic dredging and severe weather conditions. This PDI will also consider types of durable materials which could be used to construct the cofferdams. The conceptual remedy outlined in the ROD assumed the cofferdams would be constructed using steel sheet piling. The feasibility of using a synthetic curtain and other potentially durable, impermeable materials to prevent the horizontal flow and under flow from the primary treatment cell and to serve as a cofferdam will also be evaluated as part of this PDI.

Figure 3.1.13-1 for PDI-16: Cofferdam Simulation Pilot Test illustrates the approximate location of the cofferdam for the simulation pilot test. Based on water quality changes in the Pond between base and storm flow conditions observed during the Early Action data collection phase, coupled with the offset geometry of the AAD inflow relative to the deep area in the north end of the Pond, we propose conducting the pilot test with an “L”-shaped barrier configuration rather than straight across the Pond. This configuration, as shown in Figure 3.1.13-1, will likely mitigate the impact from both Halls Brook, as well as AAD (the two greatest contributors to flow to the northern portion of the HBHA Pond during base and storm flow conditions), and thus we believe is better at evaluating the chemocline depth/elevation change in response to barrier installation because it shelters the area from both Halls Brook and AAD flows.

We recognize that some groundwater discharge may occur to the south of the proposed location shown on Figure 3.1.13-1, but based on the data collected to date, the significant contaminant discharge to the Pond appears to be located in the northern section of the Pond. In addition, we believe that confining the area to a smaller footprint, like the northern 1/3 of the pond (east-west) and using the centerline of the Pond (north-south) in an L-shaped configuration (as shown on Figure 3.1.13-1) will capture the most heavily impacted groundwater discharging to the Pond. Because it will be more confined (compared to a test using a larger portion of the Pond), we anticipate the response of the chemocline will be more readily measured in the timeframe of the test (i.e., the smaller the area, the faster we would anticipate accumulation of dense water behind the barrier).

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[23] Note: During the remedial design, AASHTO Design Specifications or other appropriate method for determining stream pressure loading will be used, consistent with standard engineering practice and factoring in the cofferdam’s proposed materials of construction, orientation to flow, and/or other relevant design considerations as appropriate. Given the pilot test of a flexible curtain to simulate a flexible cofferdam concept, the nature of the evaluation of surface water forces on the pilot tested curtain will be more qualitative (e.g., observation of anchorage requirements).

For the reasons cited above, we believe the test should be run in the more confined L-shaped configuration and location.

Based on the discharge area of contaminated groundwater, this northern test should generally be the first simulation test conducted within the Pond. Depending upon the results of the initial pilot test, and considering the schedule and seasonal constraints, additional cofferdam simulation test locations may be targeted within the HBHA Pond (e.g., further south).

The cofferdam simulation test will be performed using materials similar to those used for silt controls (silt curtain baffles). A schematic of the simulated cofferdam barrier is provided on Figure 3.1.13-2. As shown, the barrier uses a ballast chain(s) along the base of the curtain (which is a standard approach used for silt curtains). In this application, we anticipate that the weighted chain will settle into the loose, floc-like sediment bed to establish the seal. Monitoring will be performed downstream of the barrier to evaluate flow under or through the barrier. If the ballast chain method of anchoring is unsuccessful, other measures would be evaluated and applied, as appropriate, considering field conditions, timing constraints, the apparent root cause of problems observed (if any), and other relevant considerations. This flexible curtain system is suitable for pilot testing the general approach. However, this curtain as proposed is generally not applicable to a winter iced-in condition, and therefore, this type of curtain for PDI-16 will be run during warmer periods to test the general concept.

To fulfill the data collection objectives of PDI-16, real-time water quality monitoring will be conducted at three fixed CTD stations (see PDI-4C and Figure 3.1.3.3-1) and manually along the alignment of the barrier (to supplement data retrieved from the fixed locations). Grab samples will be taken and submitted for laboratory analysis to correlate field measurements with chemical data, as described in the FSP. Additional information regarding sample locations, depths and frequency of sampling is presented in the FSP (Appendix C).

As noted for PDI-15 above, schedule and seasonal considerations permitting, it may be possible to overlap portions of PDI-16 with PDI-15 to separately, as well as simultaneously, evaluate the effects of the cofferdam simulation (PDI-16) and aeration (PDI-15) in the northern portion of the Pond (i.e., primary cell).

3.2 WHP In-situ Enhanced Bioremediation

3.2.1 PDI-9: West Hide Pile Investigations and Assessment

The goal of PDI-9 is to obtain sufficient data to assess the potential for unacceptable human health and ecological risks associated with groundwater, shallow groundwater, surface water, and sediment in the vicinity of the WHP and Lower South Pond; and conduct studies to support the design of the In-situ Enhanced Bioremedation at the West Hide Pile.

Consistent with the ROD and the SOW, PDI-9 will consist of the following three sub-sections:

- PDI-9A: West & East Hide Pile Investigations and Assessment
- PDI-9B: WHP Enhanced Bioremediation Studies
- PDI-9C: Additional Actions to Address Unacceptable Risk(s)

Each of these PDI subsections are described below.

3.2.1.1 PDI-9A - West& East Hide Pile Investigations and Assessment

PDI-9A will collect additional groundwater, surface water and sediment data within the WHP, Lower South Pond and adjacent wetlands as shown on Figure 3.2.1-1 to further characterize contaminated groundwater migration extent and potential aquatic impacts. This subsection will focus on the evaluation and understanding of contaminated groundwater plumes' (e.g. arsenic, ammonia, benzene, naphthalene, trichloroethene, 1-2-Dichloroethane) migration to and potential impacts on adjacent surface water and sediments. If screening thresholds listed in the FSP are exceeded, a human health and/or ecological risk characterization will be conducted on Lower South Pond and adjacent wetlands. For subsection PDI-9B, EPA will make a determination whether the In-Situ Enhanced Bioremediation component of the remedy at the WHP is necessary for implementation based on the identification of unacceptable risk. For subsection PDI-9C, if EPA determines unacceptable estimates of human health and/or ecological risks (e.g. surface water and/or sediments), then additional actions may be necessary under the Consent Decree to adequately address those risks.

The following general steps will be followed for PDI-9A:

- **Step 1** - Sampling and analysis of groundwater (from WHP wells), shallow groundwater (piezometers), surface water and bulk sediment (from the Lower South Pond) will be completed.
- **Step 2A (HH)** - If COC concentrations are below the human health (HH) screening thresholds, no further action will be required with respect to human health. If concentrations exceed the HH screening thresholds, then an evaluation of whether ICs can mitigate the HH risk will be conducted. If ICs apply, then ICs will be pursued; otherwise, Step 3 described below will be performed.
- **Step 2B (ECO)** - If COC concentrations in media are below applicable ecological screening thresholds, no further action will be required. If applicable concentrations exceed the screening thresholds, then Step 3 will be performed.
- **Step 3 -** If Step 2A/2B show exceedances of screening thresholds, then EPA will conduct the applicable supplementary risk characterization. Additional groundwater investigation and characterization may also be required in the vicinity of the WHP.

The risk screening Performance Standards for both human health and ecological receptors are presented in the following table:

Media	Ecological Risk	Human Health Risk
Sediment	Arsenic: 300 mg/kg Lead: 600 mg/kg Chromium: 1000 mg/kg Appropriate ecological screening criteria for ammonia, benzene, naphthalene, TCE, 1,2-DCA and any other compounds detected	Arsenic: 300 mg/kg Lead: 600 mg/kg Chromium: 1000 mg/kg Appropriate human health screening criteria for ammonia, benzene, naphthalene, TCE, 1,2-DCA and any other compounds detected.[1]
Surface Water	Arsenic: 150 ug/L Benzene: 46 ug/L Ammonia: NRWQC (2009) Appropriate ecological screening criteria for naphthalene, TCE, 1,2-DCA, and any other compounds detected.	Appropriate human health screening criteria for arsenic, ammonia, benzene, naphthalene, TCE, 1,2-DCA and any other compounds detected.[1]

[1]Settling Defendants anticipate that contaminant concentrations contribution to human health risk for the recreational wading scenario will be negligible.

For Step 1, it is anticipated that three locations will be sampled for groundwater and seventeen locations for sampling of shallow groundwater, surface water and sediment. Additional information regarding sampling to be completed in Step 1, along with the screening thresholds, is presented in the FSP (Appendix C).

The data should be sufficient for EPA to determine if additional unacceptable human health and/or ecological risks from OU2 groundwater plumes to groundwater, surface water and/or sediments exist in the vicinity of the WHP and Lower South Pond. If Institutional Controls can be properly established on the properties restricting human health exposure to contaminated groundwater and EPA determines that there are no other unacceptable human health and/or ecological risks, then the Settling Defendants anticipate that EPA will make a determination that the In-Situ Enhanced Bioremediation component of the remedy will not be necessary.

3.2.1.2 PDI-9B - WHP In-situ Enhanced Bioremediation Studies

For subsection PDI-9B, EPA will make a determination whether the In-Situ Enhanced Bioremediation component of the remedy at the WHP is necessary for implementation considering the identification of unacceptable risk and whether institutional controls have been properly established on the properties restricting human health exposures to contaminated groundwater. .PDI-9B shall be focused on the data collection and design of In-Situ Enhanced Bioremediation. Details of PDI-9B will be provided in an addendum to the RDWP, subject to EPA approval. The selected remedy for In-Situ Enhanced Bioremediation included oxidant injection to increase oxygen levels within the WHP and address the organic contaminant benzene in groundwater through aerobic biological degradation, as well as arsenic and ammonia contamination in groundwater through precipitation and reversing reducing conditions which contribute to contaminant migration. In terms of oxidizing capacity, the Settling Defendants anticipate organic ligands in WHP groundwater would compete with benzene for free oxidant. In addition, the highly reduced ligands may adversely react with the selected oxidant. To ensure efficiency, safety and cost-effectiveness in the field, bench scale pilot tests will be performed to evaluate various oxidants to accomplish the objectives of the selected remedy. Subsection PDI-9B will consider the results of bench scale pilot testing and help determine the type, amount, distribution, delivery, and frequency of oxidant to be injected into the WHP to address benzene. The Settling Defendants may evaluate other non-oxidation injections as part of the In-Situ Enhance Bioremediation Studies to address groundwater contamination at the WHP.

The final design of the In-situ Bioremediation shall be consistent with the selected remedy objective of treating benzene contamination in groundwater below cleanup standards, and addressing any other groundwater plume contamination migration (e.g. arsenic, ammonia) from the West Hide Pile.

3.2.1.3 PDI-9C Additional Actions to Address Unacceptable Risk(s)

The scope of PDI-9C will be developed, subject to EPA approval, if EPA determines unacceptable risks based upon the results of PDI-9A and additional actions are necessary. The details of any scope will be provided in an addendum to the RDWP, subject to EPA approval.

3.3 Removal and Restoration of Near Shore Sediments from the Wells G&H Wetland and CBCA

3.3.1 PDI-2: Wells G&H and CBCA Wetlands Sediment Dredging/Excavation

The SOW requires dredging in areas of accessible sediments within the Wells G&H Wetland (i.e., up to 30 ft from the shoreline) that exceed a human health-based concentration of 300 mg/kg arsenic and 4.9 mg/kg benzo(a)pyrene, with disposal of sediments off site. The SOW also requires dredging in areas

of accessible CBCA sediments along the bog irrigation channels to a human health-based concentration of 230 mg/kg arsenic, with disposal of sediments off site. PDI-2 will delineate the sediment to be removed, evaluate solidification methods for handling, transportation and disposal of wetland sediments, and will support the civil engineering design for construction staging, equipment access, and the dredging/excavation design for material handling, dewatering, and disposal planning.

Vertical sampling will provide information relevant to the determination of the required depth of dredging/excavation. A shallow sediment sample will be collected from 0-0.5 ft, and vertical sediment samples will be collected below at continuous one-foot (1') intervals to determine vertical extent of sediments exceeding arsenic and benzo(a)pyrene concentrations mentioned in the previous paragraph (0.5 to 1.5 ft, 1.5 to 2.5 ft, etc). Horizontal samples (0-6") will collected at least every fifty-feet (50') as shown in Figures 3.3.1-1 and 3.3.1-2 to determine horizontal extent of the sediments exceeding these concentrations beyond those areas previously identified in the ROD and SOW. The PDI will avoid duplicating sample locations with previous RI sample locations and focus on refining the accessible horizontal extent of contamination and determining the vertical extent of contamination requiring excavation. . If additional areas exceed the concentration criteria at depths consistent with the exposure assumptions of the ROD, and EPA reasonably determines that those areas meet the accessibility criteria for representing a human health threat, then additional dredging/removal in these areas will be evaluated.

Composite samples from the sections shown on Figures 3.3.1-1 and 3.3.1-2 will be analyzed first for arsenic, and potentially benzo(a)pyrene. Benzo(a)pyrene, with a Performance Standard of 4.9 mg/kg, will only be analyzed in delineation samples for which arsenic concentration is below the applicable Performance Standard. Wetland sediment samples will be stored frozen to extend holding times up to 1 year, so that analyses for benzo(a)pyrene will not be compromised by holding time exceedance.

Although wetland sediments are not expected to require a dewatering design, they may warrant some solidification to facilitate handling, transportation, and disposal. Four bulk composite samples (two from Wells G&A, two from CBCA, minimum of 5 gallons each) will be collected from more than one sample location where the Performance Standard is exceeded for solidification testing to determine the need and effect of different solidifying agents on the sediment from the wetland areas. The goal of this testing will be to determine what solidifying agents and weights of agents are needed to cost-effectively handle and dispose of the sediment. Solidification testing is performed on the homogenized sediment removing only the very largest particles prior to the test. The testing will include the use of quick lime, Portland cement, and other agents that may be readily available in the Boston metro area. Test procedures are described in the FSP.

Supernatant from settling of wetland sediment within each 5-gal container will be sampled to determine the need for handling or treatment of the dewatering stream. It is anticipated that the dredging design will include returning dewatering effluent from settling to the wetlands. Sampling will be performed on up to four (4) effluent samples for dissolved and particulate (measured as the difference between total and dissolved) arsenic.

The weight bearing capacity of wetlands soil/sediment for construction equipment accessibility will also be evaluated during this PDI adjacent to the areas of concern.

PDI-2 will also consider the need for and appropriate design and construction of "a transition zone permeable barrier separating contaminated sediments from clean/restored sediments and minimizing potential for recontamination during storm events", as contemplated in the FS. This PDI will also collect information to further support a wetland restoration plan. The additional sediment sampling will build upon existing sediment data collected and presented in the RI, and further fill necessary data gaps regarding extent of accessible near shore sediment contamination to be removed. See Figures 3.3.1-1 and

3.3.1-2 illustrating initial sampling locations. Additional information regarding sediment sampling for PDI-2 is presented in the FSP (Appendix C).

3.4 Institutional Controls

3.4.1 PDI-12 Soil and Groundwater Institutional Controls

Pursuant to the requirements of the SOW, Institutional Controls (ICs) will be implemented to prevent contact with contaminated media such as groundwater, surface and subsurface soil, and sediments, as well as to ensure that components of the remedy can and will be maintained to ensure long term performance of their stated objectives. There is a broad range of ICs that may be applicable to these various components ranging from easements and covenants to deed notices and advisories. The purpose of this task will be to evaluate the applicability of this full range of IC options for the Industri-plex OU2 remedy with regard to exposure pathways to be controlled, assess the compliance of particular IC mechanisms with MassDEP and EPA guidance and policy, and prepare a description to be included in the 30% Design Submission of how recommended ICs will meet the performance objectives of the remedy.

Consistent with the selected remedy in the ROD and SOW, institutional controls shall be designed and implemented to:

- Control risks from exposures to contaminated surface soils (0'-3' bgs) and subsurface soils (3'-15' bgs)
- Control risks from exposures to contaminated groundwater
- Control risks from exposures to contaminated deeper interior wetland sediments
- Ensure the remedy remains protected and establishes permanent access

In addition, the selected remedy describes institutional controls studies and an Institutional Control Plan. Institutional controls studies are necessary to evaluate the most appropriate form(s) of Institutional Controls for the various components of the remedy, which includes coordination with various stakeholders (representatives from EPA, MassDEP, Settling Defendants, city officials, landowners, etc.). Information gathered from the institutional controls studies would be applied to the draft Institutional Controls Plan required under the 95% and 100% Remedial Design.

ICs shall be designed to be consistent with EPA's publication "Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups" (OSWER 9355.0-74 FS-P, cited in EPA's Administrative Record Compendium of Guidance Documents). ICs may be established in the form of a Grant of Environmental Restriction and Easement, running with the land. Any such Institutional controls for which a request to MassDEP to serve as grantee is anticipated shall also be consistent with EPA and MassDEP guidance documents and regulatory requirements, including any model forms/documents applicable to ICs (e.g. Grant of Environmental Restriction and Easement). EPA, in consultation with MassDEP, shall approve of the form, design and implementation of each IC remedy component.

The first step of this PDI will be to delineate the type of ICs that may be needed to restrict contact with soils, groundwater, or deeper interior wetland sediments above clean-up standards as identified in the ROD. Based on the list of likely exposure pathways established in the ROD, suitable use restrictions to prevent exposures via those pathways can be developed into a basis for establishing appropriate ICs. Subsequently, data from other studies will be used to establish the physical limits of the areas in which ICs need to be implemented (e.g. caps, groundwater contaminant plumes, subsurface sediments).

Other PDIs which will also provide data for the delineation of these physical limits include:

- PDI-3: Groundwater data will be collected within both OU2 and OU1 site boundaries that will be used in evaluating the need for ICs
- PDI-10: Groundwater and surface water data will be collected along surface water channels that will be used in evaluating the need for ICs

Long term security and protection from damage to ensure long term efficiency and enforceability, if applicable, will be considered in the development of ICs. In addition, several survey and land-ownership-related studies will be carried out to provide data necessary for the evaluation of the most appropriate IC alternatives and to promote their eventual implementation, including:

- Survey information for all parcels likely to be impacted by ICs to delineate either property boundaries where entire parcels will be subject to ICs and/or restricted areas within parcels when only a portion of that parcel will be subject to the IC
- Examination of property titles and related title examination work for such properties

These data will assist in the evaluation of the classes of ICs potentially suitable for OU2 including controls which fall into one or more of the categories identified in relevant EPA guidance documents including; (i) government controls (state and/or local land use controls such as zoning restrictions, ordinances, building restrictions, etc.); (ii) proprietary controls (easements, covenants); and (iii) informational devices (i.e., deed notices and advisories); and (iv) EPA enforcement and permit tools with IC components, although such do not appear to be applicable at this time. The various IC options within each of these categories judged to be potentially relevant upon initial screening will be assessed as to their consistency with and practicality for the overall demands of the remedy. . Experience gained at Industri-plex OU1 will be applied to this evaluation, and consideration will be given to the extent (if any) that Industri-plex OU2-related ICs require the modification of Industri-plex OU1-related ICs. This analysis will also evaluate whether the “layering” or sequencing of different forms of ICs may be appropriate.

PDI-12 data collection efforts and coordination related to ICs are divided into the following categories:

- PDI-12A: Soil IC Delineation
- PDI-12B: Groundwater IC Delineation
- PDI-12C: Remedy Monitoring, Protection and Permanent Access
- PDI-12D: IC Studies

3.4.1.1 PDI-12A: Soil IC Delineation

ICs will be established to restrict contact with surface and subsurface soils with concentrations above the Performance Standards to ensure the long-term effectiveness and protectiveness of response actions performed at the Site. One area where ICs may be implemented is the former Lake Mishawum lakebed (FLM) area, which historically received runoff and was filled before the construction of the HBHA Pond. This PDI will build upon existing data, and is designed to collect additional soil data from various vertical intervals to fill any RI data gaps and further delineate the extent of surface soils (0’-3’ bgs) and subsurface soils (3’-15’) contamination in the FLM area requiring institutional controls. In areas where surface or sub-surface soil contamination exceeds the 50 mg/kg (parts per million) cleanup standard for arsenic outlined in the Section IV.A.2 of the SOW, Institutional Controls will be imposed to restrict excavations without adequate worker health and safety precautions (e.g. engineering controls, personal protective equipment (PPE), monitoring) to minimize or prevent direct contact with contaminated soil during removal activities, and restrict potential on-site and off-site spread of contamination. Furthermore, on properties where surface soils exceed the cleanup standards, land use will be restricted so that child care facilities are prohibited in those areas, as well as other analogous land uses where children will be exposed to soil at similar high frequency and intensity such as schools, residential yards, etc.

Figure 3.4.1.1-1 provides the initial soil sample locations to further delineate the extent of surface and subsurface soil contamination needed for assessment of ICs.

PDI-12A includes the advancement of 40 soil borings within the footprint of the FLM in locations near industrial properties. Figure 3.4.1.1-1 shows the proposed soil borings in relation to individual parcels and historic samples results. Soil sampling and analysis for arsenic will also be completed on parcels falling within FLM where soil concentration data do not exist. Where elevated arsenic is detected in soil in FLM, groundwater sampling will be conducted to assess impacts to groundwater. Refer to the FSP (Appendix C) for additional details on the field sampling procedures.

3.4.1.2 PDI-12B: Groundwater Institutional Control Delineation

ICs will be established on select properties to restrict contact with groundwater exhibiting concentrations above the Performance Standards. This PDI will build upon existing data, and collect additional groundwater data to further delineate the extent of groundwater contamination requiring ICs. In areas where groundwater contamination exceeds the cleanup standards in the SOW Section IV.A.1 (i.e. Arsenic at 150 ug/L [parts per billion, or ppb], Benzene at 4 ug/L, Ammonia at 4,000 ug/L, 1,2-Dichloroethane at 2 ug/L, Trichloroethene 1 ug/L, and Naphthalene at 5 ug/L), ICs will be imposed to restrict drinking water, industrial process water, or other purposes (such as water for a commercial car wash facility and groundwater encountered during excavation activities). The Performance Standards presented in the SOW as applicable to groundwater on OU2 are summarized in Table 1.2.3-1.

To assess the limits of groundwater contamination requiring ICs, PDI-12B will rely on groundwater data collected in numerous PDIs including:

- PDI-3 Groundwater Investigation
- PDI-9 West Hide Pile Investigations and Assessment
- PDI-10 Impermeable Caps
- PDI-14 Ammonia Background Investigation

As mentioned previously in PDI-12A, additional groundwater profiling will be completed in the vicinity of the FLM where elevated arsenic concentrations are observed in soils, or where historical data indicate groundwater contamination exists. The exact location of the groundwater profiling locations in the FLM area will be determined by the observed concentrations in soil. However Figure 3.4.1.1-1 shows fifteen proposed groundwater profiling locations in the vicinity of FLM to supplement the groundwater investigations proposed in other PDIs to evaluate the need for ICs to restrict contact with groundwater exhibiting concentrations above the Performance Standards. Figure 3.4.1.2-1 assimilates all of the proposed groundwater sampling (PDI-3, PDI-9, PDI-10, PDI-12) described in this RDWP. The groundwater data collected at the locations shown on this Figure will be used as the basis for assessing the need for ICs and will be also be used to assess background ammonia conditions (PDI-14) at the Site.

Groundwater profiling in the vicinity of FLM (see Figure 3.4.1.1-1) will be completed using direct push technology (DPT) driving a groundwater sampling tool (e.g., GeoProbe™ groundwater profiler, Waterloo Profiler™) and low-flow sampling methods to the extent feasible. Groundwater samples will be collected from the water table to the top of bedrock or to a total depth of approximately 30 ft, whichever is less, at 10-ft increments. Where bedrock extends below 35 ft, an additional groundwater sample will be collected from the deeper portion of the overburden at an elevation consistent with a nearby MSGRP RI sample location that exhibited COC concentrations above the OU-2 cleanup criteria. Therefore at each location, groundwater samples will be collected at approximately 5-10 ft (water table), 15-20 ft (near the depth of the bottom of FLM), and 25-30 ft, and a deeper portion of overburden where bedrock extends below 35 ft. Additional information on the details of PDI-12B is presented in the FSP (Appendix C).

3.4.1.3 PDI-12C: Remedy Monitoring, Protection and Permanent Access

This PDI will consider ICs to ensure that any remedial components constructed as part of the selected remedy are not disturbed or otherwise compromised by any other use or activity. Remedial components may include monitoring wells throughout the site, covers or caps over contaminated soil areas, or low-head cofferdams or other structures installed in the HBHA Pond as part of the remedy. In addition, this PDI will evaluate ICs necessary to ensure that permanent access is obtained to all components of the remedy. While details of the final remedy, including environmental monitoring plan and operations and maintenance plan, will not be well understood until the 95% and 100% designs, the potential forms of ICs to protect the remedy and ensure access need to be considered early in the design process.

3.4.1.4 PDI-12D: Institutional Control Studies

This PDI studies and evaluates the estimated duration, long-term effectiveness and enforceability of various forms of ICs, including but not limited to deed restrictions, easements, regulatory action, zoning ordinances, and/or other legal and/or administrative measures, either individually or applied in combination on an individual property. The evaluation will take into consideration all relevant EPA and MassDEP guidance documents and regulatory requirements, including any available model forms/documents applicable to ICs. As part of this PDI, representatives from various stakeholders (e.g., EPA, MassDEP, Settling Defendants, city officials, landowners) will be established as a working group to discuss and further evaluate various forms of the ICs applicable for the various media (soils, groundwater and deeper interior wetland sediments) and long-term remedy protection, monitoring and access. Information gathered and/or recommendations formed from these working group studies will be considered further in the draft Institutional Controls Plan required under the 95% and 100% Remedial Design.

3.5 Sequence and Key Decision Framework of PDIs

Figure 3.1-1 is a CPM schedule showing the relationships, timing, and sequence of PDIs as described in Section 3.1 and 3.2 (*et seq*). The CPM schedule is intended to show dependencies and approximate durations; actual dates, timing, duration of PDI tasks may vary from this schedule. In addition, actual dates of submittal shown on Figure 3.1-1 may vary because the actual submittal date depends on the duration of EPA review periods and other considerations. Access to properties owned or controlled by third parties is required to perform most of the PDIs discussed above. In the monthly status reports required under the SOW, the Settling Defendants have kept EPA informed of their progress in gaining access to the properties involved in the PDI process.

4.0 ENGINEERING DESIGN PROCESS

As stated in Section 1.2.3 and consistent with the ROD and SOW, there are six major remedy components of the selected remedy. These remedy components will undergo a remedial design to achieve the Remedial Action Objectives and Cleanup Standards including Performance Standards outlined in Sections 1.2.1 and 1.2.2, respectively. Standard engineering principles will be applied throughout the remedial design and remedial action.

As described in Section 1.3.3, the six major remedy components were consolidated into four "engineering design components". These four engineering design components include the HBHA Pond, West Hide Pile, Near Shore Sediments, and Institutional Controls, where Wetlands are incorporated under the HBHA Pond component. These four engineering design components are further described below under Section 4.2. In addition, Section 1.3.3 further describes "design considerations" associated with each engineering design component. These design considerations include some objectives of the selected remedy consistent with the ROD and SOW and are further described below under Section 4.3.

The remedial design process will consider the historical (e.g., pre-ROD), SWMP, early action activity, and PDI data (see Section 3 for PDI descriptions), as well as any other appropriate data obtained during the remedial design process. The data and design considerations will form the engineering design components. The data, design considerations, and engineering design components will support the preparation of 30%, 95% and 100% remedial designs as outlined in Section 1, the ROD and the , including among other things, Draft Final Institutional Control Plan(s), a Draft Final O&M Plan, and a Draft Final Environmental Monitoring Plan, consistent with the selected remedy.

4.1 Design Elements

Basic design elements will be applied to engineering design process, where appropriate, including:

- Land Surveying and Base Map Development
- Staging and Site Preparation
- Material & Equipment Availability, and Material Durability, Testing and Handling
- Waste Disposal
- Environmental Monitoring and Controls
- Sequencing and Schedules

4.1.1 Land Surveying and Base Map Development

Sufficient survey data will be collected to support the design and construction processes. These survey data will support the preparation of base and design maps/drawings, including drainage areas, as well as support the preparation of hydrological flood model and institutional control documents. In general, the upland land survey[24] will include, but not necessarily be limited to, collecting the following information:

- Topographic contours
- Edge of water
- Site features, including, but not limited to, roadways, paths, bridges, drainages, culverts, fence, and other significant features
- Above- and below-grade utilities, including ownership of utility

[24] For bathymetry in HBHA Pond, see PDI-1: HBHA Pond Sediment Dredging.

- Benchmarks in the Site vicinity
- Property and easement boundaries
- Soundings in the Pond

Survey data will be processed and documented onto a site plan that will be utilized for design drawings. To the extent existing survey data of suitable quality exists, it may obviate the need for certain survey elements noted above and will be incorporated into the base map, as appropriate.

4.1.2 Staging and Site Preparation

Some work may involve activities adjacent to active railroad lines. This work will need to be coordinated with the railroad to ensure the safety of workers and general public and efficient implementation of the activities. Overhead utilities will be evaluated as part of the overall work to also to ensure the safety of workers and general public and efficient implementation of the activities. The work requires sediment dredging from the wetlands and ponds. Appropriate equipment will be utilized during dredging activities (mechanical and hydraulic equipment, low load bearing equipment, swamp/crane mats) to complete the work, and minimize any impacts to wetlands and restrict any releases downstream. Some work within ponds may use cranes, possibly barge mounted, for construction in the Northern Portion of the HBHA Pond.

4.1.3 Material & Equipment Availability, and Material Durability, Testing and Handling

Various materials and equipment will need to be evaluated and selected as part of the engineering design process, including material durability, testing and handling. The design will address materials and equipment selection, materials handling, and equipment decontamination (fixed and/or mobile contamination reduction zones/decontamination areas). Consideration shall be given to the availability of materials. The design will include QA/QC Plans and other installation requirements. It is likely that sediments dredged and surface water removed from the Southern Portion of the HBHA Pond will be primarily removed by hydraulic dredging, where sediment-water slurry will be pumped to a dewatering/stabilization area before sediment is transported off-site for proper disposal at an acceptable, permitted disposal facility. The type and scope of hydraulic dredging will determine the necessary pump and pipe sizes. Near-shore sediments will be likely be primarily removed by mechanical dredging, where heavy equipment (excavators, lined dump trucks) will remove contaminated sediments and restore the areas. Near shore sediments will likely be transported to nearby dewatering location/stabilization area before being transported off-site for proper disposal at an acceptable, permitted disposal facility. Excavations into soils and sediments will be necessary when constructing the Northern Portion of the HBHA Pond remedy. Excavated material will be stockpiled in designed soil management areas, where potentially contaminated soils will be segregated with separate erosion controls preventing run-on/off from the stockpile areas. All off-site materials (e.g. soils, amended soils for sediment restoration, rip-rap, shall be located and analyzed to ensure the materials are do not contain unacceptable levels of VOC, SVOC, Metals, PCB, Pesticides and other environmental contaminants). Rip-rap material for drainage areas/side slopes and/or dissipation systems shall be of appropriate size to ensure cap permanence/longevity, prevent erosion, and reduce surface water velocities.

4.1.4 Waste Disposal

Materials for off-site disposal shall be appropriately sampled, analyzed and characterized for proper off-site disposal at approved, licensed facilities. The off-site rule shall apply to material proposed for off-site disposal.

4.1.5 Environmental Controls and Monitoring

4.1.5.1 Environmental Controls (Erosion, Suspended Solids, Dust and Odor)

Erosion controls shall be placed around work areas to minimize erosion during construction and prevent run-on and run-off from work areas. Suspended solid controls shall be established for all in-water work activities to restrict downstream migration of suspended solids during construction. At a minimum, silt curtains shall be placed downstream of in-water work activities including dredging operations, cofferdam installation and wetlands restoration. Other appropriate suspended solids controls may be considered to restrict suspended solids migration. Dust controls and odor controls shall be established, if necessary for the implementation of the remedial action. Dust controls shall be applied to any activity that has the potential to produce significant amounts of transprortable dust, and shall include, but not be limited to, the following: dust suppression water sprays and/or foams, applications of calcium carbonate, etc. Odor controls shall be applied to any activity that has the potential to produce unpleasant odors to the point of public nuisance or safety risk to on-site personnel, and shall include, but not be limited to, the following: covering material with clean soils, odor suppression foams or masking agents.

4.1.5.2 Environmental Monitoring (Surface Water, Dust and Odor)

Surface water monitoring and action levels shall be established for remedial action construction activities. Surface water quality shall be monitored daily to evaluate erosion controls and construction activities including water activities. If surface water conditions exceed surface water action levels, then further engineering controls shall be implemented immediately including: decreasing rate of/stopping construction activities, changing methods of construction, increasing erosion controls, etc. The primary considerations for establishing the surface water action levels shall be cleanup standards, ARARs, worker, public and environmental health and safety protection and preservation.

Air and dust monitoring and action levels shall be established for remedial action construction activities. Air and dust monitoring shall be performed daily to evaluate air and dust controls and construction activities. If air or dust conditions exceed the action levels, then further engineering controls shall be implemented including: decreasing rate of/stopping construction activities, changing construction methods, increasing air/dust controls (e.g. water spraying and other dust suppression techniques). The considerations for establishing the air and dust action levels shall be cleanup standards, ARARs, worker, public and environmental health and safety protection and preservation.

Odors shall be monitored by field personnel during construction activities. Odors caused by construction activities shall be minimized by odor controls to ensure the protection of public health and welfare. In addition, any complaints regarding odor concerns associated with construction activities will be evaluated immediately and where appropriate, further controls shall be implemented to prevent/minimize these odors.

4.1.6 Sequencing and Scheduling

As outlined in the ROD and SOW, implementation of final Remedy Design and Remedial Action for the selected remedy will be sequenced “from upstream to downstream locations, so that contamination does not migrate from unremediated upstream areas and potentially impact downstream components of the remedy, unless otherwise approved by EPA. Sequencing may not apply to (i) the implementation of In-Situ Enhanced Bioremediation at the West Hide Pile; and (ii) groundwater, surface water and sediment investigations at/near the West Hide Pile, East Hide Pile, and adjacent wetlands investigations. Consistent with this sequencing, no construction work shall occur in the Wells G&H Wetlands and Cranberry Bog Conservation Area until construction is substantially complete in upstream areas

(e.g. HBHA Pond component of the remedy)." (SOW, p. 20). Also, seasonal conditions which may impact the design schedule will be minimized through the design process.

4.2 Remedy Engineering Design Components

As outlined in Section 1.3.3 and 4, there are primarily four engineering design components of the remedial design which will be further described under this section. These components are consistent with the ROD and SOW. Refer to Section 1.3.3 for specific details of the engineering design components.

4.3 Design Considerations for Engineering Design Components

As described in Section 1.3.3, a number of design considerations shall be considered under each of the engineering design components referenced in Section 4.2, consistent with the ROD and SOW. These design considerations include some of the objectives of the selected remedy. Refer to Section 1.3.3 for specific details of the engineering design considerations. Where appropriate the design considerations have been coordinated with PDIs (Section 3.0).

5.0 PROJECT ORGANIZATION

5.1 EPA Project Personnel

The EPA is the lead agency responsible for managing the removal and cleanup activities at the Industri-plex OU2. Joe LeMay, P.E. will serve as the EPA Region I Remedial Project Manager (RPM).

Figure 5.1-1 is a project organization chart highlighting the relationships between the Agencies, Settling Defendants, Project Coordinator/Supervising Contractor, and the project design team firms summarized below.

5.1.1 Roles and Responsibilities

The EPA Region I RPM is primarily responsible for the following items related to the Industri-plex OU2:

- Conducting/coordinating the EPA review and approval of RD/RA submittals
- Coordinating, directing, and reviewing the work the Settling Defendants and their Contractors/Consultants perform to assure compliance with the NCP, ROD, and RD/RA CD and SOW
- Conducting public meetings and providing an Administrative Record for the public

5.2 EPA Oversight Contractor

AECOM is the EPA oversight contractor for the RD.

5.3 MassDEP Involvement

The MassDEP will provide review and comment regarding the state regulatory aspects of this project. Their review process for RD/RA documents will occur concurrently with that of the EPA as described in the SOW.

5.4 Settling Defendants

The Settling Defendants for the Industri-plex OU2 CD include:

- Pharmacia Corporation by its Attorney-in-Fact Monsanto Company
- Stauffer Management Company LLC, litigation agent for Bayer CropScience

5.4.1 Roles and Responsibilities

The Settling Defendants are responsible for the design, construction, and maintenance of the selected remedy.

5.5 Project Coordinator / Supervising Contractor

The Settling Defendants have designated ***de maximis, inc.*** (de maximis) as the Supervising Coordinator with responsibility for directing and supervising all actions called for in the RD/RA CD and SOW. Bruce Thompson of de maximis will serve as the Project Coordinator for all actions called for in the RD/RA CD and SOW.

The Supervising Contractor's Project Coordinator is responsible for administration of the Settling Defendant's actions required by the RD/RA CD and SOW. The Project Coordinator is responsible for implementing the project and has the authority to commit the resources necessary to meet project objectives and requirements. The Project Coordinator's primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully. The Project Coordinator functions as the major point of contact and control matters concerning the project. The Project Coordinator is responsible for defining project objectives, developing a detailed schedule, and establishing project policy and procedures to address the specific needs of the project.

5.6 Project Design Team

Haley & Aldrich has been designated as the consultant for the development and implementation of the RD/RA program for the Industri-plex OU2. Roux Associates, Inc. (Roux) has been designated as the consultant for the development and implementation of the SWMP. Geosyntec Consultants (Geosyntec) will perform peer review and technical support during the RD/RA phase, including the SWMP, work.

5.6.1 Haley & Aldrich – Remedial Design Contractor

The Remedial Design Contractor (RDC) will supervise and direct the design work pursuant to the CD. The RDC's Project Manager, Russell Schuck, P.G. is responsible for assisting the Project Coordinator in day-to-day project management. The Project Manager is responsible for coordinating all field activities and the procurement of project subcontractors. Additional responsibilities include assisting in monitoring the progress and quality of investigative data collection, preparing and reviewing interim monitoring reports, and providing technical support of project activities.

The following list provides the main RDC subcontractors to support the RD (followed by the general role each is filling on the project design team):

- Hard Hat Inc. (formerly HEC) - Sediment Dredge Design and Dewatering Treatability Studies
- VHB - Wetland Mitigation, Concrete/Structural
- Geosyntec Consultants - Flood Routing Modeling
- Flow Science - Hydrodynamic Modeling
- Meridian Land Services - Land Survey
- ALPHA Analytical - Standard Chemical Testing
- Microbial Insights - Microbiological Testing
- Ozark Underground Laboratories – Dye Tracer Analysis
- CR Environmental, Inc. - Hydrographic Survey
- Haley & Aldrich - Geotechnical Laboratory Testing
- GeoTesting Express - Geotechnical Laboratory Testing

5.6.2 Roux Associates – Surface Water Monitoring Program Implementing Contractor

The SWMP implementing contractor is responsible for the preparing and implementing the SWMP work plan. The SWMP's Project Manager, Larry McTiernan, P.G., LSP, is responsible for assisting the Project Coordinator in day-to-day activities related to SWMP implementation. The Project Manager is responsible for coordinating all field activities and the procurement of project subcontractors. Additional responsibilities include assisting in monitoring the progress and quality of investigative data collection, preparing and reviewing interim monitoring reports, and providing technical support of project activities related to SWMP implementation. The SWMP primary subcontractor related to SWMP implementation is ALPHA Analytical, which will perform standard chemical testing for the SWMP.

5.6.3 Geosyntec Consultants – Surface Water Modeling, Peer Review, and Technical Support Consultant

The technical support consultant (Geosyntec) provides technical input to the Project Coordinator and other project design team members. Geosyntec's Project Manager, Carl Elder, Ph.D., P.E. will assist the Project Coordinator in various capacities, including participating in the preparation of the surface water flood routing modeling analysis, as well as general peer review technical support where needed.

6.0 PROJECT SCHEDULE

The Remedial Design CPM schedule (Figure 6-1) identifies the deliverables and associated timeframes for the RD effort based on the CD and SOW, assuming EPA review duration periods as shown therein. Items in maroon indicate review/approval tasks; items in grey indicate meeting periods; and items in black indicate task rollups. The schedule includes approximate duration for EPA review and approval period, which may vary from what has been assumed and impact later submittal deadlines that depend on the timing of preceding approvals and other tasks, and weather. The SOW provides the following durations of the RD milestones:

- 30% RD, 360 days from approval of this RDWP and POP, unless EPA extends the deadline
- 95% RD, 90 days following EPA's approval or modification of the 30% RD
- 100% RD, 90 days following EPA's approval or modification of the 95% RD

It should be noted that the RA items specified in the SOW have not been included on Figure 6-1 for clarity and focus on the RD.

The PDI schedule (Figure 3.1-1) demonstrates the anticipated timeframes and interdependencies of the individual PDIs outlined in this RDWP. The schedule generally assumes the RDWP will be approved of by 24 May 2010. It should be noted that Figure 3.1-1 (and Figure 6-1 as appropriate) will be updated as necessary based on the actual dates of approval, other schedule modifications, and to incorporate adjustments to the individual PDI sequencing and schedule that may be necessary to accommodate weather conditions and other schedule impacts.

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TABLE 1.2.2-1
PERFORMANCE STANDARDS
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

		Arsenic	Ammonia	Benzene	1,2-Dichloroethane	Trichloroethene	Naphthalene	Benzo(a)pyrene
Groundwater Performance Standards		150 µg/L	4000 µg/L	4 µg/L	2 µg/L	1 µg/L	5 µg/L	NA
Soil Performance Standards		50 mg/kg	NA	NA	NA	NA	NA	NA
HBHA Pond Surface Water Performance Standards		150 µg/L	varies per NRWQC	46 µg/L	NA	NA	NA	NA
Sediment Performance Standards	**Near Shore CBCA**	230 mg/kg	NA	NA	NA	NA	NA	NA
	Near Shore Wells G&H Wetland	300 mg/kg	NA	NA	NA	NA	NA	4.9 mg/kg
	Deeper Interior HBHA Wetland and Wells G&H Wetland	300 mg/kg	NA	NA	NA	NA	NA	NA
	HBHA Pond*	273 mg/kg	NA	NA	NA	NA	NA	NA

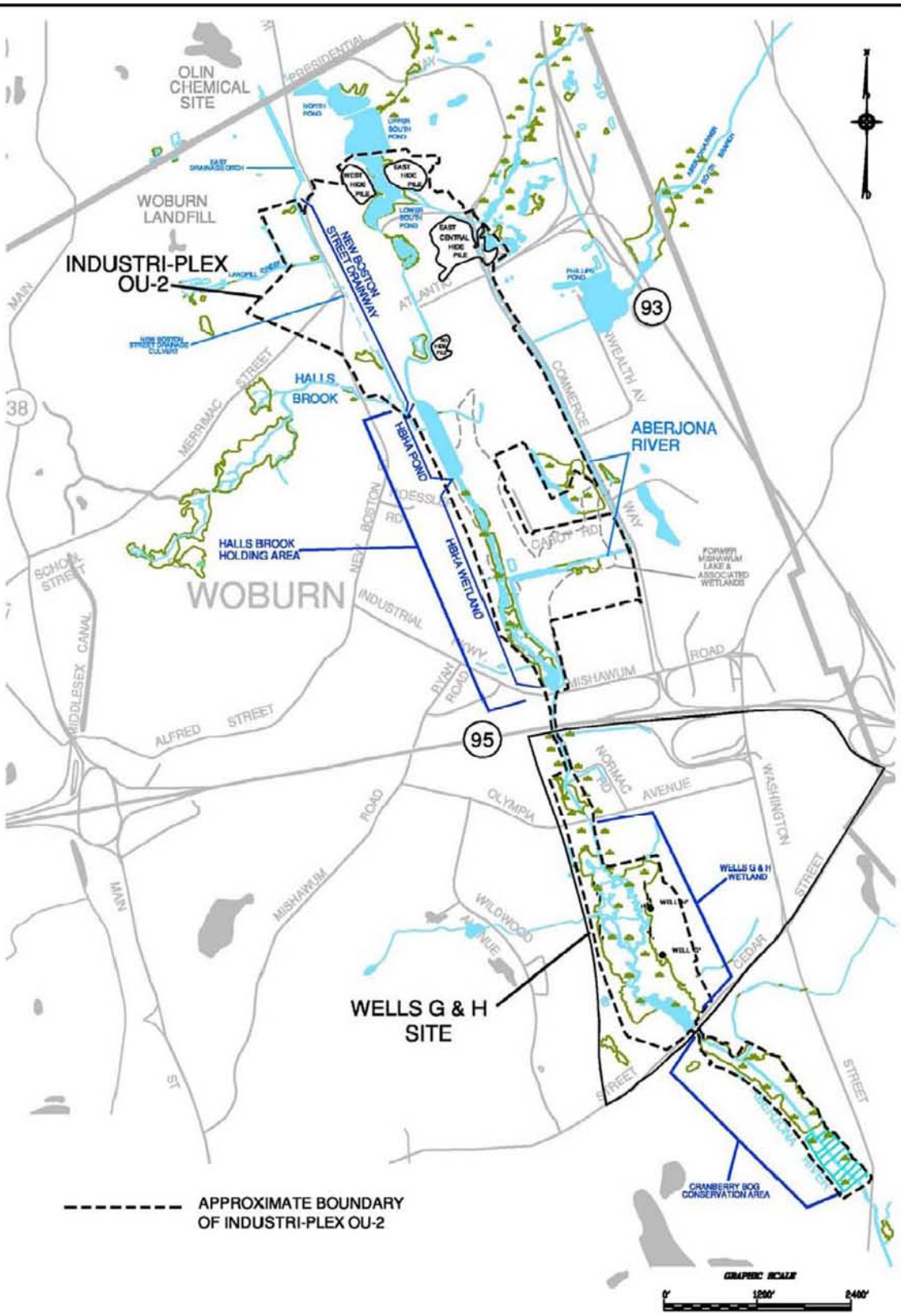
Notes:
µg/L = micrograms per liter
mg/kg = milligrams per kilogram
NA = none applicable
* = Ecological basis
The surface water performance standard for ammonia is the NRWQC-CC (chronic criterion) value for Fish Early Life Stages Present and is a 30-day average concentration of total ammonia nitrogen (in mg N/l), not to be exceeded more than once every three years on average.

TABLE 2.3-1
ARSENIC CONCENTRATIONS UNDER BASEFLOW
AND STORMFLOW CONDITIONS
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MA

	Baseflow		Stormflow[2]	
	Range	**Average**	**Range**	**Average**
Total Arsenic	0.0068-0.0431	0.0202	0.0205-0.0815	0.048
Dissolved Arsenic	0.0012-0.0096	0.0049	0.0037-0.0274	0.0104

Notes:
1. All values given in μg/L.
2. Data from Tetra Tech NUS, Inc. 2005. Samples collected during baseflow and stormflow conditions at Sample Station 2.
3. Samples for stormflow were taken during storms of 0.97 in., 2.80 in., 1.15 in., 1.26 in., 1.12 in., and 1.48 in. on 25 April, 12 May, 23 July, 29 August, 23 September, and 16 October 2002, respectively.

Storm Water Monitoring Station	Data Type	Time Interval between Measurements	Measurement Dates	Source	Comments
SW-01-TT	Flow	5 minutes	10/17/2008 - 08/31/2009	ROUX ISCO SAMPLERS	Water Levels recorded by Isco samplers, and flows calculated based on newly developed rating curves on 09/22/2009.
SW-02-TT	Flow	5 minutes	10/17/2008 - 08/31/2009	ROUX ISCO SAMPLERS	Water Levels recorded by Isco samplers, and flows calculated based on newly developed rating curves on 09/22/2009.
SW-04-TT	Flow	5 minutes	10/25/2008 - 08/31/2009	ROUX ISCO SAMPLERS	Water Levels recorded by Isco samplers, and flows calculated based on newly developed rating curves on 09/22/2009.
SW-2-IP	Flow	5 minutes	10/17/2008 - 08/31/2009	ROUX ISCO SAMPLERS	Water Levels recorded by Isco samplers, and flows calculated based on newly developed rating curves on 09/22/2009.
SW-03-TT	Water Level	5 minutes	09/01/2009 - 09/25/2009 10/25/2009 - 11/30/2009	ROUX ISCO SAMPLERS	
SW-01-TT	Rainfall	5 minutes	10/21/2008 - 08/29/2009	ROUX ISCO SAMPLERS	
SW-02-TT	Rainfall	5 minutes	11/05/2008 - 08/29/2009	ROUX ISCO SAMPLERS	
SW-04-TT	Rainfall	5 minutes	10/25/2008 - 08/29/2009	ROUX ISCO SAMPLERS	
SW-2-IP	Rainfall	5 minutes	10/21/2008 - 08/29/2009	ROUX ISCO SAMPLERS	
SW-03-TT	Rainfall	5 minutes	09/01/2009 - 09/25-2009 10/25/2009 - 11/30/2009	ROUX ISCO SAMPLERS	



Source: Figure A-3 from the SOW

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REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

INDUSTRI-PLEX OU2 SITE PLAN

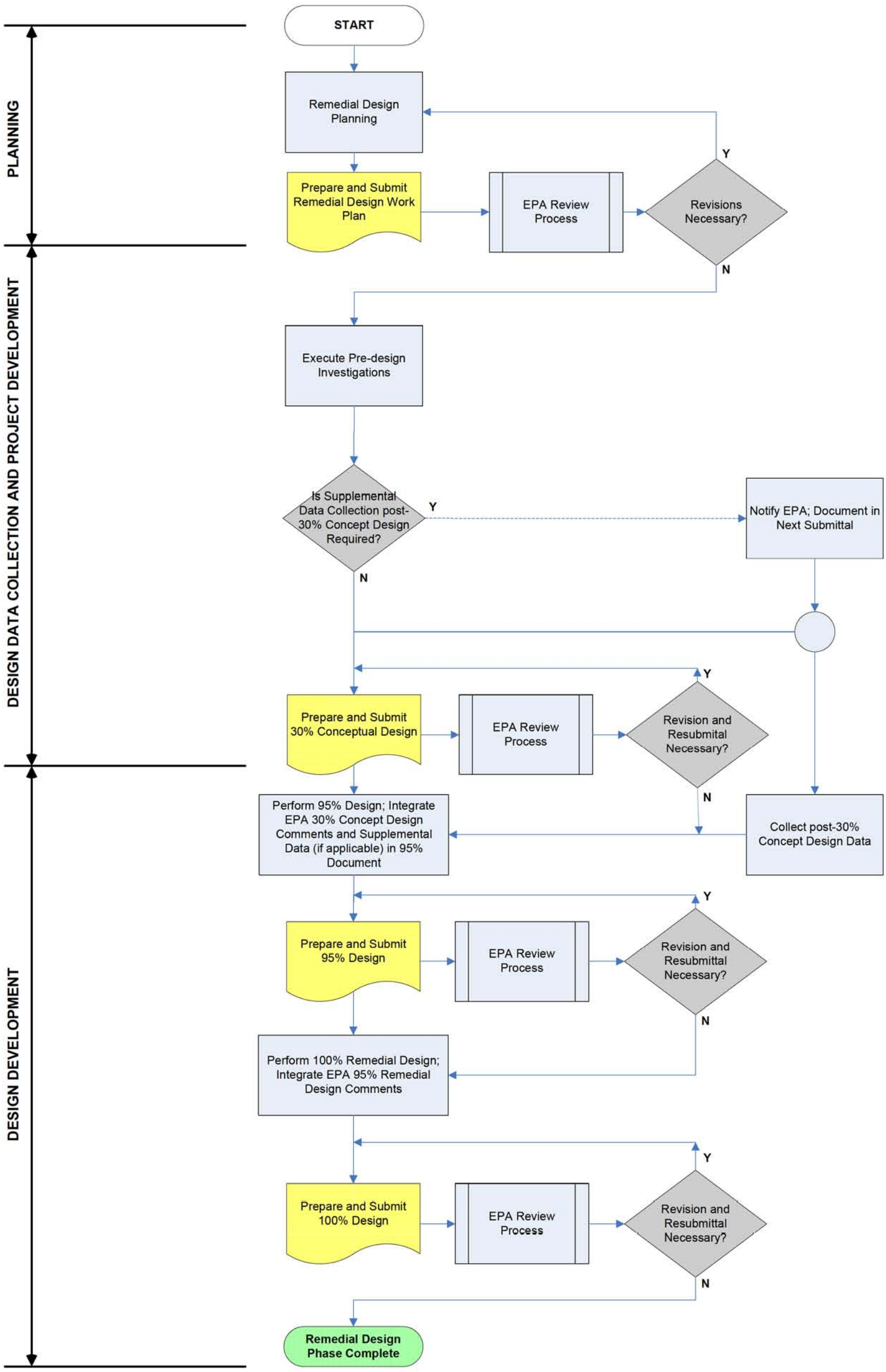
SCALE: NONE
MARCH 2010

FIGURE ES-1

DRAFT

G:\33020\030\RDWP\Revised per EPA Feb 2010\Figures\Figure ES-1 2010-0316-HAI-OU2SITEPLAN-D.vsd

G:\33020\030\RDWP\Revised per EPA Feb_2010\Figures\Figure ES-3 2010-0316-HAI-RDWPLevel1DesignProcessFlowchart-D.vsd



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LEGEND:

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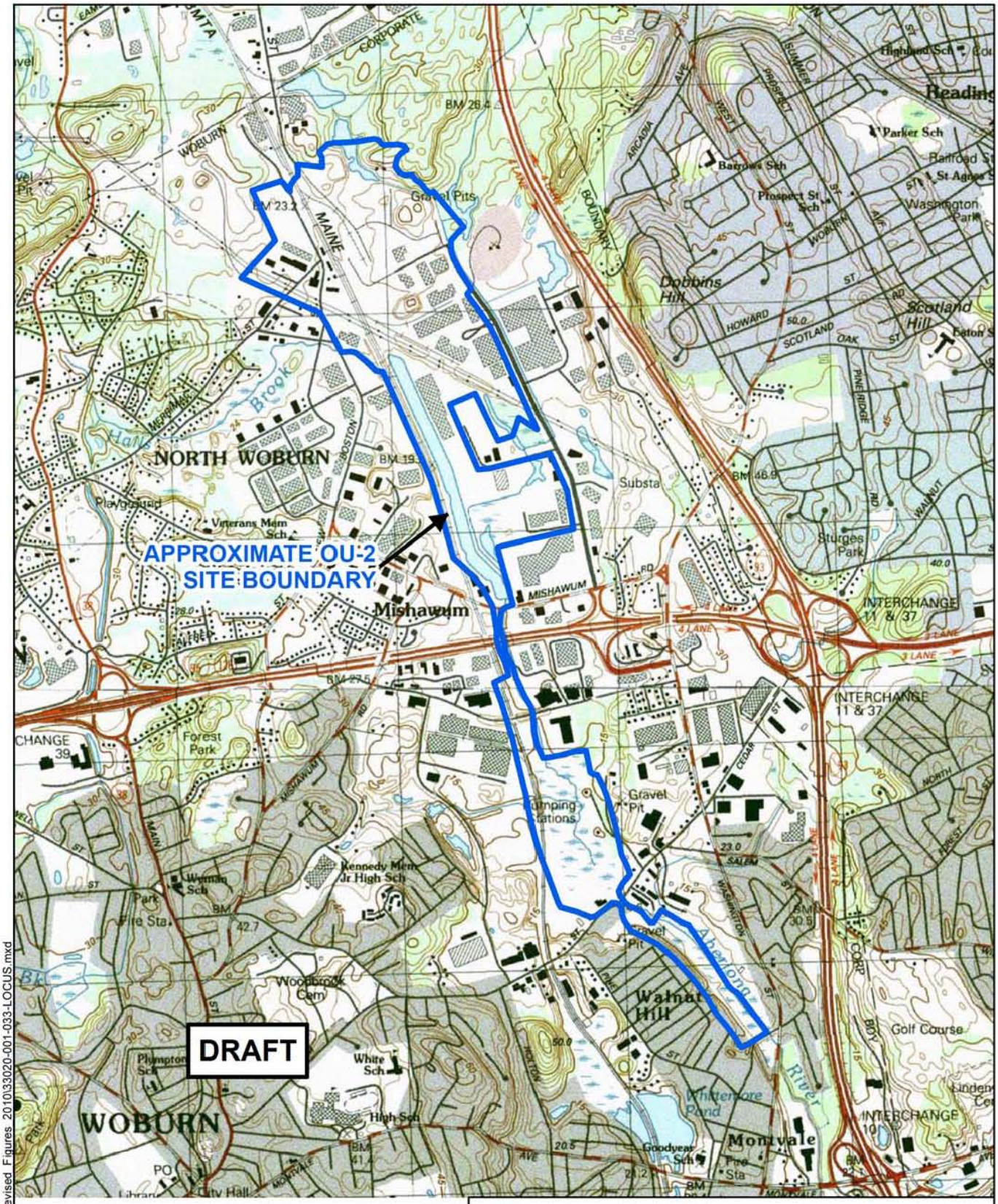
REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

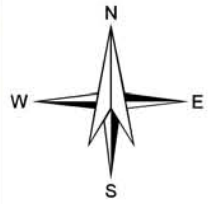
REMEDIAL DESIGN WORK PLAN:
DESIGN PROCESS FLOWCHART

SCALE: NONE
MARCH 2010

FIGURE ES-2



SITE COORDINATES: 42°30'21"N 71°8'12"W



U.S.G.S. QUADRANGLE: WILMINGTON, MA

HALEY & ALDRICH

REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

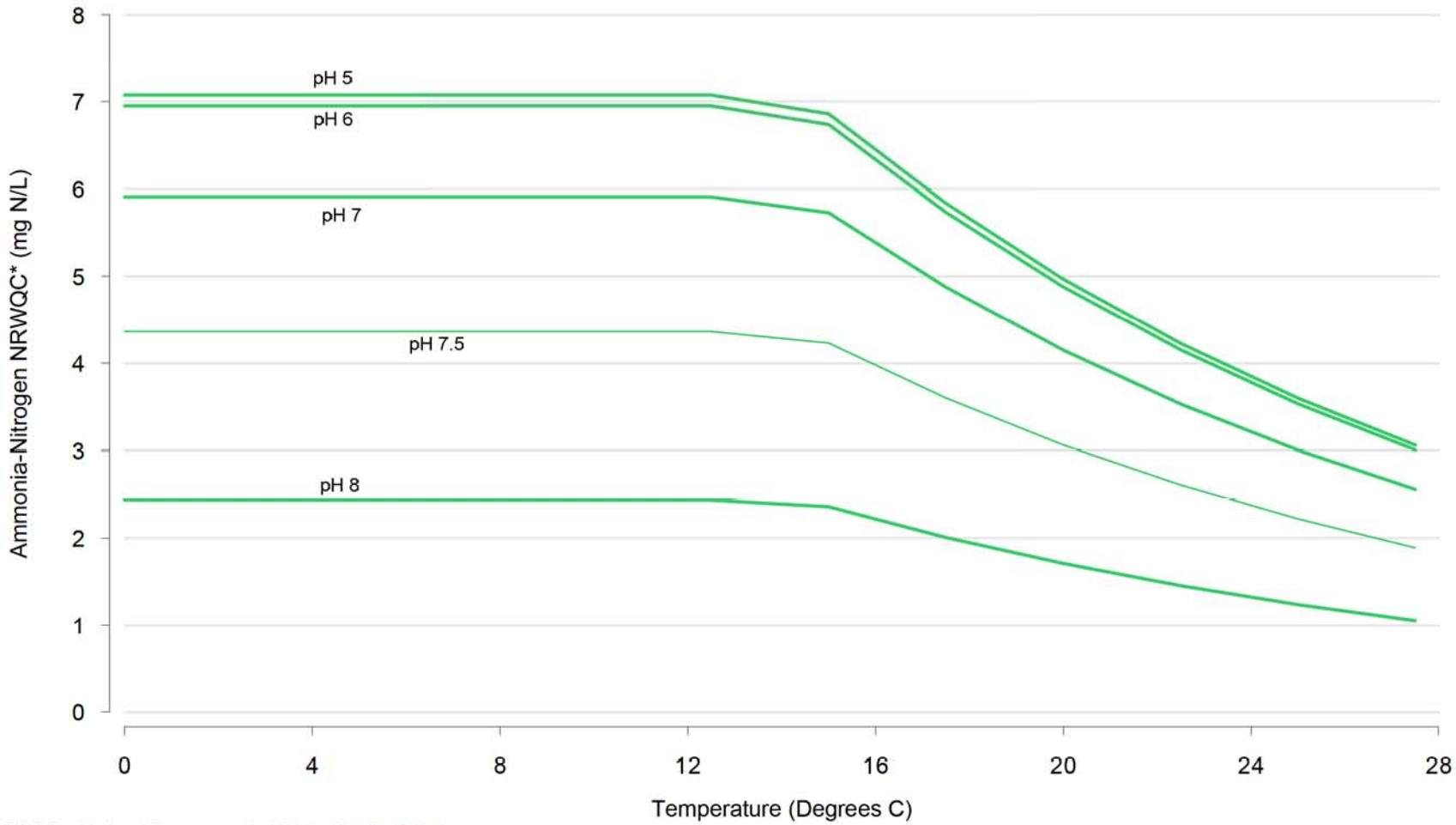
LOCUS

SCALE: 1:24,000
MARCH 2010

FIGURE 1.1.2-1

G:\33020\GLOBAL\GIS\MapProjects\Revised Figures 2010\33020-001-033-LOCUS.mxd

G:\33020\030\RDWP\Revised per EPA Feb_2010\Figures\2010-0317-HAI-RDWPAmmoniaNRWQC-D.grf



* NRWQC = National Recommended Water Quality Criteria

Calculation of Freshwater Ammonia Criterion when fish early life stages are present:
$CCC = [(0.0577 / 1+10^{7.688-pH}) + (2.487 / 1+10^{ph-7.688})] * MIN(2.85, 1.45 *10^{0.028(25-T)})$
From: Ammonia Aquatic Life Criteria EPA 822-R-99-014 (1999)

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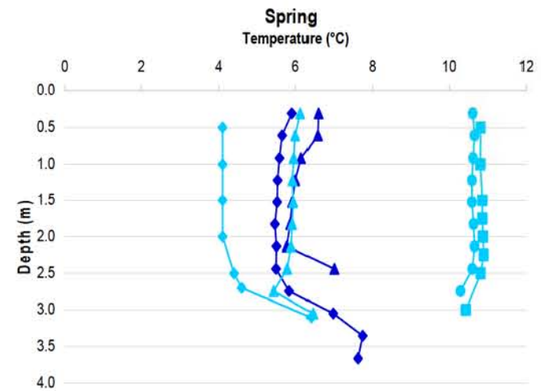
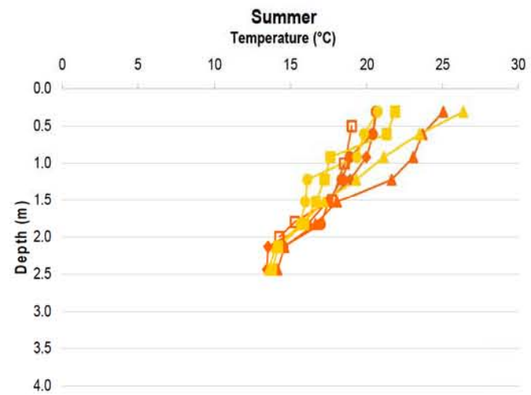
REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

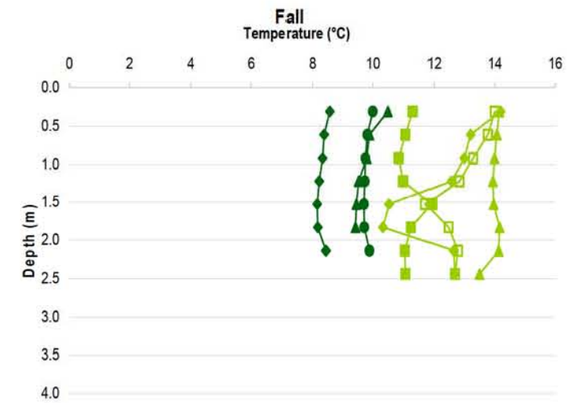
AMMONIA NRWQC - CHRONIC CRITERION
FISH EARLY LIFE STAGES PRESENT

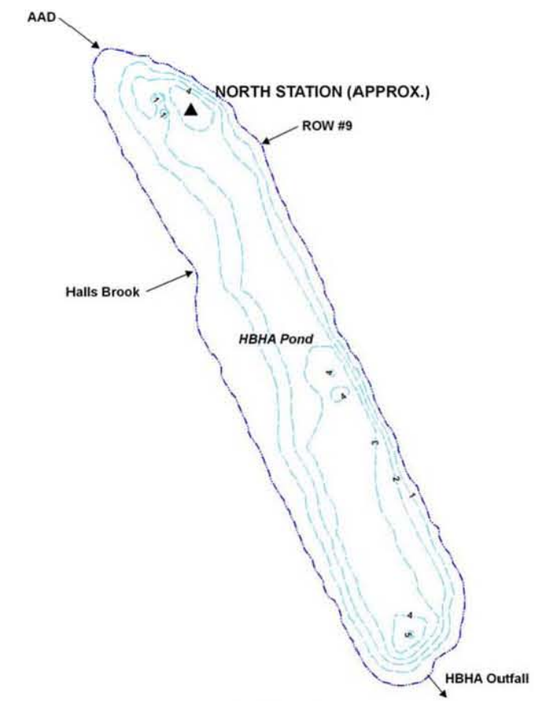
SCALE: NONE
MARCH 2010

FIGURE 1.2.2-1

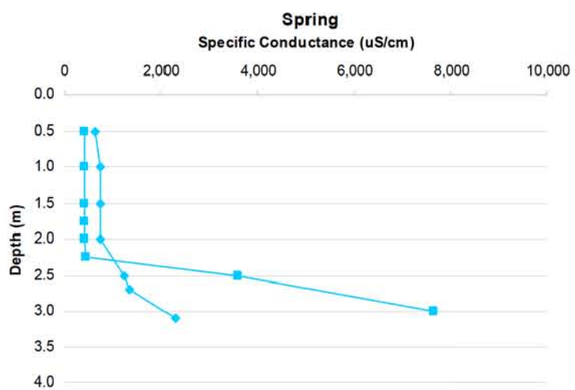


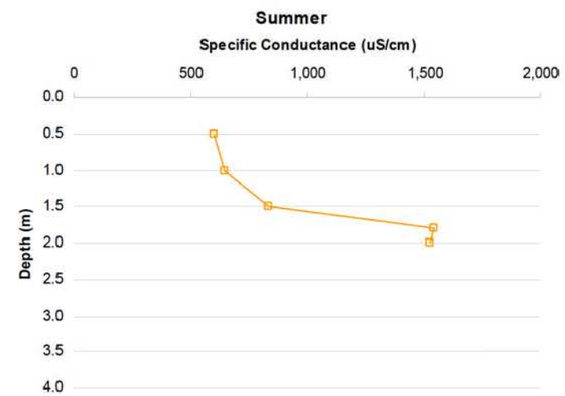


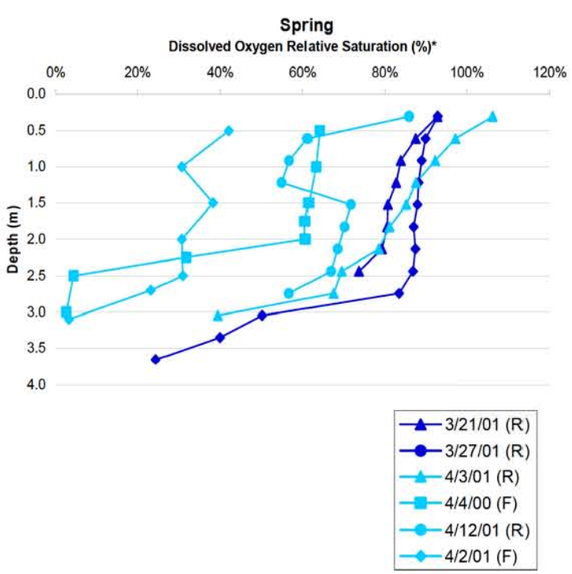


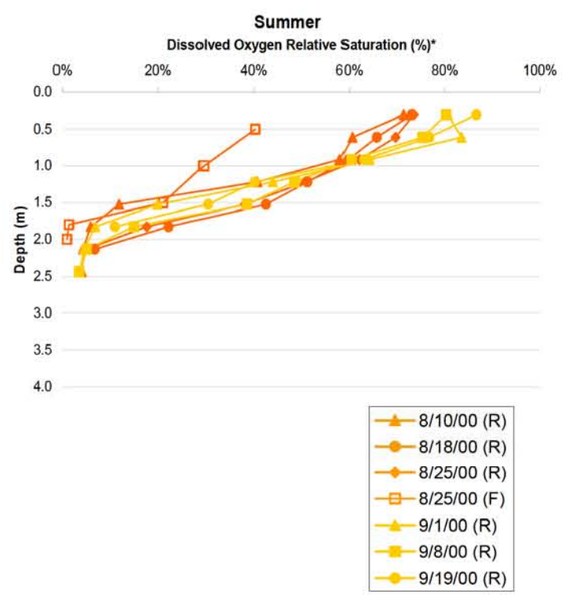


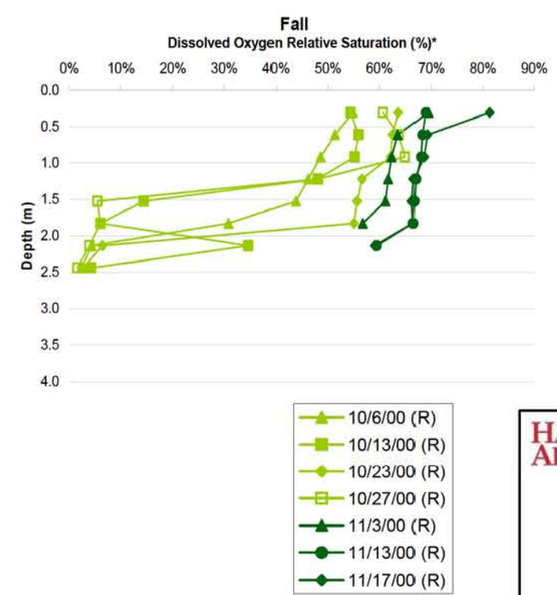
KEY PLAN











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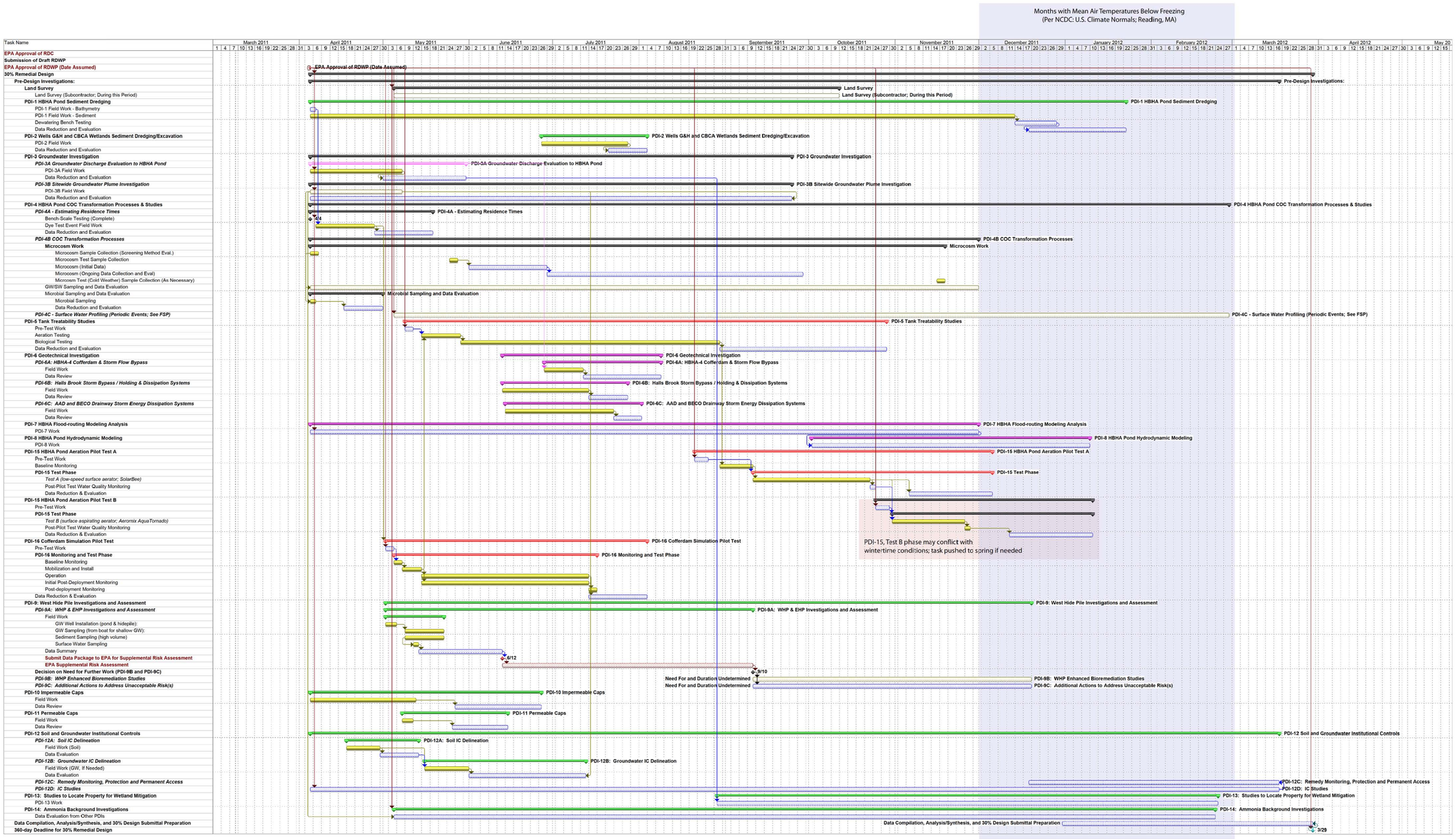
REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

STRATIFICATION MEASURED AT THE NORTH MONITORING STATION IN HBHA POND

SCALE: NONE
MARCH 2010

FIGURE 2.2-1

G:\33020\030\RDWP\Revised per EPA_Feb 2010\Figures\FIGURE 2.2-1 2010-0317-HAI-STRAT-D.grf



NOTES:

1. CPM = CRITICAL PATH METHOD.
2. LINES/ARROWS DEPICT CRITICAL PATH, DEPENDANT TASKS, AND/OR SCHEDULE REQUIREMENTS DESCRIBED IN THE SOW.
3. CPM SCHEDULE IS CONCEPTUAL AND IS DESIGNED TO SHOW DEPENDENCES AND APPROXIMATE DURATIONS; ACTUAL DATES, TIMING, DURATION OF PDI TASKS MAY VARY FROM THIS SCHEDULE.
4. ACTUAL DATES OF SUBMITTAL MAY VARY FROM THIS SCHEDULE BECAUSE IT DEPENDS ON THE DURATIONS OF EPA REVIEW/APPROVAL AND OTHER CONSIDERATIONS.

FUSCIA = TASKS INITIATED UPON RDWP APPROVAL TO COLLECT KEY SITE DATA (PRE-REQUISITE)
GREEN=FLEXIBLE SCHEDULE ELEMENTS
OLIVE=FIELD WORK ITEMS
RED = TIME/SEASON CRITICAL SCHEDULE ELEMENTS
PURPLE = CONTINGENT/MODERATE FLEXIBILITY TASK

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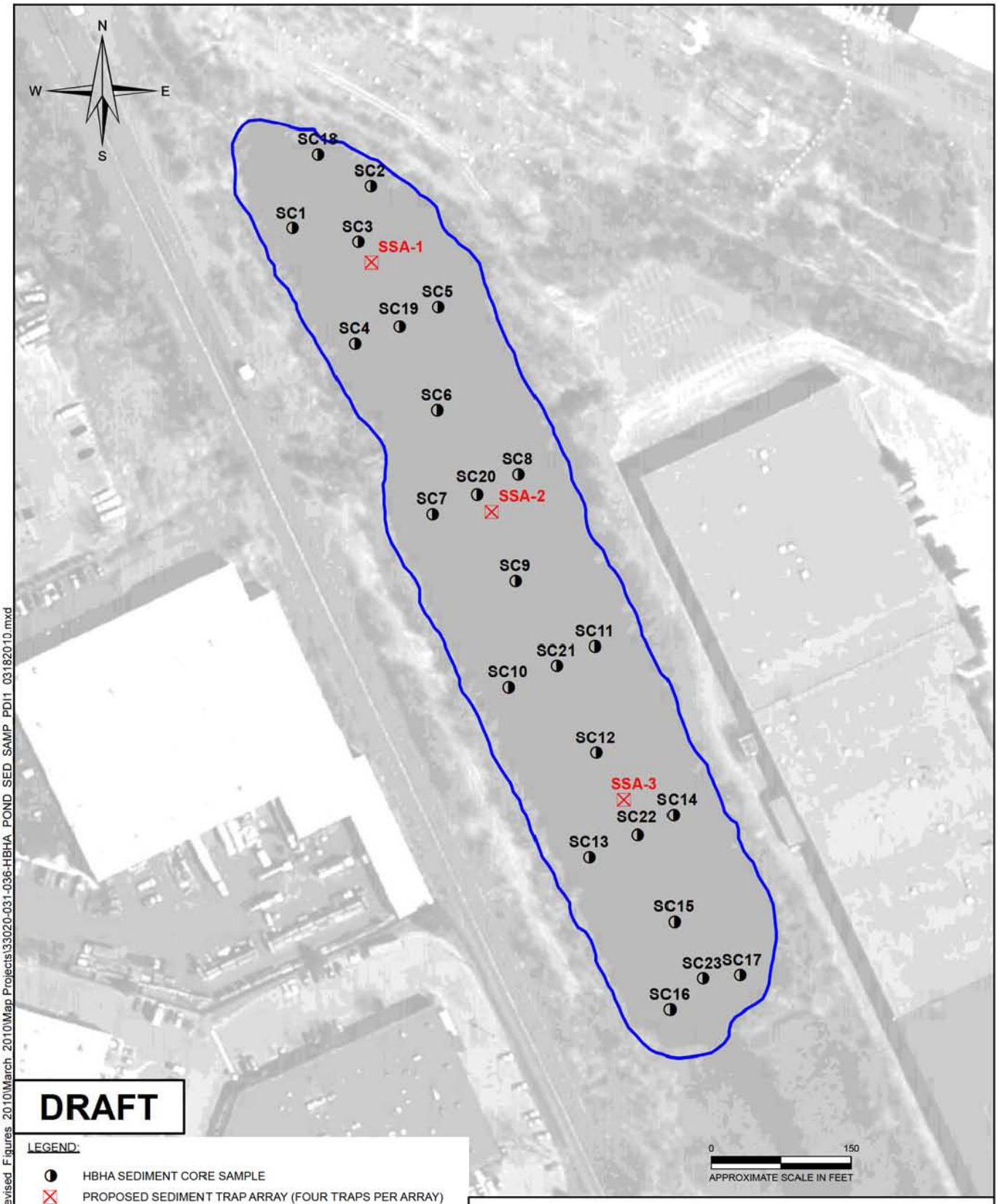
REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

PRE-DESIGN INVESTIGATION CPM SCHEDULE

SCALE: NONE
MARCH 2011

FIGURE 3.1-1

G:\33020\045\PDI Scheduling\Figure 4-1\2011-0309-PDI-schedule.ai



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LEGEND:

- HBHA SEDIMENT CORE SAMPLE
- PROPOSED SEDIMENT TRAP ARRAY (FOUR TRAPS PER ARRAY)

NOTES:

1. ALL LOCATIONS, DIMENSIONS, AND AREAL EXTENTS SHOULD BE CONSIDERED APPROXIMATE.
2. 2001 1/2 METER RESOLUTION COLOR ORTHOIMAGERY OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS.
3. LOCATIONS OF SEDIMENT TRAP ARRAYS CONSIDERED APPROXIMATE. TRAPS WILL BE INSTALLED WHERE THE SOF LAYER THICKNESS IS GREATEST, BASED ON PROBING CONDUCTED AS PART OF PDI-1.

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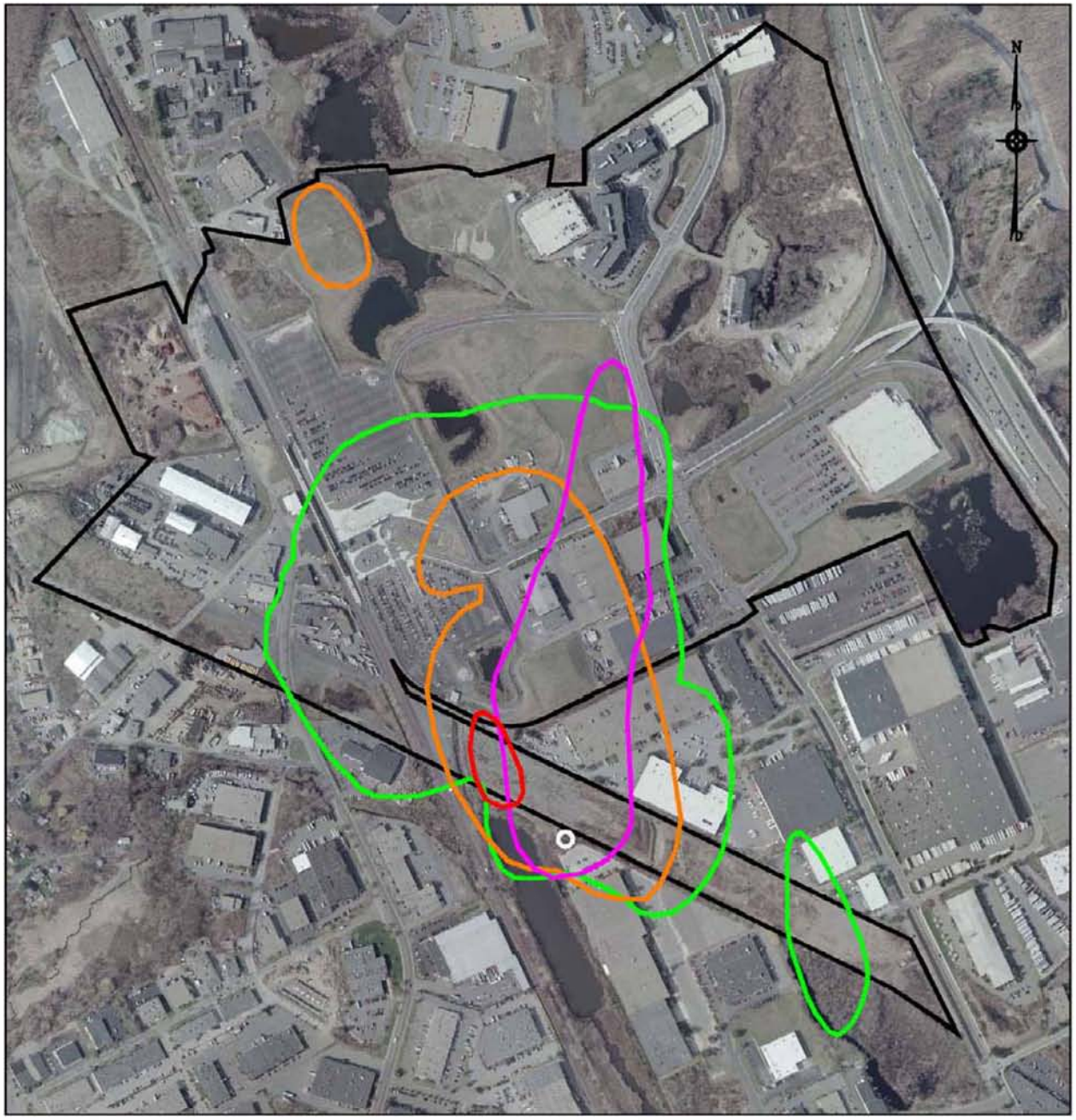
REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

PDI-1 PROPOSED HBHA POND DREDGING DELINEATION SAMPLE LOCATIONS

SCALE: AS SHOWN
MARCH 2010

3.1.1-1

G:\33020\GLOBAL\GIS\MapProjects\Revised Figures 2010\March 2010\Map Projects\33020-031-036-HBHA POND SED SAMP PDI1 03182010.mxd



SITE BOUNDARY
ARSENIC CONCENTRATION > PRG OF 150 µg/L
BENZENE CONCENTRATION > PRG OF 6 µg/L
TRICHLOROETHENE CONCENTRATION > PRG OF 5 µg/L
1,2-DICHLOROETHANE CONCENTRATION > PRG OF 7 µg/L
NAPHTHALENE CONCENTRATION > PRG OF 6 µg/L

GRAPHIC SCALE
0' 800'

Source: Figure 2-4 from the MSGRP RI

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REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

INTERPRETED EXTENT OF GROUNDWATER PLUMES

SCALE: NONE
MARCH 2010

FIGURE 3.1.2.1-1

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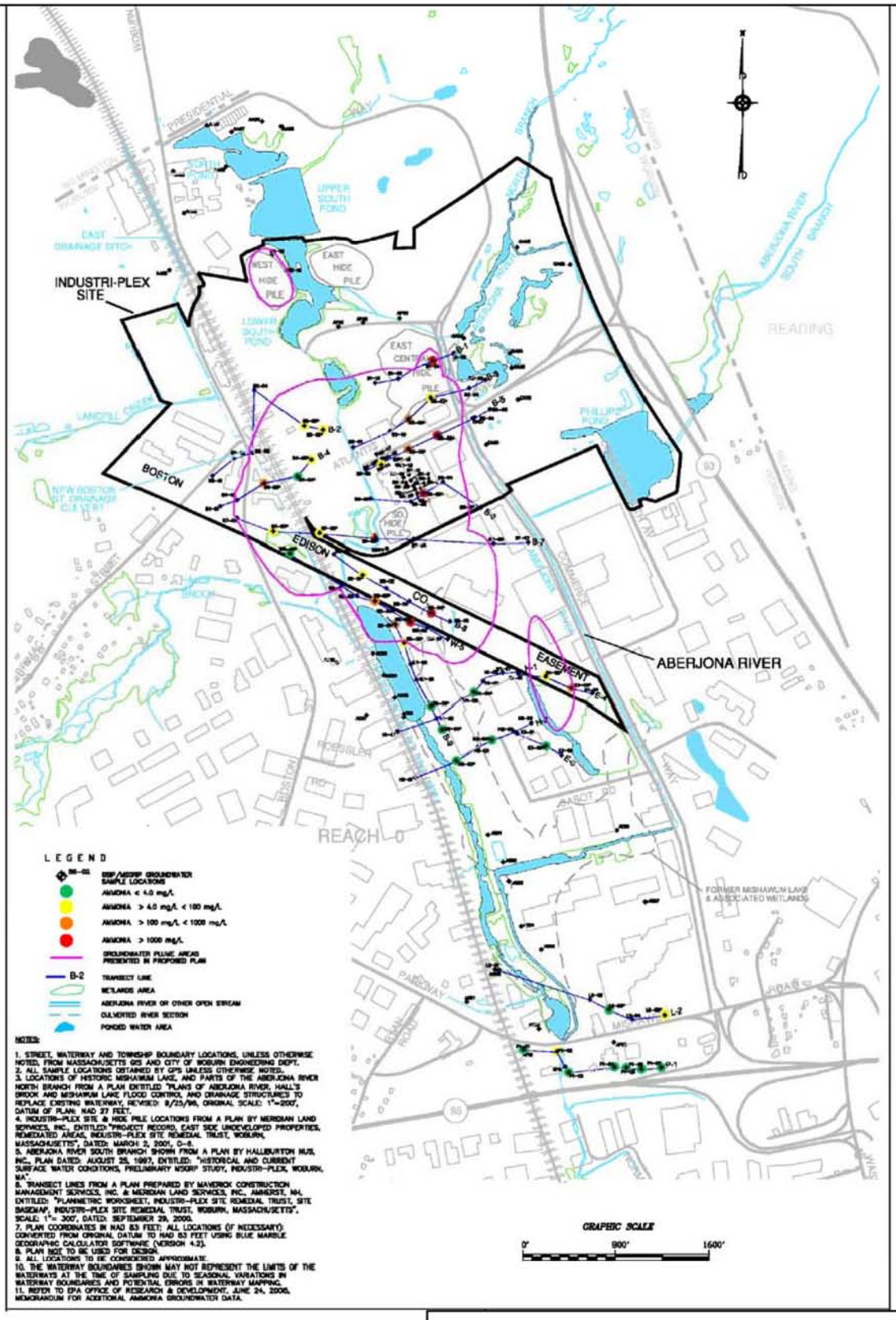
G:\33020\030\RDWP\Revised per EPA Feb 2010\Figures\Figure 3.1.2.1-1 2010-0316-HAI-GWPLUME-D.vsd



SOURCE: FIGURE3-1 FROM THE MSGRP RI

HALEY & ALDRICH

REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN MASSACHUSETTS

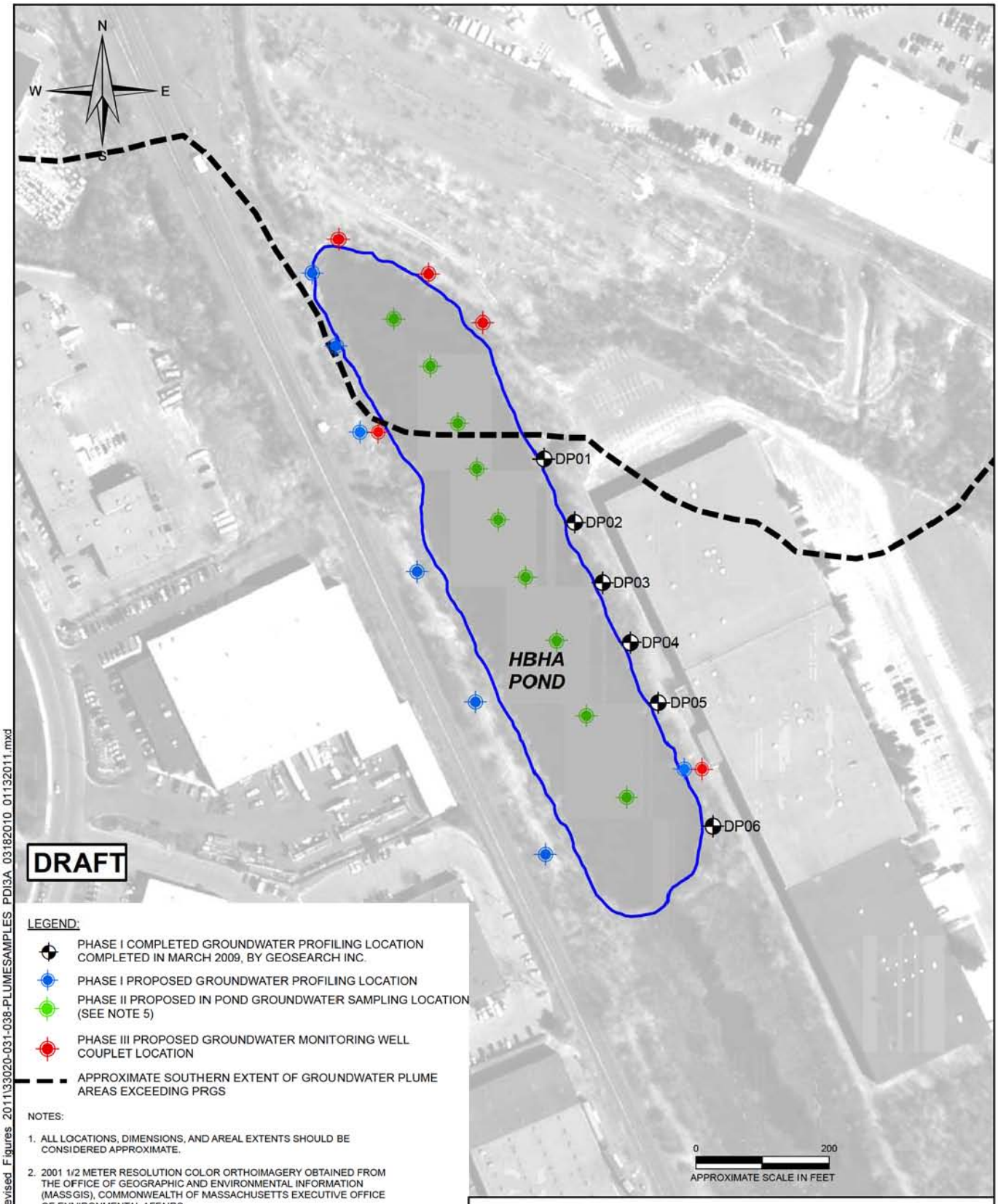
INTERPRETED EXTENT OF AMMOINA GROUNDWATER PLUME

SCALE: AS SHOWN
MARCH 2010

FIGURE 3.1.2.1-2

DRAFT

G:\33020\GLOBAL\GIS\MapProjects\Revised Figures 2010\March 2010\Map Projects\33020 INTERP EXTENT OF AMMONIA PLUME 03192010.mxd



LEGEND:

- PHASE I COMPLETED GROUNDWATER PROFILING LOCATION COMPLETED IN MARCH 2009, BY GEOSEARCH INC.
- PHASE I PROPOSED GROUNDWATER PROFILING LOCATION
- PHASE II PROPOSED IN POND GROUNDWATER SAMPLING LOCATION (SEE NOTE 5)
- PHASE III PROPOSED GROUNDWATER MONITORING WELL COUPLET LOCATION
- APPROXIMATE SOUTHERN EXTENT OF GROUNDWATER PLUME AREAS EXCEEDING PRGS

NOTES:

1. ALL LOCATIONS, DIMENSIONS, AND AREAL EXTENTS SHOULD BE CONSIDERED APPROXIMATE.
2. 2001 1/2 METER RESOLUTION COLOR ORTHOIMAGERY OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS.
3. GROUNDWATER PLUME EXTENT DERIVED AND PRESENTED AS A COMPOSITE OF MULTIPLE PARAMETERS SHOWN ON FIGURE BY TETRA TECH NUS, INC., GROUNDWATER PLUME AREAS EXCEEDING PRGS, INDUSTRI-PLEX SITE, WOBURN, MASSACHUSETTS.
4. ACTUAL NUMBER OF MONITORING WELL COUPLETS WILL BE DETERMINED BASED ON PHASE I & II RESULTS.
5. AT THE PHASE II PROPOSED IN-POND GROUNDWATER SAMPLING LOCATIONS, VERTICAL GRADIENT INFORMATION WILL ALSO BE COLLECTED DURING INSTALLATION. FOUR TEMPORARY PIEZOMETERS WILL BE LEFT IN PLACE FOR ADDITIONAL MONITORING OF VERTICAL GRADIENTS. THE LOCATIONS OF THESE TEMPORARY PIEZOMETERS WILL BE DETERMINED BASED ON INITIAL FIELD DATA COLLECTED DURING PHASE I AND PHASE II.

HALEY & ALDRICH

REMEDIAL DESIGN
INDUSTRI-PLEX SUPERFUND SITE OPERABLE UNIT NO. 2
WOBURN, MASSACHUSETTS

PDI-3A GROUNDWATER PLUME DISCHARGE AREA DELINEATION

SCALE: AS SHOWN
FEBRUARY 2011

FIGURE 3.1.2.1-3

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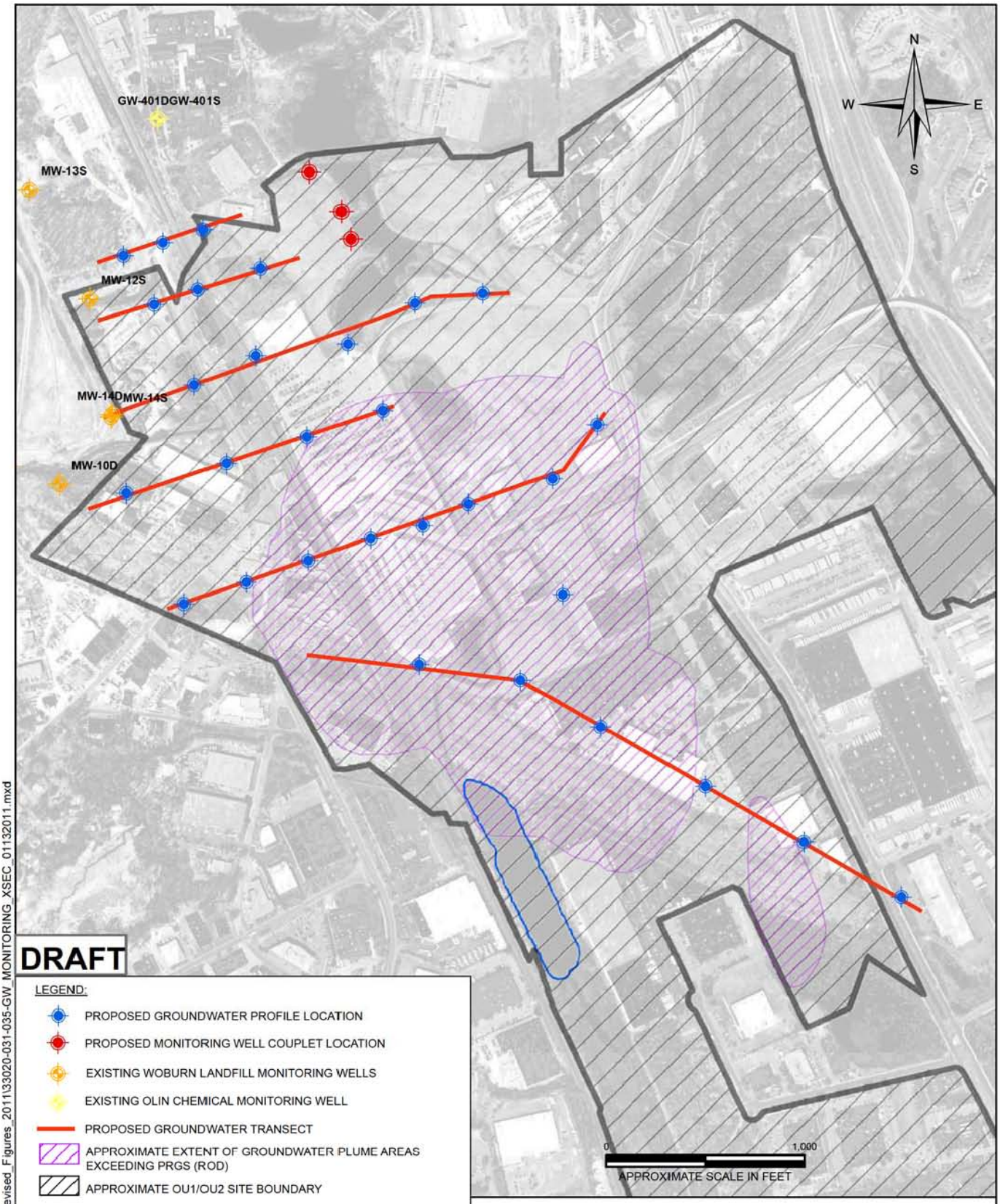

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LEGEND:

- PROPOSED GROUNDWATER PROFILE LOCATION
- PROPOSED MONITORING WELL COUPLET LOCATION
- EXISTING WOBURN LANDFILL MONITORING WELLS
- EXISTING OLIN CHEMICAL MONITORING WELL
- PROPOSED GROUNDWATER TRANSECT
- APPROXIMATE EXTENT OF GROUNDWATER PLUME AREAS EXCEEDING PRGS (ROD)
- APPROXIMATE OU1/OU2 SITE BOUNDARY

NOTES:

1. ALL LOCATIONS, DIMENSIONS, AND AREAL EXTENTS SHOULD BE CONSIDERED APPROXIMATE.
2. 2008 30 CENTIMETER RESOLUTION COLOR ORTHOIMAGERY OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS),COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS.
3. EXISTING MONITORING WELL LOCATIONS PROVIDED BY DDMS ON 11 FEB 2010.
4. LOCATION OF PERMANENT WELLS WILL BE IDENTIFIED FOLLOWING THE EVALUATION OF THE PRE- AND POST-ROD DATA.

HALEY & ALDRICH

REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

PDI-3B PROPOSED GROUNDWATER SAMPLING TRANSECTS

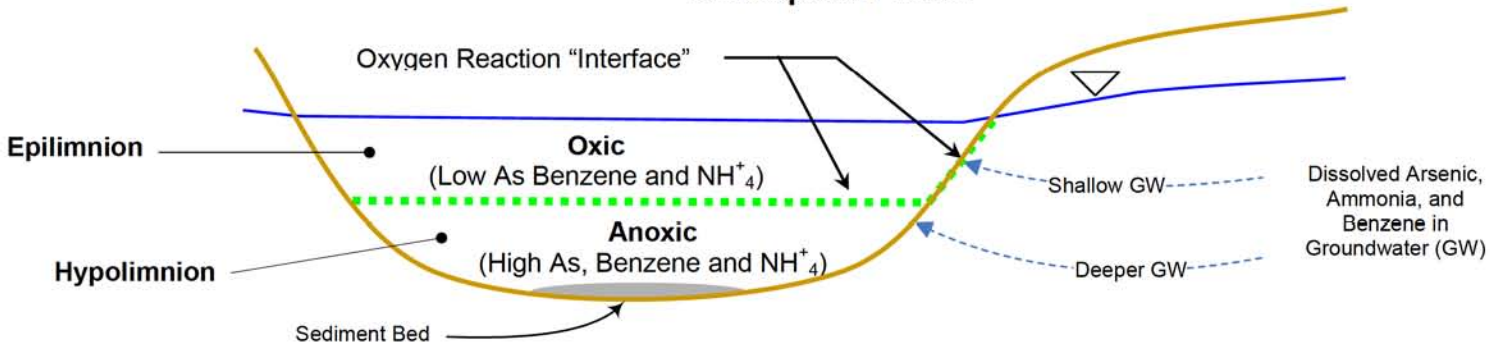
SCALE: AS SHOWN
FEBRUARY 2011

FIGURE 3.1.2.2-1

G:\133020\GLOBAL\GIS\MapProjects\Revised_Figures_2011\33020-031-035-GW_MONITORING_XSEC_01132011.mxd

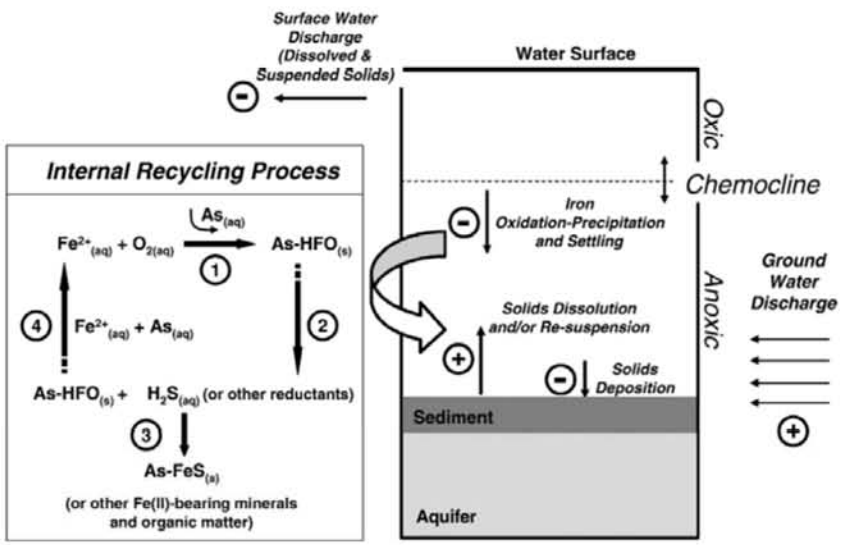
G:\33020\030\RDWP\Final Draft_March 2010\Figures\2010-0321-HAI-RDWPConceptualDiagrams and Processes-D.vsd

Conceptual Profile



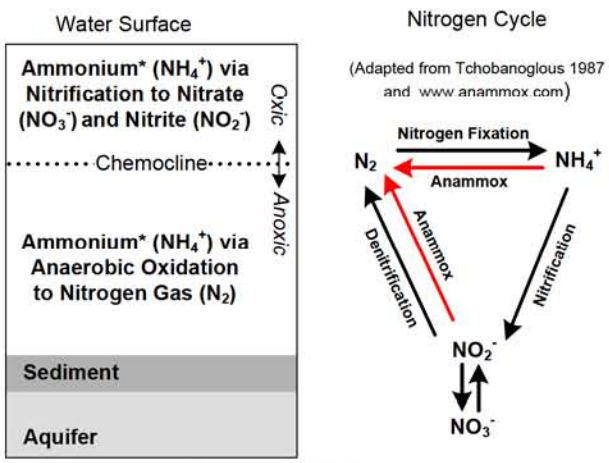
Conceptual Diagrams of Fate and Transformation Scenarios

Arsenic



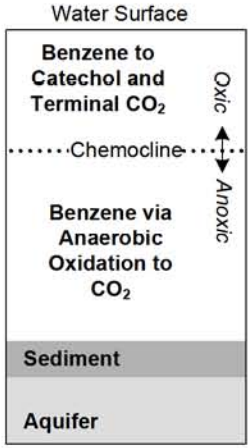
From Ford (2005)

Ammonia



* Ammonium (NH_4^+) likely to be the dominate species present at pH of HBHA Pond

Benzene



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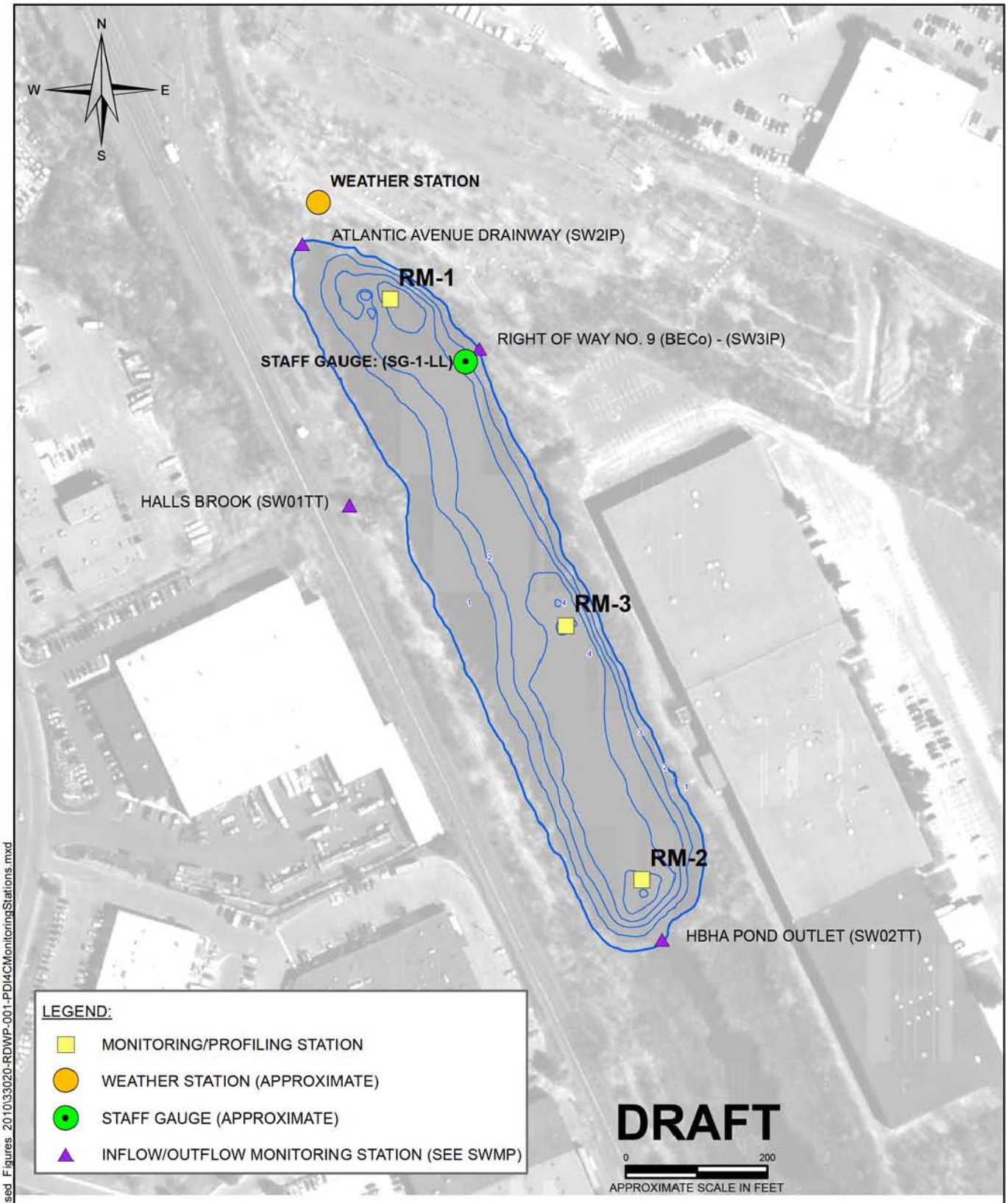
REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

CONCEPTUAL PROFILE, FATE AND TRANSFORMATION PATHWAY DIAGRAMS

DRAFT

SCALE: NONE
MARCH 2010

FIGURE 3.1.3.2-1



NOTES:

1. ALL LOCATIONS, DIMENSIONS, AND AREAL EXTENTS SHOULD BE CONSIDERED APPROXIMATE.
2. 2001 1/2 METER RESOLUTION COLOR ORTHOIMAGERY OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS.
3. BATHYMETRY TAKEN FROM NATURAL ATTENUATION STUDY (FORD, 2004)

HALEY & ALDRICH

REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

PDI-4C MONITORING STATIONS AND RELATED LOCATIONS

SCALE: AS SHOWN
MARCH 2010

FIGURE 3.1.3.3-1

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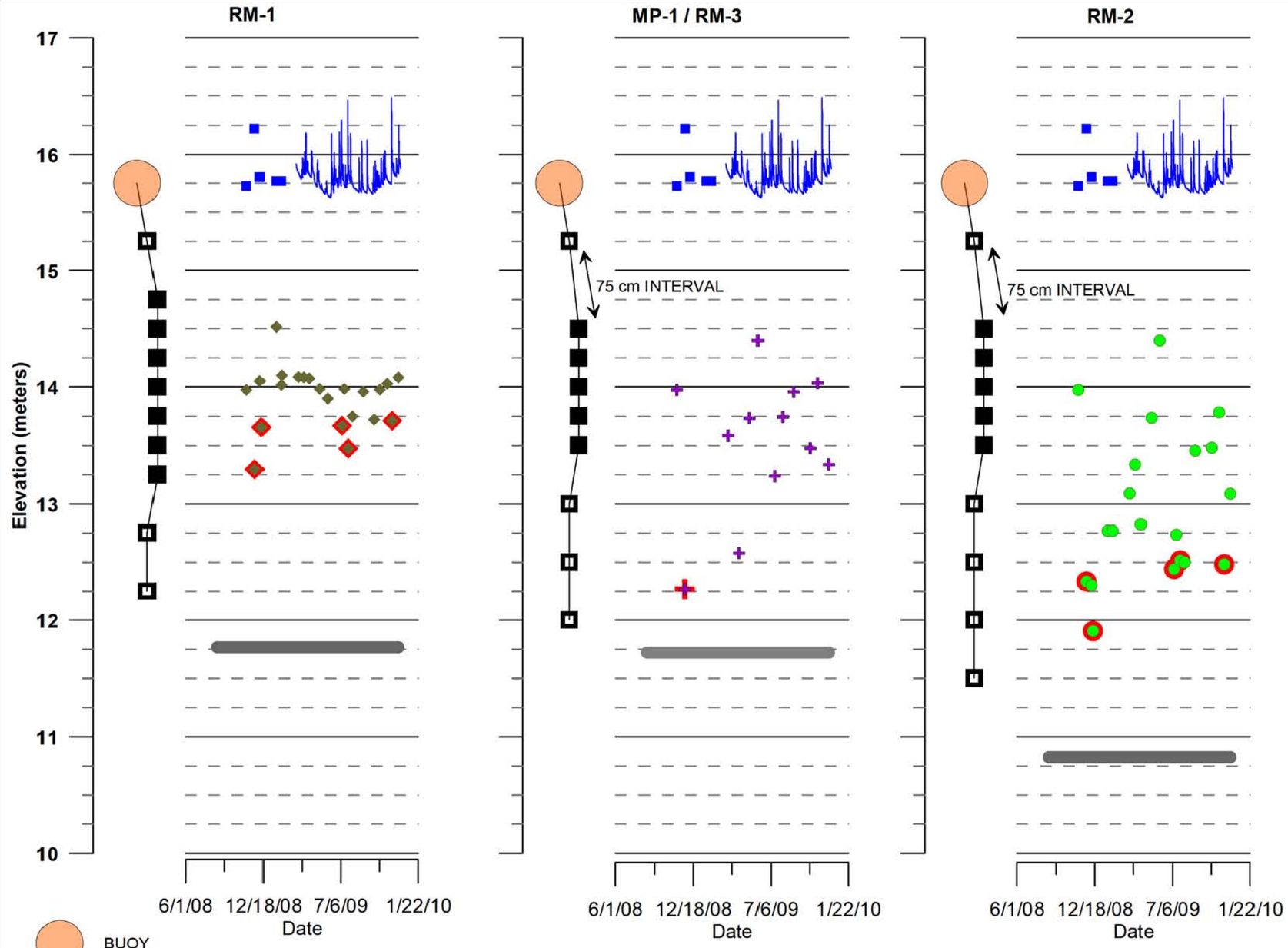

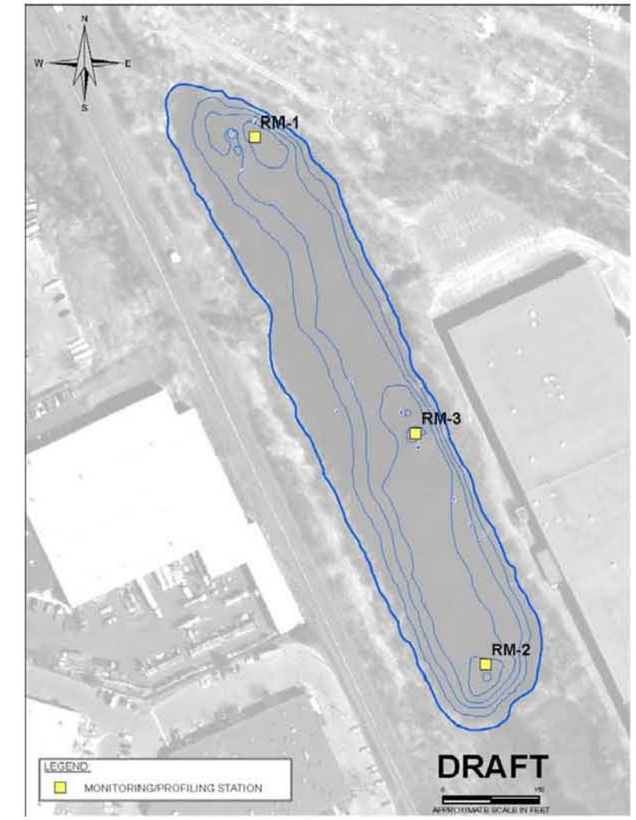

LEGEND

- Discrete Water Level Surface Est (See Note 2)
- Time Series Electronic Staff Gauge Reading at SG-1-LL (See Note 2)
- Rough Est of Pond Bottom at Location (See Note 3)
- Rough Est of Chemocline at RM-2
- Rough Est of Chemocline at MP-1
- Rough Est of Chemocline at RM-1
- STORM EVENT

NOTES:

1. ALL LOCATIONS, DIMENSIONS, AND SITE FEATURES SHOULD BE CONSIDERED APPROXIMATE.
2. ALL ELEVATION SHOULD BE CONSIDERED ESTIMATED (** STAFF GAUGE DATUM ELEVATION ESTIMATED AND REMAINS TO BE SURVEYED).
3. TOTAL DEPTH ESTIMATE BASED ON MAXIMUM TOTAL DEPTH FIELD MEASUREMENT DURING SERIES OF PROFILING EVENTS.

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REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

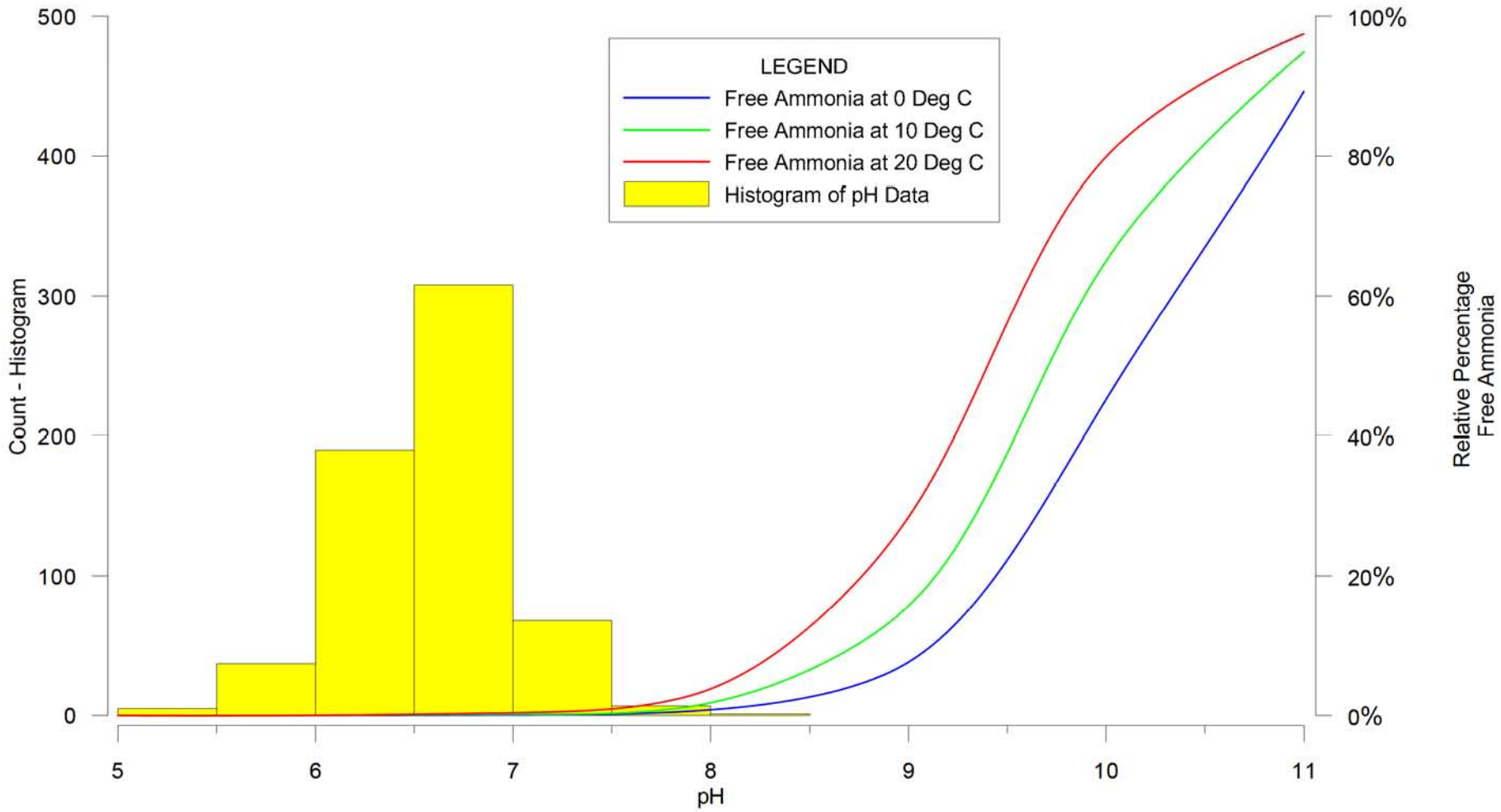
PDI-4C CTD SENSOR STATION CONFIGURATION

SCALE: NONE
MARCH 2010

FIGURE 3.1.3.3-2

G:\33020\030\RDWP\Final Draft_March 2010\Figures\2010-0312-HAI-CTDSENSORARRAY.grf

G:\33020\030\RDWP\Revised Per EPA_Feb 2010\Figures\2010-0316-RDWPHAlPhHIST-D.grf



DRAFT

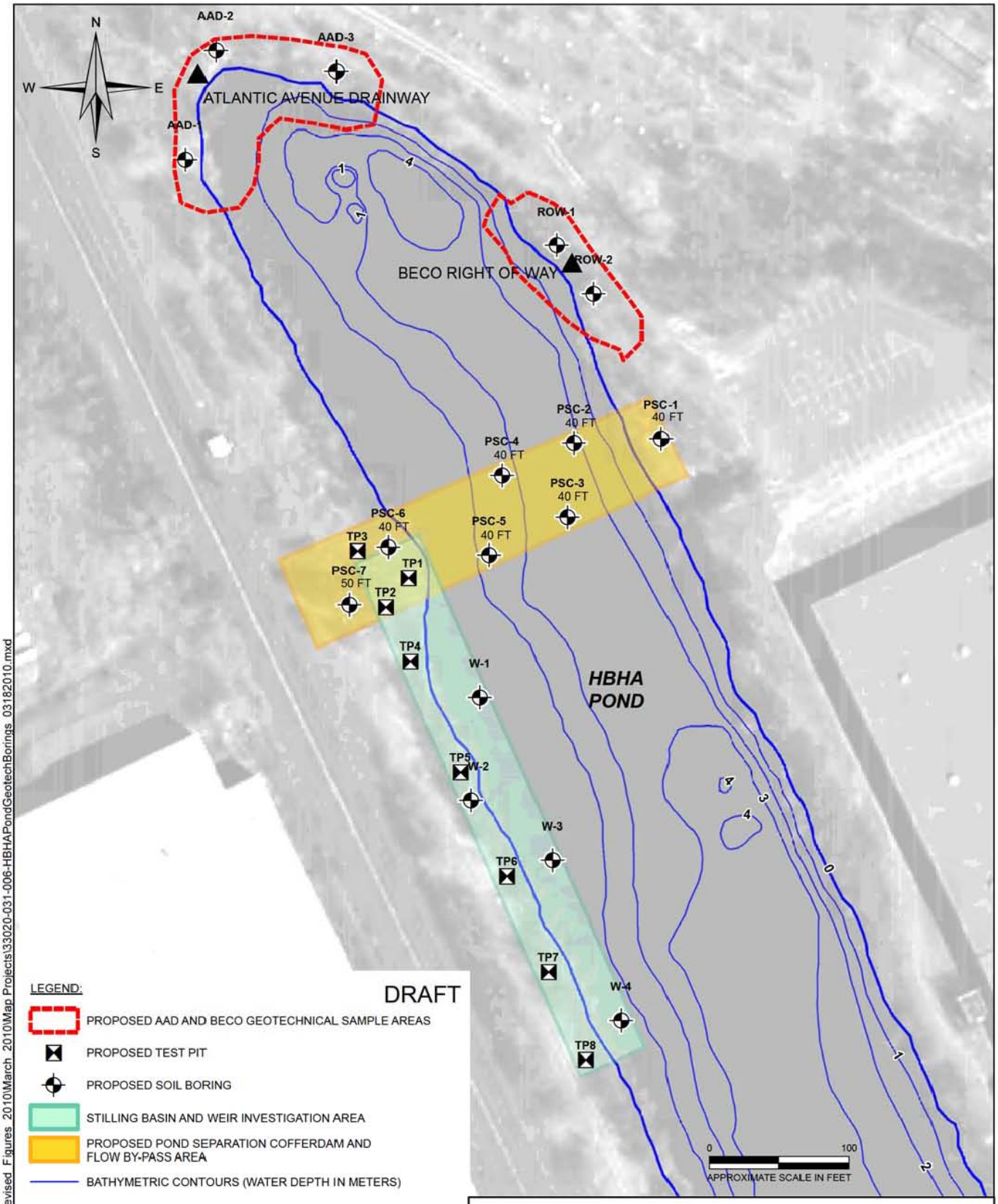
HALEY & ALDRICH

REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

FREE AMMONIA VS. pH CHART AND pH HISTOGRAM

SCALE: NONE
MARCH 2010

FIGURE 3.1.4-1



DRAFT

LEGEND:

- PROPOSED AAD AND BECO GEOTECHNICAL SAMPLE AREAS
- PROPOSED TEST PIT
- PROPOSED SOIL BORING
- STILLING BASIN AND WEIR INVESTIGATION AREA
- PROPOSED POND SEPARATION COFFERDAM AND FLOW BY-PASS AREA
- BATHYMETRIC CONTOURS (WATER DEPTH IN METERS)

NOTES:

1. ALL LOCATIONS, DIMENSIONS, AND AREAL EXTENTS SHOULD BE CONSIDERED APPROXIMATE.
2. PROPERTY AND EASEMENT BOUNDARIES SHALL BE ESTABLISHED BEFORE WORK.
3. 2001 1/2 METER RESOLUTION COLOR ORTHOIMAGERY OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS.
4. BATHYMETRY TAKEN FROM NATURAL ATTENUATION STUDY (FORD, 2004).

HALEY & ALDRICH

REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

PDI-6 HBHA POND
GEOTECHNICAL BORINGS

SCALE: AS SHOWN
MARCH 2010

FIGURE 3.1.5-1

G:\33020\GLOBAL\GIS\MapProjects\Revised Figures 2010\March 2010\Map Projects\33020-031-006-HBHAPondGeotechBorings 03182010.mxd

G:\33020\Global\GIS\Map Projects\Revised_Figures_2010\ 33020-975-002-ExposedSewerCrossing.mxd

NOTES:

1. ALL LOCATIONS, DIMENSIONS, AND AREAL EXTENTS SHOULD BE CONSIDERED APPROXIMATE.
2. PHOTOGRAPH TAKEN ON 28 SEPTEMBER 2007.

DRAFT

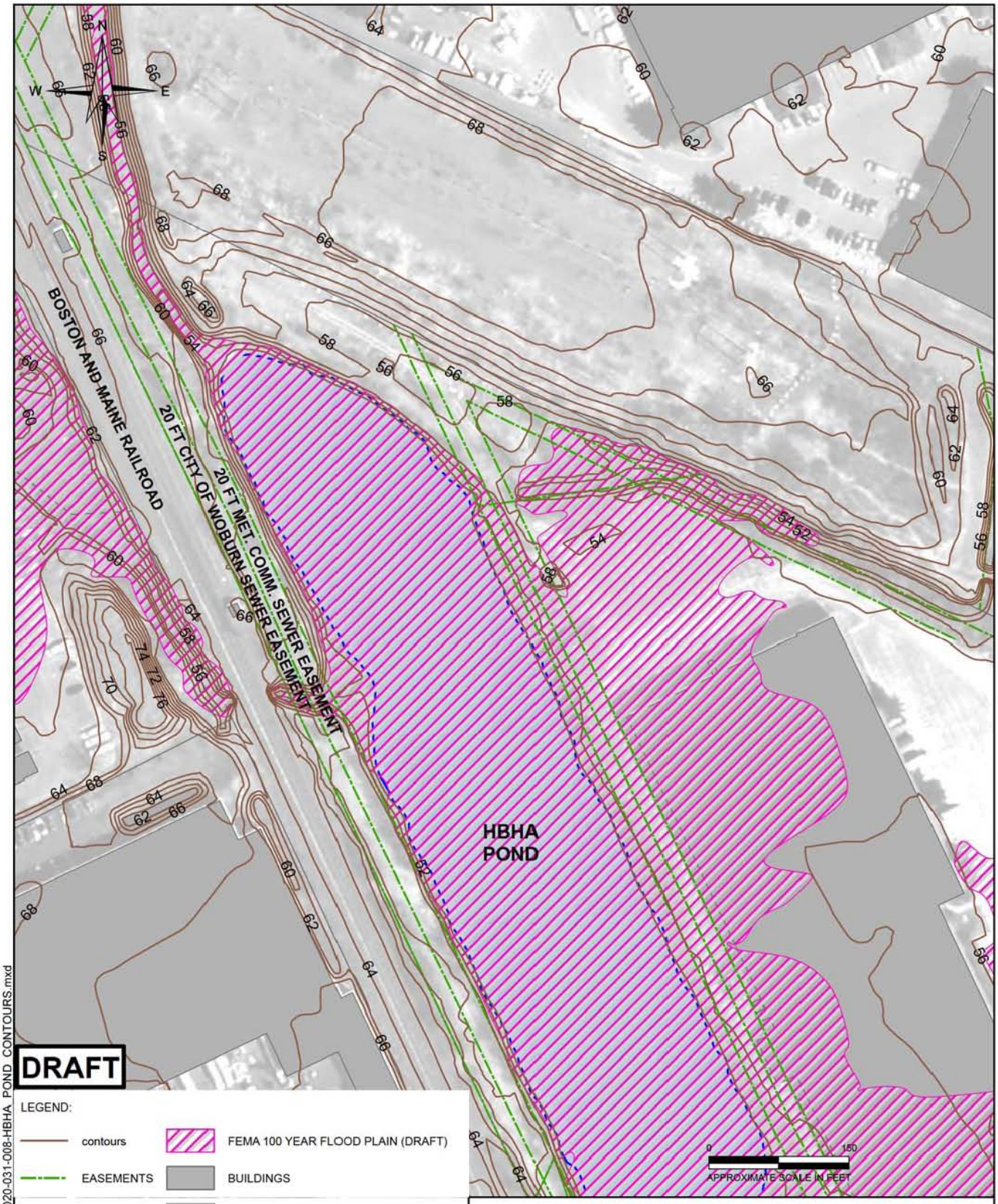
HALEY & ALDRICH

REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

PDI-6 EXPOSED SEWER LINES

SCALE: AS SHOWN
MARCH 2010

FIGURE 3.1.5.1-1



DRAFT

LEGEND:

- contours
- EASEMENTS
- FEMA 100 YEAR FLOOD PLAIN (DRAFT)
- BUILDINGS
- PARCELS

NOTES:

1. ALL LOCATIONS, DIMENSIONS, AND AREAL EXTENTS SHOULD BE CONSIDERED APPROXIMATE.
2. BASE MAP IMAGE OBTAINED FROM THE CITY OF WOBURN G.I.S. LAYERS USED IN TAX MAP 15.
3. 2001 1/2 METER RESOLUTION COLOR ORTHOIMAGERY OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS.

HALEY & ALDRICH

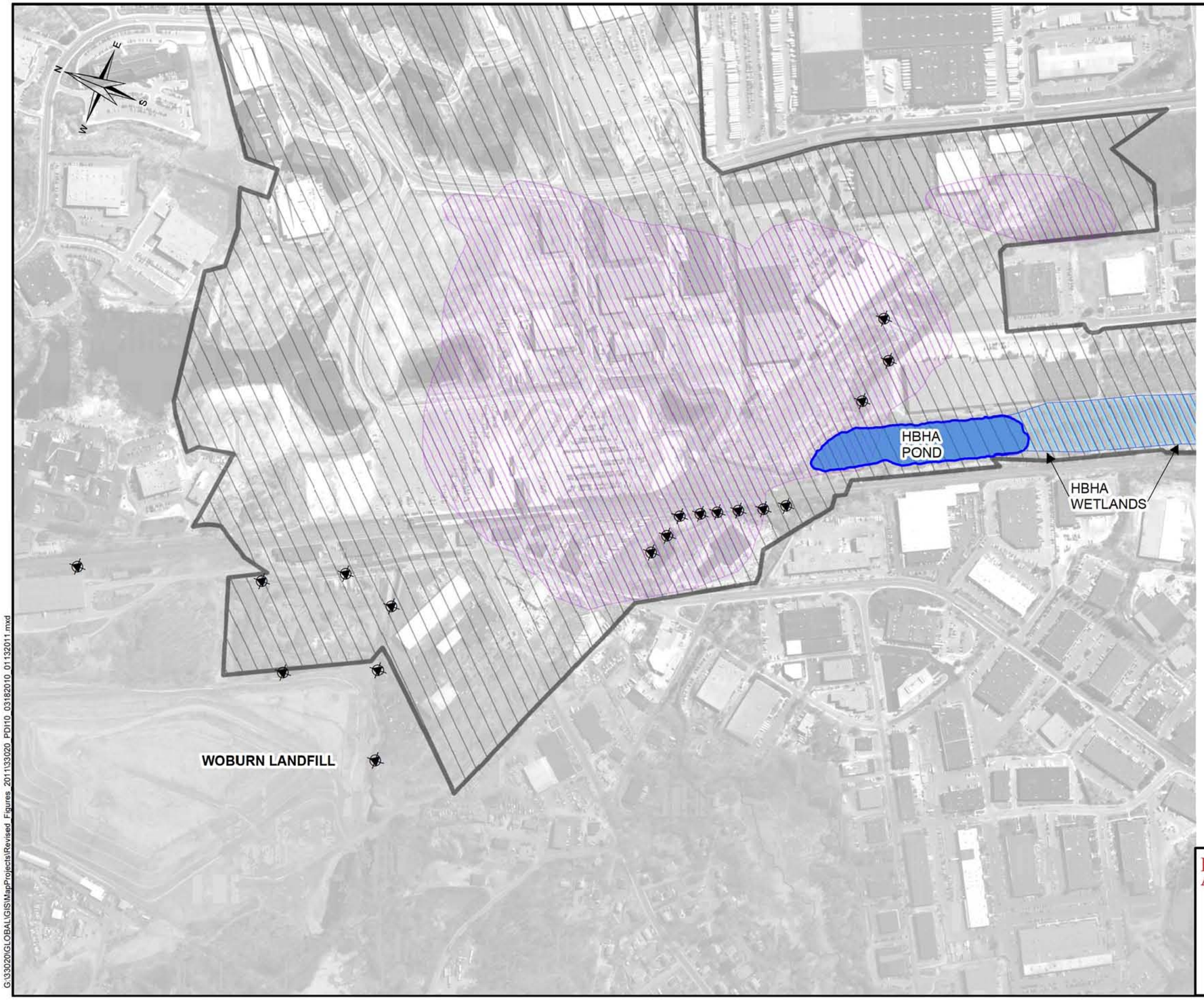
REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

PDI-6: LOCATION OF SEWER EASEMENT ADJACENT TO HBHA POND

SCALE: AS SHOWN
MARCH 2010

FIGURE 3.1.5.1-2

G:/33020/Global/GIS/Map Projects/33020-031-008-HBHA_POND_CONTOURS.mxd



LEGEND:

- PROPOSED TEMPORARY DRIVE POINT PIEZOMETER
- APPROXIMATE OU1/OU2 SITE BOUNDARY
- APPROXIMATE EXTENT OF GROUNDWATER PLUME AREAS EXCEEDING PRGS

NOTES:

1. ALL LOCATIONS, DIMENSIONS, AND AREAL EXTENTS SHOULD BE CONSIDERED APPROXIMATE.
2. 2001 1/2 METER RESOLUTION COLOR ORTHOIMAGERY OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFARIS.
3. GROUNDWATER PLUME EXTENT DERIVED AND PRESENTED AS A COMPOSITE OF MULTIPLE PARAMETERS SHOWN ON FIGURE BY TETRA TECH NUS, INC., GROUNDWATER PLUME AREAS EXCEEDING PRGs, INDUSTRI-PLEX SITE, WOBURN, MASSACHUSETTS.

DRAFT

0 250 500 1000
SCALE IN FEET

HALEY & ALDRICH

REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

PDI-10 IMPERMEABLE CAP INVESTIGATIONS

SCALE: AS SHOWN
FEBRUARY 2011

FIGURE 3.1.8-1

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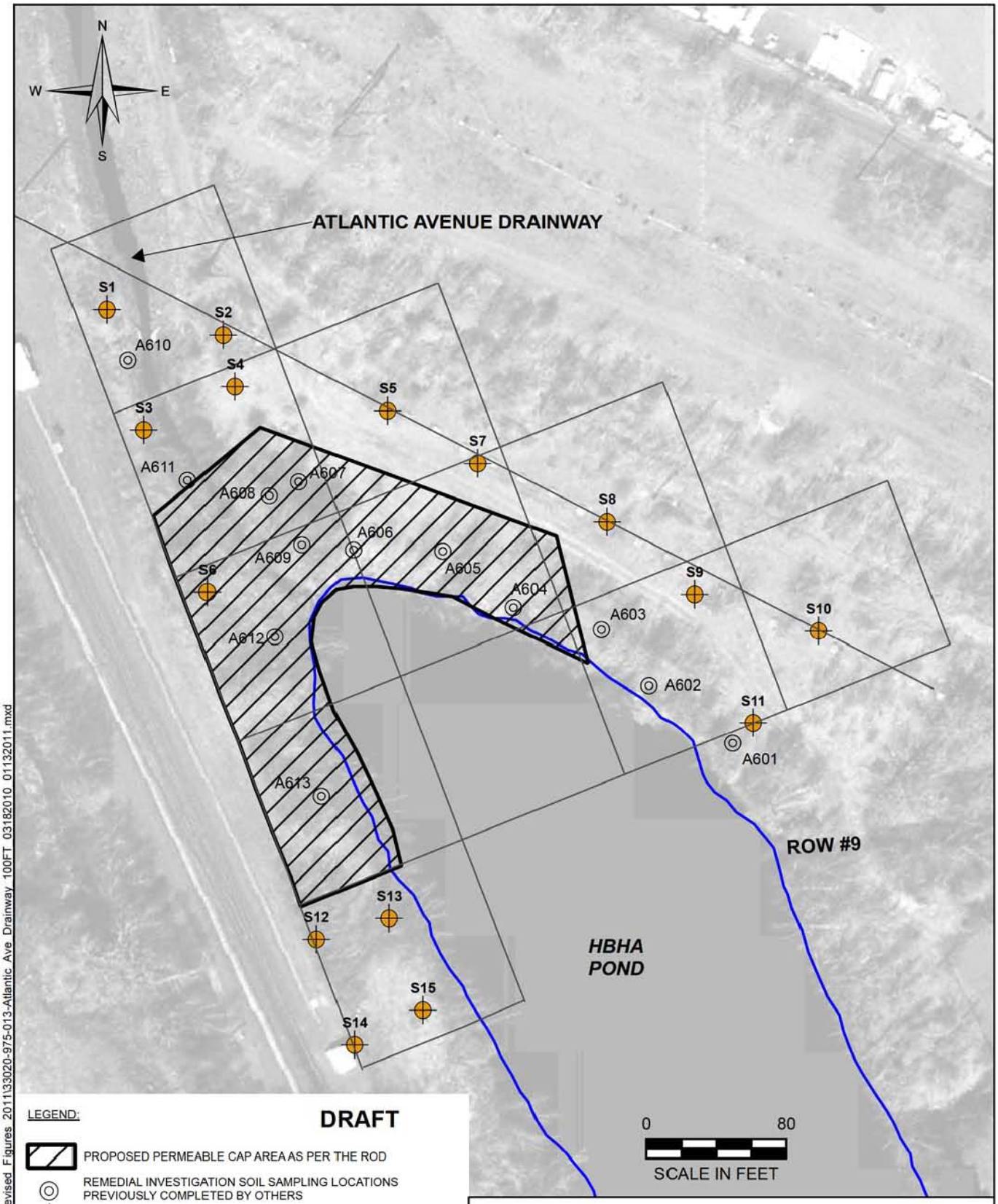

LEGEND:

DRAFT

PROPOSED PERMEABLE CAP AREA AS PER THE ROD

REMEDIAL INVESTIGATION SOIL SAMPLING LOCATIONS PREVIOUSLY COMPLETED BY OTHERS

PROPOSED SOIL SAMPLING LOCATION

NOTES:

1. ALL LOCATIONS, DIMENSIONS, AND AREAL EXTENTS SHOULD BE CONSIDERED APPROXIMATE.
2. PROPERTY AND EASEMENT BOUNDARIES SHALL BE ESTABLISHED BEFORE WORK.
3. 2008 30 CENTIMETER RESOLUTION COLOR ORTHOIMAGERY OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS.

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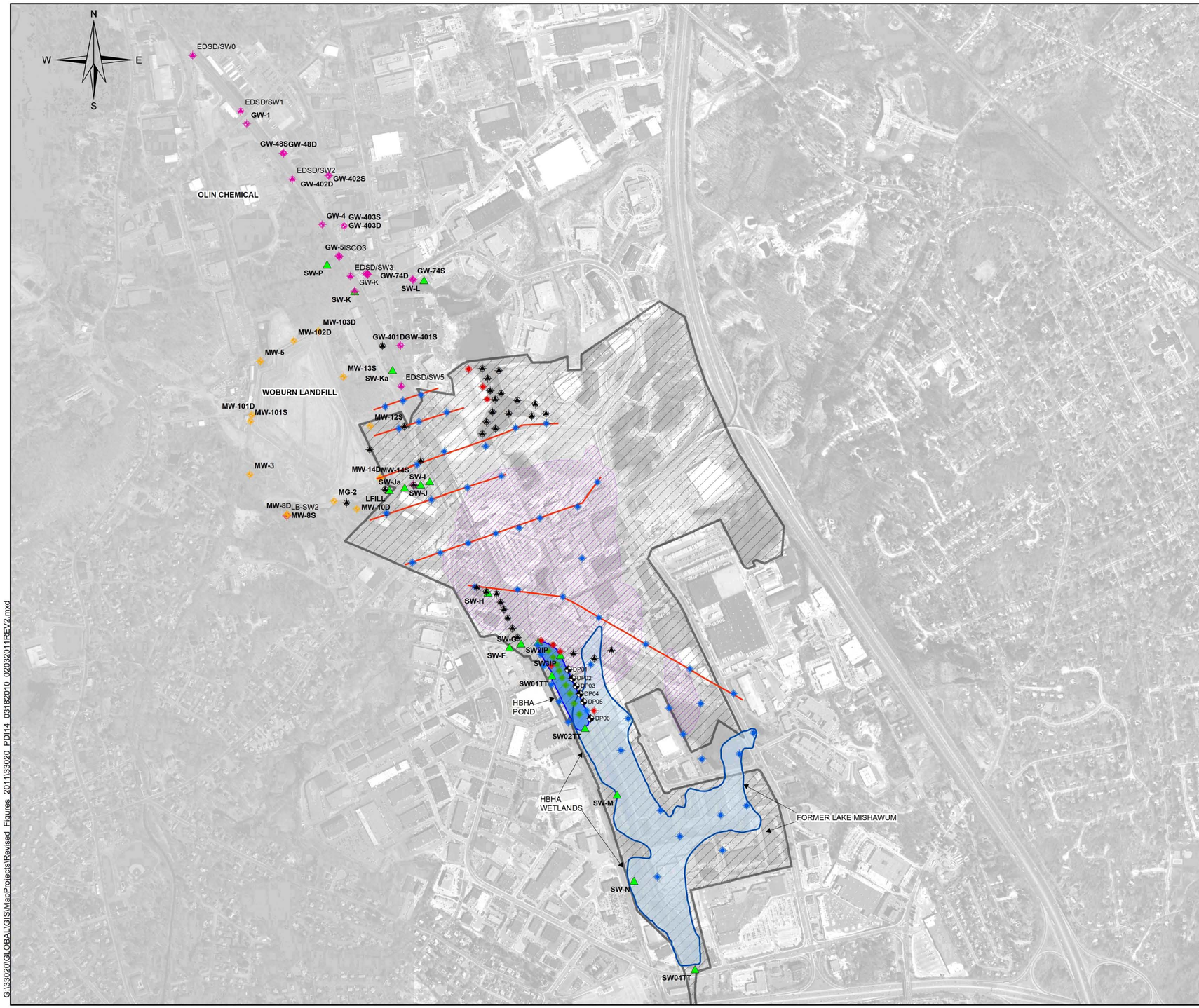
REMEDIAL DESIGN
INDUSTRI-PLEX OPERABLE UNIT NO. 2
WOBURN, MASSACHUSETTS

PDI-11 PERMEABLE CAP INVESTIGATION

SCALE: AS SHOWN
FEBRUARY 2011

FIGURE 3.1.9-1

G:\33020\GLOBAL\GIS\MapProjects\Revised Figures 2011\33020-975-013-Atlantic Ave Drainway 100FT 03182010 01132011.mxd



LEGEND:

- PROPOSED GROUNDWATER PROFILING LOCATION
- COMPLETED GROUNDWATER PROFILING LOCATION COMPLETED IN MARCH 2009, BY GEOSEARCH INC.
- PROPOSED IN POND GROUNDWATER SAMPLING LOCATION
- PROPOSED GROUNDWATER MONITORING WELL COUPLET LOCATION
- PROPOSED TEMPORARY DRIVE POINT PIEZOMETER AND SURFACE WATER SAMPLING LOCATION
- EXISTING AMMONIA BACKGROUND SURFACE WATER SAMPLING LOCATION
- EXISTING OLIN CHEMICAL SURFACE WATER SAMPLING LOCATION
- EXISTING OLIN CHEMICAL MONITORING WELL LOCATION
- EXISTING WOBURN LANDFILL MONITORING WELL LOCATION
- APPROXIMATE OU1/OU2 SITE BOUNDARY
- APPROXIMATE EXTENT OF GROUNDWATER PLUME AREAS EXCEEDING PRGS (ROD)

NOTES

1. ALL LOCATIONS, DIMENSIONS, AND AREAL EXTENTS SHOULD BE CONSIDERED APPROXIMATE.
2. 2001 1/2 METER RESOLUTION COLOR ORTHOIMAGERY OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFARIS.
3. GROUNDWATER PLUME EXTENT DERIVED AND PRESENTED AS A COMPOSITE OF MULTIPLE PARAMETERS SHOWN ON FIGURE BY TETRA TECH NUS, INC., GROUNDWATER PLUME AREAS EXCEEDING PRGs, INDUSTRI-PLEX SITE, WOBURN, MASSACHUSETTS.
4. ACTUAL NUMBER OF MONITORING WELL COUPLETS WILL BE DETERMINED BASED ON PHASE I & II RESULTS.
5. OLIN CHEMICAL SURFACE WATER SAMPLING AND MONITORING WELL LOCATIONS OBTAINED FROM DDMS, 11 MARCH 2010.
6. WOBURN LANDFILL MONITORING WELL LOCATIONS OBTAINED FROM DDMS, 11 MARCH 2010.

DRAFT

0 300 600 1,200 1,800 2,400 Feet

HALEY & ALDRICH

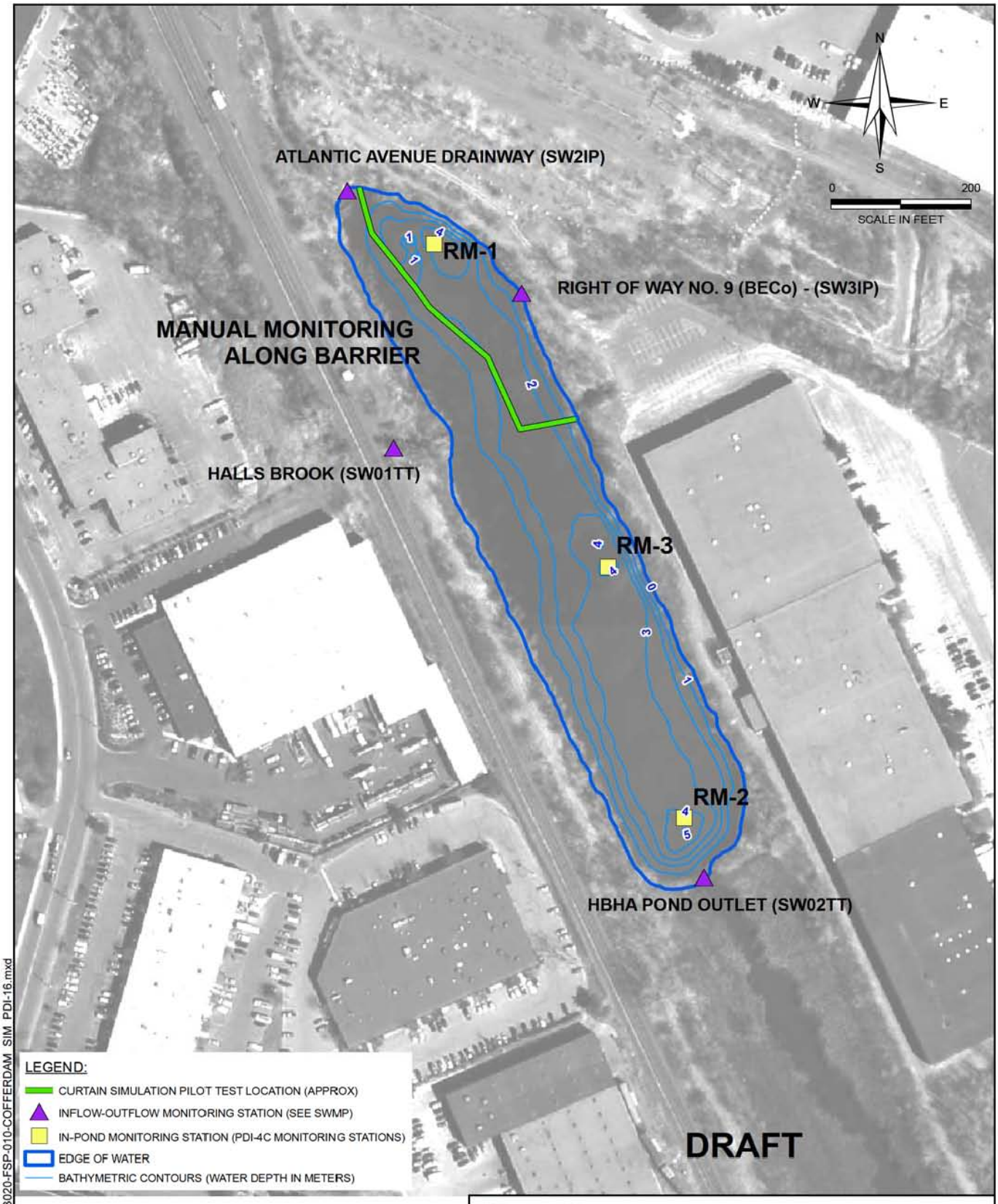
REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

PDI-14 AMMONIA BACKGROUND SAMPLING LOCATIONS

SCALE: AS SHOWN
FEBRUARY 2011

FIGURE 3.1.11-1

G:\33020\GLOBAL\GIS\MapProjects\Revised_Figures_2011\33020_PDI14_031820110_02032011REV2.mxd



NOTES:

1. ALL LOCATIONS, DIMENSIONS, AND AREAL EXTENTS SHOULD BE CONSIDERED APPROXIMATE.
2. 2001 1/2 METER RESOLUTION COLOR ORTHOIMAGERY OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS.
3. BATHYMETRY TAKEN FROM NATURAL ATTENUATION STUDY (FORD, 2004).

HALEY & ALDRICH

REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

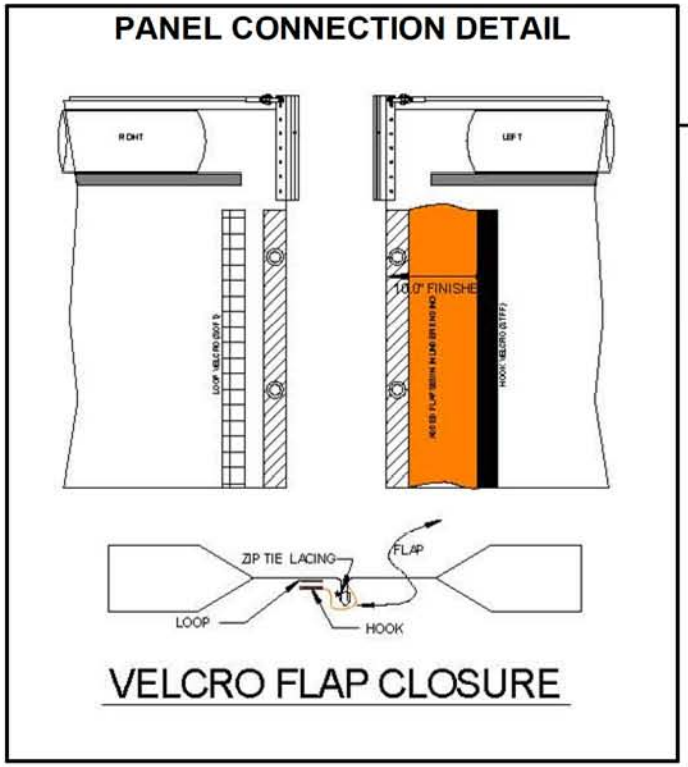
PDI-16 COFFERDAM
SIMULATION PILOT TEST
LAYOUT PLAN

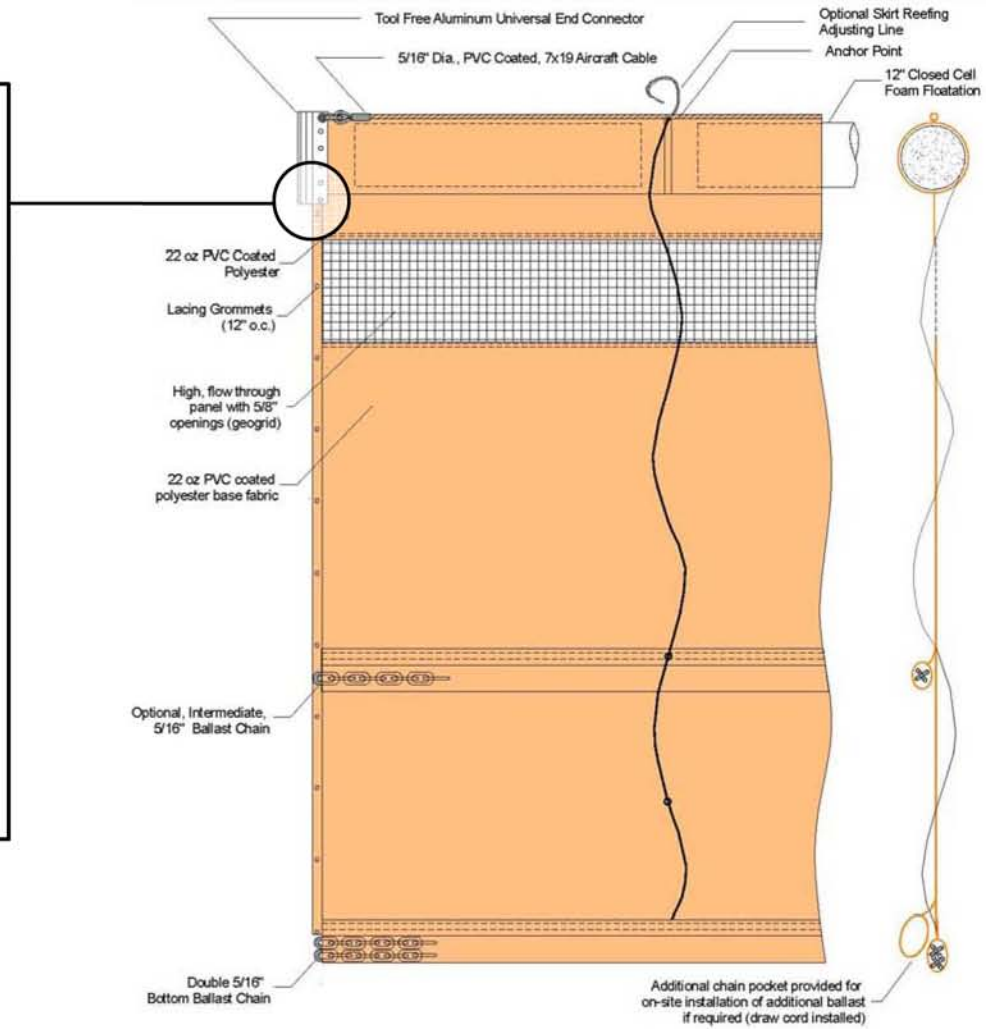
SCALE: AS SHOWN
MARCH 2010

FIGURE 3.1.13-1

G:\33020\GLOBAL\GIS\MapProjects\33020-FSP-010-COFFERDAM_SIM_PDI-16.mxd

G:\33020\030\RDWP\Final Draft_March 2010\Figures\2010-0312-HAI-RDWP_Curtain_Schematic-D.vsd





NOTES:

1. ADAPTED FROM SCHEMATIC FIGURE PROVIDED BY BROCKTON EQUIPMENT/SPILLDAM, INC. ON 3/10/2010.

2. MINOR ADJUSTMENTS TO BE MADE PRIOR TO FABRICATION OR DURING INSTALLATION BASED ON FIELD CONDITIONS.

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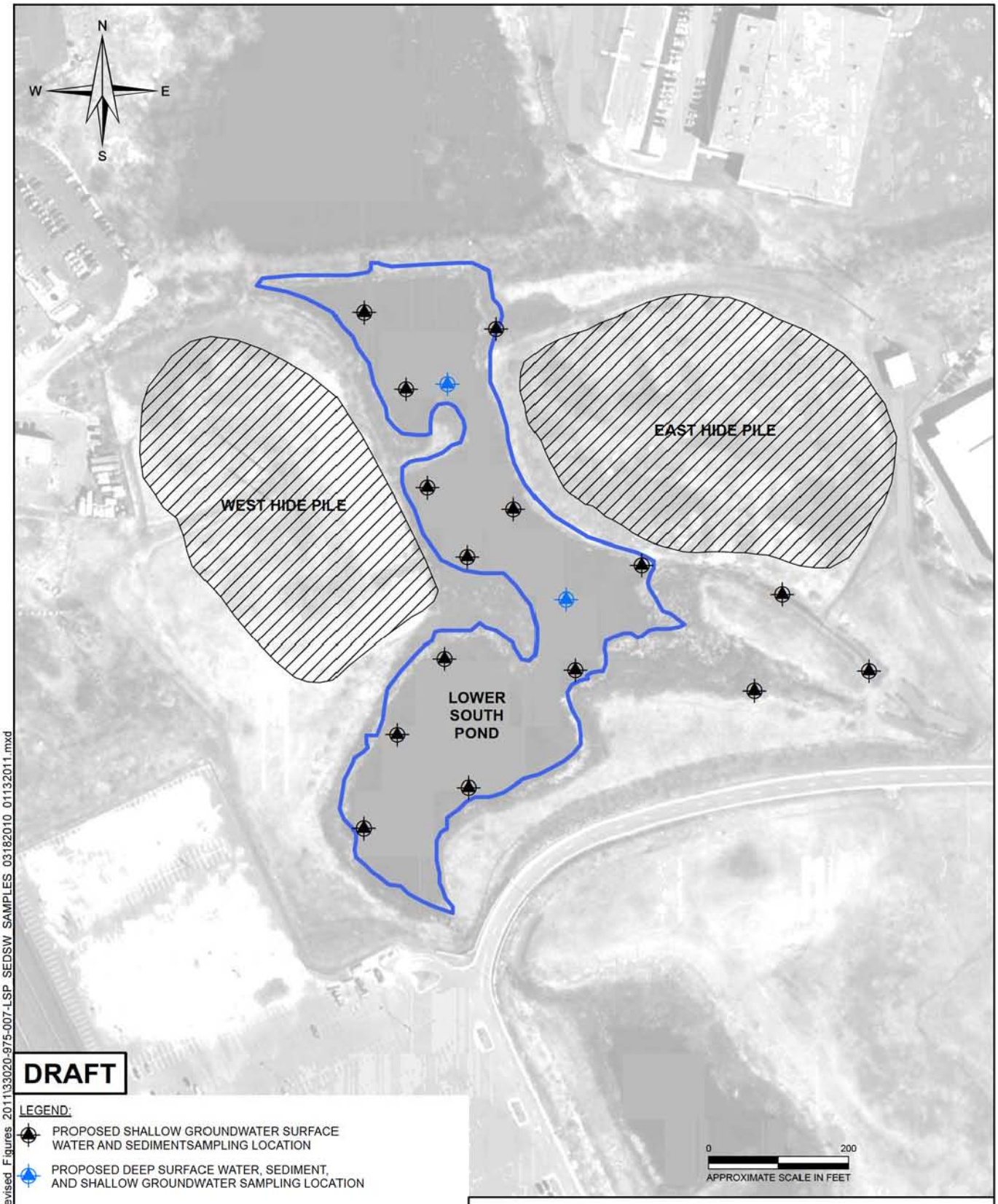
HALEY & ALDRICH

REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

PDI-16 COFFERDAM SIMULATION
FLEXIBLE CURTAIN SCHEMATIC DETAIL

SCALE: NONE
MARCH 2010

FIGURE 3.1.13-2



DRAFT

LEGEND:

- PROPOSED SHALLOW GROUNDWATER SURFACE WATER AND SEDIMENTSAMPLING LOCATION
- PROPOSED DEEP SURFACE WATER, SEDIMENT, AND SHALLOW GROUNDWATER SAMPLING LOCATION

NOTES:

1. ALL LOCATIONS, DIMENSIONS, AND AREAL EXTENTS SHOULD BE CONSIDERED APPROXIMATE.
2. 2001 1/2 METER RESOLUTION COLOR ORTHOIMAGERY OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS.
3. WEST HIDE PILE, EAST HIDE PILE, AND LOWER SOUTH POND APPROXIMATED FROM MSGRP REMEDIAL INVESTIGATION REPORT, RI FIGURE 2-5A SURFACE WATER SAMPLE LOCATIONS - REACH 0.

HALEY & ALDRICH

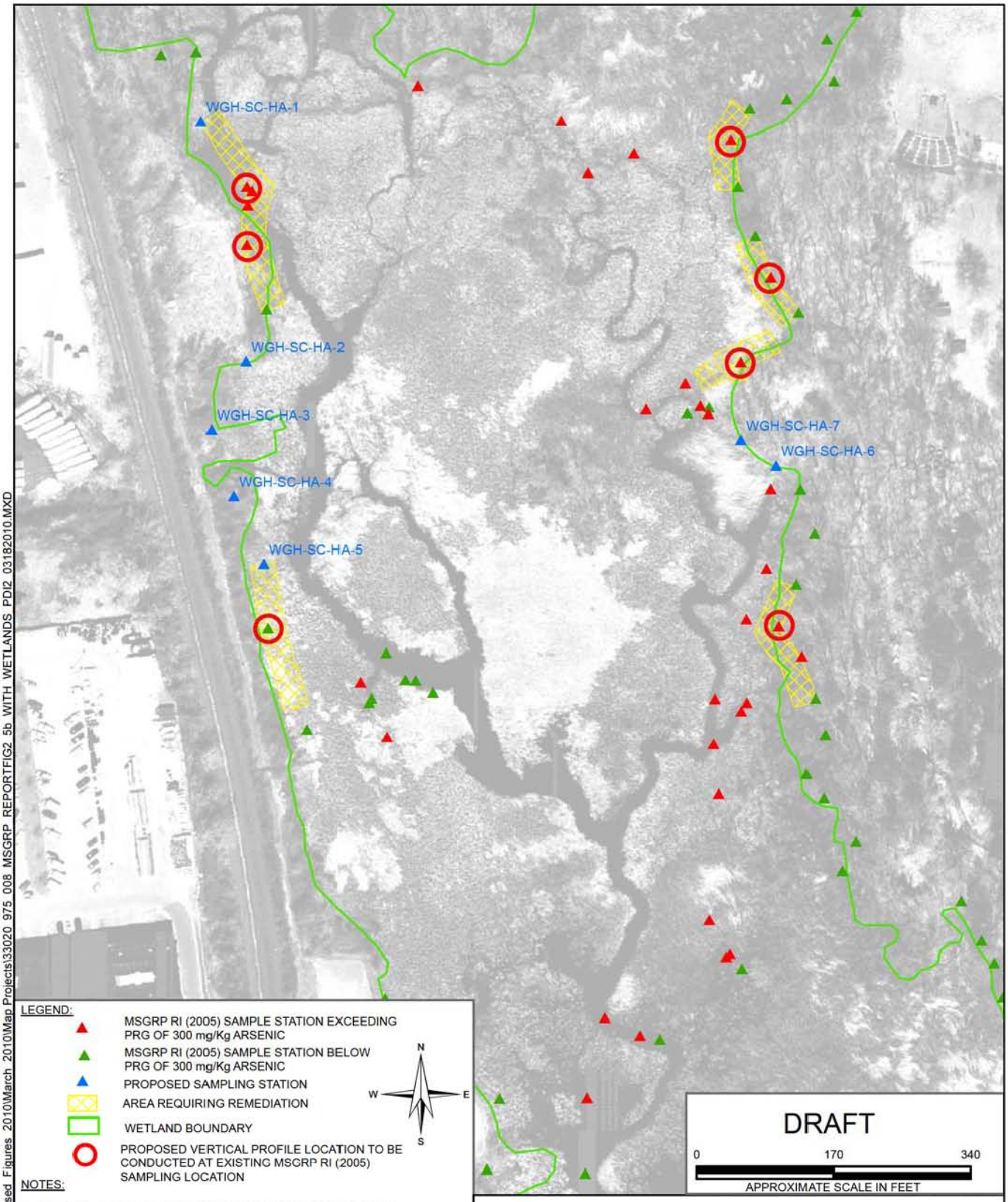
REMEDIAL DESIGN
INDUSTRI-PLEX S SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

PDI-9 WEST & EAST HIDE PILE INVESTIGATION

SCALE: AS SHOWN
FEBRUARY 2011

FIGURE 3.2.1-1

G:\33020\GLOBAL\GIS\MapProjects\Revised Figures 2011\33020-975-007-LSP SEDSW SAMPLES 03182010 01132011.mxd



LEGEND:

- MSGRP RI (2005) SAMPLE STATION EXCEEDING PRG OF 300 mg/Kg ARSENIC
- MSGRP RI (2005) SAMPLE STATION BELOW PRG OF 300 mg/Kg ARSENIC
- PROPOSED SAMPLING STATION
- AREA REQUIRING REMEDIATION
- WETLAND BOUNDARY
- PROPOSED VERTICAL PROFILE LOCATION TO BE CONDUCTED AT EXISTING MSGRP RI (2005) SAMPLING LOCATION

N W E S

NOTES:

1. EXISTING LOCATIONS EXPORTED FROM DDMS DATABASE ON 28 JANUARY 2010
2. SEDIMENT SAMPLE LOCATIONS AND WETLAND BOUNDARY SHOWN ON FIGURE 2-7b, "SEDIMENT SAMPLE LOCATIONS-REACH 1 MSGRP REMEDIAL INVESTIGATION REPORT", PREPARED BY TETRA TECH NUS INC. MARCH 2005. WETLAND BOUNDARY DIGITIZED FROM FIGURE.
3. 2008 30 CENTIMETER RESOLUTION COLOR ORTHOIMAGERY OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MassGIS),COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS.
4. AREAS REQUIRING REMEDIATION DIGITIZED FROM FIGURE 2-5b "SURFACE SEDIMENT PRG EXCEEDENCE-ARSENIC-REACH 1, MSGRP FEASABILITY", PREPARED BY TETRA TECH NUS INC. DATED 22 APRIL 2005

HALEY & ALDRICH

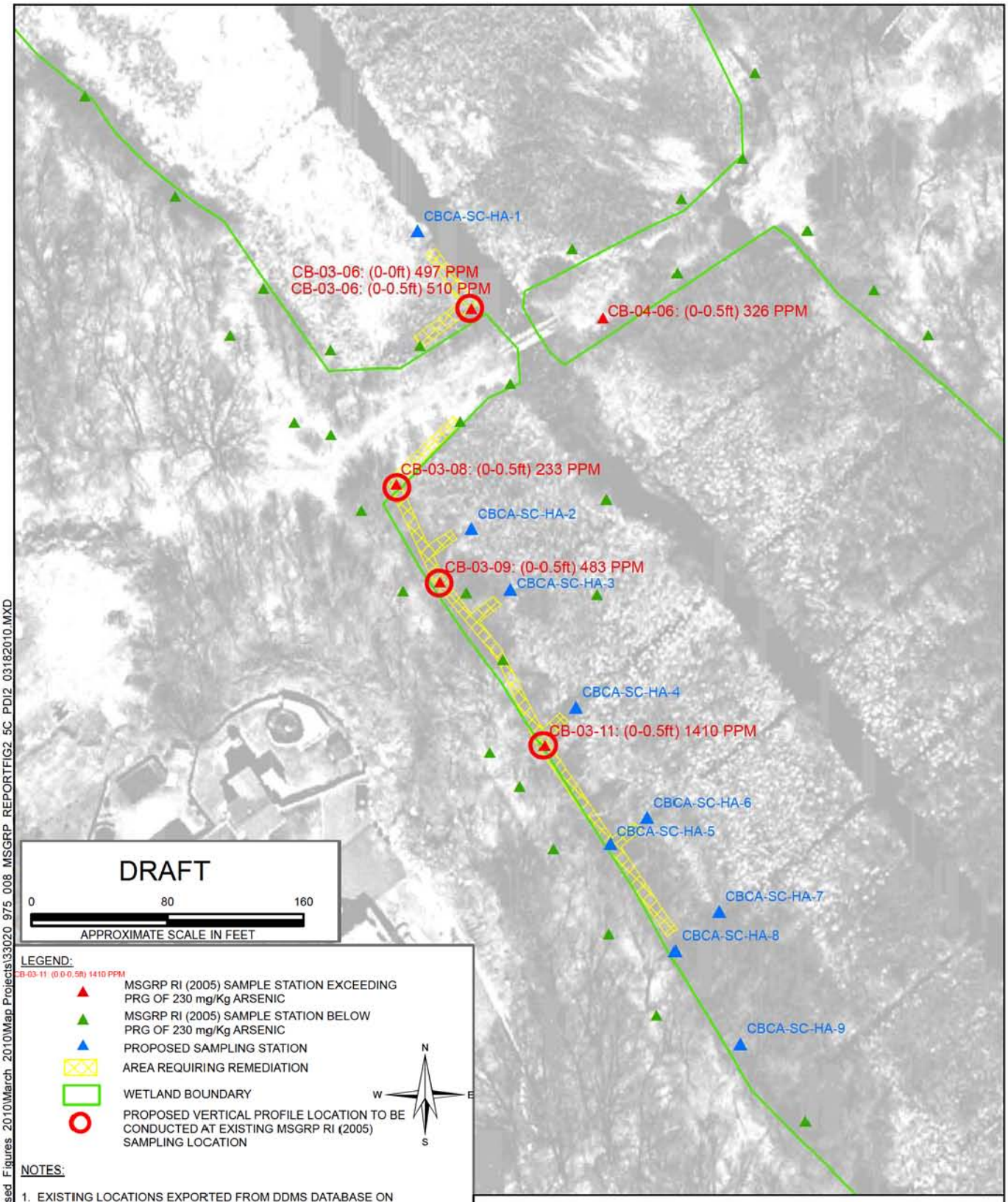
REMEDIAL DESIGN INDUSTRI-PLEX SITE
OPERABLE UNIT NO. 2
WOBURN, MASSACHUSETTS

PDI-2 WELLS G AND H WETLAND
PROPOSED SAMPLING LOCATIONS

SCALE: AS SHOWN
MARCH 2010

FIGURE 3.3.1-1

G:\33020\GLOBAL\GIS\MapProjects\Revised Figures 2010\March 2010\Map Projects\33020 975 008 MSGRP REPORTFIG2 5b WITH WETLANDS PDI2 03182010.MXD



LEGEND:

CB-03-11: (0-0.5ft) 1410 PPM

- MSGRP RI (2005) SAMPLE STATION EXCEEDING PRG OF 230 mg/Kg ARSENIC
- MSGRP RI (2005) SAMPLE STATION BELOW PRG OF 230 mg/Kg ARSENIC
- PROPOSED SAMPLING STATION
- AREA REQUIRING REMEDIATION
- WETLAND BOUNDARY
- PROPOSED VERTICAL PROFILE LOCATION TO BE CONDUCTED AT EXISTING MSGRP RI (2005) SAMPLING LOCATION

N W E S

NOTES:

1. EXISTING LOCATIONS EXPORTED FROM DDMS DATABASE ON 28 JANUARY 2010
2. SEDIMENT SAMPLE LOCATIONS AND WETLAND BOUNDARY SHOWN ON FIGURE 2-7c, "SEDIMENT SAMPLE LOCATIONS-REACH 1 MSGRP REMEDIAL INVESTIGATION REPORT", PREPARED BY TETRA TECH NUS INC. MARCH 2005. WETLAND BOUNDARY DIGITIZED FROM FIGURE.
3. 2008 30 CENTIMETER RESOLUTION COLOR ORTHOIMAGERY OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MassGIS),COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS.
4. AREAS REQUIRING REMEDIATION DIGITIZED FROM FIGURE 2-5c "SURFACE SEDIMENT PRG EXCEEDENCE-ARSENIC-REACH 1, MSGRP FEASABILITY", PREPARED BY TETRA TECH NUS INC. DATED 22 APRIL 2005

HALEY & ALDRICH

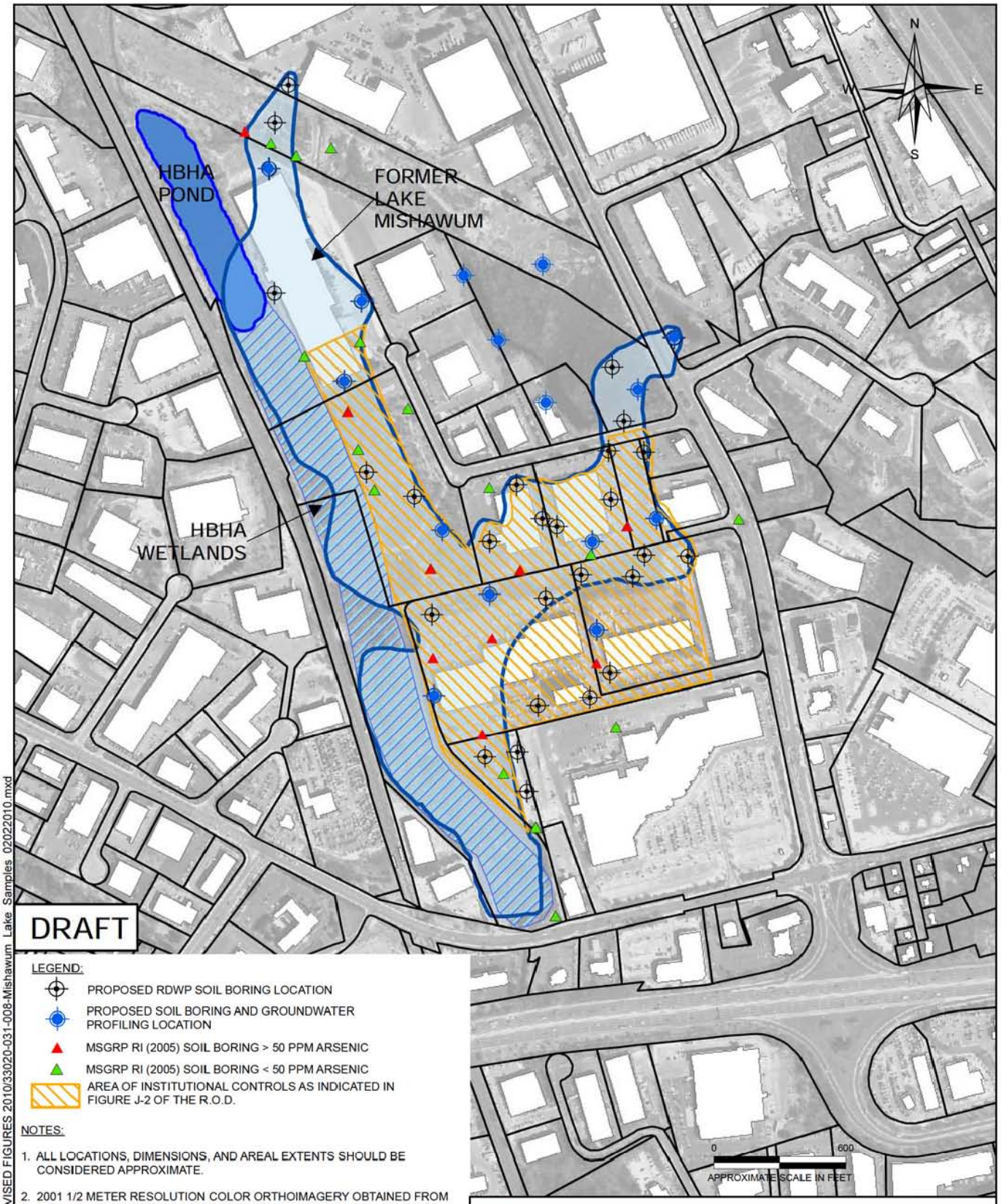
REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT NO. 2
WOBURN, MASSACHUSETTS

PDI-2 CRANBERRY BOG CONSERVATION AREA WETLAND SAMPLING LOCATIONS

SCALE: AS SHOWN
MARCH 2010

FIGURE 3.3.1-2

G:\33020\GLOBAL\GIS\MapProjects\Revised Figures 2010\March 2010\Map Projects\33020_975_008_MSGRP_REPORTFIG2_5C_PDI2_03182010.MXD



DRAFT

LEGEND:

- PROPOSED RDWP SOIL BORING LOCATION
- PROPOSED SOIL BORING AND GROUNDWATER PROFILING LOCATION
- MSGRP RI (2005) SOIL BORING > 50 PPM ARSENIC
- MSGRP RI (2005) SOIL BORING < 50 PPM ARSENIC
- AREA OF INSTITUTIONAL CONTROLS AS INDICATED IN FIGURE J-2 OF THE R.O.D.

NOTES:

1. ALL LOCATIONS, DIMENSIONS, AND AREAL EXTENTS SHOULD BE CONSIDERED APPROXIMATE.
2. 2001 1/2 METER RESOLUTION COLOR ORTHOIMAGERY OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS.
3. FORMER LAKE MISHAWUM APPROXIMATED FROM FIGURE BY TETRA TECH NUS, INC. DATED 14 MARCH 2005 TITLED "SOIL SAMPLING LOCATIONS - REACH 0", FIGURE 2-3A, MSGRP REMEDIAL INVESTIGATION REPORT.
4. LOCATIONS SHOWN ON BUILDINGS WILL BE SHIFTED IN THE FIELD DURING SAMPLING TO THE NEAREST LOCATION WITHIN THE GRID OUTSIDE THE BUILDING FOOTPRINT.
5. BUILDINGS AND PARCEL BOUNDARIES FROM THE CITY OF WOBURN G.I.S.
6. HISTORIC LOCATION DATA EXPORTED FROM DDMS

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REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

PDI-12A FORMER LAKE MISHAWUM
SOIL & GROUNDWATER INVESTIGATION

SCALE: AS SHOWN
MARCH 2010

FIGURE 3.4.1.1-1

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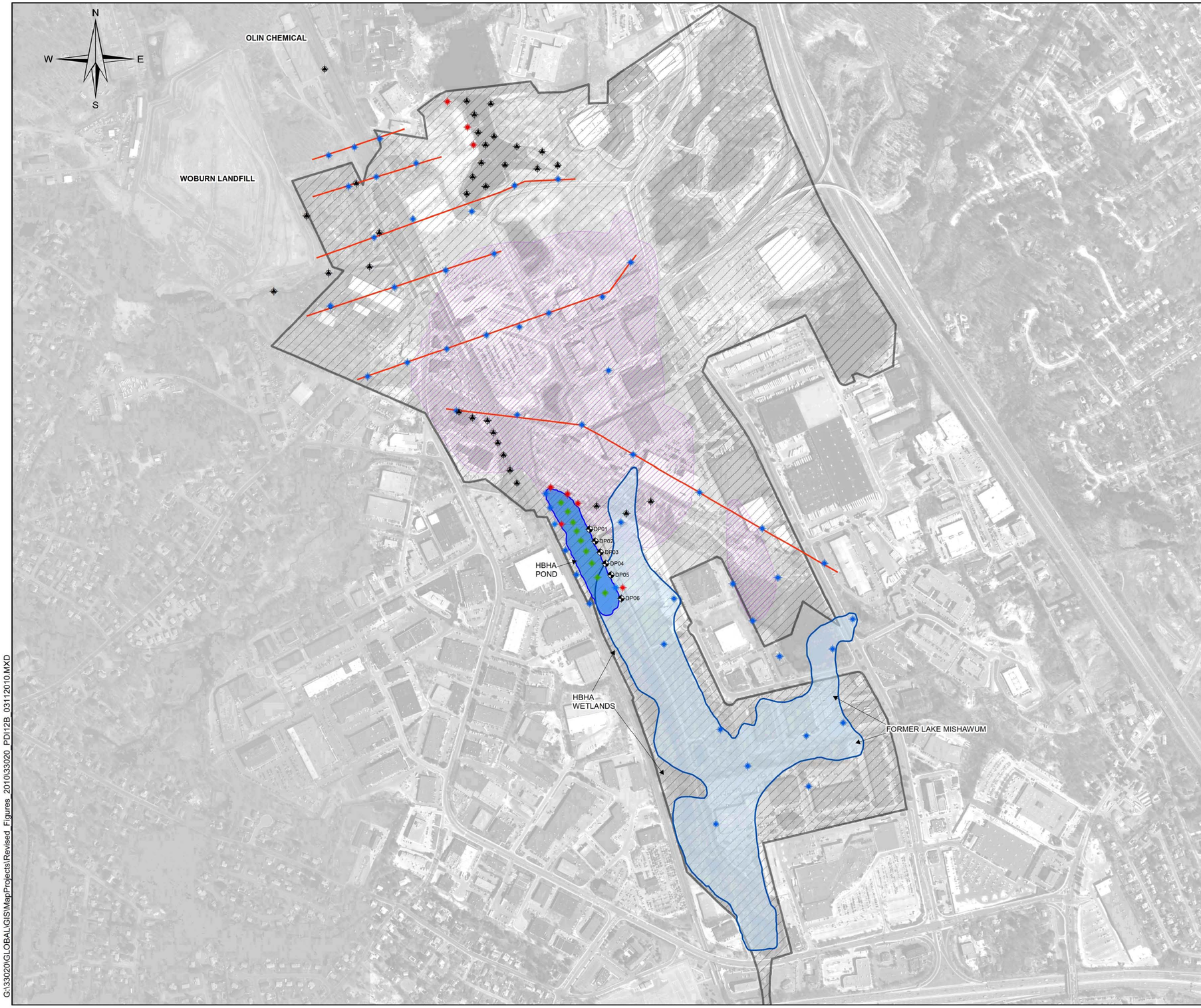


LEGEND:

- PROPOSED GROUNDWATER PROFILING LOCATION
- COMPLETED GROUNDWATER PROFILING LOCATION COMPLETED IN MARCH 2009, BY GEOSEARCH INC.
- PROPOSED IN POND GROUNDWATER SAMPLING LOCATION
- PROPOSED GROUNDWATER MONITORING WELL COUPLET LOCATION
- PROPOSED TEMPORARY DRIVE POINT PIEZOMETER
- APPROXIMATE OU1/OU2 SITE BOUNDARY
- APPROXIMATE EXTENT OF GROUNDWATER PLUME AREAS EXCEEDING PRGS (ROD)

NOTES:

1. ALL LOCATIONS, DIMENSIONS, AND AREAL EXTENTS SHOULD BE CONSIDERED APPROXIMATE.
2. 2001 1/2 METER RESOLUTION COLOR ORTHOIMAGERY OBTAINED FROM THE OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFARIS.
3. GROUNDWATER PLUME EXTENT DERIVED AND PRESENTED AS A COMPOSITE OF MULTIPLE PARAMETERS SHOWN ON FIGURE BY TETRA TECH NUS, INC., GROUNDWATER PLUME AREAS EXCEEDING PRGs, INDUSTRI-PLEX SITE, WOBURN, MASSACHUSETTS.
4. ACTUAL NUMBER OF MONITORING WELL COUPLETS WILL BE DETERMINED BASED ON PHASE I & II RESULTS.

DRAFT

0 200 400 800 1,200 1,600 Feet

HALEY & ALDRICH

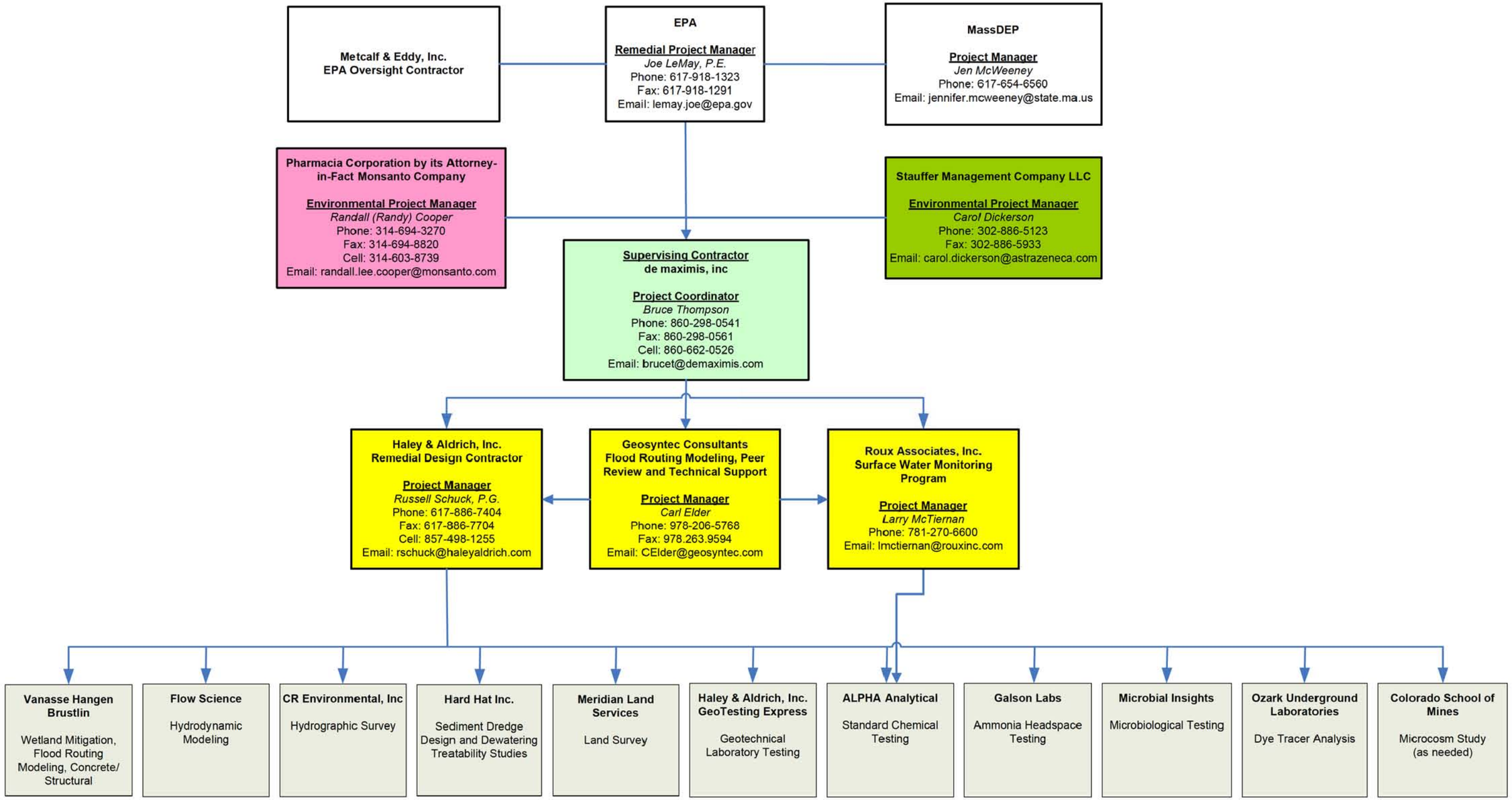
REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

PDI-12B GROUNDWATER INSTITUTIONAL CONTROL DELINEATION PROPOSED GROUNDWATER SAMPLING LOCATIONS

SCALE: AS SHOWN
FEBRUARY 2011

FIGURE 3.4.1.2-1

G:\33020\GLOBAL\GIS\MapProjects\Revised_Figures_2010\33020_PDI12B_03112010.MXD



G:\33020\030\RDWP\Revised per EPA Feb 2010\Figures\Figure 5.1-1 2010-0316-HAI-RDWPORGCHART-D.vsd

HALEY & ALDRICH

REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

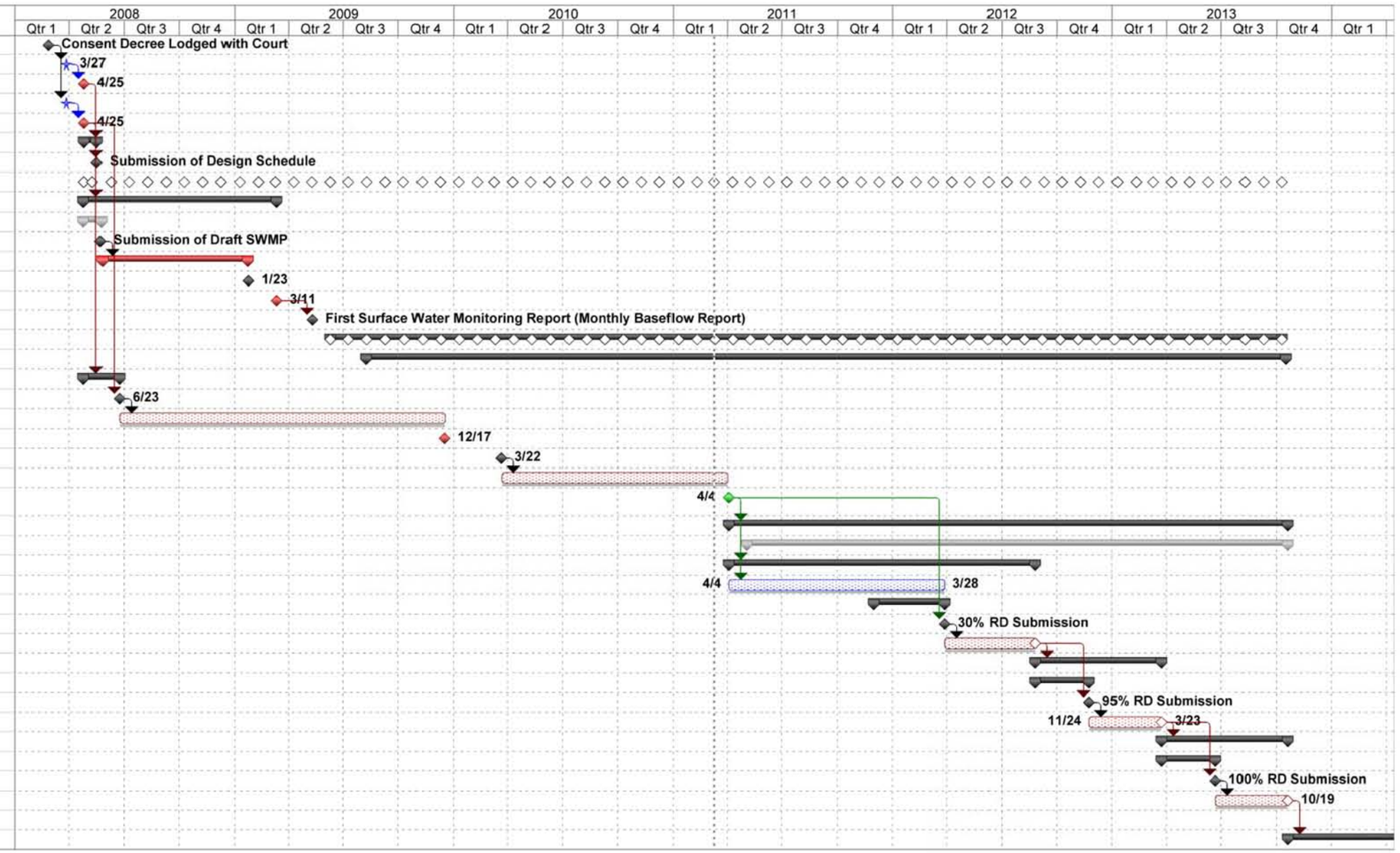
PROJECT ORGANIZATION CHART

SCALE: NONE
MARCH 2010

FIGURE 5.1-1

DRAFT

Task	Task Name
1	Consent Decree Lodged with Court
2	Identification of Supervising Contractor (SC)
3	EPA Approval of SC
4	Identification of Remedial Design Contractor (RDC)
5	EPA Approval of RDC
6	Design Schedule
11	Submission of Design Schedule
12	Monthly Design Progress Reports (start in month EPA approves SC)
80	Surface Water Monitoring Plan (SWMP)
81	Surface Water Monitoring Project Operation Plan (POP) Initial Draft Preparation
92	Submission of Draft SWMP
93	EPA Review of Draft SWMP
97	Final Draft SWMP Submitted to EPA
98	EPA Conditional Approval of SWMP
99	First Surface Water Monitoring Report (Monthly Baseflow Report)
100	Surface Water Monitoring Report (Monthly Baseflow Report)
154	Surface Water Monitoring Report (Quarterly Stormflow Report)
173	RD Work Plan (RDWP) including Project Operations Plan (POP) Preparation
184	Submission of Draft RDWP
185	EPA Review of Draft RDWP
186	Receipt of EPA Comments on Draft
187	Submit Revised Final Draft RDWP to EPA
188	EPA Review of Revised RDWP
189	EPA Approval of RDWP (Date Assumed)
190	Remedial Design (RD) Elements
191	Monthly RD Project Meetings
216	30% Remedial Design
217	Pre-Design Investigations (Refer to PDI Schedule for Sequence/Timing)
218	30% Design Submittal
230	30% RD Submission
231	EPA Review and Approval of 30% RD
232	95% Remedial Design
233	95% Design Submittal
254	95% RD Submission
255	EPA Review and Approval of 95% RD
256	100 % Remedial Design
257	100% Design Submittal
275	100% RD Submission
276	EPA Review and Approval of 100% RD
277	
278	Remedial Action (RA) Elements



REMEDIAL ACTION (RA) PHASE
CONTINUES BEYOND
(RA TASKS OMITTED FOR CLARITY)

LEGEND/NOTES
MAROON = REVIEW/APPROVAL TASKS; DURATIONS UNCERTAIN
GREEN = KEY MILESTONE (TIMING UNCERTAIN)
GREY = MEETING PERIODS
BLACK = TASK ROLLUP
OLIVE=FIELD WORK ITEMS

1. CPM = CRITICAL PATH METHOD.
2. LINES/ARROWS DEPICT CRITICAL PATH, DEPENDANT TASKS, AND/OR SCHEDULE REQUIREMENTS DESCRIBED IN THE SOW.
3. CPM SCHEDULE DESIGNED TO SHOW DEPENDENCES AND APPROXIMATE DURATIONS. ACTUAL DATES OF SUBMITTAL MAY VARY FROM THIS SCHEDULE BECAUSE IT DEPENDS ON THE DURATIONS OF EPA REVIEW/ APPROVAL AND OTHER CONSIDERATIONS.

DRAFT

HALEY & ALDRICH

REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

REMEDIAL DESIGN CPM SCHEDULE

SCALE: NONE
MARCH 2011

FIGURE 6-1

G:\33020\030\RDWP\RDWP_January 2011\Figures\2011-0309-HAI-RDWP_CPM_SchedulesS-D.vsd

ATTACHMENT 1

Microbiological Monitoring Supplement

DRAFT

Attachment 1 - Microbiological Monitoring Supplement

Industri-Plex OU2 Site
Remedial Design Work Plan
Woburn, Massachusetts

There are several biological mechanisms that can occur in the natural substrates of on-site wetlands or groundwater environs to transform ammonia to nontoxic products. In order to gain an understanding of these mechanisms, we propose to perform specific biomarker analyses for the functions of interest. Of all commercial molecular biological tools (MBTs) available, one type has proven to be most popular, accurate and informative: quantitative polymerase chain reaction (qPCR) of 16S rRNA (or rDNA) that code for functional genes that provide a quantitative copy number of the particular genes of interest. Cell estimates of the bacteria are then determined by correlating the number of gene copies measured to that of a known standard of the target organism. These biomarkers target specific functions, as may be the case of the Halls Brook Holding Area (HBHA) Pond transformation of ammonia. Real-time PCR offers an accurate, sensitive method for target gene quantification (Wang et al., 1999) without the labor intensive post-PCR analysis and assumptions of competitive PCR (Baldwin et al., 2003). The real-time PCR assay relies on detection of a fluorescent signal from a hydrolysis probe (TaqMan), molecular beacon, or DNA specific dye (SYBR Green) produced during real-time PCR. The point at which the fluorescent signal exceeds a background level is a function of initial concentration of the target gene in the sample. The approach has a high degree of sensitivity (~10E+2 cells) and a dynamic range of over seven orders of magnitude.

In this project we will use qPCR to

- Identify the presence of essential biological pathways of contaminant transformation in the HBHA Pond
- Quantify the relative amount of genes involved in the particular function of transforming the contaminants.

The bacteria involved in the nitrogen cycle have been described and can be monitored in particulate samples obtained from the HBHA Pond. As an example, nitrification is a two-step process involving two groups of bacteria: ammonia-oxidizing bacteria (AOB) oxidize NH_3 to NO_2^- and nitrite-oxidizing bacteria (NOB) oxidize NO_2^- to NO_3^-. There have been several real-time PCR target assays developed for ammonia-oxidizing bacteria. Anaerobic ammonia oxidation has also been described and may be responsible for a significant portion of ammonia transformation in the hypolimnion. The results provided will include the amount of total bacteria and the relative proportion of bacteria in each compartment of the nitrogen cycle (nitrification via NOB and AOB, denitrification bacteria via NirS and NirK genes, and anaerobic ammonia oxidation via anammox bacteria). The results will also include a ratio of total bacteria to each of these specific functional bacteria in the samples.

REFERENCES

Baldwin, B.R., C.H. Nakatsu, and L. Nies. 2003. Detection and Enumeration of Aromatic Oxygenase Genes by Multiplex and Real-Time PCR. Appl. Environ. Microbiol., 69(6), 3350-3358.

Wang, T., and M.J. Brown. 1999. mRNA quantification by real time TaqMan polymerase chain reaction: validation and comparison with RNase protection. Analytical Biochemistry. 269(1), 198-201.

APPENDIX A - E BOUND
SEPARATELY AND INDIVIDUALLY

APPENDIX F SUBMITTED SEPARATELY BY ROUX ASSOCIATES, INC.

DRAFT

REMEDIAL DESIGN PROJECT OPERATIONS PLAN
APPENDIX A

SITE MANAGEMENT PLAN

Industri-plex Operable Unit 2
(including Wells G&H Operable Unit 3) Superfund Site
Woburn, Massachusetts

Prepared by:

Haley & Aldrich, Inc.
465 Medford Street
Boston, Massachusetts 02129

March 2011

DRAFT

Disclaimer: This document is a DRAFT document prepared by the Settling Defendants under a government Consent Decree. This document has not undergone formal review by the EPA and MassDEP. The opinions, findings, and conclusions, expressed are those of the author and not those of the U.S. Environmental Protection Agency or the Massachusetts Department of Environmental Protection.

TABLE OF CONTENTS

		Page
LIST OF TABLES		**iii**
LIST OF FIGURES		**iii**
1.0	**INTRODUCTION**	**1**
2.0	**SITE DESCRIPTION**	**2**
2.1	Name and Location	2
2.2	Site History	2
3.0	**SITE AND PROPERTY ACCESS**	**4**
3.1	Site Access	4
3.2	Access to Private/Public Property	4
3.3	Property Owner Contact Information	5
4.0	**SITE SECURITY**	**6**
4.1	Field Office	6
4.2	Health and Safety Controlled Access Areas	7
4.3	Contingency Planning	8
4.4	Property Security	8
5.0	**FIELD ACTIVITIES**	**9**
5.1	Utility Mark-out and Geophysical Survey	9
5.2	Exploration Location Survey	9
5.3	Soil Investigation	9
5.4	Groundwater Investigation	9
5.5	Sediment Investigation	10
5.6	Surface Water Investigation	10
5.7	Decontamination and Investigation Derived Waste Management	10
5.8	Air Monitoring	11
	5.8.1 Personal Air Monitoring	11
	5.8.2 Perimeter Air Monitoring	12
5.9	Data Management	12
6.0	**KEY PERSONNEL**	**15**
6.1	EPA Project Personnel	15
6.2	MassDEP Involvement	15
6.3	Settling Defendants	16
	6.3.1 Roles and Responsibilities	16
6.4	Project Coordinator	16
	6.4.1 Supervising Contractor	16
6.5	Project Design Team	16

TABLE OF CONTENTS
(continued)

Page

6.5.1 Haley & Aldrich – Remedial Design Contractor 16
6.5.2 Roux Associates – Surface Water Monitoring Program Contractor 17
6.5.3 Geosyntec – Surface Water Modeling, Peer Review, and Technical Support Consultant17

7.0 FINANCIAL REPORTS 18

REFERENCES 19

TABLES
FIGURES
ATTACHMENT A1 - Property Access Figures
ATTACHMENT A2 - Sample Property Access Letter
ATTACHMENT A3 - Haley & Aldrich Operating Procedures for Decontamination and Investigation Derived Waste
ATTACHMENT A4 - GEMS Relational Database Model Flow Chart

LIST OF TABLES

Table No.	Title
3.2-1	Ownership Information – Properties Requiring Access During Pre-Design Investigations

LIST OF FIGURES

Figure No.	Title
2.1-1	Project Locus
6.1-1	Project Organization Chart
6.5-1	Haley & Aldrich, Inc. Project Organization Chart

LIST OF ACRONYMS

Acronym	Agency/Organization/Definition
AAD	Atlantic Avenue Drainway
CBCA	Cranberry Bog Conservation Area
CD	Consent Decree
COCs	Contaminants of Concern
CRZ	Contamination Reduction Zone
EHP	East Hide Pile
EPA	United States Environmental Protection Agency
FLM	Former Lake Mishawum
FSP	Field Sampling Plan
GIS	Geographic Information System
GUIs	Graphical User Interfaces
GWTB	Groundwater Treatment Building
HBHA	Halls Brook Holding Area
IDLH	Immediately Dangerous to Life and Health
MassDEP	Massachusetts Department of Environmental Protection
MBTA	Massachusetts Bay Transportation Authority
NAD	North American Datum
NAVD	North American Vertical Datum
NBSD	New Boston Street Drainway
NCP	National Contingency Plan
OU2	Industri-plex Superfund Site Operable Unit 2
PDIs	Pre-Design Investigations
PEL	Permissible Exposure Limits
PID	Photoionization Detector
POP	Project Operations Plan
PPE	Personal Protective Equipment
RD/RA	Remedial Design/Remedial Action
RDC	Remedial Design Contractor
RDWP	Remedial Design Work Plan
RHSC	Regional Health & Safety Coordinator
ROD	Record of Decision
ROW No. 9	Right of Way Number 9
RPM	Remedial Project Manager
SMP	Site Management Plan
SOW	Statement of Work
SSO	Site Safety Officer
TOU	Thermal Oxidizer Unit
VBA	Visual Basic for Applications
VHB	Vanasse Hangen Brustlin, Inc.
WHP	West Hide Pile

1.0 INTRODUCTION

This Site Management Plan (SMP) is submitted as Appendix A of the Remedial Design Work Plan (RDWP) Project Operations Plan (POP) for the Industri-plex Superfund Site Operable Unit No. 2, Woburn, Massachusetts (hereinafter "Industri-plex OU2" or "Site"). Haley & Aldrich, Inc. has prepared this SMP on behalf of Pharmacia Corporation by its Attorney-in-Fact Monsanto Company and Stauffer Management Company LLC, as litigation agent for Bayer CropScience, Inc. (Settling Defendants). This SMP was prepared in accordance with the Consent Decree that was lodged on February 27, 2008 with the United States District Court for the District of Massachusetts in connection with Civil Action
No. 1:08-cv-10325 (CD), and with the Remedial Design /Remedial Action (RD/RA) Statement of Work (SOW) that is attached as Appendix D to the CD.

The SMP provides a written understanding and commitment of how various project aspects such as access, security, contingency procedures, management responsibilities, investigation-derived waste handling and disposal, and data management will be managed. This SMP will be updated as necessary to reflect new information or significant changes in the project team, scope, or objectives.

This SMP addresses the following requirements of the SOW:

1. A map and list of properties, property owners and their contact information;
2. A description of the exclusion zone, contamination reduction zone and clean area, complete with a map of these areas;
3. A written description of the necessary procedures for gaining access to properties within the RA footprint and a sample access letter, and plans for notifying the United States Environmental Protection Agency (EPA) and Massachusetts Department of Environmental Protection (MassDEP);
4. A written description of how private and government property will be protected on the Site;
5. A written description of how unauthorized site access will be prevented;
6. A summary of existing access agreements;
7. A written description of the field offices;
8. A contingency and notification plan for potentially dangerous activities;
9. A monitoring plan for airborne contaminants;
10. Identification of key personnel, and establishment of roles and responsibilities;
11. Identification of Contractors and Subcontractors, and their roles and responsibilities;
12. Financial reports for expenditures for RD/RA activities;
13. A written description of the procedures for handling and disposal of Investigation Derived Wastes (IDWs); and
14. A written description of the electronic data management plan.

NOTE: This version of the SMP focuses on the work to be completed in support of the RD. Sections that are presented herein that are related to the RA will be updated in the revision of the Project Operation s Plan (POP) which will accompany design submittals.

2.0 SITE DESCRIPTION

This section provides a description and summarizes the history of the Site.

2.1 Name and Location

Industri-plex OU2
Woburn, Middlesex County, Massachusetts

EPA Identification Numbers:
Industri-plex - MAD076580950
Wells G&H - MAD980732168

Industri-plex OU2 is located in Woburn as shown on the Site Locus presented as Figure 2.1-1.

2.2 Site History

In 1983, the United States Environmental Protection Agency (EPA) identified two Superfund sites along the Aberjona River in Woburn, Massachusetts: the Industri-plex and Wells G&H Superfund Sites.

Situated in north Woburn, the Industri-plex Superfund Site is primarily contaminated with metals (e.g., arsenic) and buried animal hide wastes. The original 1986 Record of Decision (ROD) and the 1989 CD governing the implementation of the ROD for Industri-plex OU1 defined the Industri-plex Superfund Site as being comprised of 245 acres. Industri-plex OU1 and OU2 overlap in some areas covered under the 1986 Industri-plex OU1 ROD.

The Wells G&H Superfund Site consists of approximately 330 acres situated in East Woburn, Massachusetts, located approximately 1 mile downstream of Industri-plex OU1 along the Aberjona River (EPA, 2006). The Wells G&H Site is primarily contaminated with volatile organic compounds (VOCs) for which the Settling Defendants at Industri-plex have no responsibility. But investigations at Wells G&H identified the presence of heavy metals, including arsenic, chromium, mercury, and zinc, and some PAHs, in Aberjona River sediments. These non-VOC forms of sediment contamination were designated "OU3" at the Wells G&H Site. EPA merged the Wells G&H OU3 into Industri-plex OU2 to establish one comprehensive cleanup plan for the Aberjona River and associated wetlands (*ibid)*. Hereinafter, the area of concern will be referred to as the "Site" or "Industri-plex OU2."

On 31 January 2006, EPA issued a ROD[1] selecting a remedy for Industri-plex OU2. The selected remedy is structured to provide a comprehensive approach that utilizes source control, exposure control or prevention, and management of migration components to address the risks identified by EPA. The work proposed for the Site serves as the final remedy for the Industri-plex Superfund Site.

A major portion of the Industri-plex OU2 remedy relates to the Halls Brook Holding Area (HBHA). The HBHA consists of a surface water body (pond) and a downstream wetland originally designed and constructed to serve as a storm water management facility. The pond portion of the HBHA is approximately 4.6 acres in size (hereinafter the "Pond" or "HBHA Pond"). Immediately south of the Pond is the HBHA wetland, which covers approximately 10.6 acres. Surface water discharges into the

[1] Unless indicated otherwise, use of "ROD" in this SMP refers to the 2006 Industri-plex OU2 ROD.

Pond from three main sources: Halls Brook (primary contributor under base flow), Atlantic Avenue Drainway (AAD), and Right of Way Number 9 (ROW No. 9) outfall. Water exits the Pond from one outlet at its south end.

Other portions of the Site include New Boston Street Drainway (NBSD), West Hide Pile (WHP) Area, Former Lake Mishawum (FLM), Wells G&H wetland, and Cranberry Bog Conservation Area (CBCA). NBSD is a drainage swale located between the WHP area and Town of Woburn landfill that flows into Halls Brook. WHP is located north of the HBHA Pond at the northern boundary of Industri-plex OU2. Immediately east of the WHP is the Lower South Pond and East Hide Pile (EHP). Lower South Pond flows primarily into AAD, which in turn flows into HBHA Pond. Lake Mishawum and its associated wetlands were partially filled during historic development activities. FLM's extent overlaps a portion of the present-day HBHA. The Wells G&H wetland and CBCA areas are located south and downstream of the HBHA along the Aberjona River.

Additional information on the site history, property ownership, usage, etc. is provided in the ROD, CD, SOW, and the Administrative Record.

3.0 SITE AND PROPERTY ACCESS

This section addresses CD and SOW requirements related to describing access to the Site, access to private/public property for RD/RA activities, a map of private/public properties, and a list of property owners with their contact information.

3.1 Site Access

This section describes Site entry and egress for Site workers, visitors, equipment, deliveries, and other activities necessary to complete the RD work at the Site. The Site access elements described herein are subject to receiving the appropriate signed property access agreements and may be altered with subsequent versions of this SMP. As noted previously in Section 1.0, revisions may also need to be made to accommodate for access needs that are presented in future phases of this project.

A majority of RD activities will be conducted in and around the HBHA Pond. The main access road to this area begins in the western portion of the Metro North Business Center located at 74 Commerce Way. The access road leads to the former Groundwater Treatment Building (GWTB). The GWTB will be used as the main field office during the work supporting the RD. This is an access route to the main field office, HBHA Pond and wetlands, and the Area A6 (Atlantic Ave) drainway. All Site visitors will enter through the main gate located on this access road and proceed to the GWTB to sign in before proceeding to other parts of the Site. Sign in and security procedures are discussed in Section 4.1. Another access to this portion of the Site is from Cabot Road off of Commerce Way. A secondary vehicle access road runs along the western side of HBHA Pond, through portions of 280 Mishawum Road, the Massachusetts Bay Transportation Agency (MBTA) Right-of-Way and the 36 Cabot Road property. This road will be used to access the western shoreline of the HBHA Pond.

Access to the New Boston Street Drainway (NBSD) to the west of the railroad tracks will be via New Boston Street. The East Hide Pile (EHP), West Hide Pile (WHP) and Thermal Oxidizer Unit (TOU) Building will be accessed via the exit road leading from the Anderson Regional Transportation Center.

The east side of Wells G&H Wetlands Area will be accessed via a City of Woburn owned access road off of Salem Street. The west side of Wells G&H Wetland area will be accessed through two private properties. CBCA Wetlands can be accessed off of Washington Circle via a sewer easement access path which runs along the western side of CBCA.

3.2 Access to Private/Public Property

The RDWP and Field Sampling Plan (FSP) describe a series of Pre-Design Investigations (PDIs) that require access to some properties not owned by the Settling Defendants. The properties and the corresponding owners of each of the parcels that fall within and adjacent to the Site boundaries are listed in Table 3.2-1. Figures showing the parcels that require access to complete the individual PDIs as well as the media that will be sampled on each parcel are presented in Attachment A1. This section describes procedures for obtaining land-owner approval to access privately owned and public property for field activities, and identifies locations and owners of property where access is required for RD PDIs and/or for the RA.

As of the date of this SMP, the process of obtaining access agreements is in progress and the Settling Defendants have obtained forty (40) access agreements. Access agreements are needed for the

properties identified in Table 3.2-1, which lists owners, their contact information, the source of the property ownership information, and date obtained. Negotiations are ongoing with the owners of several of the properties within and adjacent to the Site.

Letters requesting access to private and public properties within and adjacent to the footprint of the proposed remedial activities will be prepared by the Project Coordinator and sent via registered mail or overnight courier service to the property owner(s). The letter will inform the property owner of the planned remedial activities, describe the nature and anticipated duration of the planned work, provide a description of the potential impacts of the work, provide assurance that such impacts will be mitigated to the extent practicable, and describe restoration plans, if appropriate. An example of the notification letter is included in Attachment A2.

Copies of the property access request letters, letter delivery receipts, and executed property access agreements, will be provided to EPA and MassDEP. If an access agreement cannot be obtained, EPA and MassDEP will be notified in writing, including a description of the efforts made to obtain the necessary access, and the reason for denial of access.

3.3 Property Owner Contact Information

As noted above, Table 3.2-1 lists the names and addresses of the property owners where access will need to be obtained. Should access to additional properties be required in order to complete any RD/RA activities, the EPA will be informed, and the appropriate property owner will be contacted to request access, as described in Section 3.2.

4.0 SITE SECURITY

This section describes the field offices that will be used on the Site and the security measures that will be in place to protect the equipment being stored at the Site. The establishment of the different levels of contamination zones to provide health and safety protection is also described below.

4.1 Field Office

The Settling Defendants own two buildings on the Site. Descriptions and location of the buildings are as follows:

- The former Groundwater Treatment Building (GWTB) is adjacent to the southern portion of the MBTA Anderson Regional Transportation Center parking lot.
- The OU1 Thermal Oxidation Unit (TOU) building is located to the north east of the MBTA Anderson Regional Transportation Center parking lot, adjacent to the Raytheon building.

The GWTB will be used primarily for the tank treatability studies but will also function as a storage space for equipment and expendables.

The TOU building will be used primarily for equipment and supplies storage during the field activities conducted in support of the RD phase of the project. This facility can also provide additional office and meeting space as well as additional space for subcontractors, EPA and MassDEP personnel and contractors as needed.

The primary field office and headquarters for this phase of the project will be located in a trailer adjacent to the GWTB. The field office will have at a minimum, electrical power, telephone communication, sanitary facility(s) and storage space for equipment. Copies of all pertinent RD/RA documents will be kept in this field office.

RD activities being conducted outside of the HBHA (e.g., Wells G&H and CBCA wetlands, NBSD), will use a designated vehicle as a site-specific activity headquarters. Copies of all pertinent RD documents will be kept with the field team during these activities.

The GWTB, TOU building and any trailers used on Site will be locked after the established work day hours and then opened at the beginning of the work day when the first Site personnel arrives. The Site manager will designate personnel to be responsible for unlocking the access gates and field office door at the beginning of the day and confirming that the access gates and office are locked at the end of the day.

A Site workers and visitors' log will be kept and maintained, to have an accurate log of who was on the Site on a given day and for what length of time. The log will be present at the entrance of the primary field office. All worker's and visitors entering the Site, including but not limited to regular field personnel, subcontractors, truck drivers, and other Site visitors are required to check into the field office and sign their name and time of Site visit on the Site visitors' log. Upon leaving the site, all workers and visitors must sign out by noting the time of their departure next to their original sign in entry.

4.2 Health and Safety Controlled Access Areas

Access areas will be established to prevent Site worker and public exposure to chemically contaminated media. These areas consist of the following work zones:

- Exclusion Zone
- Contamination Reduction Zone (CRZ)
- Support Zone

Due to the nature of the work to be completed at the Site in support of the RD, the above mentioned zones will be specific for work in each PDI area of the Site, rather than establishing one Exclusion Zone, CRZ, and support zone for the entire Site. These areas will be established by the Site Safety Officer [(SSO); whose responsibilities are further described in the Health and Safety Plan (HASP)] prior to the start of a specific work activity. Placement of these work zones will be based upon a review of available Site information, potential chemical hazards associated with the PDI, and health and safety hazards associated with the specific work activity. Access to these areas will be in accordance with approved procedures.

Exclusion Zone. The Exclusion Zone isolates the area of contaminated media, and serves to restrict the potential spread of contamination from work areas of the Site to support areas and off-site locations. The Exclusion Zone will be demarcated by a tape line or physical barrier. Personnel entering the Exclusion Zone must comply with the following requirements:

- Enter through the CRZ
- Wear the prescribed level of Personal Protective Equipment (PPE)
- Be authorized to enter the Exclusion Zone

Personnel, equipment, or materials will exit the Exclusion Zone at the location where decontamination and disposal activities will occur. Decontamination will follow the guidance of Haley & Aldrich Operating Procedure OP3027 - Decontamination (Attachment A3). Disposable equipment and materials will be containerized according to Haley & Aldrich Operating Procedure OP3028 - Investigation Derived Waste (Attachment A3).

Restricted areas for heavy machinery (e.g., excavators, drill rigs, etc.) use will be clearly marked and identified within the Exclusion Zone to assure safe operation. Plans to provide emergency access to the Exclusion Zone are provided in Section 8 of the HASP.

Contaminant Reduction Zone. The CRZ is an area adjacent to the Exclusion Zone, designated for decontamination and disposal activities associated with work conducted in the Exclusion Zone. Decontamination will follow the guidance of Haley & Aldrich Operating Procedure OP3027-Decontamination. Disposable equipment and materials will be containerized according to Haley & Aldrich Operating Procedure OP3028 - Investigation Derived Waste. After undergoing the decontamination process or containerization, personnel equipment or materials will be permitted to exit the CRZ.

During the RD project phase, activities that will require health and safety control areas will consist primarily of field sampling. Sampling activities will employ temporary establishment of Exclusion Zones and CRZs. Such temporary work zones will be broken down daily at the completion of the day's activities. Investigation-derived wastes will be managed as described in Haley & Aldrich Operating Procedure OP3028 - Investigation Derived Waste and Section 5 of this SMP. All areas outside the Exclusions Zones and CRZs will be considered Support Zones as described below.

Support Zone. A Support Zone will be established at each Site-specific activity and will contain the necessary support facilities for Site operations and general administrative and logistic purposes. It will also serve as the communication center, storage of sampling equipment and personal protective equipment and source of emergency assistance for operations in the exclusion zones and CRZs. In an effort to minimize the extents of CRZs, the support zones shall be set up in a portion of each site-specific area that is known to be or is likely to be free of contamination.

4.3 Contingency Planning

Contingency planning is addressed within the HASP, and covers the following subjects/emergencies:

1. Fire
2. Medical
3. Hazardous Materials Spill
4. Rescue
5. Weather Related Emergencies
6. Evacuation Alarms
7. Emergency Services
8. Emergency Evacuation Plan

In addition, activities involving boats will require coordination with the local fire department for water rescue measures. This arrangement is outlined in Section 8 of the HASP.

These plans were developed in accordance with Haley & Aldrich Operating Procedure OP1021 - Emergency Action Plan.

4.4 Property Security

At this time, the RDWP field activities do not require the use of any government property.

All equipment and sampling devices will be stored in the designated field office, or secured on location during ongoing field activities. As described in Section 3.1, the field offices are located within a locked fenced area, and will be locked when Site personnel are not present. Multi-language warning signs will be posted at various locations along the site perimeter and fence lines in areas where there is potential for trespassers to come in contact with contaminated media.

5.0 FIELD ACTIVITIES

The specific field activities that will be performed in support of the RD are described in the RDWP and the FSP. A brief summary of the types of sampling activities is presented herein.

5.1 Utility Mark-out and Geophysical Survey

As a precautionary measure in the interest of safety and protection of property, underground and overhead utilities in the vicinity of sampling locations will be identified and marked prior to field activities. Mark-out will be conducted in accordance with relevant state and local regulations. Underground utilities will be identified based on Site drawings, utility company identification, communication with Dig Safe System, Inc. (Dig Safe), and/or geophysical survey. Geophysical surveys can identify buried utility lines/pipes, former disposal trenches or pits, limits of existing landfills, buried drums and/or waste material, as well as other subsurface features that may impact field work. Geophysical techniques that may be used to support field investigations associated with the Industri-plex OU2 RDWP include: magnetometry, ground penetrating radar, terrain conductivity, and borehole imaging. These will be applied, as needed, in accordance with state and local regulations, as well as relevant contractor operational guidelines.

5.2 Exploration Location Survey

A licensed Massachusetts surveyor will be retained to conduct a survey for the purpose of locating any completed explorations. Surveying techniques will be employed by the subcontractor to match site-specific conditions. Horizontal locations will be referenced to the Massachusetts State Planar coordinates (North American Datum (NAD) 1983). Vertical data will be referenced to the (North American Vertical Datum (NAVD), 1988). Data will be collected using appropriate surveyor's equipment, to be decided by the subcontractor. This equipment will likely include tradition optical survey equipment and Global Positioning System (GPS).

5.3 Soil Investigation

PDI-6, PDI-11 and PDI-12 require collection of surface and subsurface soil samples to characterize site geotechnical features and contaminant levels. Several sampling techniques will be used, such as direct-push boreholes (i.e. GeoProbe® boreholes), test pits, and hand sampling techniques (e.g., hand auger, trowel, slide hammer). These methods will be selected based on their relevance and field conditions present at the time of sampling. Haley & Aldrich staff will observe all subcontractors. The subcontractor will provide Haley & Aldrich staff with soil samples, at which point they will be visually classified, logged and sub-sampled. Soil samples collected by hand sampling techniques will be performed by Haley & Aldrich staff, and will not typically involve subcontractors. Soil sampling SOPs are included in Attachment C1 of the FSP.

5.4 Groundwater Investigation

PDI-3, PDI-9, PDI-10, PDI-12, and PDI-14 require groundwater sampling. Groundwater samples for PDIs 3, 9, 10 and 12 are for the purpose of determining the nature and extent of contamination surrounding Halls Brook Holding Area (HBHA), WHP & EPH, NBSD, and Former Lake Mishawum (FLM). Samples for PDI 14 are for the purpose of evaluating the background levels of ammonia. Groundwater will be monitored at the site by sampling existing monitoring wells, and/or installing and sampling new monitoring wells, piezometers, and temporary well points. Several sampling techniques will be used, such as Low Stress/Low Flow sampling (i.e., slow pumping of groundwater combined

with use of a flow cell and chemical meter to establish parameter stabilization prior to sampling), direct push sampling (i.e., use of a GeoProbe® to drive in situ or vertical sampling devices to the desired sample horizon), as well as other situation-specific techniques. Groundwater sampling SOPs are included in Attachment C1 of the FSP.

5.5 Sediment Investigation

PDI-1, PDI-2, PDI-4, and PDI-9 require sampling sediment. Sediment samples for PDI-1 and PDI-2 are for the purpose of defining dredge volumes and dewatering characteristics in HBHA Pond, Wells G & H wetlands, and Cranberry Bog Conservation Area (CBCA) Wetlands. Sediment will be sampled under PDI-9 for the purpose of determining the nature and extent of benzene contamination in Lower South Pond, adjacent to the WHP. Samples will be collected using several situation-specific procedures, including petite ponar sampler, Ekman dredge sampler, piston or ball-check corer, and peristaltic pumping. Once collected, samples will be subsampled as appropriate for the target analytes. Sediment sampling SOPs are included in Attachment C1 of the FSP.

5.6 Surface Water Investigation

PDI-4, PDI-5, PDI-9, PDI-10, PDI-14, PDI-15, and PDI-16 require surface water sampling. Samples for the PDI-4 series are for the purpose of determining the nature and extent of contamination within HBHA Pond. Surface water samples for PDI-9 and PDI-10 are for the purpose of determining the nature and extent of contamination surrounding HBHA Pond, the WHP, and NBSD. Samples for PDI-5 are for the purpose of determining the effectiveness of the various treatability studies for surface water contaminants. Samples for PDI 14 are for the purpose of establishing the background levels of ammonia within the various surface water bodies present on and adjacent to Industri-plex OU2, including HBHA Pond, Halls Brook, NBSD, and Atlantic Avenue Drainway (AAD). Samples for PDI-15 are for the purpose of evaluating the performance of the aeration pilot test. Samples for PDI-16 are for the purpose of evaluating the performance of an environmental control for construction within the HBHA Pond. Surface water sampling SOPs are included in Attachment C1 of the FSP.

5.7 Decontamination and Investigation Derived Waste Management

Management and characterization of investigation soils and/or groundwater is required in accordance with the Remedial Design Work Plan. In some areas and/or sections within the Site it may be acceptable to return exploration soil cuttings/test pit soils and groundwater to the point of collection. In other areas it may not be practical to return cuttings/soils to their origin, and they will be better handled by collection, followed by characterization/disposal. These practices are consistent with EPA procedure for IDW at RCRA facilities and CERCLA sites. Typically, investigative derived wastes are dealt with following "Best Management Practices"; and are not handled under RCRA regulations until proven to be listed and/or identified as characteristically hazardous waste. Investigative soils and groundwater often cannot be considered a listed waste due to the lack of generator knowledge concerning chemical source, chemical origin, and timing of chemical introduction to the subsurface. Consequently, waste sampling and characterization is performed to determine if the wastes exhibit a characteristic of hazardous waste. Once the IDW characterization is complete, RCRA regulations apply if determined hazardous; if determined to be non-hazardous solid wastes, best management /solid waste handling practices apply. The disposal of soil cuttings, test pit soils and/or purged groundwater will be reviewed on a case by case basis prior to initiation of field activities. Two scenarios typically exist:

1. No Disposal/No Containerization Required - This scenario applies when sufficient Site information exists that allows investigative soils, cuttings, and/or purged groundwater to be

placed back into the borehole. This may be employed when it is believed that the area of concern will require a final remedy involving in-situ treatment, or an off-Site disposal removal effort is likely required, or no chemical impact is evident; and the material replacement does not pose a health threat or the potential to contaminate new areas.

2. Disposal Required/Containerization Required - This scenario applies when sufficient Site information is available to determine that all materials handled will be containerized and disposed.

   If a known listed hazardous and/or characteristically hazardous waste/contaminated environmental media is being handled, then handling will be performed in accordance with RCRA Subtitle C.

Alternatively, no information may be available in the area of activity or investigation, and where impacted media/soils are identified. Activities such as new construction and/or maintenance works below grade may encounter environmental conditions that were previously unknown. Where no information is available, all investigative soils, cuttings, and/or purged groundwater should be handled and containerized as contaminated until laboratory analysis confirms that the IDW can be treated otherwise.

5.8 Air Monitoring

Personal air monitoring within the Exclusion Zone will be conducted to ensure that any Immediately Dangerous to Life and Health (IDLH) or other hazardous conditions are identified and mitigated. Perimeter monitoring will be conducted, if warranted, during future phases of the project that have the potential to release vapors or dusts. Any actions taken to suspend or modify work process as a result of these readings will be communicated to EPA prior to resumption of work.

5.8.1 Personal Air Monitoring

Air monitoring of the breathing zone will be conducted using an 11.7eV Photoionization Detector (PID) and is required at the commencement of activities on the Site, when first exposed to the contaminated media. Work shall not commence until a PID is present on Site. If elevated concentrations of volatiles are detected by the PID in the breathing zone (greater than 1ppm), compound specific Draeger Tubes will be used to determine the compound and concentration of the compound in the air. Fugitive dust and the exposure to Contaminants of Concern (COCs) through the inhalation of dust is not anticipated to be an issue during the RD support phase of the project. If fugitive dust does become a problem, engineering controls will be employed to mitigate the dust issue.

The following is the standard air monitoring plan within Exclusion Zones to be followed while conducting work on the Site:

- Prior to the beginning of work obtain background readings with the PID away from the site.
- Monitor the breathing zone (9 inch radius hemisphere centered at the nose and forward of the shoulders) with the PID when first exposed to the media.
- Monitoring should be conducted most frequently (e.g., every 15-30 minutes) when work first begins in a particular area. After this, and if no exceedances of exposure limits are noted (see Table 4.4-1 in HASP), monitoring may be conducted less frequently (e.g., every 60 minutes).
- If any reading above background levels is detected with the PID for 5 minutes or longer, back away for a few minutes. Screen the air again after any vapors/gases have been given a chance to dissipate.

- If detection levels above background are still noted at or around 1 ppm, use a Draeger tube for benzene to try to determine if the compound setting off the PID is benzene. If so, evacuate the area and call the Regional Health and Safety Coordinator (RHSC) and Project Manager for further guidance.
- If the Draeger tube test for benzene returns a negative result, consult Table 4.4-1 in the HASP for the Permissible Exposure Limits (PEL) for ammonia (50 ppm) and the other volatiles on site. Conduct Draeger tube tests as necessary to identify the constituent setting off the PID. Understand the PEL for that compound and continue to use the PID as a screening device. Draeger tube tests shall be taken as necessary to ensure worker safety.
- Record monitoring data and PPE upgrades in field book or on Record of Field Monitoring form and maintain with project files. Record time, location and results of monitoring and actions taken based upon the readings.

In addition to the air monitoring plan that is established for the Site using a PID and Draeger tube approach to air monitoring, multiple gas detectors will be used when necessary including, but not limited to working in enclosed spaces or buildings.

All monitoring/screening equipment must be intrinsically safe where warranted. Instruments will be calibrated and maintained in accordance with the manufacturer's recommendations. Calibration records will be maintained in a daily field log book. Backup monitoring equipment is required to be available on Site as determined by the Site Safety Officer. Field activities will be suspended if the properly calibrated field monitoring instrumentation is not available.

5.8.2 Perimeter Air Monitoring

If warranted, perimeter air monitoring will be conducted to ensure that activities being performed on the Site are not adversely affecting the ambient air. It is anticipated that during the portion of the work being completed in support of the RD, that the tasks being conducted will not require perimeter monitoring. If perimeter monitoring becomes a concern during the design phase and will therefore be necessary when implementing the design, a perimeter air monitoring plan will be developed.

5.9 Data Management

The "data" that will be obtained through PDIs at Industri-plex OU2 will be many and diverse. Data include physical and analytical measurements that have been or will be collected from the Site. Data management is a process by which these data are managed in an organized fashion, taking into consideration contemporaneous and future sampling efforts and their resulting data. It is paramount that this collective dataset (consisting of both historic and future data) be managed in a thoughtful, organized and rigorous format that is readily available by those parties that need to access the data quickly. To this end, a highly structured environmental database is utilized in conjunction with a Geographic Information System (GIS) and an internet communication platform to:

- Archive historic environmental data
- Normalize data from different sources (putting disjointed data in a common format so that they can be compared against one another)
- Distribute the data to authorized personnel in a timely fashion
- Query that data in a fashion that allows a user to quickly obtain data based on sample locations, parameters, measurement value, data quality, and date criteria
- Compare the data against environmental clean-up goals to quickly identify samples with analytical values that exceed criteria

- Trend the data temporally so that positive and negative relationships can be visualized between and among sample measurements
- Map and spatially analyze the data so that spatial relationships among the data might be realized

The database platform is provided by the Geographic Environmental Management System or "GEMS"; an industry tested environmental database platform developed by Summit Envirosolutions, Inc. GEMS is a Visual Basic for Applications (VBA) application written on Microsoft Access® 2003. GEMS consists of two separate Access files, one used to house the Graphical User Interfaces (GUIs) and one dedicated to housing the environmental data, referred to as the "dataset". The environmental database is then accessed via the graphical user interface database. The tables within the dataset are highly structured utilizing relational database concepts and practices (please refer to the GEMS Relational Database Model Flow Chart in Attachment A4 for a schematic of tables and columns and relationships among them). Generally speaking, these tables were constructed to represent the characteristics and resulting data associated with any environmental sampling efforts including by not limited to:

- **Sample Locations** - physical attributes describing the physical location that the sample was collected (e.g., well name, construction, screen elevation, boring drill method, install date, elevations, coordinates)
- **Field Sample Properties** - attributes associated with the actual sample collected from the Sample Location (e.g., sample name, collected by, sample date, weather conditions at the time of sampling)
- **Sample Measurements, Results or Description** - actual physical or analytical numeric results generated by various measuring techniques depending on the parameter values desired (e.g., depth to water, chemical concentration, soil type, measurement method, measurement method detection limits, entity that did the measurement)

The database consists of tables designed to store these data, and also tables associated with providing list of valid values acceptable for use in describing these data. These valid value tables are crucial in that they are utilized to standardize or normalize the data so that queries can be performed with confidence that they are returning all the results associated with the question that the user has asked.

The GEMS user interface was designed to enforce referential database integrity and approved valid values. Without this enforcement, a database query for all trichloroethene, for example, may not truly return all data it has that matches those criteria because some of the data is stored as trichloroethylene (a known synonym) thereby producing an incomplete representation of the dataset.

The GEMS user interface contains a Quality Assurance/ Quality Control interface that one can run to identify parameter and location names that exist in the dataset but which are not in the approved set of valid values. Users are then provided the option to either add that parameter or sample location name as a new approved value or change it to that of an existing respective value from the list of values.

Historic data imported to the Industri-plex OU2 database at the time of this writing include historic analytical data provided by the EPA and surface water data measured through the use of Isco® samplers. Forthcoming data will be imported into the database through the use of the EDD (Electronic Data Deliverable) vehicle. The GEMS v6 EDD format has been provided to the lab so that their forthcoming deliverables can be imported directly into the data, quality checked and distributed in a very timely fashion.

Third-party data validation reports (marked up lab reports) will be used to then update any result values and qualifiers which the validator has changed. The original result, original qualifier, validation date and validator's name are then recorded and stored in the actual table row which received a validator's update.

Once a GEMS dataset has been updated with a new set of data from a recent field sampling event, it will be imported into the Project Portal™ web application for distribution to the collective project team. Project Portal is a .Net® web application designed to centralize and distribute documents, schedules, environmental data and maps to large environmental project teams in a highly efficient manner. Project Portal employs a rigorous rights management system to enforce which users are permitted to perform individual operations. Project Portal consists of the following modules, all available for use by the Industri-plex project team:

- Document Management System
- Project Calendar Sharing and Collaboration
- Query-able Environmental Database Access
- Interactive and embedded On-line GIS
- Custom Project Tables (database) which users can use to create tables for distributing tabular data of any nature

Environmental data uploaded into Project Portal's Environmental Database Module, is stored in a MySQL® server-grade relational database backend. The Environmental Database module allows authorized users to query the Industri-plex OU2 environmental dataset through an intuitive interface that allows them to query data based from their custom sample location, sample parameter (e.g., analyte) sample date and exceedances filter setting selections. The user may then either simply view, graph, map or export the subsequent query results to various formats including Microsoft Excel®, a comma-separate value (.csv) file, Environmental System Research Institute (ESRI)® shapefile or a Google Earth® (.kml) file.

If the user chooses to map the query results, those values will be plotted to the interactive GIS Module utilizing the coordinates stored in the database. The result value will be posted next to each sample location.

6.0 KEY PERSONNEL

The following provides a summary of the Technical Team acting on behalf of the Settling Defendants, and their responsibilities.

de maximis, inc. Supervising Contractor Bruce Thompson Project Coordinator Responsible for overseeing and directing all activities required by the CD and SOW	
Haley & Aldrich, Inc.	Responsible for preparing and implementing the RDWP
Geosyntec Consultants, Inc.	Responsible for peer review with focus on surface water flow modeling and constructed wetlands, and performance of flood routing modeling
Roux Associates, Inc.	Responsible for preparing and implementing the Surface Water Monitoring Plan (SWMP)

6.1 EPA Project Personnel

The EPA is the lead agency responsible for managing the removal and cleanup activities at Industri-plex OU2. Mr. Joseph LeMay, P.E. will serve as the EPA Region I Remedial Project Manager (RPM).

Figure 6.1-1 is a project organization chart highlighting the relationships between the Agencies, the Settling Defendants, Project Coordinator/Supervising Contractor, and the project design team firms summarized below.

The EPA Region I RPM is primarily responsible for the following items related to Industri-plex OU2:

- Conducting/coordinating EPA's review and approval of RD/RA submittals
- Coordinating, directing, and reviewing the work the Settling Defendants and their Contractors/Consultants to assure compliance with the National Contingency Plan (NCP), ROD, and RD/RA CD and SOW
- Conducting public meetings and providing an administrative record for the public

6.2 MassDEP Involvement

The MassDEP will provide review and guidance for the state regulatory aspects of this project. Their review and approval of RD/RA documents will occur concurrently with that of the EPA as described in the SOW. Ms. Jennifer McWeeney will serve as MassDEP Project Manager.

6.3 Settling Defendants

The Settling Defendants responsible to implement the Industri-plex OU2 CD include:

- Pharmacia Corporation by its Attorney-in-Fact Monsanto Company
- Stauffer Management Company LLC, as Litigation Agent for Bayer CropScience

6.3.1 Roles and Responsibilities

The Settling Defendants are responsible for the design, construction, and maintenance of the selected remedy.

6.4 Project Coordinator

The Settling Defendants have designated Mr. Bruce Thompson of de maximis, inc. (de maximis) as the Project Coordinator with responsibility for administration of all actions called for in the RA/RD CD and SOW. The Project Coordinator is responsible for implementing the project and has the authority to commit the resources necessary to meet project objectives and requirements. The Project Coordinator's primary function is to ensure that technical, financial and scheduling objectives are achieved successfully. The Project Coordinator functions as the major point of contact and control matters concerning the project. The Project Coordinator is responsible for defining project objectives, developing a detailed schedule and establishing project policy and procedures to address the specific needs of the project.

6.4.1 Supervising Contractor

The Settling Defendants have designated de maximis as the Supervising Contractor. All aspects of the work to be performed by the Settling Defendants pursuant to Sections VI, VII, VIII, and XV of the CD shall be under the direction and supervision of the Supervising Contractor.

6.5 Project Design Team

Haley & Aldrich has been designated as the consultant for the development and implementation of the Industri-plex OU2 RD. Roux Associates, Inc. (Roux) has been designated as the consultant for the development and implementation of the SWMP. Geosyntec Consultants (Geosyntec) will perform peer review and technical support during the RD phase, including the SWMP, and performance of the flood routing modeling.

6.5.1 Haley & Aldrich – Remedial Design Contractor

The Remedial Design Contractor (RDC) will supervise and direct the design work pursuant to the CD. An organizational chart of the Haley & Aldrich team is presented in Figure 6.5-1. The RDCs Project Manager, Russell Schuck, P.G. is responsible for day-to-day project management. The Project Manager is responsible for coordinating all field activities and the procurement of project subcontractors. Additional responsibilities include assisting in monitoring the progress and quality of investigative data collection, preparing and reviewing interim monitoring reports, and providing technical support of project activities.

The following list provides the main RDC subcontractors to support the RD (followed by the general role each is filling on the project design team):

- Hard Hat Services - Sediment Dredge Design and Dewatering Treatability Studies
- Vanasse Hangen Brustlin, Inc. (VHB) - Wetland Mitigation, Flood Routing Modeling, Concrete/Structural
- Flow Science - Hydrodynamic Modeling
- Meridian Land Services - Land Survey
- ALPHA Analytical - Standard Chemical Testing
- Microbial Insights - Microbiological Testing
- Ozark Underground Laboratories - Dye Tracer Analysis
- CR Environmental, Inc. - Hydrographic Survey
- Haley & Aldrich - Geotechnical Laboratory Testing
- GeoTesting Express - Geotechnical Laboratory Testing
- Galson Laboratories - Ammonia Headspace Analysis
- Colorado School of Mines - Microcosm Study (as needed)

6.5.2 Roux Associates – Surface Water Monitoring Program Contractor

Roux Associates will prepare and implement the SWMP. Roux Associates's Project Manager, Larry McTiernan, P.G., LSP, is responsible for day-to-day activities related to SWMP implementation. The Project Manager is responsible for coordinating all field activities and the procurement of project subcontractors. Additional responsibilities include assisting in monitoring the progress and quality of investigative data collection, preparing and reviewing interim monitoring reports, and providing technical support of project activities related to SWMP implementation. The primary subcontractor related to SWMP implementation is ALPHA Analytical, which will perform standard chemical testing for the SWMP.

6.5.3 Geosyntec – Surface Water Modeling, Peer Review, and Technical Support Consultant

The technical support consultant (Geosyntec) provides technical input to the Project Coordinator and other project design team members. Geosyntec's Project Manager, Carl Elder, Ph.D., P.E. will assist the Project Coordinator in various capacities, including participating/supporting the surface water flood routing modeling analysis, as well as general peer review technical support where needed.

7.0 FINANCIAL REPORTS

Mr. Bruce Thompson of de maximis, Project Coordinator, will provide overall financial management for the Settling Defendants and, pursuant to the RD/RA SOW, will provide regular financial reports of the Settling Defendants expenditures on RD/RA activities.

REFERENCES

1. EPA RCRA - Guidance and Policies: Management of Remediation Waste Under RCRA (October 1998).

2. EPA RCRA - Management of Contaminated Media (October 1998).

3. EPA CERCLA Guidance (Options Relevant to RCRA Facilities): Guide to Management of Investigation - Derived Wastes (January 1992).

4. EPA Office of Solid Waste- SW846 Chapter 9 Sampling Plan, Chapter 10 Sampling Methods (September 1986).

TABLE 3.2-1
OWNERSHIP INFORMATION- PROPERTIES REQUIRING ACCESS DURING PRE-DESIGN INVESTIGATIONS
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

DRAFT

Figure ID	MBL	Property Address	Within OU1 Boundary (Yes/No)	Owner Name	Additional Property Information					Mailing Address	City/Town	State	Zip Code	Surface Water Monitoring Station	Surface Water Sampling	Sediment Sampling	Monitoring Well Installation	Groundwater Sampling	Elevation Survey	Soil Boring Exploration	Traverse
					Additional Contact Information	Source	Date Identified	Access Request Certified Mail Tracking #													
								Access Request Sent	Access Request Certified Mail Tracking #												
A1-1	040502	316 New Boston Street	No	New England Resins & Pigments	Paul O'Connor (p) 781-935-8910 email: poconnor@neresins.com	City of Woburn Assessor's Office website-www.neresins.com	5/14/2008; 5/16/2008	6/13/2008	7008 0150 0000 0128 3377	315 New Boston Street	Woburn	MA	01801		X		X	X	X	X	
A1-2	150112	185 New Boston Street	No	Joseph J. Maggiore et al., M D G Realty Trust	The Begley Companies Doug Porter (p) 781-935-9000 email:dporter@begleycompanies.com Attorney Representation, Richard Michienzi, Esq. (p) 781-396-0055	ISRT, C. Brooks; www.begleycompanies.com; Doug Porter	1/24/2008; 6/2008; 11/3/2008	6/17/2008	7008 0150 0000 0128 3353	185 New Boston Street	Woburn	MA	01801		X			X	X		
A1-3	141701	195 New Boston Street	No	TREC, LLC	Sunbelt Rentals Dave Williams (p) 508-842-0097 email: david.williams@sunbeltrentals.com	ISRT; C. Brooks	2/20/2008	5/12/2008	NA - correspondence via US Mail	800 Hartford Turnpike	Shrewsbury	MA	01545				X	X	X		
A1-4	310202	MBTA Rail Road Row	No	MBTA, c/o J. Wolfson Manager	Transit Realty Associates Patricia Barrett (p) 617-482-2525 Noble & Wickersham LLP Julie Taylor (p) 617-491-9816	ISRT; C. Brooks	8/25/2009	Draft Access Agreement sent to J. Taylor on 2/13/2008	NA - correspondence via email and phone	10 Park Plaza, Room 5750	Boston	MA	02116							X	
A1-5	100101	74 -110 Commerce Way	No	MetroNorth Business Ctr LLC, c/o National Development of New England	MetroNorth Business Center, LLC 2310 Washington Street Newton Lower Falls, MA 02462 Brian Clancy, Senior VP (Main Contact) (p) 617-527-9800 email: bclancy@natdev.com. Steve Lyons (Site Contact) (c) 617-828-5522	Peter Alpert - Ropes & Gray	Early 2008	Agreement correspondence via Ropes & Gray	Agreement correspondence via Ropes & Gray	2310 Washington Street	Newton Lower Falls	MA	02162				X	X	X	X	X
A1-6	150104	32 & 36 Cabot Road	No	DEK Portfolio LLC, c/o Great Point Investors	Spaulding & Slye Drew Pepoli (p) 617-531-4131 email: andrew.pepoli@ssinvests.com	Review Property Access files from 2000, GSIP; initial call, Andrew Pepoli	Prior to 1/23/2008; 1/25/2008	2/1/2008	NA - correspondence via email and phone	98 North Washington Street, 5th Floor	Boston	MA	02114	X	X	X	X	X	X	X	
A1-7	150120	0 Cabot Road	No	DEK Land LLC		Not contacted regarding this work to date	12/17/2009	Not sent to date	--									X	X	X	X
A1-8	150105	35 Cabot Road	No	Rumford, Linscott LLP	Cummings Properties Craig Ziady Legal Council for Cummings Properties email: craig@cummings.com	City of Woburn Assessor's Office	8/22/2008	8/28/2008	7008 0150 0000 0129 0092	200 West Cummings Park	Woburn	MA	01801				X	X	X	X	
A1-9	150102	12 Cabot Road	No	Pontiac Properties LLP		City of Woburn Assessor's Office	8/22/2008	8/28/2008	7008 0150 0000 0129 0092	200 West Cummings Park	Woburn	MA	01801					X	X	X	
A1-10	200104	34 Commerce Way	No	Sudbury Research Center Inc		City of Woburn Assessor's Office	8/22/2008	8/28/2008	7008 0150 0000 0129 0092	200 West Cummings Park	Woburn	MA	01801					X			
A1-11	200102	10 Commerce Way	No	MHP Realty, LLC		City of Woburn Assessor's Office	8/22/2008	8/28/2008	7008 0150 0000 0129 0092	200 West Cummings Park	Woburn	MA	01801				X	X	X	X	
A1-12	150119	8 Cabot Road	No	8 Cabot Road Inc.		City of Woburn Assessor's Office	8/22/2008	8/28/2008	7008 0150 0000 0129 0092	200 West Cummings Park	Woburn	MA	01801						X	X	
A1-13	150110	0 Cabot Road (vacant land)	No	C C & F, c/o Tax Department	Wilmer Hale Robert Fitzpatrick (p) 617-526-6382 email: robert.fitzpatrick@wilmerhale.com	City Of Woburn Assessor's Office; City of Woburn Treasure's Office; Juan Prieto, Cabot Cabot & Forbes; Robert Fitzpatrick, WilmerHale	8/7/2008; 8/22/2008; 10/30/2008; 12/17/2009	10/14/2008	7006 2760 0004 9841 4091	99 Summer Street, #910	Boston	MA	02110				X	X	X	X	
A1-14	150103	20 Cabot Road	No	MVRH Realty LLC	Massachusetts Veterinary Referral Hospital 20 Cabot Road Woburn, MA 01801 Ames Prentiss (p) 781-305-2260	City of Woburn Assessor's Office; Initial call to MVRH	8/7/2008; 8/29/2008	8/22/2008	7008 0150 0000 0129 0337	20 Cabot Road	Woburn	MA	01801						X	X	
A1-15	150106	31 Cabot Road	No	Grainger WW	Grainger John Julian, Assistant General Council (Contact) (p) 847-535-0560email: john.julian@grainger.com email: john.julian@grainger.com	City of Woburn Assessor's Office; Jane Waggart/ Marvin F. Poer Co.; Tressa Chamber/Grainger; John Julian/Grainger	5/22/2008; (8/7/2008 & 8/22/2008), 12/2/2008; 2/27/2009	8/22/2008	7008 0150 0000 0129 0344	100 Grainger Parkway	Lake Forest	IL	60045-5203				X	X	X		
A1-16	150109	11 Cabot Road	No	Lili Gorchev	Not contacted to date	City of Woburn, GIS	12/17/2009	Not sent to date	NA	4 Robinson Park	Winchester	MA	01890				X	X	X	X	
A1-17	150101	36 Commerce Way	No	Blackacre Realty, c/o John M Destefano	Blumsack & Canzano 36 Commerce Way Woburn, MA 01801 Richard Canzano (p) 781-935-3500, (f) 781-935-7887 email: rmcanzano@aol.com	City of Woburn Assessor Database; Wronka Limited-Commercial Real Estate Advisor	9/5/2008-Call to Wronka; 10/10/2008-ID Blumsack & Canzano;	10/14/2008	7006 2760 0004 4077	36 Commerce Way	Woburn	MA	01801						X	X	
A1-18	200103	20 & 30 Commerce Way	No	RREEF/DB Real Estate c/o RAR2-Boston Industrial Qrs, Inc.	RREEF 600 Unicorn Park Woburn, MA 01801 Kay Geary (p) 781-938-1733, (f) 781-938-1278 email: kay.geary@rreef.com	City of Woburn Assessor's Office; www.rreef.com-contact us; RREEF- Local Office	9/5/2008; 9/5/2008;10/15/2008	10/14/2008	7007 3020 0002 1259 8361	600 Unicorn Park	Woburn	MA	01801				X	X	X	X	
A1-19	200121	Hall Brook Holding Area	No	Mark-Phillip Trust, c/o Resources for Responsible Management	Resources for Responsible Site Management, Inc. Trustee for the Industri-plex Site Custodial Trust P.O. Box 487 Chestnut Hill, MA 02467	EPA	2/27/2008	8/4/2008	NA - Correspondence via US Mail	P.O. Box 487	Chestnut Hill	MA	02467	X	X				X		
A1-20	100106	30 Atlantic Ave	Yes															X	X		

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WOBURN, MASSACHUSETTS

DRAFT

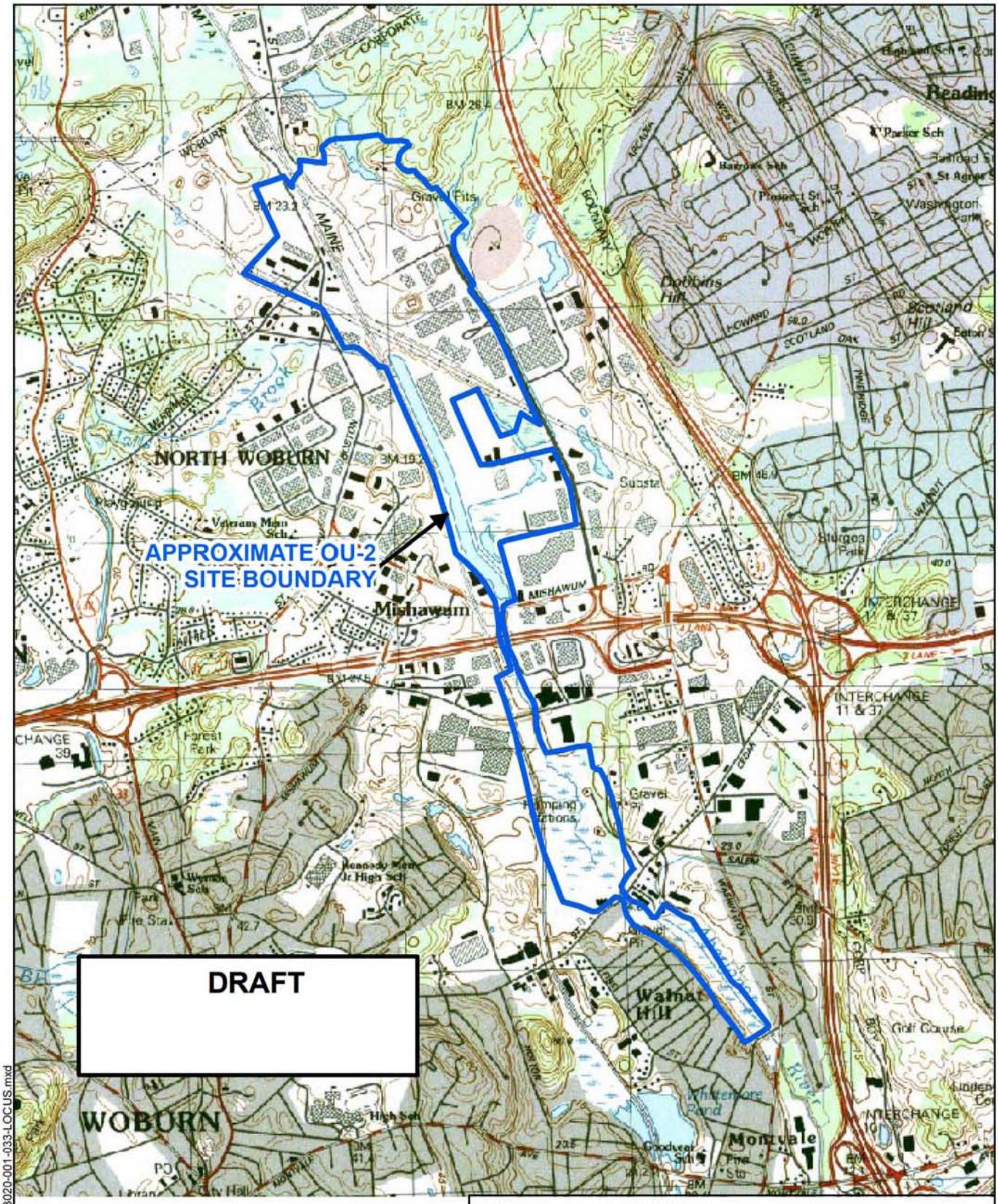
Figure ID	MBL	Property Address	Within OU1 Boundary (Yes/No)	Owner Name	Additional Property Information					Mailing Address	City/Town	State	Zip Code	Surface Water Monitoring Station	Surface Water Sampling	Sediment Sampling	Monitoring Well Installation	Groundwater Sampling	Elevation Survey	Soil Boring Exploration	Traverse
					Additional Contact Information	Source	Date Identified	Access Request Certified Mail Tracking #													
								Access Request Sent	Access Request Certified Mail Tracking #												
A1-21	251802	0 Olympia Avenue	No, Wells G&H	George D. Whitten c/o Olympia Aberjona LLC	Resident Agent for Olympia Aberjona, LLC Peter I Brown (p) 781-729-5000	City of Woburn Assessor's Office; MA Corporate Database Search ; Google Search; Juniper Services, website-www.juniperllc.com	9/5/2008	10/14/2008	7006 2760 0004 9841 4084	31 Holton Street	Winchester	MA	01890			X			X		X
A1-22	320115	0 Salem Street R	No, Wells G&H	Beatrice Company	Ken Anderson Beatrice Company Peter Cox - 978-589-3012 email: peter.cox@aecom.com	City of Woburn Assessor's Office, www.Switchboard.com; MA Corporate Database; MA Land Record Review; Property Visit	8/13/2008; 8/13/2008; 8/13/2008; 6/11/2009; 9/3/2009	8/27/2008	Correspondence via phone and email	2 Technology Park Drive	Westford	MA	01886								X
A1-23	320117	280 Salem Street R	No	City of Woburn	Mayor Scott Galvin (p) 781 -897-5901 email: sgalvin@cityofwoburn.com John Corey City Engineer (p) 781 897-5882 email: jcorey@cityofwoburn.com	City of Woburn Assessor's Office; Talked with C. Culhane; Directed to Mark Reich	10/17/2008	10/22/2008-Addendum for this and MBL #451223	NA -Sent via email to Mark Reich on 10/22/08							X			X		X
A1-24	320114	Salem Street R	No				12/17/2009	Not sent to date	--										X	X	
A1-25	040107	Woburn Landfill	No				12/17/2009	Not sent to date	--						X		X	X	X	X	
A1-26	200123	0 Mishawum Road	No	Woburn Mall Associates, c/o Koffler/Gid Woburn LLC	Nixon Peabody LLP Donald Cooper (p) 617) 345-6077 email: dcooper@nixonpeabody.com	Woburn GIS	12/17/2009	Not sent to date	NA	1303 South Frontage Road	Hastings	MN	55033						X	X	
A1-27	200120	280 Mishawum	No	Mishawum Road, LLC	Tom Derro (p) 978- 371-1955 email: bderro@aol.com	City of Woburn Assessor's Office; MA Corporate Database	5/29/2008	5/21/2008; 9/15/2008	NA												X
A1-29	090206	217 New Boston Street	Yes	John M. Koster, Trustee	Not contacted to date	NA	12/17/2009	Not sent to date	NA	P.O. Box 42	Woburn	MA	01801					X	X		
A1-30	100107	100 Atlantic Avenue	Yes	Christopher Gordon Trustee, c/o Mass Port Authority	Mass Port Authority (Airport Business Office) One Harborside Drive, Suite 200S East Boston, MA 02128 Jack Hamphill The Mass Port Authority, Capital Programs Division One Harborside Drive, Suite 200S East Boston, MA 02128-2909 Kenneth F. Johnson Jr.													X	X		
A1-32	090108	216 New Boston Street	Yes	P X Realty Trust, Paul O'Neill	Lorena (O'Neill) Watt (p) 561-531-9300	City of Woburn Assessor's Office; Property Visit; MA Corporate Database; O'Neill Financial Management LLC website: www.yrip.com; www.switchboard.com; New England Real Estate Journal 4/28-5/4/06; Contacted Lorana Watt (initial contact)	2/27/2008; 6/12/2008; 6/26/2008; 6/26/2008; 6/26/2008; 11/3/2008	6/17/2008	7008 0150 0000 0129 0146	15695 Sea Mist Lane	Wellington	FL	33414		X		X	X	X		
A1-33	090107	225 Merrimac Street	Yes							15695 Sea Mist Lane	Wellington	FL	33414					X	X		
A1-34	100111	0 Commerce Way	Yes	Anthony S. Femmino Trustee, Chestnut Hill Realty Trust	Orphan Properties Tim Cosgrave, OU1 Project Coordinator when access is needed (Contact)	ISRT	7/28/2008	8/5/2008	7008 0150 0000 0129 0122	728 Boylston Street	Chestnut Hill	MA	02467					X	X		
A1-35	100109	0 Atlantic Avenue	Yes														X	X	X	X	
A1-36	100108	41 Atlantic Avenue	Yes	Atlantic Ave Associates Inc, c/o David A Welles	Atlantic Avenue Associates, Inc. 11863 Wimbledone Circle, #537 Wellington, FL 33414 David Wells (p) 561-422-8844 (c) 860-798-4242	City of Woburn Assessor's Office; MA Corporate Database	6/23/2008	8/4/2008	7008 0150 0000 0129 0153	11863 Wimbledone Circle, #537	Wellington	FL	33414					X	X		
A1-37	090704	210 New Boston Street	Yes	WJP Realty Trust, William Covalucci Trustee	Not contacted to date	NA	NA	Not sent to date	NA	210 New Boston Street	Woburn	MA	01801					X	X		
A1-38	090105	Longwood Avenue	Yes	Nstar Gas and Electric Company	NSTAR Jeffrey M. Stevens (p) 617-424-2141 email: jeffrey.stevens@nstar.com	City of Woburn GIS	12/17/2009	Not sent to date	--	800 Boylston Street, 17th Floor	Boston	MA	02199					X	X		
A1-39	090703	Merrimac Street							--	800 Boylston Street, 17th Floor	Boston	MA	02199					X	X		
A1-40	090208	0 New Boston to B & M	Yes			City of Woburn Assessor's Office; Contacted Jeffrey Stevens	5/14/08; 6/10/08-Initial call/contact	6/17/2008	7008 0150 0000 0128 3384	800 Boylston Street, 17th Floor	Boston	MA	02199		X		X	X	X		
A1-41	150111	0 Commerce Way W													X		X	X	X	X	
A1-42	090106	204 Merrimac Street	Yes	Positive Start Realty Inc	Robert Derosa President Positive Start Realty Inc. 8 Clinton Street Woburn, MA 01801	City Of Woburn GIS	12/17/2009	6/2/2010	7008 0150 0000 0313	8 Clinton Street	Woburn	MA	01801					X	X		
A1-43	040709	229 New Boston Street	Yes	John M. Koster Trustee	Mr. John M. Koster c/o 225-231 New Boston Street LLC 217 New Boston Street P.O. Box 42 Woburn, MA 01801 Phone: (781) 938-5010	City of Woburn Assessors Office and Commonwelath of Massachusetts Corporate Division	8/24/2010	9/8/2010	Not Sent Certified as have agreement in place for other property of same owner	P.O. BOX 42	Woburn	MA	01801					X	X		

TABLE 3.2-1
OWNERSHIP INFORMATION- PROPERTIES REQUIRING ACCESS DURING PRE-DESIGN INVESTIGATIONS
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

DRAFT

Figure ID	MBL	Property Address	Within OU1 Boundary (Yes/No)	Owner Name	Additional Property Information					Mailing Address	City/Town	State	Zip Code	Surface Water Monitoring Station	Surface Water Sampling	Sediment Sampling	Monitoring Well Installation	Groundwater Sampling	Elevation Survey	Soil Boring Exploration	Traverse
					Additional Contact Information	Source	Date Identified	Access Request Certified Mail Tracking #													
								Access Request Sent	Access Request Certified Mail Tracking #												
A1-46	150302	5 Commonwealth Ave	Yes	Chen James (Feng Yow) Trustee Chang- Meih Kao Trustee	Murtha Cullina Joseph Tarby III, Esq (Initial Contact) Partner email: jtarby@murthalaw.com (p) 781-933-5505 (p2) 781-897-4980 Mr. David Platt (Main /Current Contact) Murtha Cullina email: dplatt@murthalaw.com (p) 860-240-6062 Mascon Resident Agent: Jeannie Chen 5 Commonwealth Ave Woburn, MA 01801 (p) 781-938-5800 (f) 781-932-4900	City of Woburn Assessor's Office	12/26/2008	1/29/2009	--	5 Commonwealth Ave	Woburn	MA	01801					X	X		
A!-47	100104	10 Atlantic Avenue	Yes	Mid A Terrace Llc, C/O Howland Development Co	c/o Howland Development 155 West Street Wilmington, MA 01887 Resident Agent: Alfred J. Carolan, Jr. 65 Franklin Street Boston, MA 02110 (p) 877-860-4412	City Of Woburn Assessor Database; Commomwealth of MA Corporate Database; Google	2/24/2011	2/25/2011	7008 0150 0000 0128 3438	155 WEST STREET	WILMINGTON	MA	01887					X	X		

Notes:
MBL = Map/Block/Lot



SITE COORDINATES: 42°30'21"N 71°8'12"W

U.S.G.S. QUADRANGLE: WILMINGTON, MA

HALEY & ALDRICH

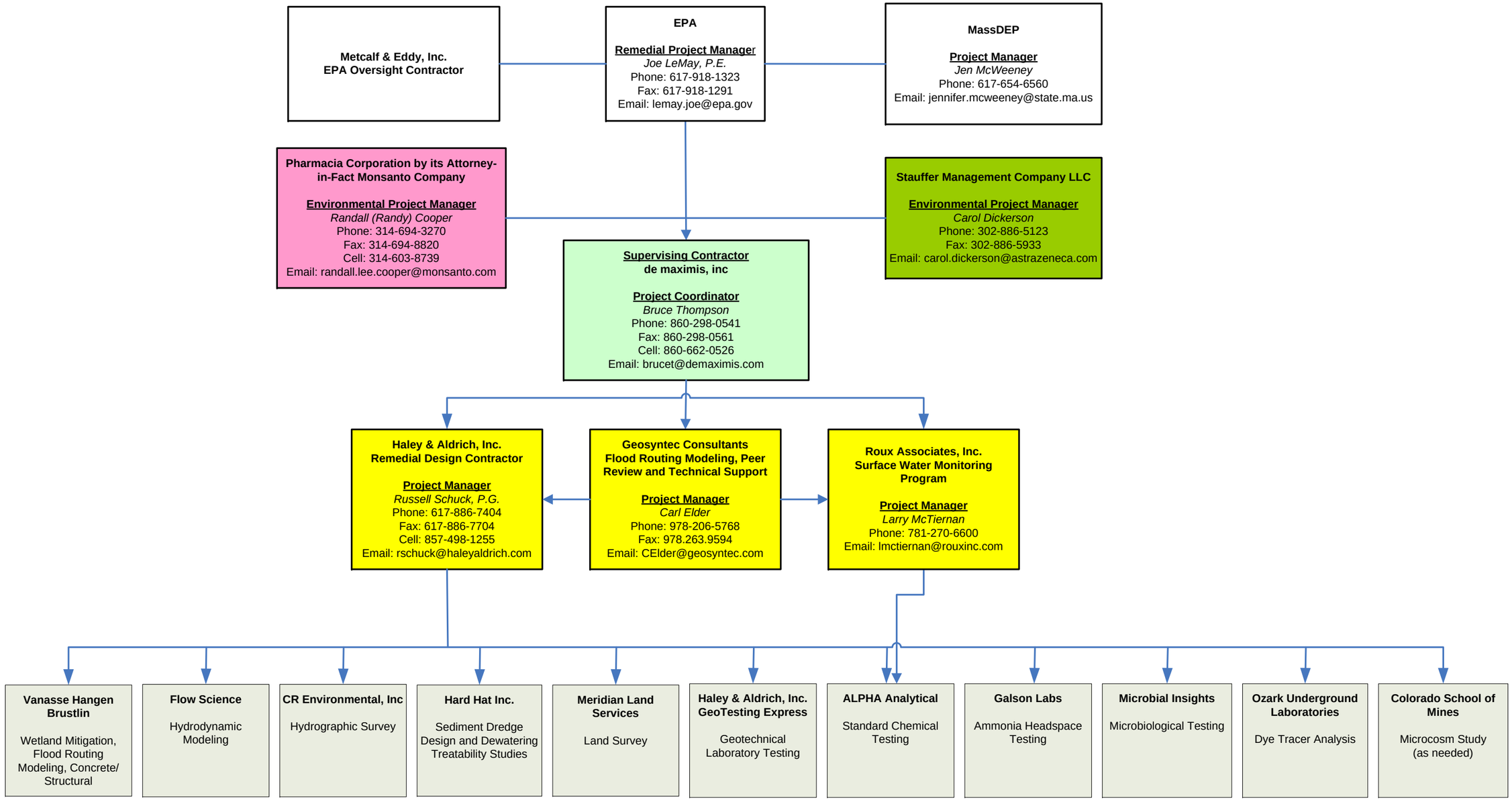
REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

PROJECT LOCUS

SCALE: 1:24,000
MARCH 2011

FIGURE 2.1-1

G:\33020\GLOBAL\GIS\MapProjects\33020-001-033-LOCUS.mxd



G:\33020\030\RDWP\Revised per EPA Feb_2010\Figures\Figure 5.1-1 2010-0316-HAI-RDWPORGCHART-D.vsd

DRAFT

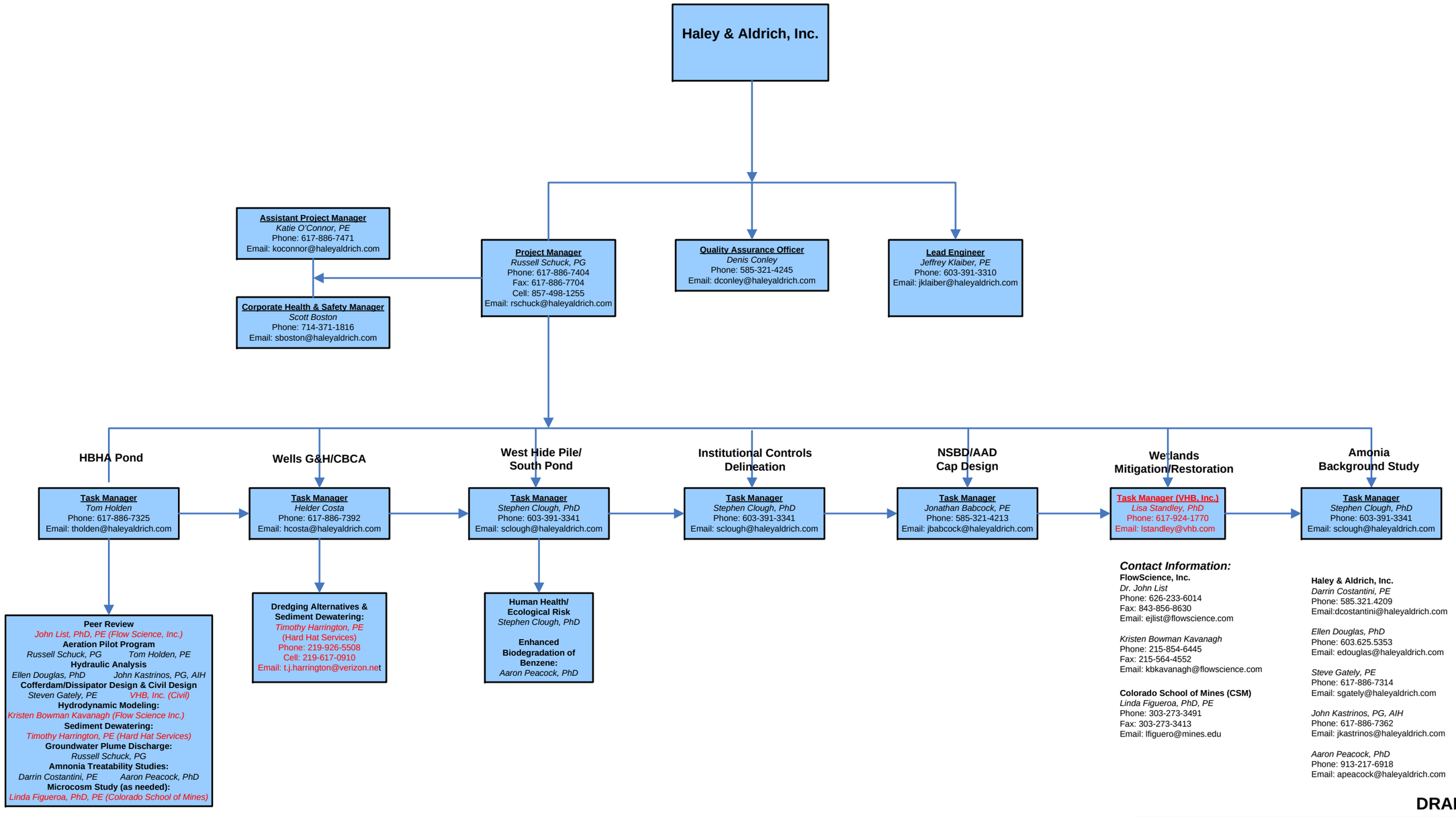
HALEY & ALDRICH

REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

PROJECT ORGANIZATION CHART

SCALE: NONE
MARCH 2011

FIGURE 6.1-1



DRAFT

HALEY & ALDRICH

REMEDIAL DESIGN
INDUSTRI-PLEX SITE OPERABLE UNIT 2
WOBURN, MASSACHUSETTS

HALEY & ALDRICH, INC.
PROJECT ORGANIZATION CHART

SCALE: NONE
MARCH 2011

FIGURE 6.5-1

\\bos\common\33020\031\SMP\Revised per EPA_Feb 2010\Figures\2010-0303-HAI-Project Org Chart_Figure 6.5-1_F.vsd

ATTACHMENT A1

Property Access Figures

Groundwater Sample Location

Surface Water Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
316 NEW BOSTON STREET
Woburn, Massachusetts

MXD: A1-1_316NewBostonSt.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-1

de maximis Data ddms Management Solutions Inc.
1217 Bandana Boulevard North
Saint Paul, Minnesota 55108
Main Phone: (651) 842-4224
www.ddmsinc.com

R:\Projects\DEF\demax-1547\3204-Industri-PlexOU2\DataAnalysis\GISData\Projects\Access Requests - March 2010

Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Surface Water Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
185 NEW BOSTON STREET
Woburn, Massachusetts

MXD: A1-3_185NewBostonSt.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-2

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1217 Bandana Boulevard North
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R:\Projects\DEF\demax-1547\3204-Industri-PlexOU2\DataAnalysis\GISData\Projects\Access Requests - March 2010

Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Groundwater Sample Location

Surface Water Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
195 NEW BOSTON STREET
Woburn, Massachusetts

MXD: A1-3_195NewBostonSt.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-3

de maximis Data Management Solutions Inc.
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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Groundwater Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
MBTA Railroad Row
Woburn, Massachusetts

MXD: A1-4_MBTA_RailRoadRow.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-4

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Exploration Soil Boring

Groundwater Profile Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
74 COMMERCE WAY
Woburn, Massachusetts

MXD: A1-5_74-110-CommerceWay.mxd
Project No.: 3204
Plot Date: 3/4/2011
Arc Operator: JJK
Reviewed by: JL

Figure A1-5

de maximis Data Management Solutions Inc.
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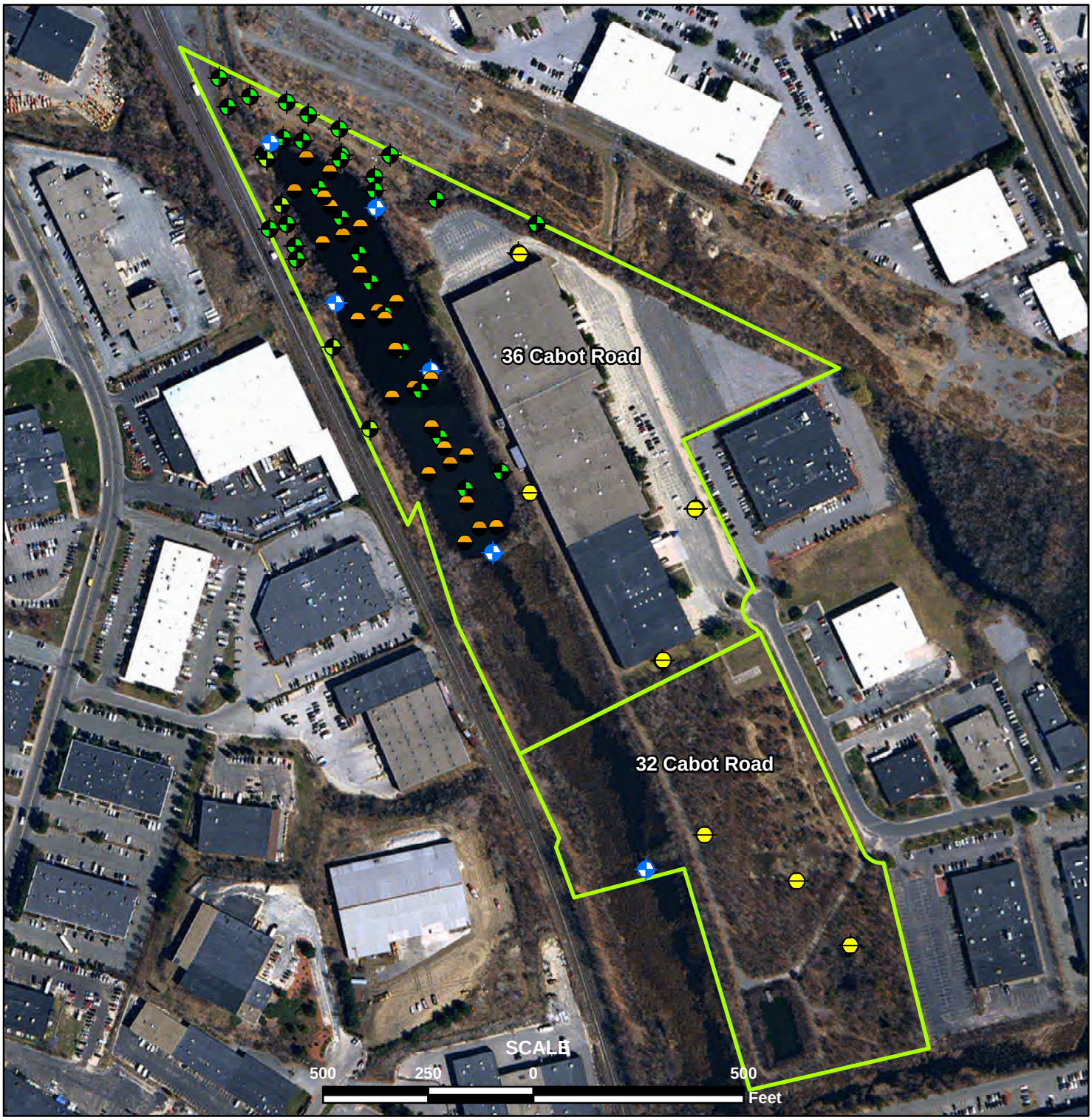
R:\Projects\DEF\demax-1547\3204-Industri-PlexOU2\DataAnalysis\GISData\Projects\Access Requests - March 2010\A1-5_74-110-CommerceWay.mxd

Map adapted from a 2008 aerial photograph and City of Woburn GIS Data



Groundwater Sample Location
Sediment Sample Location
Soil Boring
Surface Water Sample Location
Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
32 & 36 CABOT ROAD
Woburn, Massachusetts

MXD: A1-6_32&36CabotRoad.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-6

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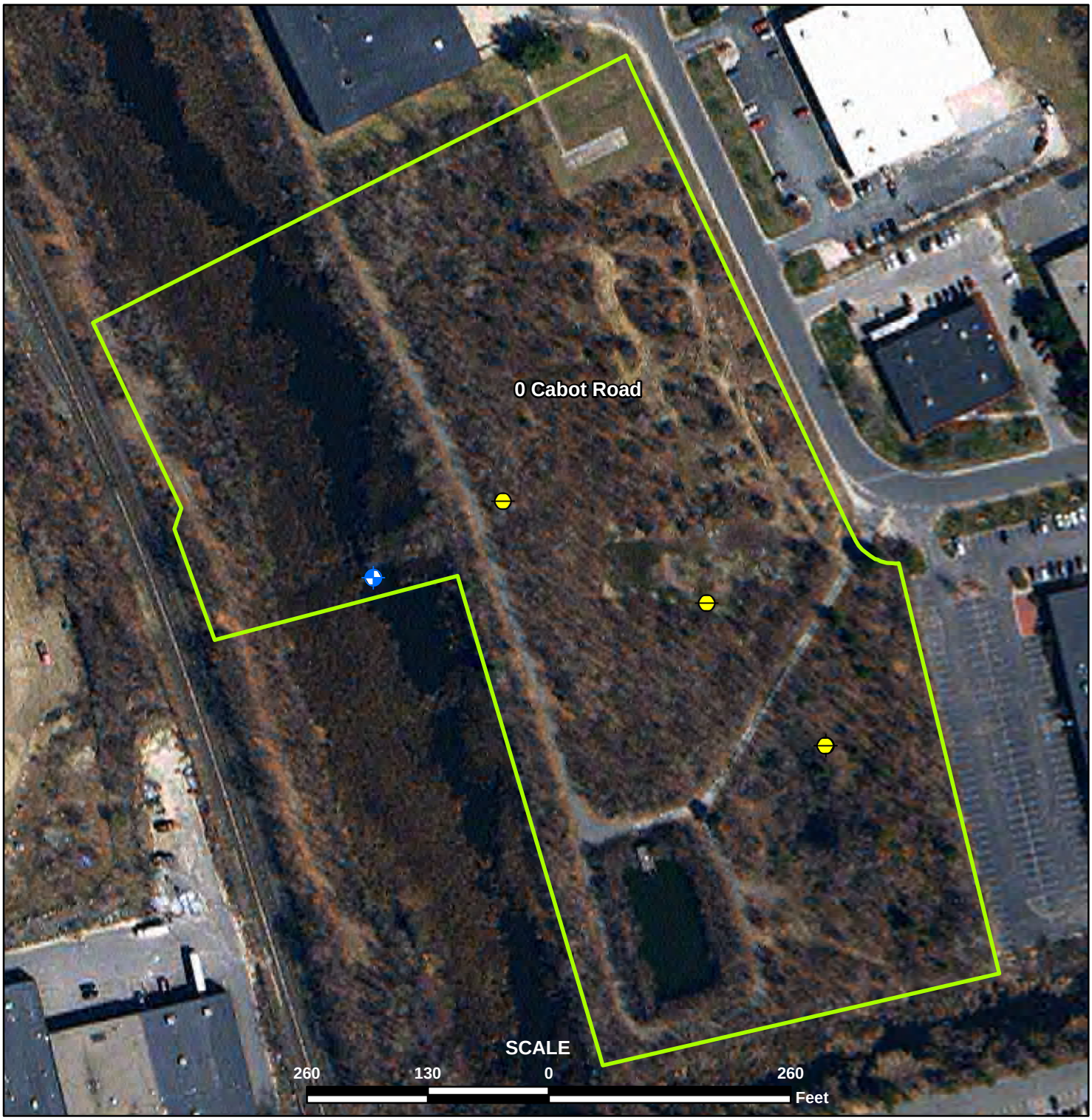
R:\Projects\DEF\demax-1547\3204-Industri-PlexOU2\DataAnalysis\GISData\Projects\Access Requests - March 2010

Map adapted from a 2005 aerial photograph and City of Woburn GIS Data



Soil Boring

Surface Water Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
0 CABOT ROAD
Woburn, Massachusetts

MXD: A1-7_0CabotRoad.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-7

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Groundwater Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
35 CABOT ROAD
Woburn, Massachusetts

MXD: A1-8_35CabotRoad.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-8

de maximis Data Management Solutions Inc.
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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Exploration Soil Boring and Groundwater Profile Sample

Exploration Soil Boring

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
12 CABOT ROAD
Woburn, Massachusetts

MXD: A1-9_12CabotRoad.mxd
Project No.: 3204
Plot Date: 9/17/2010
Arc Operator: JJK
Reviewed by: JL

Figure A1-9

de maximis Data ddms Management Solutions Inc.
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www.ddmsinc.com

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Map adapted from a 2008 aerial photograph and City of Woburn GIS Data

Groundwater Sample Location

Property Boundary

ACCESS REQUEST
34 COMMERCE WAY
Woburn, Massachusetts

Figure A1-10

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

MXD: A1-10_34CommerceWay.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

de maximis Data ddms Management Solutions Inc.
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Main Phone: (651) 842-4224
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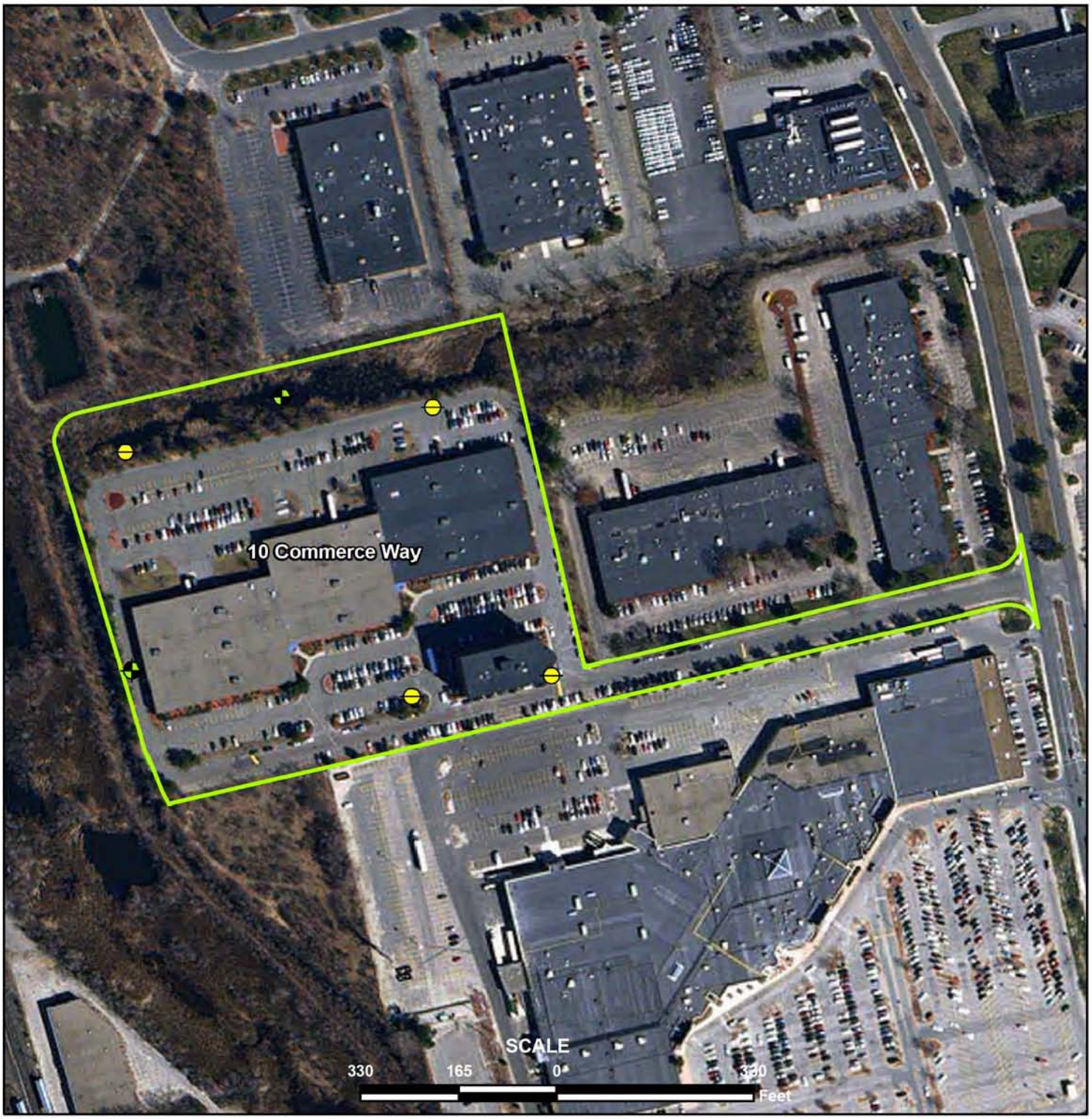
R:\Projects\DEF\demax-1547\3204-Industri-PlexOU2\DataAnalysis\GISData\Projects\Access Requests - March 2010

Map adapted from a 2005 aerial photograph and City of Woburn GIS Data



Groundwater Sample Location

Soil Boring

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
10 COMMERCE WAY
Woburn, Massachusetts

MXD: A1-11_10CommerceWay.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-11

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Exploration Soil Boring

Exploration Soil Boring & Groundwater Profile Sample

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
8 CABOT ROAD
Woburn, Massachusetts

MXD: A1-12_8CabotRoad.mxd
Project No.: 3204
Plot Date: 9/14/2010
Arc Operator: JJK
Reviewed by: JL

Figure A1-12

de maximis Data Management Solutions Inc.
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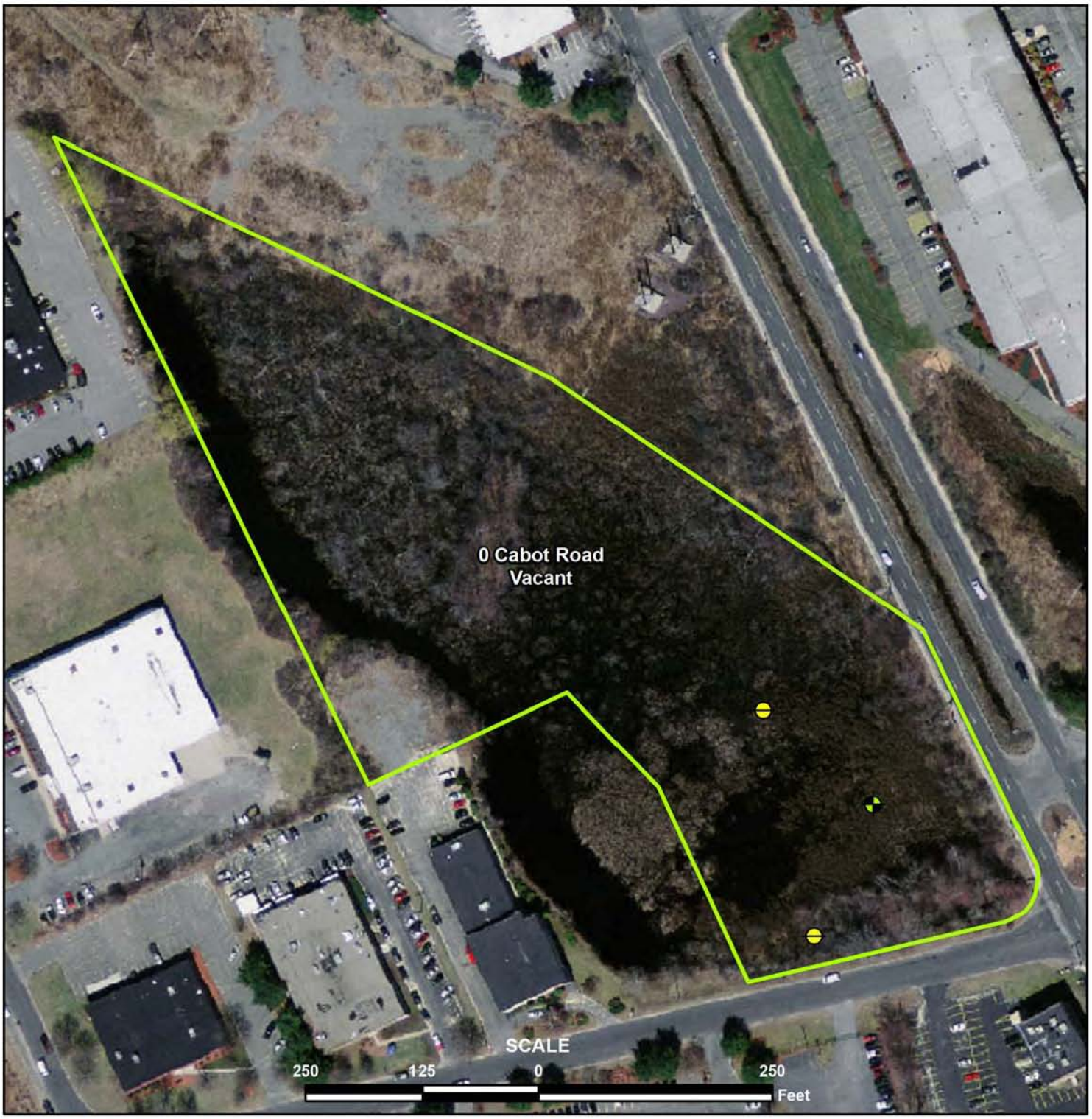
R:\Projects\DEF\demax-1547\3204-Industri-PlexOU2\DataAnalysis\GISData\Projects\Access Requests - March 2010

Map adapted from a 2008 aerial photograph and City of Woburn GIS Data



Exploration Soil Boring & Groundwater Profile Sample

Exploration Soil Boring

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
0 CABOT ROAD-VACANT
Woburn, Massachusetts

MXD: A1-13_0CabotRoad_Vacant.mxd
Project No.: 3204
Plot Date: 8/27/2010
Arc Operator: JJK
Reviewed by: JL

Figure A1-13

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Map adapted from a 2008 aerial photograph and City of Woburn GIS Data

Soil Boring

Property Boundary

ACCESS REQUEST
20 CABOT ROAD
Woburn, Massachusetts

Figure A1-14

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

MXD: A1-14_20CabotRoad.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

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1217 Bandana Boulevard North
Saint Paul, Minnesota 55108
Main Phone: (651) 842-4224
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R:\Projects\DEF\demax-1547\3204-Industri-PlexOU2\DataAnalysis\GISData\Projects\Access Requests - March 2010

Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Groundwater Sample Location

Property Boundary

ACCESS REQUEST
31 CABOT ROAD
Woburn, Massachusetts

Figure A1-15

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

MXD: A1-15_31CabotRoad.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

de maximis Data ddms Management Solutions Inc.
1217 Bandana Boulevard North
Saint Paul, Minnesota 55108
Main Phone: (651) 842-4224
www.ddmsinc.com

R:\Projects\DEF\demax-1547\3204-Industri-PlexOU2\DataAnalysis\GISData\Projects\Access Requests - March 2010

Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Groundwater Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
11 CABOT ROAD
Woburn, Massachusetts

MXD: A1-16_11CabotRoad.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-16

de maximis Data Management Solutions Inc.
1217 Bandana Boulevard North
Saint Paul, Minnesota 55108
Main Phone: (651) 842-4224
www.ddmsinc.com

R:\Projects\DEF\demax-1547\3204-Industri-PlexOU2\DataAnalysis\GISData\Projects\Access Requests - March 2010

Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Soil Boring

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
36 COMMERCE WAY
Woburn, Massachusetts

MXD: A1-17_36CommerceWay.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-17

de maximis Data Management Solutions Inc.
1217 Bandana Boulevard North
Saint Paul, Minnesota 55108
Main Phone: (651) 842-4224
www.ddmsinc.com

R:\Projects\DEF\demax-1547\3204-Industri-PlexOU2\DataAnalysis\GISData\Projects\Access Requests - March 2010

Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Exploration Soil Boring & Groundwater Profile Sample

Exploration Soil Boring

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
20 & 30 COMMERCE WAY
Woburn, Massachusetts

MXD: A1-18_20&30CommerceWay.mxd
Project No.: 3204
Plot Date: 8/30/2010
Arc Operator: JJK
Reviewed by: JL

Figure A1-18

de maximis Data ddms Management Solutions Inc.
1217 Bandana Boulevard North
Saint Paul, Minnesota 55108
Main Phone: (651) 842-4224
www.ddmsinc.com

R:\Projects\DEF\demax-1547\3204-Industri-PlexOU2\DataAnalysis\GISData\Projects\Access Requests - March 2010

Map adapted from a 2008 aerial photograph and City of Woburn GIS Data

Surface Water Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
HALLS BROOK HOLDING AREA
Woburn, Massachusetts

MXD: A1-19_HallsBrookHoldingArea.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-19

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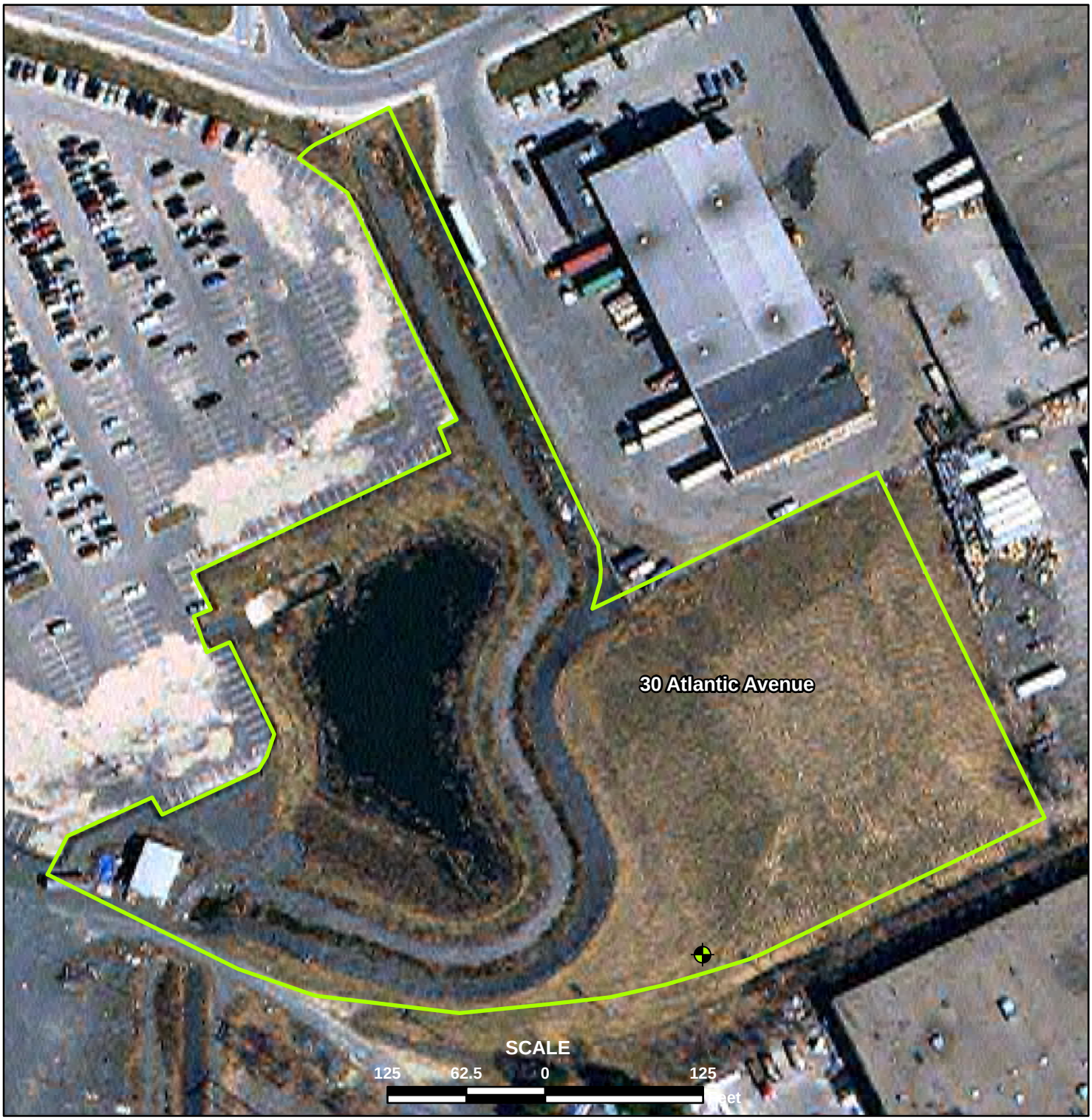
Map adapted from a 2005 aerial photograph and City of Woburn GIS Data



Groundwater Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
30 ATLANTIC AVENUE
Woburn, Massachusetts

MXD: A1-20_30AtlanticAve.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-20

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Soil Boring

Property Boundary

ACCESS REQUEST
0 OLYMPIA AVENUE
Woburn, Massachusetts

Figure A1-21

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

MXD: A1-21_0OlympiaAve.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Property Boundary

ACCESS REQUEST
0 SALEM STREET R
Woburn, Massachusetts

Figure A1-22

MXD: A1-22_SalemStreetR.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Property Boundary

ACCESS REQUEST
280 SALEM STREET R
Woburn, Massachusetts

Figure A1-23

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

MXD: A1-23_280SalemStreetR.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

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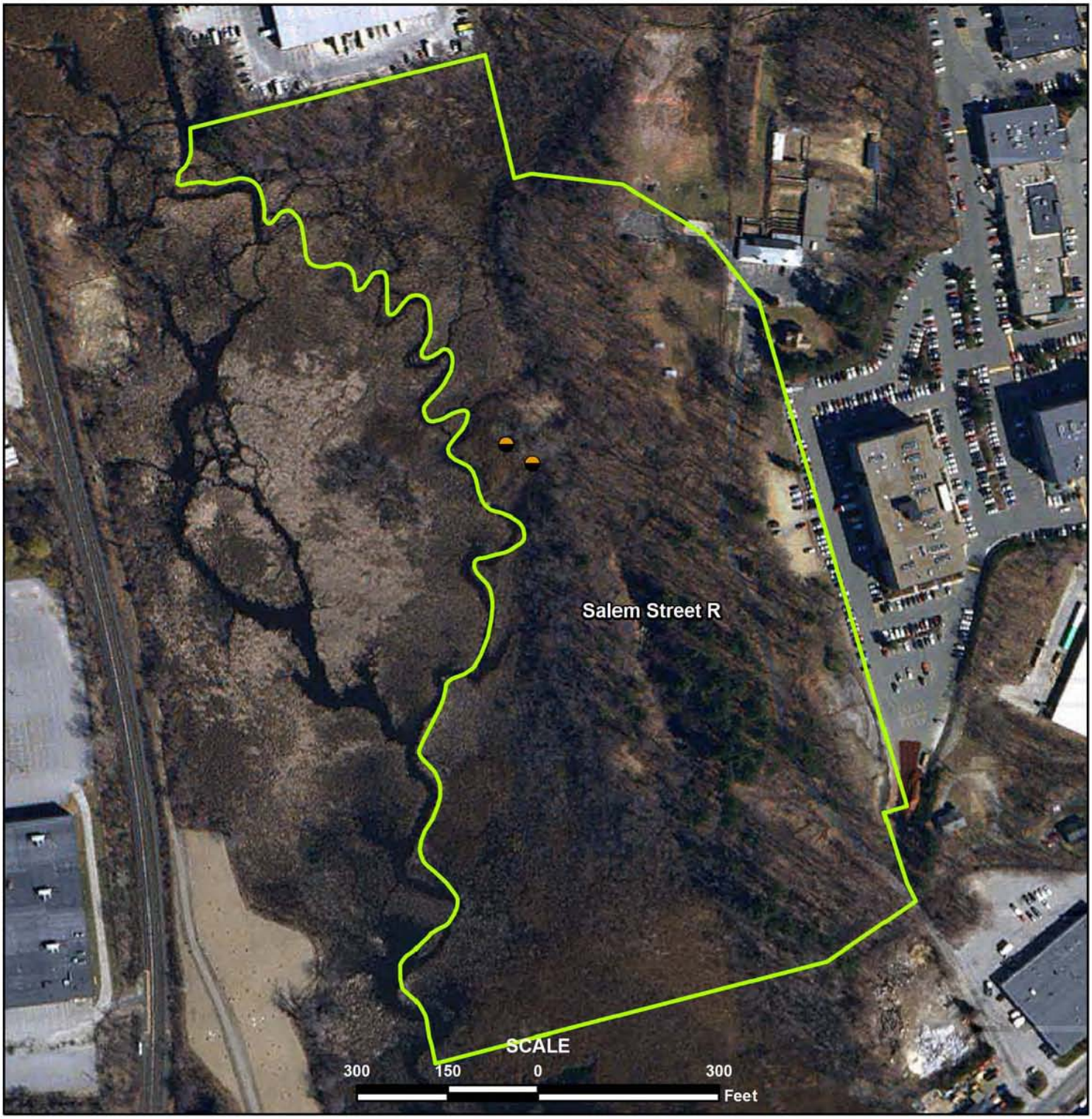
Map adapted from a 2005 aerial photograph and City of Woburn GIS Data



Sediment Sample Location

Property Boundary

ACCESS REQUEST
SALEM STREET R
Woburn, Massachusetts

Figure A1-24

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

MXD: A1-24_SalemStreetR.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Groundwater Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
WOBURN LANDFILL
Woburn, Massachusetts

MXD: A1-25_WoburnLandfill.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-25

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Soil Boring

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
0 MISHAWUM ROAD
Woburn, Massachusetts

MXD: A1-26_0MishawumRoadl.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-26

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Property Boundary

ACCESS REQUEST
280 MISHAWUM ROAD
Woburn, Massachusetts

Figure A1-27

MXD: A1-27_280MishawumRoad.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Groundwater Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
NEW BOSTON STREET R
Woburn, Massachusetts

MXD: A1-28_NewBostonStreetR.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-28

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Groundwater Sample Location

Property Boundary

ACCESS REQUEST
217 NEW BOSTON STREET
Woburn, Massachusetts

Figure A1-29

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

MXD: A1-29_217NewBostonStreet.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Groundwater Sample Location

Property Boundary

ACCESS REQUEST
100 ATLANTIC AVENUE
Woburn, Massachusetts

Figure A1-30

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

MXD: A1-30_100AtlanticAvenue.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Property Boundary

ACCESS REQUEST
315 NEW BOSTON STREET
Woburn, Massachusetts

Figure A1-31

MXD: A1-31_315NewBostonStreet.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Groundwater Profile Sample Location

Temporary Drive-Point Piezometer/Surface Water Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
216 NEW BOSTON STREET
Woburn, Massachusetts

MXD: A1-32_216NewBostonStreet.mxd
Project No.: 3204
Plot Date: 2/28/2011
Arc Operator: JJK
Reviewed by: TM

Figure A1-32

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Map adapted from a 2008 aerial photograph and City of Woburn GIS Data

Property Boundary

ACCESS REQUEST
225 MERRIMAC STREET
Woburn, Massachusetts

Figure A1-33

MXD: A1-33_225MerrimacStreet.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Groundwater Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
0 COMMERCE WAY
Woburn, Massachusetts

MXD: A1-34_0CommerceWay.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-34

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Groundwater Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
0 ATLANTIC AVENUE
Woburn, Massachusetts

MXD: A1-35_0AtlanticAvenue.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-35

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Groundwater Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
41 ATLANTIC AVENUE
Woburn, Massachusetts

MXD: A1-36_41AtlanticAvenue.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

Figure A1-36

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Groundwater Sample Location

Property Boundary

ACCESS REQUEST
210 NEW BOSTON STREET
Woburn, Massachusetts

Figure A1-37

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

MXD: A1-37_210NewBostonStreet.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

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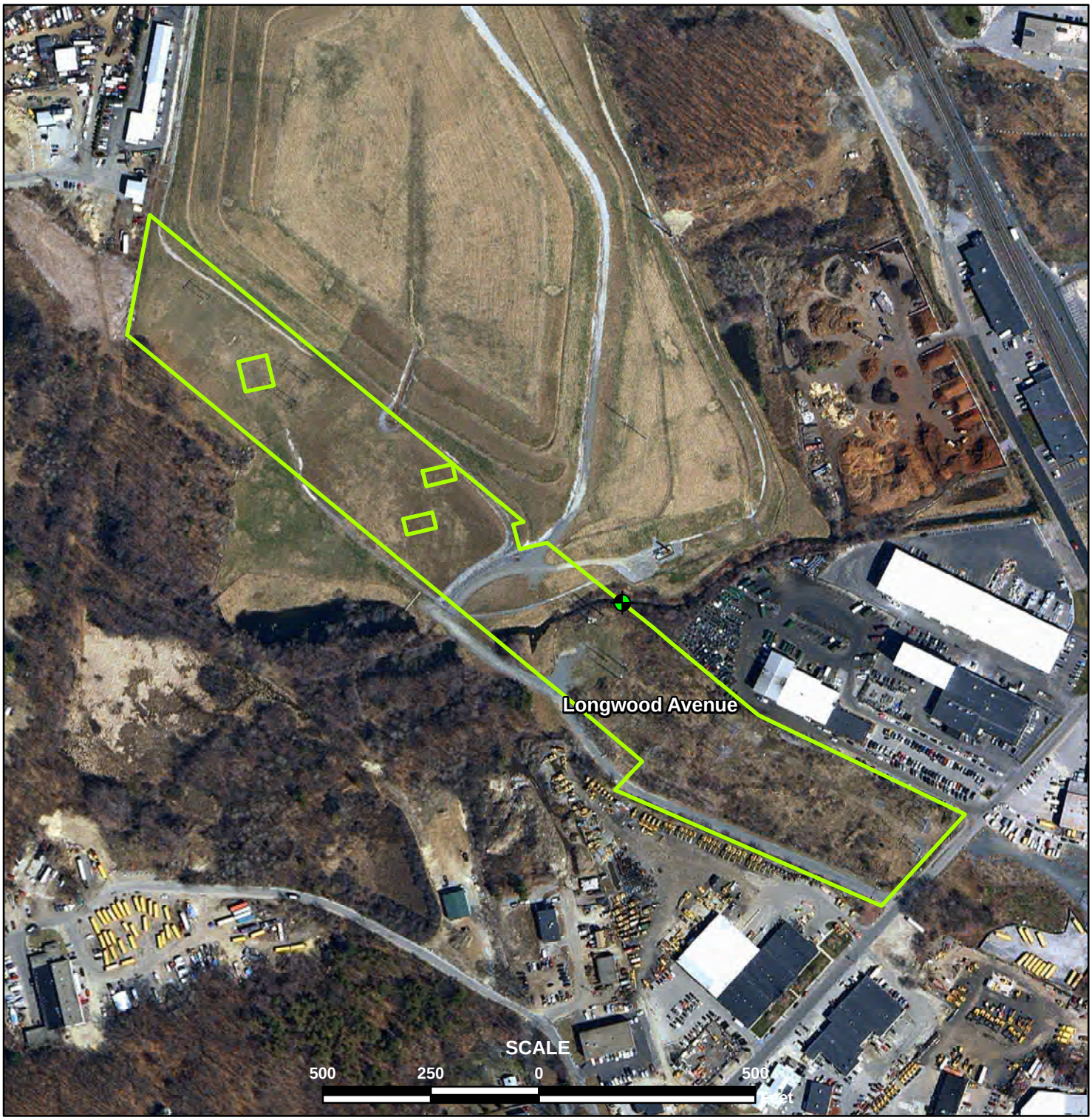
Map adapted from a 2005 aerial photograph and City of Woburn GIS Data



Groundwater Sample Location

Property Boundary

ACCESS REQUEST
LONGWOOD AVENUE
Woburn, Massachusetts

Figure A1-38

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

MXD: A1-38_LongwoodAvenue.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

Groundwater Sample Location

Property Boundary

ACCESS REQUEST
MERRIMAC STREET
Woburn, Massachusetts

Figure A1-39

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

MXD: A1-39_MerrimacStreet.mxd
Project No.: 3204
Plot Date: 17 MARCH 2010
Arc Operator: JJK
Reviewed by: TM

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Map adapted from a 2005 aerial photograph and City of Woburn GIS Data

ATTACHMENT A2

Sample Property Access Letter

Shallow Temp Drive-Point Piezometer

Surface Water Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
0 NEW BOSTON STREET TO B&M
Woburn, Massachusetts

MXD: A1-40_0NewBostonToB&M.mxd
Project No.: 3204
Plot Date: 8/20/2010
Arc Operator: JJK
Reviewed by: JL

Figure A1-40

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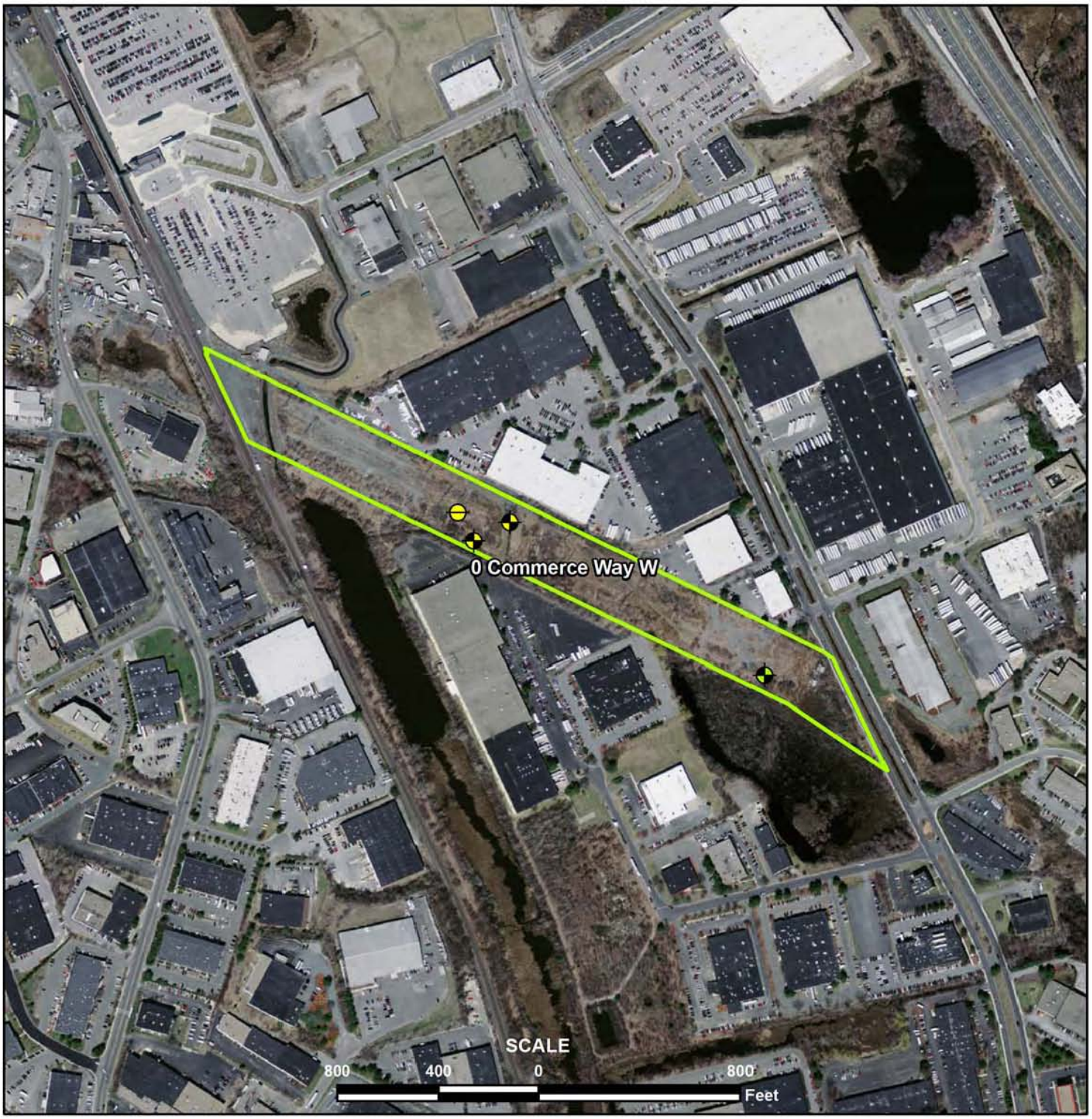
Map adapted from a 2008 aerial photograph and City of Woburn GIS Data



Shallow Temp Drive-Point Piezometer

Exploration Soil Boring & Groundwater Profile Sample

Soil Boring

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
0 COMMERCE WAY W
Woburn, Massachusetts

MXD: A1-41_0CommerceWay.mxd
Project No.: 3204
Plot Date: 8/20/2010
Arc Operator: JJK
Reviewed by: JL

Figure A1-41

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Map adapted from a 2008 aerial photograph and City of Woburn GIS Data

Groundwater Sample Location

Property Boundary

ACCESS REQUEST
204 MERRIMAC STREET
Woburn, Massachusetts

Figure A1-42

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

MXD: A1-42-204MerrimacStreet.mxd
Project No.: 3204
Plot Date: 19 MAY 2010
Arc Operator: JJK
Reviewed by: TM

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Map adapted from a 2008 aerial photograph and City of Woburn GIS Data

Groundwater Profile Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
229 NEW BOSTON STREET
Woburn, Massachusetts

MXD: A1-43_229NewBostonStreet.mxd
Project No.: 3204
Plot Date: 9/2/2010
Arc Operator: JJK
Reviewed by: JL

Figure A1-43

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Map adapted from a 2008 aerial photograph and City of Woburn GIS Data

Groundwater Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
5 COMMONWEALTH AVE
Woburn, Massachusetts

MXD: A1-46_5CommonwealthAve.mxd
Project No.: 3204
Plot Date: 26 APRIL 2010
Arc Operator: JJK
Reviewed by: JL

Figure A1-46

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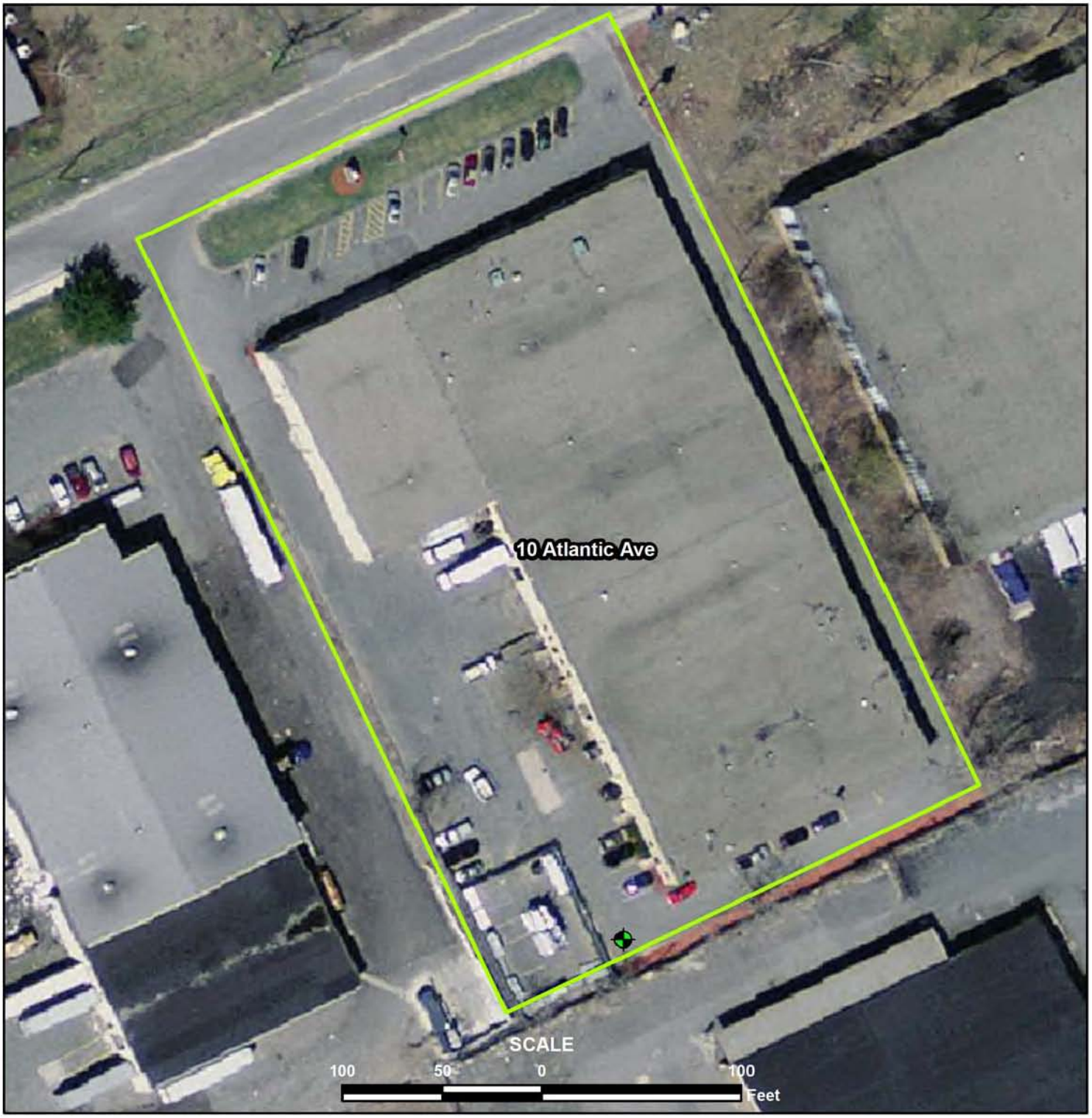
Map adapted from a 2005 aerial photograph and City of Woburn GIS Data



Groundwater Profile Sample Location

Property Boundary

Projection: Lambert Conformal Conic
Coordinate System: MA State Plane (Mainland)
FIPS Zone: 2001
Units: US Feet
Datum: North American Datum (NAD) 83

ACCESS REQUEST
10 ATLANTIC AVE
Woburn, Massachusetts

MXD: A1-47_10AtlanticAve.mxd
Project No.: 3204
Plot Date: 2/24/2011
Arc Operator: JJK
Reviewed by: JL

Figure A1-47

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Map adapted from a 2008 aerial photograph and City of Woburn GIS Data

Date

{Property Owner Name}
{Property Owner Address}
{Property Owner Town/City}

Subject: Access to Property at {Property Address/Town}

Dear Sir/Madame or Mr. / Ms.:

This letter requests access to your property located at {Property Owner Address} to conduct certain investigations in support of the Remedial Design / Remedial Action (RD/RA) at the Industri-Plex Operable Unit Two (OU-2) Superfund Site (the "Site") in Woburn, MA. The City of {Property Owner Town/City} public records indicate that the property is defined as {Property Parcel ID}.

de maximis inc. has been selected by Pharmacia Corporation f/k/a Monsanto Company by its Attorney-in-Fact Monsanto Company and Stauffer Management Company LLC (the "Companies") to serve as Project Coordinator and Supervising Contractor for the RD/RA activities at the Site.

The Companies have entered into a Consent Decree (CD) with the United States Environmental Protection Agency ("EPA") pursuant to which remedial response actions at the Site will be designed and implemented. The CD was lodged on February 27, 2008. RD related activities are anticipated to take at least two years.

Information on the history of the Site can be found at
http://www.epa.gov/region1/superfund/sites/industriplex

Pursuant to Paragraph 26 of the CD, if access to any property is necessary to perform investigation or response actions, an access agreement must be obtained that grants access to the Companies, their authorized representatives (meaning contractors retained by the Companies, which include ***de maximis, inc***., Roux Associates, Haley & Aldrich, Inc., and Geosyntec Consultants), EPA and the Commonwealth of Massachusetts, as well as their officers, employees, agents, contractors, consultants, and other authorized representatives for purposes of implementing and overseeing the implementation of the work to be performed under the CD. The specific work will be detailed in project work plans that will be reviewed and approved by EPA in consultation with the Massachusetts Department of Environmental Protection (MassDEP). The purpose of the RD is to collect samples from various media for laboratory analysis, to support the design process.

Prior environmental studies conducted at the Site have included {list out activities, if any} on your property. We currently anticipate that completing the RD will require the following activities on your property:

- land survey;
- installation of surface water monitoring stations:
- surface water monitoring;
- collection of sediment samples;
- exploration soil borings and collection of soil samples; and
- installation of temporary or permanent groundwater monitoring wells and collection of groundwater samples.

The RD process will proceed in a phased manner, starting with the activities detailed below. The need for remedial action activities on your property will be determined based on the results of the RD process. We will contact you again at the conclusion of the RD process to discuss whether the RD process has identified specific activities needed on your property.

{Property Owner} should know that at times during RD activities, a representative from de maximis, one or several of the contractor firms named above or EPA may be on-site to observe and oversee these activities.

At this time, we are requesting permission to access your property to conduct the following activities:

Land Survey

Land survey is a necessary, ancillary task to provide survey control and a base map for design development. The land survey task will involve the following major elements:

- Locate visible Site features, including, roadways, paths, drainages, culverts, fence, and other features
- Subsurface utility information will be compiled from field observations/measurements and available record information.

This activity will utilize one, 2-person team, a vehicle and the necessary field instruments to conduct the land survey. The team will be wearing regular work clothes with high visibility vest. This activity will take up to one to two days to complete.

Surface Water Sampling

This activity will be performed by a 2-person team. Surface water sampling equipment will consist of one vehicle, coolers containing sample bottles, and field instruments. The team will be wearing regular work clothes, hip waders (if needed) and protective gloves. This activity will be conducted monthly for two years.

Sediment Sampling

This activity will be performed by a 2-person team. Equipment used for the collection of sediment samples include one vehicle, coolers containing sample bottles, stainless steel spoons and bowls, and field instruments. The team will be wearing regular work clothes, hip waders and protective gloves. This activity will take one week to complete.

Monitoring Well Installation

The Companies will be installing {# of Wells} as shown on the attached figure. This activity will be performed by one field geologist and a two person drilling team. Drilling equipment will consist of a drill rig, a geoprobe and/or hand driven monitoring point, two support vehicles, coolers containing sample bottles, stainless steel spoons and bowls, and field instruments. The team will be wearing regular work clothes with protective gloves. This activity will take one to two weeks to complete.

Monitoring Well Elevation Survey

This activity will utilize one, 2-person team, a vehicle and a water level measuring device. The monitoring well survey will consist of locating and opening {# of Wells} existing wells and documenting observations. Collecting groundwater elevations will consist of lowering the water level measurement device into the existing monitoring well to measure the depth to groundwater. The team will be wearing regular work clothes with protective gloves. This activity will take one to two hours to complete.

Groundwater Sampling

This activity will also consist of one, 2-person team, a vehicle and an array of small equipment. The equipment list will consist of a pumping apparatus, coolers with sample bottles, poly tubing, instrumentation to measure groundwater quality parameters, water level meter, a tool box, airlines and regulators and a bottle of nitrogen (inert gas - non-flammable). The nitrogen bottle will be used in place of a generator to limit intrusive noise. The team will be wearing regular work clothes with protective gloves. This activity will take two to three days to complete.

Exploration Soil Boring

The Companies will be installing {# of Borings} as shown on the attached figure. This activity will consist of one field geologist and a two person drilling team. Drilling equipment will consist of a drill rig, a geoprobe and/or hand driven monitoring point, two support vehicles, coolers containing sample bottles, stainless steel spoons and bowls, and field instruments. This activity will take two to three days to complete.

General Assumptions

- Working hours are from 8am to 5pm Monday through Friday.
- de maximis will provide {Property Owner} one week notice prior to start of any activity on-site.
- All investigative derived waste (IDW) (i.e., soil, groundwater) will be removed from your property and properly disposed.

de maximis and other contractors retained by the Companies will be responsible for the health and safety of their workers while on your property, and will provide you with certificates of insurance at the time we notify you of our intent to start work. In addition, de maximis will maintain the work areas in an appropriate manner, and will coordinate with you or your representative to address any necessary restoration of our work locations.

With respect to the results of any testing performed at your property, de maximis will provide you with the sampling results after EPA review and we will make ourselves available to discuss with you the results of tests conducted on your property. Attached please find a draft agreement for your review and execution, and a figure showing the location of work to be done on or in the vicinity of your property.

Thank you in advance for your cooperation in helping ***de maximis, inc.*** with this program at the Site. A representative of de maximis will contact you in the next week to discuss any questions you may have regarding this work. In the meantime, if you have any questions in connection with this matter, please contact me at (860) 298-0541.

Sincerely,

Bruce Thompson
de maximis, inc.
Project Coordinator

CONSENT FOR ACCESS TO PROPERTIES

In signing this agreement, {Property Owner} hereby licenses and authorizes the Companies, their contractors, EPA and the Commonwealth of Massachusetts, to access portions of the property (excluding buildings) located at {Property Owner Address} in {Property Owner's Town} for purposes relating to the Consent Decree (CD) with the United States Environmental Protection Agency ("EPA") pursuant to which remedial response actions at the Site will be designed and implemented. The CD was lodged on February 27, 2008.

Name: _____

Address of Properties:
City:
State:

I consent that officers, employees, contractors, and authorized representatives of the United States Environmental Protection Agency (USEPA), Commonwealth of Massachusetts and the Companies, may enter upon and have continued access to my property for the purposes of conducting certain work under the terms and as described in the attached letter to me from Bruce Thompson dated {date of letter}.

I realize that these actions are undertaken pursuant to response and enforcement responsibilities under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA).

This written permission is given by me voluntarily and with knowledge of my right to refuse.

Name: _____

Title: _____

Firm: _____

Date Authorized: _____

ATTACHMENT A3

Haley & Aldrich Operating Procedures for Decontamination and Investigation Derived Waste

OPERATING PROCEDURE: (OP3027)

DECONTAMINATION PROCEDURE

LEVEL II (Interim)

Haley & Aldrich

PREPARATION AND APPROVALS

VERSION	AUTHORED/DATE	REVIEWED / DATE	REVIEWED / DATE	REVIEWED / DATE	APPROVED / DATE
Ver. 0.1	R. Selover: 04/05/08	DMC 04/06/08	JBB 04/07/08		

Total Pages: 6

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TABLE OF CONTENTS

		Page
LIST OF TABLES		**i**
LIST OF FIGURES		**i**
1.	**PURPOSE**	**1**
2.	**EQUIPMENT & SUPPLIES**	**1**
3.	**PROCEDURE**	**1**
3.1	Decontamination of Sampling Equipment	2
3.2	Decontamination of Monitoring Equipment	3
3.3	Disposal of Wash Solutions and Contaminated Equipment	3
APPENDIX A – References		A-1

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OPERATING PROCEDURE: OP3027

DECONTAMINATION PROCEDURE

1. PURPOSE

This procedure describes decontamination of field equipment potentially exposed to contaminants. Proper decontamination is required to minimize the potential for cross-contamination that would compromise sample quality. The degree of decontamination required will be dependent on the nature of the activity, equipment used and on the amount of exposure to contaminants.

2. EQUIPMENT & SUPPLIES

Decontamination equipment and solutions are generally selected based on ease of decontamination and disposability.

- Polyethylene sheeting;
- Metal racks to hold deconned equipment;
- Soft-bristle scrub brushes or long-handle brushes for removing gross contamination and scrubbing with wash solutions;
- Large galvanized wash tubs, stock tanks, or wading pools for wash and rinse solutions;
- Plastic buckets or garden sprayers for rinse solutions;
- Large plastic garbage cans or other similar containers lined with plastic bags can be used to store contaminated clothing;

Contaminated liquids and solids should be segregated and containerized in DOT-approved plastic or metal drums, appropriate for offsite shipping/disposal if necessary.

3. PROCEDURE

Decontamination activities must be performed in a controlled contaminant reduction area outside any exclusion zones established on the site. Care must be taken to minimize the potential for transfer of contaminated materials to the ground or onto other materials. Regardless of the size or nature of the equipment being decontaminated, the process will utilize a series of steps that involve removal of gross material (dirt, grease, oil etc.), washing with a detergent, and multiple rinsing steps. In lieu of a series of washes and rinse steps, steam cleaning with low-volume, high-pressure equipment (i.e. steam cleaner) is acceptable.

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Drill rigs, backhoes and other exploration equipment must be decontaminated prior to initiating site activities, in-between exploration locations to minimize cross- contamination potential, and prior to mobilizing off site after completion of site work. Heavy equipment is generally decontaminated with a combination of steam-cleaning equipment and manual scrubbing. Particular attention should be paid to parts in direct contact with contaminants, e.g. shovels, tires, augers, drilling decks, etc.

A decontamination pad must be constructed that is appropriate for the size and type of equipment being decontaminated for control and containerization of all decontamination fluids.

At a minimum, the decontamination pad will have the following elements:

- an impermeable barrier capable of containing decontamination fluids;
- a low point where fluids will collect and can be pumped into appropriate containers;
- durability to withstand equipment such as vehicle and foot traffic;
- appropriate ancillary equipment such as racks to place decontaminated equipment to drain without further exposure to contaminated fluids;
- Labels to alert personnel as to the potential presence of contaminated materials.

3.1 Decontamination of Sampling Equipment

All equipment that comes in contact with the sampling media (i.e. Surface Water, Sediment, etc.) must be decontaminated as specified below. An alternative approach is to have multiple pieces of equipment, and a centralized decontamination location where the procedures below can be reproduced in a grouped setting.

Stainless steel samplers used for the collection of samples for chemical analysis will be cleaned prior to use and between each sampling point in accordance with the following procedure:

- brush with soapy (phosphate-free soap) water; and
- rinse with de-ionized water provided by the laboratory.

The peristaltic pump used for surface water purging and sampling and/or pond sediment sampling will be decontaminated prior to use and between each location according to the following procedures:

- spray the discharge tubing, with de-ionized water (provided by the laboratory) to rinse off particulates;
- pump soapy (phosphate-free soap) water solution through the pump and;
- circulate potable water through the pump and discharge tubing until all traces of soap are gone; and
- pump de-ionized water (provided by the laboratory) through the pump and tubing.

NOTE: If the tubing is dedicated to each monitoring location and disposed of after sampling is completed, decontamination will be not required.

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3.2 Decontamination of Monitoring Equipment

Because monitoring equipment is difficult to decontaminate, care should be exercised to *prevent* contamination. Sensitive monitoring instruments should be protected when they are at risk of exposure to contaminants. This may include enclosing them in plastic bags allowing an opening for the sample intake. Ventilation ports should not be covered.

If decontamination is required, wipe the instruments down with detergent-wetted wipes or sponges, and wiped with de-ionized water-wetted wipes or sponges.

3.3 Disposal of Wash Solutions and Contaminated Equipment

All decontamination fluids such as wash water, rinsates, solids and materials used that cannot be effectively decontaminated (such as polyethylene sheeting) will be containerized and labeled with an indelible marker as to contents and date of placement in the container, and any appropriate stickers required. Storage of decontamination wastes on site will not exceed 90 days under any circumstances. Characterization of wastes for proper disposal will be performed immediately upon completion of the investigation to minimize storage time on site.

Please refer to Haley & Aldrich Operating Procedure OP3028-Investigation Derived Wastes for a complete discussion of handling and disposal of these materials.

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APPENDIX A
REFERENCES

ASTM D5088 - Practice for Decontamination of Field Equipment Used at Non-Radioactive Waste Sites

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OPERATING PROCEDURE: OP3028

INVESTIGATION DERIVED WASTES

LEVEL II (Interim)

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PREPARATION AND APPROVALS

VERSION	AUTHORED/DATE	REVIEWED / DATE	REVIEWED / DATE	REVIEWED / DATE	APPROVED / DATE
Ver. 0.1	R. Selover: 04/05/08	DMC 04/06/08	JBB 04/07/08		

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TABLE OF CONTENTS

		Page
LIST OF TABLES		**i**
LIST OF FIGURES		**i**
1.	**PURPOSE**	**1**
2.	**EQUIPMENT & SUPPLIES**	**2**
3.	**PROCEDURE**	**2**
	3.1 Waste Characterization Procedure	4
APPENDIX A – References		A-1
APPENDIX B – Forms		B-1
APPENDIX C – Glossary		C-1

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OPERATING PROCEDURE: OP3028

INVESTIGATION DERIVED WASTES

1. PURPOSE

This procedure applies to the management and characterization of investigation soils and/or groundwater as required in accordance with the Remedial Design Work Plan. In some areas and/or sections within the Site it is permitted to return soil cuttings/test pit soils and groundwater to the source area. In other areas it may not be practical to return cutting/soils to their origin, and they are better handled by this characterization/disposal procedure. These practices are consistent with USEPA procedure for IDW at RCRA facilities and CERCLA sites (reference 1, 2, 3). Typically, investigative derived wastes are dealt with following "Best Management Practices"; and are not handled under RCRA regulations until proven to be listed and/or identified as characteristically hazardous waste (reference 1). Investigative soils and groundwater often cannot be considered a listed waste due to the lack of generator knowledge concerning chemical source, chemical origin, and timing of chemical introduction to the subsurface. Consequently, waste sampling and characterization is performed to determine if the wastes exhibit a characterization of hazardous waste. Once the IDW characterization is complete, RCRA regulations apply if determined hazardous; if determined to be non-hazardous solid wastes, best management /solid waste handling practices apply. The disposal of soil cuttings, test pit soils and/or purged groundwater must be reviewed on a case by case basis prior to initiation of field activities. Two scenarios typically exist:

1. No Disposal/No Containerization Required - When sufficient Site information exists that allows investigative soils, cuttings, and/or purged groundwater to be placed back into the borehole or spread on the ground surface. This may be employed when it is believed that the area of concern will require a final remedy involving in-situ treatment, or an off-Site disposal removal effort is likely required, or no chemical impact is evident; and the material replacement does not pose a health threat or contaminate new areas.

   Alternatively, no information may be available in the area of activity or investigation, and impacted media/soils are identified. Activities such as new construction and /or maintenance works below grade may encounter environmental conditions that were unknown. Again it is logistically practical to complete the activity, employ health and safety measures appropriate to the conditions identified, and evaluate the extent and magnitude of the impact. Timely notification to the client would be required to formulate a course of action, and collect chemical samples from the area of concern (if warranted). Investigative works maybe conducted in areas where it is not known if impacted soils/groundwater exist, and the presence of hazardous constituents is not known. Again RCRA guidance permits Best Management Practices of keeping media on-Site (reference 2).

2. Disposal Required/Containerization Required – When sufficient facility and/or Site information regarding the investigative Site conditions warrant that all materials handled will be contained and disposed of.

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Investigation results may dictate that all IDW be recovered and contained. This approach may be performed to facilitate quick closure/allow access quickly back into the investigative area regardless of environmental impact or not.

If a known listed hazardous and/or characteristically hazardous waste/contaminated environmental media is being handled, then handling must be performed in accordance with RCRA Subtitle C (reference 2).

The following procedure describes the techniques for characterization of investigation derived waste (IDW) for disposal purposes. IDW may consist of soil cuttings (augering, boring, well installation soils, test pit soils), rock core or rock flour (from coring, reaming operations), groundwater (from well development, purging and sampling activities), personal protective equipment (PPE), and disposal equipment (DE).

2. EQUIPMENT & SUPPLIES

- Sample spoons, trowel, auger.
- Sample mixing bowl.
- Sampling bailer, or pump.
- Sample glassware.
- Ratchet to open drums.

3. PROCEDURE

The procedures for handling and characterization of field activity generated wastes are:

1. Soil/Rock Cuttings - Soils removed from boring activities and well construction tasks (including rock flour from bedrock coring) will be contained within an approved container, suitable for transportation and disposal.

2. Once placed into the approved container, any free liquids (i.e., groundwater) will be poured off for disposal as waste fluids. No free liquid as determined by the "paint filter test" (reference 5) shall be present.

3. Contained soils will be screened for the presence of Volatile Organic Compounds VOCs), using a Flame-ionization detector (FID); this data will be logged for future reference.

4. Once screened, full and closed; the container will be labeled in accordance with the Project Specific label and placed into the temporary container storage area. At a minimum, the following information will be shown on each container label: date and time of filling/generation, Site name, source of soils

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(i.e., borehole or well), and Site contact information. If necessary, the exterior of the container will be cleaned to remove any lose soil/cuttings.

5. Prior to container closure, representative samples from the containers will be collected for waste characterization purposes and submitted to the project laboratory.

6. Alternatively, it maybe practical to collect waste characterization samples as the containers are filled. The waste characterization sampling scheme will be dictated by the Remedial Design Work Plan and establish the volume of soils required for analysis (depending on parameters required), the number of containers considered representative, the homogenization procedure, volatile analysis collection procedure (if required), and preparation handling requirements. Typically at a location where an undetermined site specific parameter group exists, sampling and analysis may consist of the full RCRA Waste Characterization (ignitability, corrosivity, reactivity, toxicity), or a subset of the above based upon data collected, historical information, and generator knowledge.

7. Groundwater from well construction development, purging, and sampling requires disposal and shall be contained.

   Containment may be performed in 55-gallon drums, tanks suitable for temporary storage (i.e., nalgene) or if large volumes of groundwater are anticipated, tanker trailers (5,000 to 10,000 gallons ±), or drilling "Frac" tanks may be utilized
   (20,000 gallons ±). In all cases the container/tank used for groundwater storage must be clean before use such that cross-contamination does not occur.

8. Decontamination Water/Fluids - Decon water and/or fluids will be segregated, contained, and disposed accordingly.

   Decontamination waters may be disposed of with the contained groundwater once analytical results have been acquired. Depending on the analytical results, it may be appropriate to discharge the decontamination water to the Publicly Owned Treatment Works (POTW); or discharge to an On-Site treatment system; or off-Site for treatment.

9. Personal Protective Equipment (PPE) – A number of disposal options exists for spent PPE generated from investigation tasks. The options typically employed are:

   a. Immediately disposed of within on-site dumpster/municipal trash; or
   b. If known to be contaminated with RCRA hazardous waste, dispose off-Site at a RCRA-Subtitle C facility; or alternatively decontaminate PPE/DE and dispose on-site within dumpster/municipal trash.

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3.1 Waste Characterization Procedure

The Remedial Design Work Plan will identify the appropriate sampling strategy and analytes required to determine the IDW characteristics and disposal requirements. USEPA SW-846 (reference 4) describes the rationale for sampling plan development and sampling procedures. Generally random sampling and preparation of a composite sample of the media is employed for most investigative programs. Often a minimum of 4 representative samples is required to gain valid waste characteristic data to determine the disposal option applicable (if statistics are employed). Sampling procedures for IDW are:

Solid Wastes –Grab sampling using pre-cleaned sample spoons from bulk piles, lugger boxes, or as drums are being filled. In some instances when sufficient media mixing is evident, drum sampling from a random number of drums by accessing only the top solids may be permitted. In other instances where stratification is evident, a sample trowel/hand auger or device to collect from the entire vertical profile is required. Typically, a composite sample(s) from representative areas of the container(s) is homogenized and submitted for analysis. If VOCs are being evaluated, compositing and homogenization is not permitted. Individual grab samples are typically required.

- Waste Waters – Grab sampling techniques using pre-cleaned bailers or sampling pumps are typically employed. Waters in bulk are typically sampled once using a bailer or pump. The Remdial Design Work Plan will outline the appropriate sample frequency and analytes necessary to adequately characterize the contained waters. Facility sewer discharge permit parameters will be evaluated when disposal to the POTW is being considered.

- PPE – Depending on presence of contamination with RCRA hazardous waste, use D) above.

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APPENDIX A
REFERENCES

1. USEPA RCRA - Guidance and Policies: Management of Remediation Waste Under RCRA (October 1998).

2. USEPA RCRA - Management of Contaminated Media (October 1998).

3. USEPA CERCLA Guidance (Options Relevant to RCRA Facilities): Guide to Management of Investigation - Derived Wastes (January 1992).

4. USEPA Office of Solid Waste- SW846 Chapter 9 Sampling Plan, Chapter 10 Sampling Methods (September 1986).

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APPENDIX B
FORMS

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DRUM WASTE RECORD

Page of

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP	
CONTRACTOR		DATE	

Drum Number	Boring Identification	Drill Cuttings/Wash Water		Date Generated	Comments
		Solid	Liquid		

Location of Drums:

* Please attach a site plan showing the drum locations

Notes:

APPENDIX C
GLOSSARY

DE – Disposal Equipment
IDW – Investigation Derived Wastes
PPE – Personal Protective Equipment
POTW – Publicly Owned Treatment Works
USEPA – United States Environmental Protection Agency
RCRA – Resource Conservation and Recovery Act
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act

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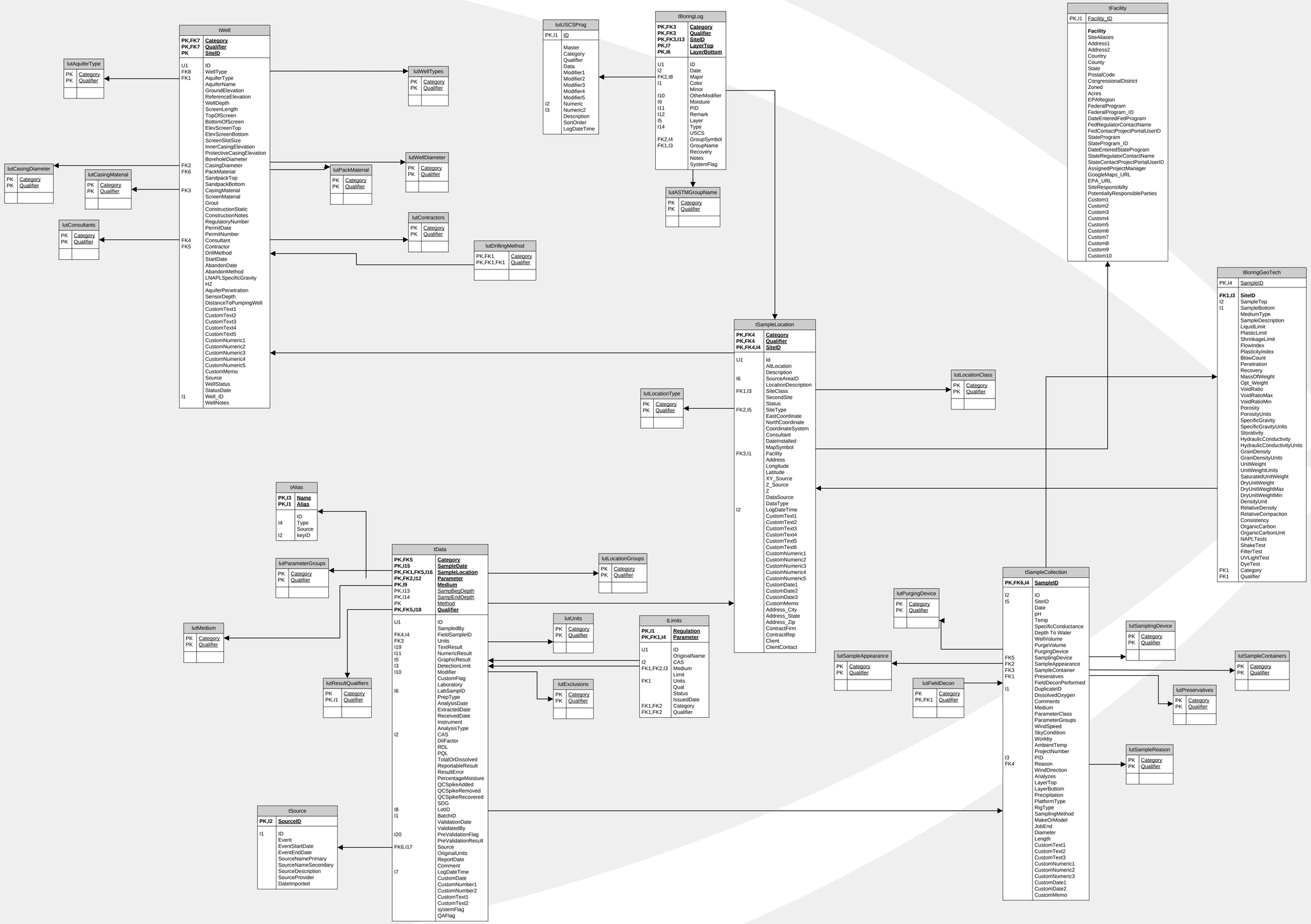
ATTACHMENT A4

GEMS Relational Database Model Flow Chart

Geographic Environmental Management System (GEMS) v6 Relational Database Model



Notes:

All look up tables (lut) are stored in one master table referred to as tSystem (shown below). They have been broken out here so that their relationship with the child tables might be better illustrated.

Storing all look up tables in one master system table has several administrative advantages and is primarily done for database optimization.

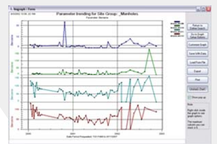
tSystem	
PK,I3	ID
	Master
I1	Category
I8	Qualifier
I2	Data
I4	Modifier1
I5	Modifier2
	Modifier3
	Modifier4
	Modifier5
I6	Numeric
I7	Numeric2
	Description
	SortOrder
	LogDateTime

GEMS, or Geographic Environmental Management System, was developed by Summit Envirosolutions, Inc. Shown here is the relational database model of one of two databases which comprise the GEMS program.

The other database contains the user interfaces (shown below) which allow a user to easier interact with the data structure shown here. The interface also provides another level of data protection in that it maintains referential database integrity and has user control levels where users can be precluded from changing or importing data.

Many labs have integrated the GEMS v6 EDD (Electronic Data Deliverable) format into their LIMS export routines.

The GEMS user interface was developed in Microsoft Access using Visual Basic for Applications (VBA) and requires Access 2003 or newer. The backend database can either reside in an Access database, Microsoft SQL Server or MySQL Enterprise Server.



GEMS has the following functionality through the user interface:

- Data Import Routines;
- Data Export Routines (RockWorks, EnviroInsite, Aquifer Test, ESRI Shapefile, more);
- Ability to create queries based on location, parameter, date and depth;
- Ability to create user-defined location and parameter groups for use in queries;
- Ability to screen query results against remediation objectives;
- Ability to filter query by lab qualifiers, modifiers (TICS, DUPS, FBs, EBs, TBs, etc), or custom defined flags;
- Ability to graph query results;
- QA/QC Module;
- Lithology data entry interface;
- Boring Log generation utility;

de maximis Data ddms Management Solutions, Inc.

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