MEDIA CLEANUP STANDARDS PROPOSAL

ZENECA INC.
DIGHTON, MASSACHUSETTS

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Media Cleanup Standards Proposal
December 2010

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Date: 12/10/10

EXECUTIVE SUMMARY

Conestoga-Rovers & Associates (CRA) has prepared this Media Cleanup Standards Proposal (MCS Proposal) on behalf of Zeneca Inc. (Zeneca) for their former manufacturing facility in Dighton, Massachusetts (Site). The MCS Proposal was prepared to meet the requirements of Section X.B.7 of the Consent Order (Order) and Section VI. of the Statement of Work (SOW), presented as Attachment 2 of the Order. The purpose of the MCS proposal is to:

1. Summarize the releases and threatened releases and summarize all contaminants of concern and media impacted
2. Provide an adequate basis for every MCS proposed
3. Provide an adequate basis for any point of compliance proposal
4. Demonstrate how the proposal adheres to and optimizes the considerations outlined in Section VI of the Order

This document develops proposed MCS for soils, groundwater, DNAPL, and sediment. MCS were not developed for surface water as the Risk Assessments did not identify any unacceptable risks due to Site-related chemicals in the surface water.

For soil and groundwater, the Human Health Risk Assessment (HHRA) was used to identify potential Chemicals of Concern (COCs). Specifically potential COCs were selected as the chemicals that, based upon the Risk Assessment results, contributed to a significant increased cancer risk of 1E-05 or a HI greater than 1.0. The potential COCs for soils were subsequently compared to Site background levels and chemicals with maximum concentrations less than the background levels were eliminated as COCs. The remaining chemicals for each Area of Concern (AOC) were identified as the COCs.

MCS were then identified for each COC for each AOC based upon the appropriate Generic Method 1 Standards as presented in the Massachusetts Contingency Plan (MCP). For COCs where no MCP cleanup levels exist, the cleanup levels were calculated using the same procedures used for the MCP cleanup levels. For VOCs in soil that were identified as COCs due to an increased risk resulting from migration to indoor air, MCS were calculated as the MCP cleanup levels do not address this exposure pathway. This resulted in the following MCS for soils and groundwater:

Soils

- S-2, S-3, S-2/GW2, S-3/GW3 (applies to areas outside the PPA/MYTA)
- S-2/GW-1, S-2/GW-2, S-2/GW-3, S-3/GW-1, S-3/GW-2, S-3/GW-3 (applies to areas within the PPA/MYTA)[1]
- Calculated soil cleanup levels (S_{air}) for protection due to migration to indoor air

Overburden Groundwater

- GW-2 and GW-3
- GW-1 (applies to off-Site locations)

Deep Overburden/Weathered Bedrock

- GW-3
- GW-1 (applies to off-Site locations)

Bedrock Groundwater

- GW-3

PCB cleanup levels under Toxic Substances Act (TSCA) Title 40 of the Code of Federal Regulations at Part 761 (40 CFR Part 761) are also identified as MCS for the soils at the Site.

For sediments, no MassDEP Method 1 Cleanup Levels exist. As directed by USEPA, the area for removal of sediment in Muddy Cove for the protection of benthos is based on the results of toxicity testing.

DNAPL was identified at the former MP Building and the Encapsulated Lagoon. The overall cleanup goal for DNAPL is to remove/treat recoverable DNAPL to the extent practicable. Residual DNAPL would be addressed the same as contaminated soil.

Points of compliance are developed for soils, groundwater and sediments. Consistent with the HHRA, soils within the 0 to 10-foot depth range are considered to be potentially accessible for direct contact. Therefore the point of compliance for the S2 and S3 cleanup levels is over the depth range of 0 to 10 feet below ground surface (ft bgs) for AOC1, AOC3, AOC4, and AOC5. Soil at any depth could potentially leach COCs to the groundwater and therefore the soil cleanup levels of S-2/GW-1, S-3/GW-1, S-2/GW-2, S-3/GW-2, S-2/GW-3, and S-3/GW-3 would apply to soils, depending upon the appropriate groundwater classification for the AOC.

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1 An area on Site and off Site to the east had transmissivity values between 10,000 and 30,000 gallons per day. This area is identified as a medium yield transmissivity area (MYTA).

The TSCA PCB point of compliance is any soils at the Site.

GW-3 groundwater criteria are based on protection of surface water. Therefore, the point of compliance for the GW-3 MCS is the shallow groundwater in AOC5 and the shallow groundwater adjacent to Muddy Cove. The deep overburden/weathered bedrock and bedrock groundwater does not discharge directly to surface water but must first pass through the shallow overburden groundwater flow zone before discharging to the Brook or Cove.

GW-2 groundwater criteria are based on protection against migration of vapors of oil and/or hazardous material to indoor air. According to the MCP, the GW-2 criteria are applicable to groundwater within 30 feet of an existing occupied building or structure, and the average annual depth to groundwater in that area is 15 feet or less. Consistent with this potential exposure scenario, the GW-2 MCS point of compliance is the shallow overburden groundwater in any areas that have existing buildings or could have future buildings.

The GW-1 groundwater criteria are based on the groundwater being used a drinking water source in the future. Currently, the groundwater at the Site and in the vicinity of the Site is not used a drinking water source. Zeneca currently owns the Site and any future remedy for the Site will include groundwater and land use restrictions that will ensure that the Site groundwater is never used as a potable water source. However, there are currently no restrictions in place preventing an off-Site private landowner from installing a well on their property. Therefore, the point of compliance for the GW-1 MCS is the off-Site overburden and deep overburden/weathered bedrock groundwater beneath the adjacent residential properties.

The point of compliance for the sediments is the average areal concentration for the exposure area assumed in the exposure scenario. The point of compliance for MCS for indirect exposure due to bioaccumulation pathways is the average for all underwater sediments. Exposures due to direct and indirect exposure pathways are dominated by chemicals in the surface layers (i.e., the benthos habitat). Consequently, the MCS should be applied to average concentrations in the top 2 or 3 inches of sediment.

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1.0 INTRODUCTION

Conestoga-Rovers & Associates (CRA) has prepared this Media Cleanup Standards Proposal (MCS Proposal) on behalf of Zeneca Inc. (Zeneca) for their former manufacturing facility in Dighton, Massachusetts (Site). Zeneca began the phased closure of the manufacturing facility in 1994. In 1994, Zeneca entered into the voluntary RCRA Corrective Action Program and since that time extensive investigations have been conducted under the Voluntary RCRA Corrective Action Program, as well as under the Massachusetts Contingency Plan (MCP). On May 14, 2004, Zeneca and the United States Environmental Protection Agency (USEPA) entered into an Administrative Order on Consent (Consent Order) for the completion of the RCRA Corrective Action.

While Consent Order negotiations were underway, the draft SRFI Work Plan was submitted to the USEPA on April 4, 2003. USEPA comments were incorporated into the final SRFI Work Plan, which was submitted to the USEPA on July 9, 2004.

The draft Supplemental RFI Interim Final Report (SRFI) was submitted to USEPA in September 2004. After responding to USEPA comments and doing additional field work, the SRFI Interim Final Report (SRFI Report) was submitted in April 2007 and revised in August 2010.

The SRFI Report presents the results of the field work conducted in accordance with the August 2003 SRFI Work Plan, May 20, 2005 Additional SRFI Sampling Plan, and the January 12, 2006 Scope of Work - Additional SRFI Sampling along with all relevant historical data.

Additional Site investigation activities were undertaken in 2009 to address identified data gaps in the SRFI. The results of the additional investigation are presented in the Supplemental RFI Interim Final Report Addendum (SRFI Addendum) submitted to USEPA in October 2010.

The Human Health Risk Assessment dated July 2007 and the Ecological Risk Assessment dated April 2007 were submitted under separate covers.

To date, investigations and risk assessments for Muddy Cove have been conducted separately from the rest of the Site. Both the Muddy Cove Ecological Risk Assessment (MCERA) dated September 15, 2005 and the Muddy Cove Human Health Risk Assessment (MCHHRA) dated November 2006 have been submitted. A sediment transport study was conducted during 2005/2006 and the results are presented in the report entitled Evaluation of Sediment and COPC Transport Processes in Muddy Cove:

Input for Decision Making on Remedial Alternatives dated October 2006. The results of the investigations undertaken at Muddy Cove were included in the April 2007 SRFI Report.

Zeneca submitted an Interim Corrective Measure (ICM) Work Plan to USEPA in June 2010 to address PCB contaminated soil in the vicinity of the former MP Building and in AOC5 north of the existing pond. Implementation of the ICM will address the PCB hot spot soils in these areas and therefore the PCB data for these areas are not presented and evaluated in the MCS Proposal.

This MCS Proposal was prepared to meet the requirements of Section X.B.7 of the Consent Order (Order) and Section VI. of the Statement of Work (SOW), presented as Attachment 2 of the Order. As described in the SOW, the MCS Proposal shall:

1. Summarize the releases and threatened releases and summarize all contaminants of concern and media impacted
2. Provide an adequate basis for every MCS proposed
3. Provide an adequate basis for any point of compliance proposal
4. Demonstrate how the proposal adheres to and optimizes the considerations outlined in Section VI of the Order

1.1 REPORT ORGANIZATION

The MCS Proposal is organized as follows:

Section 1.0	Introduction
Section 2.0	Site Description
Section 3.0	Site History
Section 4.0	Areas of Concern (AOCs)
Section 5.0	Nature and Extent of Contamination
Section 6.0	Risk Assessment Results
Section 7.0	Chemicals of Concern
Section 8.0	Proposed Media Cleanup Standards
Section 9.0	Proposed Points of Compliance
Section 10.0	References

2.0 SITE DESCRIPTION

The Zeneca Dighton property occupies an area of approximately 169 acres with the former operational portion occupying approximately 25 acres of the northernmost area. The former operational area is located between Elm Street to the west, Main Street to the north, and Route 138 to the east. The Site includes the former operation area and Muddy Cove located east of the operation area and between Route 138 and Pleasant Street. The Site is located at 333 Main Street in Dighton, Bristol County, Massachusetts, as presented on Figure 2.1. Currently, the only structures at the Site are the temporary office trailer and the Pump House. The former building slabs, paved areas, tanks, and utilities are shown on Figure 2.2.

The heavily wooded and vacant portion of the Zeneca property south of the Site has not been used for manufacturing activities. Surrounding the Zeneca property is a gravel pit and cemetery to the northwest near the corner of Elm and Main Streets, residential and commercial land to the north and east, and Muddy Cove to the southeast. The eastern boundary of the Site is approximately 1,000 feet northwest of the Taunton River. The Site and Zeneca property boundaries along with the land usage of the properties are shown on Figure 2.3. Figure 2.3 also identifies the adjacent property owners.

A 24-acre reservoir, formerly used for non-contact cooling water and fire protection, is located to the west of the Site; the reservoir was constructed in 1950 on property owned by Zeneca. Zeneca continues to maintain the dam/spillway on Elm Street. Muddy Cove Brook flows to the east from the reservoir through the central portion of the Site to its confluence with the Taunton River, approximately 1,000 feet southeast of the Site. The Brook flows beneath Route 138, where it widens to form Muddy Cove. Muddy Cove Brook was channelized on the eastern portion of the Site during the 1970s to divert the Brook south of the Encapsulated Lagoon. Two former small ponds (Upper Pond and Lower Pond) and a Retention Area that are part of Muddy Cove Brook are located in the central portion of the Site. Excavation of sediments and bank materials in the vicinity of the ponds and the Retention Area during the Muddy Cove Brook Sediment Removal Project (2000 to 2001) resulted in the combination of the Upper and Lower Ponds into a single larger pond. Wet and marshy areas generally abut Muddy Cove Brook.

The system of chemical sewers (pollution control sewers) and the majority of the storm sewers were decommissioned between March 1993 and April 1995. The sewers that were decommissioned were reportedly cleaned and sealed off, but not removed. The former sewer system is shown on Figure 2.4. One storm sewer outfall (011S) remains in service.

The sanitary sewer previously discharged to a leach field located on Zeneca property south of the Site of Elm Road. This leach field was closed in the early 1990s. Closure activities included the excavation and off-Site disposal of soil and drainage media.

3.0 SITE HISTORY

There is not much information on the early Site history. The Site has been a manufacturing facility since 1861, when it was reportedly used to produce cashmere wool; this facility was destroyed by fire in approximately 1867. From 1867 to 1870, the facility was used to manufacture furniture. Apparently the furniture manufacture was stopped in 1870 and the facility was idle until it became a lead oxide plant in 1875 until about 1878. The Anchor Color and Gum Works manufactured wallpaper and pigments at the Site from approximately 1878 to 1892. In 1892, the facility was purchased by Arnold, Hoffman and Company; manufacturing was expanded to include water colors, soap, and cornstarch products for the textile and paper industries. After World War I, textile dye was added to the product line. These manufacturing activities were all on the north side of Muddy Cove Brook, generally in the area of the former Wastewater Treatment Facility (WWTF), WWTF Warehouse, and S Department.

Imperial Chemical Industries (ICI) PLC of London, England acquired a majority interest in Arnold, Hoffman and Company in the 1950s, and acquired full interest in 1966. The Site was thereafter titled to its U.S. subsidiary ICI Americas. In December 1992, ICI Americas changed its name to Zeneca Inc. and the Dighton facility was part of the Zeneca Specialties business. The Zeneca Specialties business was divested in the late 1990s. However, the inactive Dighton facility remained as part of Zeneca Inc.

ICI Americas stopped the soap and cornstarch products production and gradually expanded manufacture of dyestuffs, including vat dyes that used mercury as a catalyst, and added other proprietary products through batch-type operations. These other products included Halothane (an anesthetic), antioxidants, tire cord adhesives, fire-fighting chemicals, concrete superplasticizers, and other specialty items. As a result of the Clean Water Act, in 1970, a major manufacturing change was made at the Site - the acid/vat dye manufacture was discontinued resulting in no further use of mercury as a catalyst, as well as no further use of the hot oil[2]. The use of chlorobenzene, nitrobenzene, and dichlorobenzenes in facility operations also stopped at that time. The WWTF was first put into service in 1973 and later expanded. In 1975, the production of disperse dyes began; mercury was not used in their manufacture.

Zeneca announced the shutdown of the Dighton facility and began the phased closure in 1994. Since that time, the majority of the Site buildings have been demolished, including all manufacturing buildings. The Pilot Plant and B/W Boiler were demolished in late

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2 Dye production in the former MP Building utilized a closed loop (hot oil) heat transfer fluid for jacketed reactor vessel heating.

1992. The J Building and H/BCF area were demolished in 1993. The MP Building and the S Building were demolished in 1994/1995. The Weld Shop and F/G Department were demolished in early 1995. The F/G Department was located adjacent to the S Department and was used for finishing and standardization. The WWTF, except for the Equalization Basin, the Pump House, and two clarifiers were demolished in 2002. The Equalization Basin, two clarifiers, guard shack, Main Warehouse, and Main Office were demolished in 2005. The Pump House is the only remaining building on Site.

The following sections describe the known historical operations at the facility. The former manufacturing areas are shown on Figure 3.1. The former waste treatment and storage areas that were in operation after 1980 are shown on Figure 3.2 and the known waste treatment and storage areas in operation at any point in the history of the facility are shown on Figure 3.3.

Wastewater Treatment Facility

The primary WWTF was constructed in 1973 to treat the discharges of wastewater from the production of dyes and other specialty chemicals at the Site, and has gone through several upgrades throughout its lifetime. A secondary plant was added in 1974, a powdered activated carbon system was added in 1978, and an asphalt berm was installed around the clarifier to collect rainwater to be pumped back into the headworks of the WWTF.

The WWTF Warehouse, constructed in the mid-to late-1800s, was originally used for manufacturing. The western portion of this building was used in the manufacture of cashmere, wool, furniture, lead oxide, pigments, soap, water colors, and cornstarch products. The original building was destroyed by a fire in the late 1800s and rebuilt in 1907. The building apparently continued to be used for manufacturing until it became part of the WWTF in 1973.

The WWTF treated the wastewater at the Site until 2000. The buildings, including the WWTF Warehouse, were demolished in 2002. The Equalization Basin and two clarifiers were demolished in 2005.

Main Office

The Main Office building, built in 1962, has housed offices and laboratory space throughout its history. A single floor addition to the main office housing a library and office space was later added. The Main Office building was demolished in 2005.

Main Warehouse

The Main Warehouse was built in 1948 and expanded in 1962. The loading docks on the east and west sides of the building were the main transfer points for the raw materials and finished products entering and leaving the facility. The Main Warehouse was demolished in 2005.

S Department

The S Department was one of the oldest buildings at the Site. It was a three-story building, in use since 1923 as a multi-product, dye and organic chemical intermediate manufacturing building. From 1923 to 1950, Arnold, Hoffman and Company produced cotton dyes as well as other reactive dyes at the S Department. In the late 1950s/early 1960s, ICI then added the production of Procion dyes, which are water-soluble dyes for coloring cotton fabrics, in this building. A colored aqueous waste was generated from the manufacture of these dyes. Aboveground storage tanks (ASTs) containing raw materials including hydrochloric acid, sulfuric acid, sodium hydroxide, ammonia, acetic acid, chlorosulfonic acid, and methanol were located outside this building.

F/G Department

The F/G Department was located adjacent to the S Department and was used for finishing and standardization. The F/G Department was demolished along with the Weld Shop in early 1995.

MP Department

The MP Building was a three-story, multi-product, dye and organic chemical intermediates manufacturing building from 1953 to 1970, at which time manufacturing operations were shut down. During this time period, mercury was used as a catalyst in the production of acid/vat dyes at MP. This form of dye production also utilized a closed loop (hot oil) heat transfer fluid for jacketed reactor vessel heating; the hot oil transfer room was located on the south side of the MP Building (see Figure 2.2). This hot oil is the source of PCBs in the soil south of the former MP Building. The use of the hot oil and mercury catalyst was discontinued in 1970 when ICI ceased production of acid/vat dyes.

In 1975, the MP Building was reactivated for the manufacture of water-insoluble disperse dyes; these disperse dyes did not require a mercury catalyst nor did these dyes require the use of the hot oil system. A naphthalene sulfonate formaldehyde fluidizer

for cement (Mighty G 150) was produced between 1980 and 1982. A chemical intermediate for the herbicide Fusillade was manufactured between 1982 and 1984; trichlorobenzene was used to produce this intermediate. From 1984 to the end of operations in 1994, this building also produced terephthalic acid, which was shipped to another manufacturer for use as an intermediary for a soil release agent. In addition, an algal growth inhibitor was produced. Acidic aqueous wastes from the manufacture of disperse dyes and alkaline wastes from a caustic liquid scrubber were generated during these operations. Raw materials stored in ASTs included sulfuric acid, hydrochloric acid, ammonia, caustic soda, nitrosylsulfuric, and methoxypolyethylene glycol. In addition, diesel fuel was stored in an underground storage tank (UST) located on the southern portion of the manufacturing area. The ASTs were cleaned out and removed as part of the 1994 demolition activities at the Site. The UST was removed in 1995 as part of the Site closure.

Prior to 1970, wastewater from the MP Building, as well as other departments, discharged directly into Muddy Cove Brook without treatment. This wastewater contained mercury used as a catalyst in the production of acid/vat dyes. This discharge from MP was discontinued in 1970 when the production of acid/vat dyes was discontinued. After 1973, all process wastewater was treated at the WWTF.

J Department

The J Department Building was a three-story, single product plant built in 1963 for the production of Topanol CA, an antioxidant. Wastes generated during this process included spent toluene and toluene still-bottoms. Prior to 1986, the still-bottoms were drummed and disposed off Site. After 1986, the still-bottoms (which contained >55 percent toluene) were shipped off Site on a weekly basis for use as fuel in cement kiln firing. The raw materials for this area were toluene, methanol, t-butyl-m-cresol, crotonaldehyde, and hydrochloric acid and were stored in ASTs on the south side of the building.

H Building

The H Building, located north of Muddy Cove Brook and west of the Weld Shop, was constructed in 1961 to manufacture Halothane, a brominated fluorocarbon anesthetic. Trichloroethene (TCE) was used as a refrigeration media to vaporize fluorocarbons during this process. The wastes produced from the manufacturing process include approximately 1 percent distillation residues/heavy ends, or bromine attached to fluorocarbon molecules, and an aqueous waste of sodium bromide. The heavy ends were stored in drums and transported off Site for disposal. Prior to 1973, any

wastewater from the H Building, as well as other departments, discharged directly into Muddy Cove Brook without treatment. After 1973, the aqueous waste discharged to the chemical drain leading to the WWTP.

BCF Department

The BCF Department was built adjacent to the H Building in 1975. BCF is the trade name for the fire-fighting chemical Halon 1211. TCE was also used as a refrigeration media during the production of BCF. The wastes generated from the production of this chemical include heavy ends and gaseous bromide. The heavy ends resulted from bromine atoms attaching to the bromochlorofluorocarbon (BCF) molecule. The gaseous bromide waste stream was scrubbed with caustic, forming sodium bromide. The sodium bromide was then chlorinated to recover and recycle the bromine. An aqueous sodium chloride waste stream was generated, which flowed into the chemical drain and to the WWTF. Raw material tanks containing freon, sodium hydroxide, and bromine were located on the western side of the H and BCF Department buildings. The heavy ends were stored in cylinders and sent back to ICI in the United Kingdom for reuse.

Service Station

A Service Station was previously located east of the Site, along Route 138. Aerial photographs indicate that the Service Station was constructed prior to 1937. ICI acquired this parcel in 1982 and continued leasing the station to the previous owner until August 1992 when Service Station operations were discontinued. The USTs, containing gasoline and diesel fuel, were removed from the Service Station in 1992. Subsequent remedial measures under the MCP have resulted in the removal of hydrocarbon-impacted soil from this area.

Sewers

Nitrobenzene was discovered in one of the storm drains near the MP Building prior to the demolition of the MP Building. The drains in this area were cleaned and sealed during the time period from March 1993 to April 1995 under MGL Chapter 21C regulations. The material removed was disposed as hazardous waste due to the presence of elevated concentrations of nitrobenzene.

The system of chemical sewers (pollution control sewers) and the majority of the storm sewers were decommissioned between March 1993 and April 1995. The sewers that were decommissioned were reportedly cleaned and sealed off, but not removed. The

former sewer system is shown on Figure 2.4. One storm sewer outfall (011S) remains in service.

The sanitary sewer previously discharged to a leach field located on Zeneca property south of the Site off Elm Road. This tile field was closed in the early 1990s. Closure activities included the excavation and off-Site disposal of soil and drainage media.

4.0 AREAS OF CONCERN (AOCs)

In accordance with the Consent Order, the Site is divided into five Areas of Concern (AOCs) as follows:

- AOC1 Encapsulated Lagoon and Former Service Station
- AOC2 Muddy Cove
- AOC3 Area North of Muddy Cove Brook
- AOC4 Area South of Muddy Cove Brook
- AOC5 Muddy Cove Brook

The following sections describe the AOCs at the Site, summarizing their major features and operating history. The locations of the AOCs are shown on Figure 4.1. Detailed descriptions of the AOCs are presented in Section 5.0 of the SRFI Report.

4.1 AOC1 - ENCAPSULATED LAGOON AND FORMER SERVICE STATION

The Encapsulated Lagoon is the former downstream portion of Muddy Cove Brook that originally received direct wastewater discharge and was subsequently capped in the early 1970s. Untreated wastewater containing chlorobenzenes and nitrobenzene, as well as mercury from the acid/vat dye manufacturing process at the facility, was discharged to this area prior to the shutdown of the MP Building in 1970. In 1971, Muddy Cove Brook was diverted south and the lagoon area no longer received wastewater discharge. After the WWTF went online in 1973, impacted sediments (except for the area immediately adjacent to the Retention Area) in the downstream portion of the Brook were encapsulated primarily to prevent migration of mercury from the former discharge area. The encapsulation first involved constructing a series of berms to allow equipment access to the various areas of the lagoon. The berms were constructed directly on top on the lagoon sediments creating a number of individual "cells" that were then filled with soil material and covered with a soil cover. Recent borings indicate that the Encapsulated Lagoon consists primarily of sandy fill to depths of approximately 6 to 9 feet, followed by 1 to 3 feet of peat. DNAPL was often identified in the peat layer. Native sands, silts, and clay are present beneath the peat.

Investigations were conducted as part of the voluntary RCRA Corrective Action program to determine the extent of the Encapsulated Lagoon and the former wastewater discharge area adjacent to the Retention Area/WWTF. The borders of the Encapsulated

Lagoon and/or wastewater discharge area are shown on Figure 2.2. Borings GP-709 and GP-608 drilled for the SRFI indicate that the Encapsulated Lagoon may actually extend further to the north than depicted on Figure 2.2.

A Service Station, decommissioned in 1992, was located east of the Encapsulated Lagoon, along Route 138. Several monitoring wells have been installed into the overburden in this area to monitor the concentration of hydrocarbons released to the groundwater during the operation of the Former Service Station. Groundwater sampling in the mid-1990s showed that the groundwater in the vicinity of the Former Service Station had elevated concentrations of BTEX compounds. Concentrations of dissolved organic compounds including nitrobenzene and chlorobenzene were also detected in groundwater samples collected at the Former Service Station. These compounds, however, likely originate from the vicinity of the Encapsulated Lagoon, and not the Former Service Station.

Between 1996 and 1997, Handex removed 5,037 tons of soil from the Former Service Station Area as part of the remedial measures under the MCP. The details of the soil removal at the Former Service Station are described in various Handex reports, including the Site Status report for the Former Service Station, Handex, 1995. Figure 4.2 shows the locations of the various excavations completed by Handex.

In December 1999, a Phase IV Remedy Implementation Plan (Phase IV) was submitted to MADEP. The Phase IV consisted of continued groundwater monitoring to demonstrate that monitored natural attenuation would be capable of achieving a Permanent Solution at the Site. Groundwater monitoring was conducted from 1999 to June 2002. A Phase IV completion report was submitted to MADEP in June 2001 and Phase V monitoring reports were submitted to MADEP in March and September 2002.

In July 2002, a Remedy Operation Status (ROS) submittal was sent to MADEP since a remedial solution that relies on active and continued monitoring was being conducted for the purpose of achieving a Permanent Solution. As part of the ROS, the wells are sampled semi-annually and reports on the sampling are submitted to MassDEP (with copies to USEPA).

4.2 AOC2 - MUDDY COVE

Muddy Cove is an open water body of approximately 4.6 acres located adjacent to Muddy Cove Lane and Pleasant Street. Muddy Cove contains vegetated (salt marsh) and non-vegetated mud flats, as well as creek channels. Muddy Cove is a tidal water

body that connects, on its downstream end, to the Taunton River through an inlet passing under the Pleasant Street Bridge. The upstream end is fed by Muddy Cove Brook, which flows under Route 138 (County Road) and the former B&M railroad tracks, and through an aged hurricane gate, before flowing into Muddy Cove. Activities at the former manufacturing facility resulted in discharge of a variety of chemicals into Muddy Cove Brook, including mercury and PCBs. Use and direct wastewater discharge of these chemicals stopped in 1971 (ENSR, 1995). Sampling within the Muddy Cove region indicated elevated levels of some chemicals in both surface water, sediment, and tissue samples that have their apparent source in the waste discharges from the former manufacturing facility (MCA, 2005).

During November and December 2005, additional field investigation activities were conducted in Muddy Cove by Woods Hole Group. The primary purpose of this additional investigation was to gain a better understanding of the sediment and chemical transport processes in Muddy Cove and also to provide additional delineation of chemicals of potential concern in the Muddy Cove sediments. The results are presented in the report entitled "Evaluation of Sediment and COPC Transport processes in Muddy Cove: Input for Decision Making on Remedial Alternatives", dated October 2006 (WHG, 2006).

4.3 AOC3 - MANUFACTURING AREA NORTH OF MUDDY COVE BROOK

AOC3 consists of the following former operating areas: Weld Shop/H-BCF Building area, Wastewater Treatment Facility and Warehouse, Construction Debris Area, Main Office, Main Warehouse, and the S Department. A Grant of Environmental Restriction (GER) has been placed on AOC3 that restricts future use of the property to industrial/commercial, prevents use of the groundwater for any purpose, and requires controls on any future excavation or building construction to prevent against exposure that could result in significant risk of harm. Descriptions of each of the AOC3 former operating areas are presented in the following paragraphs.

Weld Shop/H-BCF Building Area

The former Weld Shop had been in operation since the early 1950s. The H Department was constructed in 1961 and the BCF Department Building was built in 1975. Operations in the Weld Shop/H-BCF area used cutting oils and TCE as a degreaser and refrigerant. TCE and its degradation by-products had been detected in the soil and overburden groundwater in this area.

Wastewater Treatment Facility and Warehouse

The WWTF, constructed in 1973, was built to treat the discharges of wastewater from the production of dyes and other specialty chemicals at the Site, and has gone through several upgrades throughout its lifetime. A secondary plant was added in 1974, a powdered activated carbon system was added in 1978, and an asphalt berm was installed around the clarifier to collect rainwater to be pumped back into the headworks of the WWTF. The building now referred to as the WWTF Warehouse was constructed in the late 1800s. The original building was destroyed in a fire in the late 1800s and rebuilt in 1907. The western portion of this building was used in the original manufacture of cashmere, wool, furniture, lead oxide, pigments, soap, water colors, and cornstarch products. When the WWTF was built, this building became the WWTF Warehouse.

The WWTF, including the warehouse was demolished in 2002, except for the Equalization Basin, two clarifiers, and the Pump House. The Equalization Basin and the two clarifiers were demolished in 2005.

Construction Debris Area

Asphalt from facility road repairs as well as concrete and other masonry materials from building maintenance and renovation were placed in the Construction Debris area. The debris covered an area of approximately 1 acre to a depth of approximately 0 to 2 feet. The construction debris was removed from the area and disposed off Site in the mid-1980s.

Main Office

The Main Office has housed offices and laboratory space since it was built in 1962. A sub-slab venting system was installed at the Main Office in 2002 to mitigate potential migration of VOCs into the building. The Main Office was demolished and the sub-slab venting system was dismantled in 2005.

Main Warehouse

The Main Warehouse was built in 1948 and expanded to the north in 1962. The loading docks on the east and west sides of the building were the main transfer points for the raw materials and finished products entering and leaving the facility. A sub-slab venting system was installed at the Main Warehouse in 2002 to mitigate potential

migration of VOCs into the building. The Main Warehouse was demolished and the sub-slab venting system was dismantled in 2005.

S Department

The S Department was a three-story building in use since 1923 as a multi-product, dye and organic chemical intermediate manufacturing building. ASTs containing raw materials including hydrochloric acid, sulfuric acid, sodium hydroxide, ammonia, acetic acid, chlorosulfonic acid, and methanol were located outside this building. The area of the F/G Department has been included in the investigations of the S Department.

4.4 AOC4 - MANUFACTURING AREA SOUTH OF MUDDY COVE BROOK

As part of investigations conducted for RCRA Pad closure and under the Voluntary Corrective Action Program, two potential source areas were identified south of Muddy Cove Brook: the former MP Building and the Raw Product Storage area. The former RCRA waste pads were closed under Massachusetts hazardous waste regulations.

Former MP Building

The MP Building went into operation in the early 1950s for the manufacture of acid and vat dyes. The former MP Building contained the Hot Oil Transfer Room that handled oil reportedly containing PCBs. Manufacture of the vat and acid dyes ceased in early 1970s. The use of the Hot Oil Transfer Room stopped at the time, as well as the use of mercury, chlorobenzenes and nitrobenzene. In 1993, prior to the demolition of the MP Building, an inspection of the storm sewers revealed the presence of petroleum hydrocarbons, VOCs, SVOCs, and PCBs in several sewer catch basins south of the MP Building. The storm sewer system was cleaned and decommissioned as documented in the 1993 report "Storm Sewer Investigation and Cleanup in the Vicinity of the MP Building".

A PCB soil source area was identified along the southern part of the MP Building, near the area of the former Hot Oil Transfer Room. Soils with elevated concentrations of PCBs were excavated from the area in 1998/1999 as part of an IRM/RAM. A total of 3,404 tons of soil, concrete, and other debris was excavated during the remedial activities at the former MP Building area. The excavation areas are shown on Figure 4.3.

Raw Product Storage Area

ASTs containing toluene, methanol, and ammonium hydroxide solution were kept in the Raw Product Storage area; earthen berms surrounded the area. There have been no known releases from the storage tanks.

Former RCRA Waste Pads

Three concrete pads south of Muddy Cove Brook (former "J" Pad, former "MP" Pad and former "Boiler" Pad shown on Figure 3.2) were used as hazardous waste storage pads after RCRA regulations went into effect. Elevated PCBs were detected in three soil samples collected at the "Boiler" Pad. These impacted soils were subsequently excavated and disposed at an approved facility. MADEP approved the clean closure of the pads in 1994.

4.5 AOC5 - MUDDY COVE BROOK

AOC5 consists of the Brook and upland buffer area north of the Brook. This buffer area contains the former Pilot Plant and a portion of the former S Department. PCBs and other Site-related contaminants were identified in the sediments in the Upper and Lower Ponds and the Retention Area of Muddy Cove Brook. The source of the contaminants in the sediments was suspected to be due to historical surface water runoff and potentially stormwater drainage from the operating areas of the Site (e.g., the former MP Building area). In 2000, sediment in the Upper and Lower Ponds and the Retention Area was excavated and disposed off Site (see Figure 4.4) as part of an interim remediation of the Brook. The restoration of the wetlands surrounding the Ponds was completed in 2001, as presented in the Subaqueous Cap Monitoring Report (Weston, 2002). The 5-year monitoring program of the restoration was completed in 2006.

Former Pilot Plant

During the demolition of the Pilot Plant in 1992, staining was observed in the area of an oil-filled pilot plant reactor heating system located within the basement of this building. Soil and groundwater samples taken in the area had elevated TPH and PCB concentrations. In July 1993, a soil sampling program was undertaken under the former Pilot Plant to delineate the extent of PCB and TPH impact. The impacted soils were removed from the area in December 1994, under the MCP (see Figure 4.5). An additional phase of excavation was initiated in December 1998 as an interim measure to remove lead-impacted soil at the former Pilot Plant. Soil samples were collected in the

spring of 1999 to delineate the extent of the lead-impacted soil surrounding the Pilot Plant. The impacted soil was excavated in August 1999 and disposed off Site. A total of 421 tons of soil, concrete, and bricks was excavated during the 1999 remedial activities at the former Pilot Plant.

5.0 NATURE AND EXTENT OF CONTAMINATION

The following sections present a summary of the analytical results for soil, groundwater, surface water, and sediment samples collected at the Site.

Detailed discussions of the data are included in the August 2010 SRFI Report and the October 2010 SRFI Addendum. Historical and new surface and subsurface soil analytical data that represent existing conditions (e.g., non-excavated soils) are included in Appendix E of the SRFI Report and Tables 3.6A to 3.6D in the SRFI Addendum. Pre-SRFI and SRFI overburden, weathered bedrock, and bedrock groundwater analytical data are included in Appendix F of the SRFI Report. Gro undwater data collected from 2007 to 2009 are presented in Table 3.4 of the SRFI Addendum. Sediment data are included in Appendix G of the SRFI Report. Surface water data are presented in Appendix I of the SRFI Report and Table 3.5 of the SRFI Addendum. The results for the DNAPL samples collected from the former MP Building area and the Encapsulated Lagoon are presented in Appendix L of the SRFI Report.

For the purpose of the SRFI evaluation, the groundwater data were grouped into the following categories based on the hydrostratigraphic units:

Groundwater Chemistry Grouping	*Hydrostratigraphic Units*
Overburden Groundwater	Shallow Overburden Silt and Clay
Deep Overburden/Weathered Bedrock	Deep Overburden/Weathered Bedrock
Bedrock	Bedrock

For the SRFI Report and the SRFI Addendum, the soil and groundwater analytical data were compared to MCP Method 1 Standards and USEPA Preliminary Remediation Goals (PRGs). Ecological criteria were also used to screen surface water and sediment data for Muddy Cove Brook and Muddy Cove. Figures showing the exceedances of the applicable screening criteria are presented in Appendix A of this report. The figures show the soil data by AOC and the groundwater data are presented Site-wide for the three different hydrostratigraphic units (overburden, deep overburden/weathered bedrock and bedrock). The figures showing screening criteria exceedances in Appendix A are listed as follows:

AOC1

- Lagoon - Surface Soil - Not Paved - Figure A.1
- Lagoon - Surface Soil - Paved - Figure A.2
- Lagoon - Surface Soil -Paved - PPA/MYTA - Figure A.3
- Lagoon - Subsurface Soil - Figure A.4
- Lagoon - Subsurface Soil - PPA/MYTA - Figure A.5
- Service Station– Surface Soil - Not Paved PPA/MYTA - Figure A.6
- Service Station - Surface Soil - Not Paved - Figure A.7
- Service Station -- Subsurface Soil - PPA/MYTA - Figure A.8
- Service Station -- Subsurface Soil - Figure A.9

AOC2

- Sediment -Near Shore and Bank - Figure A.10
- Sediment - Off Shore– Figure A.11
- Surface Water - Figure A.12

AOC3

- Surface Soil - Not Paved - Figure A.13
- Surface Soil - Paved - Figure A.14
- Subsurface Soil - Figure A.15

AOC4

- Surface Soil - Not Paved - Figure A.16
- Surface Soil - Paved - Figure A.17
- Subsurface Soil - Figure A.18

AOC5

- Surface Soil - Not Paved - Figure A.19
- Surface Soil - Paved- Figure A.20
- Subsurface Soil - Figure A.21

- Sediment - Figure A.22
- Surface Water - Figure A.23

Off-Site Area

- Surface Soil - Unpaved - PPA/MYTA - Figure A.24
- Subsurface Soil - PPA/MYTA - Figure A.25
- Subsurface Soil - Outside PPA/MYTA - Figure A.26
- Sediment - Figure A.27

Overburden Groundwater

- Arsenic Concentrations - Figure A.28
- Lead Concentrations - Figure A.29
- Mercury Concentrations - Figure A.30
- Chlorobenzene Concentrations - Figure A.31
- Nitrobenzene Concentrations - Figure A.32
- 1,2,4–Trichlorobenzene Concentrations - Figure A.33
- Trichloroethene Concentrations - Figure A.34
- PCB Concentrations - Figure A.35

Deep Overburden/Weathered Bedrock Groundwater

- Arsenic Concentrations - Figure A.36
- Lead Concentrations - Figure A.37
- Mercury Concentrations - Figure A.38
- Chlorobenzene Concentrations - Figure A.39
- Nitrobenzene Concentrations - Figure A.40
- 1,2,4-Trichlorobenzene Concentrations - Figure A.41
- Trichloroethene Concentrations - Figure A.42
- PCB Concentrations - Figure A.43

Bedrock Groundwater

- Arsenic Concentrations - Figure A.44
- Lead Concentrations - Figure A.45
- Mercury Concentrations - Figure A.46
- Chlorobenzene Concentrations - Figure A.47
- Nitrobenzene Concentrations - Figure A.48
- 1,2,4-Trichlorobenzene Concentrations - Figure A.49
- Trichloroethene Concentrations - Figure A.50
- PCB Concentrations - Figure A.51

Summaries of the distribution of the primary Site-related chemicals detected in the various media are presented in the following sections.

5.1 SOIL

The primary Site-related chemicals detected in soil samples at concentrations above the screening criteria are arsenic, lead, mercury, chlorobenzenes, nitrobenzene, and PCBs. These parameters were detected at the highest concentrations in the Encapsulated Lagoon, the former WWTF Warehouse area, the former MP Building area, the former Pilot Plant area, south of the Pond, the former Storage Tank area, the former Main Office, the former Main Warehouse, and the Former Service Station Area. PCBs were detected at concentrations above the screening criteria primarily at locations south of the former MP Building, in the Encapsulated Lagoon, and north of the pond in AOC5. Zeneca submitted an ICM Work Plan to USEPA in June 2010 to address PCB contaminated soils in the former MP Building area and north of the pond in AOC5. Other parameters including PAHs, BTEX compounds, chromium, and trichloroethene were detected in soil samples at concentrations above the respective screening criteria; however, the frequencies and magnitudes of the exceedances were generally much lower.

5.2 OVERBURDEN GROUNDWATER

The current distributions of arsenic, lead, mercury, chlorobenzene, nitrobenzene, 1,2,4-trichlorobenzene, trichloroethene, and PCBs (the primary Site-related chemicals

found in the groundwater) in the shallow overburden groundwater at the Site are shown on Figures A.28 to A.35.[3]

The analytical results indicate that the primary source areas for shallow overburden groundwater impact at the Site are the Encapsulated Lagoon, the WWTF Warehouse area, the former MP Building area, and the Former Service Station Area.

Arsenic was detected at concentrations above the GW-1 screening criterion south of the former office building (MW-31R-S) and downgradient of the Former Service Station Area (MW-27-S).

Lead was detected at concentrations above the GW-1 and GW-3 screening criteria near the former Main Warehouse (GP-406)above the GW-3 criterion in the former WWTF Warehouse area (GP-418S), downgradient of the former Weld Shop (MW-10-14), and downgradient of the Former Service Station Area (MW-3 and MW-4).

At the Encapsulated Lagoon, arsenic, lead, chlorobenzene, 1,2,4-trichlorobenzene, and nitrobenzene are found at concentrations above groundwater screening criteria. At the Former Service Station Area, lead and chlorobenzene are found above screening criteria, although chlorobenzene in this area has likely migrated eastward from the Encapsulated Lagoon. Lead may also be present due to migration from the Encapsulated Lagoon. Nitrobenzene was also detected at elevated concentrations at three wells downgradient of the Former Service Station Area (MW-4-and TW-2); however, the concentrations are below the calculated GW-3 value. Similar to chlorobenzene, nitrobenzene in this area likely originated from the Encapsulated Lagoon and not the Former Service Station Area. Lead, chlorobenzene, and 1,2,4-trichlorobenzene were detected at concentrations above the screening criteria in the former WWTF area.

Downgradient of the former MP Building area, chlorobenzene and nitrobenzene were detected in shallow overburden groundwater monitoring well MW-37-S at concentrations exceeding the applicable screening criteria during the most recent sampling event.

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3 Data prior to 2003 are not included on these figures although they are presented in the data tables presented in Appendix F of the SRFI Report

5.3 DEEP OVERBURDEN/WEATHERED BEDROCK GROUNDWATER

The distributions of arsenic, lead, mercury, chlorobenzene, nitrobenzene, 1,2,4-trichlorobenzene, PCBs, and trichloroethene (the primary Site-related chemicals found in the groundwater) in the deep overburden/weathered bedrock are presented on Figures A.36 to A.43. Similar to the figures for the shallow overburden groundwater, the data shown on Figures A.36 through A.43 represent the most recent data for each location.

The analytical results indicate that the primary source areas for deep overburden/weathered bedrock groundwater impact are the former WWTF Warehouse area, the Encapsulated Lagoon, and the former MP Building area.

At the former WWTP Warehouse area, lead and chlorobenzene are found at concentrations above groundwater screening criteria.

At the Encapsulated Lagoon and Former Service Station Area, chlorobenzene, nitrobenzene, and 1,2,4-trichlorobenzene are found at concentrations above groundwater screening criteria. As discussed above for the shallow overburden groundwater, the source for these compounds is likely the Encapsulated Lagoon.

Chlorobenzene was detected at concentrations exceeding the GW-3 screening criteria in the area of the former MP Building.

5.4 BEDROCK GROUNDWATER

The distributions of arsenic, lead, mercury, chlorobenzene, nitrobenzene, 1,2,4-trichlorobenzene, trichloroethene, and PCBs (the primary Site-related chemicals found in the groundwater) in the bedrock groundwater are presented on Figures A.44 to A.51.

Chlorobenzene was the only COC detected at concentrations above the GW-3 screening criteria, at MW-15R-D, MW-6-75, and MW-5-58 located north (downgradient) of the former MP Building.

Lead was previously detected above the GW-3 screening level in the SRFI at monitoring well MW-20-40, east of Pleasant Street. However, the SRFI Addendum results for this well were below the GW-3 criterion.

5.5 SEDIMENT

Muddy Cove Brook

PAHs, chlorobenzenes, PCBs, and metals were detected in the sediment samples within the Pond, Retention Area, and south of the Retention Area (the Lower Reach) at concentrations above the screening criteria. The highest concentrations of arsenic, lead, and PCBs are found in the Retention Area and the Lower Reach in the channelized portion of Muddy Cove Brook. The highest concentrations of chlorobenzenes are found immediately north of Route 138 at sampling location SD-610.

Muddy Cove

Chlorobenzenes, PAHs, VOCs, PCBs, and metals were detected at concentrations above screening criteria in the sediment samples collected from Muddy Cove. The data indicate that Site-related chemicals are generally detected at higher concentrations in the center or near the northwest corner of the Cove, and vertically in the top 5 to 15 cm of the sediment column. With the exception of methylmercury, lower concentrations were found in sediments from 0 to 5 cm than in sediments from 5 to 15 cm. For methylmercury, higher concentrations were found in the sediments from 0 to 5 cm than in sediments from 5 to 15 cm. This may be due to the transport of methylmercury to the sediment-water interface by methane out-gassing. Chemicals in the subsurface sediments are distributed similar to surface sediments; however the magnitudes of concentrations are substantially lower in comparison to the 5 to 15 cm concentrations. The only COPC that had similar or higher concentrations in the deeper sediments was chlorobenzene.

Taunton River

Concentrations of chlorobenzene, mercury, and total PCBs in the sediment samples collected from the Taunton River in the vicinity of Muddy Cove are higher than in the three reference samples collected from other locations along the Taunton River. However, the concentrations of these parameters in the Taunton River sediment samples in the vicinity of Muddy Cove are significantly lower than the concentrations of these parameters in the Muddy Cove sediment samples.

Phragmites Area

Concentrations of primarily PAHs, PCBs, arsenic, chromium, mercury, lead, and copper exceeded the screening levels in sediment samples collected from the Phragmites area north of Muddy Cove. The concentrations of these parameters decrease with depth with the highest concentrations detected in the samples from 0 to 0.5 feet below ground surface (ft bgs). Very few exceedances of screening levels were detected in the samples collected from 2 to 3 ft bgs.

5.6 SURFACE WATER

Muddy Cove Brook

The overburden groundwater at the Site discharges to Muddy Cove Brook.

Aluminum, arsenic, copper, iron, lead, manganese, silver, thallium, and 1,4-dichlorobenzene were detected above screening criteria in the 2003 surface water samples collected from Muddy Cove Brook.

The highest concentrations of 1,4-dichlorobenzene in the surface water samples were detected at SW-104, in the Retention Area. The highest concentrations of metals were generally detected in the Upper/Lower Pond (SW-102 and SW-103).

Muddy Cove

Surface water samples were collected from Muddy Cove in 1999 (by Menzie-Cura & Associates) and in 2005 (by WHG). In 1999, COPCs detected at concentrations above screening criteria include aluminum, manganese, bis(2-ethylhexyl)phthalate, and PAHs. No COPCs were detected at concentrations above the screening criteria in 2005.

Encapsulated Lagoon

Surface water samples collected in 2009 from the Encapsulated Lagoon area as presented in the SRFI Addendum had concentrations of arsenic, iron, lead and bis(2-ethylhexyl)phthalate above the screening criteria. However, the sample collected of the surface water discharging from the Encapsulated Lagoon did not have parameter concentrations above the screening criteria.

5.7 DENSE NON- AQUEOUS PHASE LIQUID

Dense Non-Aqueous Phase Liquid (DNAPL) screening was performed during the Geoprobe®, monitoring well, and borehole drilling in 2003, 2005, and 2006. DNAPL was observed in the vicinity of the former MP Building and in the Encapsulated Lagoon.

Former MP Building

Historically, DNAPL was found at well MW-3-42 which is located south of the former MP Building and completed partially within the weathered bedrock and partially within the competent bedrock. During sampling in 1995, approximately 3 inches of DNAPL was observed at the bottom of MW-3-42. There have been previous efforts to periodically remove DNAPL from this well. However, the efficiency of removal rapidly decreased after DNAPL in the immediate vicinity of the well was removed.

A pilot high-vacuum enhanced fluid extraction test was performed in July 2004 at MW-3-42. During the extraction test, visible DNAPL recovery was observed. However, insufficient DNAPL was recovered to be measurable in the fluid storage tank. Laboratory results show that the DNAPL contained nitrobenzene, naphthalene, chlorobenzenes, toluene, and bis(2-ethylhexyl)phthalate. During 2006, an investigation was undertaken using an oil-water interface probe and an absorbent media lowered to the bottom of the well to determine if DNAPL was still present in MW-3-42; DNAPL was not detected in the well.

In 2005/2006, additional investigation activities were conducted in the vicinity of MW-3-42 in an attempt to further delineate the extent of DNAPL in this area. DNAPL was observed at approximately 7 to 11 ft bgs in SRFI borehole BH-701, which was advanced immediately south of the former MP Building, approximately 20 feet northeast of MW-3-42. Subsequent Geoprobe® sampling surrounding BH-701 did not detect DNAPL at any depth within the overburden.

These data all indicate that the DNAPL in this area is very limited in extent and the pumping of MW-3-42 likely removed the recoverable DNAPL from this location. Although the potential for DNAPL migration from this area is very low, the residual DNAPL in this area may be a continuing source to the groundwater.

Encapsulated Lagoon

Monitoring well MW-33-S was installed in the center of the Encapsulated Lagoon and DNAPL was encountered at this location. A sample of DNAPL was collected from

MW-33-S in July 2004 during the vacuum enhanced fluid extraction test conducted on this well. The analytical results indicated that the DNAPL contained primarily nitrobenzene, naphthalene, chlorobenzenes, toluene and bis(2-ethylhexyl)phthalate. Other chemicals, including pesticides and PCBs, were detected at lower concentrations in the DNAPL sample.

Soil samples from 25 locations within the Encapsulated Lagoon were screened for the presence of DNAPL as described in the SRFI Report. DNAPL was identified at nine locations. The DNAPL was not restricted to a particular area within the Encapsulated Lagoon. The distribution of DNAPL in the Encapsulated Lagoon generally corresponds to the area with elevated chlorobenzene concentrations.

6.0 RISK ASSESSMENT RESULTS

6.1 HUMAN HEALTH RISK ASSESSMENT - FORMER MANUFACTURING AREA AND OFF-SITE AREA

The Human Health Risk Assessment (HHRA) Report for the former manufacturing facility was submitted July 5, 2007. The HHRA provided a comprehensive evaluation of the potential current and future risk to human receptors posed by the impacts present at each of the AOCs: AOC1 (Encapsulated Lagoon and Former Service Station); AOC3 (Former Manufacturing Area North of Muddy Cove Brook); AOC4 (Former Manufacturing Area South of Muddy Cove Brook); and AOC5 (Muddy Cove Brook), and also one off-Site area located east of the Site. AOC2 (Muddy Cove) was addressed in the Muddy Cove HHRA (Menzie-Cura, November 30, 2006).

For the HHRA, the Site was partitioned into the five AOCs identified above, and also one off-Site area located to the east. Since previous remedial activities have been conducted at the Site, the HHRA evaluated only the risks and hazards associated with post-remedial residual chemicals within Site media.

Potential human receptors evaluated in the HHRA included trespassers (on and off Site), maintenance workers (on and off Site), industrial/commercial workers, construction/ utility workers (on and off Site), off-Site commercial worker, and off-Site residents. Using the 95 percent Upper Confidence Limit media concentration, and receptor-specific exposure factors, human intake levels for each COPC within each media were calculated.

The toxicity assessment included an evaluation of the toxicity of each COPC through the identification of the most current carcinogenic (cancer slope factors, CSFs) and non-carcinogenic (reference doses, RfDs) toxicity values. Toxicity values were presented as mg COPC/kg-day for oral and dermal exposure and mg COPC/m^3 for inhalation exposure. Surrogate chemical toxicity data were applied when toxicity data were lacking for the COPCs.

Using the information presented in the exposure assessment and toxicity assessment, the risk characterization step calculated a carcinogenic risk and a non-carcinogenic hazard for both the Central Tendency (CT) and Reasonable Maximum Exposure (RME) scenarios for each receptor. The AOCs for which the RME exceedances were observed in the cumulative screening level HI of 1.0 or risk of 1E-05 for industrial/commercial land uses, or 1E-06 for residential land uses and the media and receptors for which these exceedances occurred, are summarized below:

AOC	*Primary Media*	*Receptor*	*Exceeds Risk*	*Exceeds HI*
AOC1 - Encapsulated Lagoon	Surface and Subsurface Soil Soil to Indoor Air	Future Industrial/ Commercial Worker	Yes	Yes
	Surface and Subsurface Soil Groundwater	Future Construction/Utility Worker	No	Yes
AOC1 - Former Service Station	Surface and Subsurface Soil Soil to Indoor Air	Future Industrial/ Commercial Worker	Yes	Yes
	Surface and Subsurface Soil Groundwater	Future Construction/ Utility Worker	Yes	Yes
AOC3	Surface and Subsurface Soil Soil to Indoor Air	Future Industrial/ Commercial Worker	Yes	No
	Surface and Subsurface Soil Groundwater	Future Construction/Utility Worker	Yes	Yes
AOC4	Surface and Subsurface Soil	Future Industrial/ Commercial Worker	Yes	No
	Surface and Subsurface Soil Groundwater	Future Construction/Utility Worker	Yes	Yes
AOC5	Surface and Subsurface Soil Sediment	Future Industrial/ Commercial Worker	Yes	No
	Surface and Subsurface Soil Groundwater	Future Construction/ Utility Worker	Yes	Yes
Off-Site Zeneca Property	Sediment (Phragmites Area)	Current Trespasser	Yes	No
	Sediment (Phragmites Area)	Future Trespasser	Yes	No
	Surface and Subsurface Soil Groundwater	Future Construction/ Utility Worker	No	Yes
Off-Site Commercial Area	Surface and Subsurface Soil Groundwater	Future Construction/ Utility Worker	No	Yes
Off-Site Residential Area	Groundwater Household Use	Future Resident	Yes	Yes

The risk and hazards for the receptors within AOC3 were calculated without consideration of the institutional controls imposed by the existing Grant of Environmental Restrictions (GER) for AOC3. As needed, the GER requires engineering

controls for buildings and health and safety plans for excavations to mitigate any exposure that may result in risk/hazard over the point of departure for the future industrial/commercial worker and future construction/utility worker.

6.2 HUMAN HEALTH RISK ASSESSMENT - MUDDY COVE

The HHRA for Muddy Cove is presented in the Phase II Muddy Cove Human Health Risk Assessment, Menzie-Cura, November 30, 2006. The HHRA evaluated the following potential current /future receptors:

- Adolescent visitor that walks on the banks of the Cove
- Adolescent visitor/wader that walks on the banks and wades in the nearshore sediment of the cove
- Adolescent wader that wades in the nearshore sediments
- Adolescent angler that fishes from a bridge and consumes fish caught in the cove
- Child that consumes fish caught in the cove
- Nearby resident that consumes fish caught in the cove and wades in the nearshore sediments

These receptors could potentially be exposed to contaminants in the sediment, surface water, and through consumption of fish that have bioaccumulated contaminants. Based on the results of the Phase I HHRA, the risks estimated from exposure to surface water were determined to be negligible and, therefore, USEPA and Zeneca agreed that surface water would not be quantitatively assessed in the Phase II HHRA. The potential risks were characterized for each of the six receptors to yield a total cancer risk and a non-cancer hazard characterization for each receptor. The results of the risk assessment and the RME risk scenarios that resulted in an estimated increased cancer risk of 1E-06 or a HI greater than 1.0 are listed below:

Receptor	*Exceeds Risk*	*Exceeds HI*
Adolescent Visitor	Yes	No
Adolescent Visitor/Wader	Yes	No
Adolescent Wader	Yes	No
Adolescent Angler	Yes	Yes
Child/Fish Consumer	Yes	Yes
Nearby Resident	Yes	Yes

6.3 ECOLOGICAL RISK ASSESSMENT - FORMER MANUFACTURING AREA

The Ecological Risk Assessment (ERA) Report for the former manufacturing area (AOC1, AOC3, AOC4, and AOC5) was submitted April 2007. The April 2007 ERA expanded on the previous ERA conducted for the Site in 1996.

On-Site habitat contains a functional aquatic habitat, consisting of a small ponded area in the middle of the Site that is fed and drained by a small brook. Terrestrial habitat is more limited, and given the future land use as industrial/commercial land, likely to remain so.

The 1996 ERA included a screening ecological risk assessment (SLERA) and baseline ecological risk assessment (BERA). Results showing unacceptable risks to benthic invertebrates and possibly fish-eating wildlife prompted remediation of the on-Site watercourse (Muddy Cove Brook). In response to this 1996 risk assessment, sediments in an on-Site pond were removed and replaced with clean soils, and nearshore habitat of the pond was also improved.

The April 2007 ERA included elements of a SLERA and a BERA. In the SLERA, the data from the sediment and surface water sampling for the SRFI were screened against conservative ecological screening values (ESV). Based on the maximum concentration, only a small number of compounds (aluminum, manganese, silver, and 1,4-dichlorobenzene) were retained as chemicals (or compounds) of potential concern (COPCs) for surface water. However, this list of COPCs was further refined using more realistic assumptions, and no chemicals were retained for detailed analysis. Thus, review of the surface water chemistry suggests that direct toxicity to aquatic receptors is unlikely. This assessment is corroborated by the macrobenthos survey where macroinvertebrates were very abundant, and the species found were consistent with the habitat.

When the analytical results from sediment samples were screened, a large number of organic and inorganic compounds exceeded ESVs. However, the elevated concentrations of both organic and inorganic compounds were primarily limited to a small area of unremediated sediments at the very downstream end of the Muddy Cove Brook, before the brook discharges to Muddy Cove. Sediments from upstream areas, including the remediated pond sediments, had lower concentrations of chemicals. No chemicals from these upstream areas were retained as COPCs when re-screened against more scientifically defensible ecological benchmarks, suggesting little potential for

impacts in these areas. In contrast, a number of compounds could not be eliminated when more contaminated, downstream sediments were re-screened.

The results of the chemical screening are consistent with the results of the sediment bioassays where a biologically and statistically significant 40 percent reduction, compared to lab and field controls, in *Hyallela* growth was identified in the most downstream sediment. However, this same sample had excellent *Hyallela* survival, and the level of impact - 40 percent decrease in growth - is only a moderate effect on a non-lethal endpoint. Moreover, the evidence suggests that this moderate toxicity is attenuating naturally. Previous bioassays (in 1995) on sediments taken from this most downstream area showed much higher levels of toxicity to both *Hyallela* and *Chironomus*.

Potential impacts of mercury and PCBs on piscivorous wildlife were also estimated with simple food chain models. These food chain analyses indicate that there is no potential risk from the low residual levels of these chemicals found in remediated areas of the Brook or in the hard bottom portions of the downstream sections.

Thus, the available data indicated that Site-related chemicals in surface water and sediments pose no unacceptable risks to ecological receptors. The sediment remediation was successful in addressing potential risks to aquatic receptors. Consequently, no further investigation of these aquatic areas is warranted. However, potential effects from unremediated contaminated sediments might be occurring in the very downstream portion of the Brook. Even here, however, the potential impacts appear to be moderate, limited to a very small area, and attenuating naturally over time.

The on-Site soil data were also evaluated for potential ecological impacts. The analysis indicated that when all soil samples, including those under impermeable surfaces were considered, only lead, and to a lesser extent, PCBs have the potential to cause ecologically significant impacts to the most sensitive wildlife inhabiting the Site. However, the risks of these two chemicals under these circumstances are low. When samples under impermeable surfaces are excluded from consideration, no compounds have the potential to cause ecologically significant impacts on the most sensitive wildlife inhabiting the Site. Therefore, current ecological risks are low. Current risks are, moreover, limited by the low habitat quality of parts of the Site where contamination is most prevalent.

6.4 ECOLOGICAL RISK ASSESSMENT - MUDDY COVE

The results of the ERA for Muddy Cove are presented in the Phase II Muddy Cove Ecological Risk Assessment (MCERA) dated August 2005.

The results of the MCERA indicate a potential risk to the benthic community. Although the results show that the community of benthic invertebrates in Muddy Cove present at the time of sampling was not less diverse or abundant than the reference area communities, Muddy Cove sediments from several locations were toxic in the laboratory sediment toxicity tests.

The results also indicate a potential risk to local populations of fish due to exposure to aluminum, copper, and selenium. However, confidence in these risk estimates is low due to uncertainty in the toxicity studies from the literature and their extrapolation to the local species. Also, concentrations of these metals in the fish from Muddy Cove are not significantly different from the concentrations in fish caught from the reference areas, indicating that exposures to these metals are occurring throughout the area of the Taunton River.

The kingfisher, a piscivorous bird with a small foraging area, is the only wildlife receptor for which the MCERA indicates a potential for risk with a medium level of confidence. However, a nesting and habitat survey found that the Cove represents suboptimal habitat for the kingfisher, which likely only forage in the Cove occasionally. Therefore, the exposure and associated risk to this receptor is likely lower that reported in the MCERA. The risk to this receptor (due to consumption of methyl mercury in fish prey items) is only slightly elevated over that estimated for the reference sites.

6.5 ECOLOGICAL RISK ASSESSMENT - PHRAGMITES MARSH

CRA conducted an evaluation of risk to ecological receptors exposed to sediment of the phragmites marsh, located in the northwest portion of Muddy Cove. The phragmites marsh ERA is presented in Appendix D.

The evaluation concluded that concentrations of arsenic, copper, iron, mercury, selenium, and total PCBs in the 0 to 0.5-foot interval potentially pose risk to benthic invertebrates. For the 1 to 2-foot depth interval, concentrations of beryllium, copper, mercury, and selenium potentially pose risk. At depths greater than 2 feet, none of the constituents detected in sediment are likely to pose risk to benthic invertebrates.

7.0 CHEMICALS OF CONCERN

7.1 POTENTIAL COCs BASED ON RISK ASSESSMENT RESULTS

A list of potential Chemicals of Concern (COCs) for the Site was developed from the results of the risk assessments. Specifically, for human health exposure scenarios that were determined to result in exceedances of acceptable risk levels as identified in Section 6.1, the parameters that contribute to the risk exceedances were identified as potential COCs. It should be noted that for AOC3, the metals groundwater data for well MW-31-S were not used for developing the list of potential COCs. As explained in the SRFI Report and the SRFI Addendum, the groundwater samples collected from MW-31-S had high turbidity levels that impacted the metals results. Metals concentrations in other groundwater samples collected from AOC3 and from the replacement well MW-31R-S were orders of magnitude lower than reported at MW-31-S.

The development of the potential COC list also considered the results of the Ecological Risk Assessments (ERAs) for the AOCs. The ERA for the upland areas of the Site indicated that there were no unacceptable risks to ecological receptors in the upland areas. Potential ecological risks were identified for the sediments at the downstream end of Muddy Cove Brook near Highway 138 and for Muddy Cove. The potential COCs for each AOC are presented in Tables 7.1 to 7.9.

7.2 BACKGROUND DATA

Background data collected for soils and sediments were are presented in Section 8.2 the SRFI Report. Background data are also considered in development of the COC list.

Background soil samples were collected at ten locations in the eastern portion of the Site and off Site to the south. Two samples were collected at each location, one shallow (0 to 1 ft bgs) and one deeper (depths ranging from 1 to 3.7 ft bgs). The results of the background soil sampling are presented in Tables 7.10 and 7.11. The background soil data were compared to the maximum soil concentrations for metals identified in Tables 7.1 to 7.7. In cases where the maximum background soil concentration exceeded the maximum detected concentration for an identified potential COC, that compound was removed from the COC list. Specifically, this occurred for the following parameters:

Parameter	*AOC*	*Maximum Detected Concentration (mg/kg)*	*Maximum Background Concentration (mg/kg)*
Mn	Off-Site Zeneca	281	292
Mn	Off-Site Com/Res	221	292
As	Off-Site Com/Res	3.3/4.8J	4.9

7.3 FINAL LIST OF COCs

The final list of COCs for soils includes all the parameters that contribute significantly to the human health risk (i.e., human health HI above 1.0 and risk above 1E-06), minus the parameters that are present at concentrations less than the background levels. The COC list for soils for each AOC is presented in Table 7.12.

The final list of COCs in the groundwater includes all parameters that significantly contribute to exceedances of estimated human health risks as presented in Tables 7.1 through 7.8, plus parameters identified at concentrations above the GW3 criteria (all AOCs) and parameters above the GW1 criteria [overburden and deep overburden/ weathered bedrock groundwater in off-Site areas not owned by Zeneca]). Detailed review of the groundwater analytical results indicated that selenium at AOC5, nickel and silver at AOC4, and thallium, naphthalene, and 4-nitrophenol at the off-Site AOC would be identified as COCs in the groundwater following adherence with MCP standards. However, these parameters were generally found at elevated concentrations at a very low frequency (typically only in one of the many groundwater samples collected) and were not found at elevated concentrations in the most contaminated areas of the Site. Hence, it was concluded that the elevated concentrations detected for these parameters were in fact anomalous and these parameters were subsequently omitted from the COC list. The final list of COCs for the groundwater is presented in Table 7.13. Addressing these parameters will result in reducing the human health HI to below 1.0 and the risk to below -1E-06 and result in acceptable levels of ecological risk.

The COC list (based on HHRA results) for sediments in the phragmites area on the Zeneca property adjacent to Muddy Cove is presented in Table 7.14. COCs for nearshore and bank sediments in Muddy Cove are presented in Table 7.15. COCs for sediments other than bank sediments in Muddy Cove are discussed in Section 8.3.

8.0 PROPOSED MEDIA CLEANUP STANDARDS

According to the Consent Order, media cleanup standards (MCS) are to be developed for the various impacted media at the Site to assure protection of human health and the environment. MCS are defined as the "concentrations of hazardous constituents in groundwater, surface water, sediments, air, and soils that must be achieved by the corrective action" (NCP 1990 and DOE 1995) to provide adequate protection of human health and the environment. With respect to protection of human health, the USEPA goal is to reduce the threat from carcinogenic contaminants such that, for any medium, the excess risk of cancer to an individual exposed over a lifetime generally falls within a range from one in ten thousand to one in one million (i.e., $1x10^{-4}$ to $1x10^{-6}$). Guidance also states that, as a general goal, USEPA prefers cleanup levels at the more protective end of this cancer risk range. Consequently, the 1E-06 cancer risk level is considered a "point of departure." For non-cancer risks, an HI of 1.0 is similarly the preferred goal or point of departure. For both cancer and non-cancer risks, USEPA guidance recommends that MCS be based on the reasonable maximum exposure (RME). For ecological risk, MCS are to be calculated to prevent adverse effects to the assessment endpoints identified in the ecological risk assessments. Guidance recommends that, in general, MCS should be proposed for each chemical and medium that exceeds any of these "point of departure" risks.

As presented in Section 7.0, the risk assessments were used to determine the COCs that contribute significantly to the human health and environmental risk at the Site. Section 8.0 develops the MCS for the COCs for each AOC. In general, the MassDEP Method 1 generic risk based cleanup levels are proposed as MCS for soils and groundwater. The MassDEP Method 1 generic risk based cleanup levels are typically lower or similar to Site-specific risk based cleanup levels calculated based upon the Risk Assessments. Since no pertinent MassDEP Method 1 cleanup levels exist for sediments, Site-specific risk-based cleanup levels are developed for sediment. TSCA cleanup levels for PCBs are also considered as TSCA is applicable to any remediation for PCBs. The following sections present the bases for the proposed MCS for the various media.

8.1 SOILS

8.1.1 MCP METHOD 1 STANDARDS

Generic Method 1 Standards as presented in the Massachusetts Contingency Plan (MCP) were used in the selection of MCS for soils. The MCP Method 1 standards are based upon an increased cancer risk of 1E-06 and a HI of 0.2.

The MCP Method 1 criteria for categorizing soils are based on the frequency and intensity of use for adults and children, and on potential accessibility.

In accordance with the MCP 310 CMR 40.0933, the frequency of use can be either "high" or "low" according to the following criteria:

1. *"Children's frequency of use shall be characterized as high if:*
   a. *any children reside, attend school or attend day care at the disposal site; or*
   b. *large numbers of children visit the disposal site, regardless of any one child's frequency of visitation.*
2. *Adults' frequency of use shall be characterized as high when they reside at the disposal site, or when they work at the disposal site on a continuing basis [i.e., full days or shifts of eight or more hours per day on a continuing basis].*
3. *Children's or adults' frequency of use shall be characterized as low when they are present at the disposal site, but only as infrequent visitors; or when workers are present at the disposal site for only short periods of time [i.e., less than two hours per day on a continuing basis, or for full days or shifts on a sporadic basis].*
4. *It shall be presumed that children may be present at the disposal site unless it can be demonstrated that access by children age 15 and younger is specifically restricted or that such children are highly unlikely to be present, in which case children may be considered to be "Not Present".*

The intensity of use can be either "high" or "low" according to the following criteria.

1. *"Site Activities and Uses which have the potential to disturb soil and thus result in either direct contact with the soil itself or inhalation of soil-derived dust shall be characterized as high intensity use. Examples of such activities include, without limitation, gardening, digging, and recreational sports.*
2. *Passive activities which do not disturb the soil, such as walking, shopping, and bird watching shall be characterized as low intensity use."*

The accessibility of the soils can be categorized as "accessible", "potentially accessible", or "isolated" according to the following criteria:

"Soil shall be characterized as "accessible" if it is located less than three feet below the surface, and the surface is not completely covered by pavement. For buildings having earthen floors, the floor shall be considered as the soil surface.

Soil shall be characterized as "potentially accessible" if it is located at a depth of 3 to 15 feet below the surface (with or without pavement), or if the soil is located less than three feet from the surface in an area completely paved.

Soil shall be characterized as "isolated" if it is located at a depth greater than 15 feet below the surface, or if the soil is covered completely by a building or other permanent structure which does not have earthen floors, regardless of depth. Soil located at a depth greater than three feet below the earthen floor of a building or other permanent structure shall also be characterized as "isolated"".

Using the above definitions, soil would be classified as Category S-1 if either:

a) *"the soil of concern is accessible, pursuant to 310 CMR 40.0933(4)(c)1., and either:*

b) *the soil is currently used for growing fruits or vegetables for human consumption, or if it is reasonably foreseeable that the soil may be put to such use; or*

c) *a child's frequency or intensity of use is considered to be high pursuant to 310 CMR 40.0933(4)(b) and (c); or*

d) *an adult's frequency and intensity of use are both considered to be high pursuant to 310 CMR 40.0933(4)(b) and (c); or*

e) *the soil is potentially accessible, pursuant to 310 CMR 40.0933(4)(c)2., and a child's frequency and intensity of use are both considered to be high pursuant to 310 CMR 40.0933(4)(b) and (c)."*

or as Category S-2 if either:

(a) *"the soil is accessible, pursuant to 310 CMR 40.0933(4)(c)1., and:*

i) *a child's frequency and intensity of use are both considered to be low pursuant to 310 CMR 40.0933(4)(b) and (c); or*

ii) *children are not present at the disposal site and either (but not both) the adults' frequency or intensity of use is considered to be high, pursuant to 310 CMR 40.0933(4)(b) and (c); or*

(b) *the soil is potentially accessible, pursuant to 310 CMR 40.0933(4)(c)2., and:*

i) *either (but not both) a child's frequency or intensity of use is considered to be high pursuant to 310 CMR 40.0933(4)(b) and (c); or*

ii) *children are not present at the disposal site and an adult's frequency and intensity of use are both considered to be high pursuant to 310 CMR 40.0933(4)(b) and (c)."*

Soil shall be classified as Category S-3 if either:

a) *"the soil is accessible, pursuant to 310 CMR 40.0933(4)(c)1., and children are not present at the disposal site and an adult's frequency and intensity of use are both considered to be low pursuant to 310 CMR 40.0933(4)(b) and (c); or*

b) *the soil is potentially accessible pursuant to 310 CMR 40.0933(4)(c)2., and:*

i) *a child's frequency and intensity of use are both considered to be low pursuant to 310 CMR 40.0933(4)(b) and (c); or*

ii) *a demonstration has been made that children are not present at the disposal site, and either an adult's frequency or intensity of use is considered to be low pursuant to 310 CMR 40.0933(4)(b) and (c); or*

c) *the soil is isolated pursuant to 310 CMR 40.0933(4)(c)3., regardless of any receptor's frequency or intensity of use."*

Based on the current and future frequency and intensity of use and on potential accessibility, the soil on the Site would be categorized as S-2 or S-3. The off-Site soils would be categorized as S-1 or S-2. The following system for selecting soil cleanup levels is proposed, depending on future land uses:

<u>On-Site Soils</u>

- S-2, S-3, S-2/GW2, S-3/GW3 (Applies to areas outside the PPA/MYTA)
- S-2/GW-1, S-2/GW-2, S-2/GW-3, S-3/GW-1, S-3/GW-2, S-3/GW-3, (Applies to areas within the PPA/MYTA.)

<u>Off-Site Soils</u>

No COCs were identified for the off-Site soils.

Figure 8.1 shows the AOCs and the off-Site areas and identifies the MassDEP Method 1 soil criteria applicable to each area.

8.1.2 PCB CLEANUP LEVELS UNDER TOXIC SUBSTANCES CONTROL ACT (TSCA)

PCBs in the soils have been identified as a potential COC. PCBs are regulated under the Toxic Substances Act (TSCA) Title 40 of the Code of Federal Regulations at Part 761 (40 CFR Part 761). PCB cleanup criteria under TSCA depend upon the frequency of use of the property. The use of a property is classified as a high or low occupancy area under the self-implementing cleanup provisions of 40 CFR §761.61(a) as follows:

High occupancy area *is generally defined as any area where PCB remediation waste has been disposed of on site (including but not limited to any building, any floor/wall of the building, any enclosed space within the building), and where annual occupancy for any individual not wearing dermal and respiratory protection is 840 hours or more (an average of 16.8 hours or more per week) for non-porous surfaces and 335 hours or more (an average of 6.7 hours per week) for bulk PCB remediation waste. Examples include a residence, school, day care center, sleeping quarters, a single or multiple occupancy 40-hours-per-week work station, a school classroom, a cafeteria in an industrial facility, a control room, and a work station at an assembly line.*

Low occupancy area *is generally defined as any area where PCB remediation waste has been disposed of on site (including but not limited to any building, any floor/wall of the building, any enclosed space within the building), and where annual occupancy for any individual not wearing dermal and respiratory protection is less than 840 hours (an average of 16.8 hours per week) for non-porous surfaces and less than 335 hours (an average of 6.7 hours per week) for bulk PCB remediation waste. Examples include an electrical substation or a location in an industrial facility where a worker spends small amounts of time per week (such as an unoccupied area outside a building, an electrical equipment vault, or in the non-office space in a warehouse where occupancy is transitory).*

Cleanup criteria for a self-implemented cleanup for a high occupancy area are:

- ***Less than or equal to 1 part per million (ppm)*** *PCBs in the soils, other residual waste, or porous surfaces, without further conditions (see 40 CFR §761.61(a)(4)(i)(A)).*
- ***Greater than 1 ppm but less than or equal to 10 ppm*** *if the area is covered with an appropriate cap (see 40 CFR §761.61(a)(4)(i)(A)) as specified at 40 CFR §761.61(a)(7); i.e., when referring to on-site cleanup and disposal of PCB remediation waste, a cap means a uniform placement of concrete, asphalt, or similar material of minimum thickness spread over the area where remediation waste was removed or left in place in order to prevent or minimize human exposure, infiltration of water, and erosion. (See the specific requirements at 40 CFR §761.61(a)(7).)*

Cleanup criteria for a self-implemented cleanup for a low occupancy area are:

Bulk Remediation Waste and Porous Surface

- ***Less than or equal to 25 ppm*** *in the soils, other residual waste, or porous surfaces [see 40 CFR §761.61(a)(4)(i)(B)] and an institutional control [i.e., deed restriction; see 40 CFR §761.61(a)(8)].*
- ***Greater than 25 ppm but less than or equal to 50 ppm*** *in the soils, other residual waste, or porous surfaces [see 40 CFR §761 .61(a)(4)(i)(B)] provided the site is secured by a fence, marked with a sign that includes the PCB ML mark and an institutional control [i.e., deed restriction; see 40 CFR §761.61(a)(8)] is implemented.*
- ***Greater than 25 ppm but less than or equal to 100 ppm*** *provided the site is covered with an appropriate cap [i.e., a uniform placement of concrete, asphalt, or similar material of minimum thickness spread over the area where PCB remediation waste was removed or left in place in order to prevent or minimize human exposure, infiltration of water, and erosion] and an institutional control [i.e., deed restriction] is implemented. [See specific requirements at 40 CFR §761.61(a)(4)(i)(B) and §761.61(a)(7) and (a)(8).]*

8.1.3 PROPOSED SOIL CLEANUP LEVELS

The COCs and the proposed soil cleanup levels for each AOC are presented in Tables 8.1 to 8.4. For COCs where no MCP Method 1 cleanup level exists, the cleanup levels were calculated using the same procedures used for the MCP Method 1 cleanup levels. Soil cleanup levels were calculated for nitrobenzene, manganese, copper, and 1,2,3-trichlorobenzene. The calculations are presented in Appendix B. Note that there are no soil COCs for the off-Site areas as the only constituents determined to present an increased risk (arsenic and manganese) were found at concentrations that are within the background levels

MCS also were calculated for volatile COCs in soil that may impact indoor air quality at the Site. The MCS were developed to protect human health from exposure to soil COCs through vapor migration to the indoor air of a potential future on-Site building. Based on current and anticipated future land uses, the MSCs are developed for an industrial/commercial worker receptor.

For this evaluation, COCs were identified based on the inhalation exposure to soil through indoor air. Chemicals with an exceedance of the target risk of 10^{-6} and/or

hazard of 1.0 as shown in the HHRA were carried through the evaluation and a MSC was calculated for the soil to indoor air exposure pathway.

The soil MCS based on the indoor air inhalation pathway were developed using the approach applied by the USEPA (2002), which is based on the J&E Model. Johnson and Ettinger (1991) present a heuristic model for estimating the degree of attenuation occurring as volatile contaminants in soil vapor migrate upward through the vadose zone, enter an overlying building, and mix with the indoor air of the building. The degree of attenuation is quantified through the calculation of an attenuation factor, α, after Johnson and Ettinger (1991; Equation 21).

MCSs were calculated using the USEPA (2004) and model conservative default compound properties, vadose zone soil, and building properties. The compound properties applied in the estimation of the soil to indoor air MCS consist of a Henry's Law constant, a water diffusion coefficient, and an air diffusion coefficient which were taken from MCP GW2 spreadsheet (2009).

The Henry's Law constants and air diffusion coefficients were corrected to a default soil temperature of 10 degrees Celsius. The default vadose zone soil and building properties used in the USEPA (2004) model were also taken from the MCP GW2 spreadsheet (2009).

The estimated soil MCSs based on the industrial/commercial worker receptor in a building with a basement consistent with the approach used in the HHRA is presented in Appendix C. The applied vadose zone soil, building, and chemical properties are also summarized in Appendix C. The estimated MCSs are protective of potential health risks/hazards posed by the indoor air inhalation exposure pathway.

8.2 GROUNDWATER

8.2.1 MCP METHOD 1 STANDARDS

The MCP distinguishes between three different groundwater categories, as described below (310 CMR 40.0932).

"*Groundwater at all disposal sites shall be considered a potential source of discharge to surface water and shall be categorized, at a minimum, as category GW-3. The site, receptors, and exposure information identified in 310 CMR 40.0904 through 40.0929 shall be used in*

conjunction with the criteria listed below to determine if the groundwater shall also be categorized as GW-1 and/or GW-2.

Groundwater Category GW-1 *Except as provided by 310 CMR 40.0932(5), groundwater shall be defined as GW-1 if the groundwater is located:*

(a) within a Current Drinking Water Source Area; or

(b) within a Potential Drinking Water Source Area.

Groundwater Category GW-2. *Groundwater shall be defined to be in category GW-2 if it is located within 30 feet of an existing occupied building or structure, and the average annual depth to groundwater in that area is 15 feet or less. Category GW-2 groundwater is considered to be a potential source of vapors of oil and/or hazardous material to indoor air.*

MassDEP defines Current Drinking Water Supply Areas as:

- *within the Zone II for a public water supply;*
- *within the Interim Wellhead Protection Area for a public water supply;*
- *within 500 feet of a private water supply well; or*
- *within the Zone A of a Class A surface water body used as a public water supply.*

Potential Drinking Water Source Areas are defined as groundwater located:

- *greater than 500 feet from a public water supply distribution pipeline, unless the groundwater is located under a parcel of land or a facility where any portion of that parcel of land or facility is located less than 500 feet from a public water supply distribution pipeline;*
- *within an area designated by a municipality specifically for the protection of groundwater quality to ensure its availability for use as a source of potable water supply protection zones (e.g., Aquifer Protection District or Zone); or*
- *within a Potentially Productive Aquifer that has not been excluded as a Non-Potential Drinking water Source Area.*

A Potentially Productive Aquifer (PPA) is a medium yield aquifer that has a transmissivity of between 10,000 and 30,000 gallons per foot per day (gpfd) and a yield of 100 to 300 gallons per minute (gpm). As described in the SRFI report, a portion of the overburden in the northeast section of the Site was identified by the MADEP as a PPA, based on information included in the United States Geological Survey (USGS) 1973 Hydrogeologic Investigations Atlas HA-460 "Water Resources of the Taunton River

Basin, Southeastern Massachusetts (Williams et al., 1973). Although sufficiently transmissive sand and gravels were not identified in the northern area of the Site that was designated as a PPA, an area on Site and off Site to the east was identified that had transmissivity values between 10,000 and 30,000 gallons per day (gpd). This area is referred to as a MYTA.

Presently, there are no existing structures on the Property other than the Pump House and the temporary Office Trailer. However, there are no current institutional controls for AOC1, AOC2, AOC4, and AOC5 preventing future structures from being built and, therefore, Class GW-2 could apply to these areas in the future. In AOC3, a Grant of Environmental Restriction (GER) has been established that requires the potential presence of indoor air issues to be evaluated for any new buildings.

There are no municipal drinking wells near the Site. Houses that are located within 500 feet of the Site, specifically the houses on Marion Avenue and Elm Street, are supplied by Town water and do not have private water supply wells.

Based on the current and potential future groundwater use at the Site, the following system for selecting groundwater cleanup levels is proposed:

Overburden Groundwater

- GW-2 and GW-3
- GW-1 (applies to off-Site locations only)

Deep Overburden/Weathered Bedrock

- GW-3[4]
- GW-1 (applies to off-Site locations only)

Bedrock Groundwater

- GW-3[5]

Figure 8.2 shows the on-Site AOCs and the off-Site areas and identifies the MassDEP Method 1 groundwater criteria applicable to each area.

---

4 GW-2 does not apply to the deep overburden/weathered bedrock groundwater since the depth is greater than 15 feet.

5 GW-2 does not apply to the bedrock groundwater since the depth is greater than 15 feet.

8.2.2 PROPOSED GROUNDWATER CLEANUP LEVELS

A summary of the proposed groundwater cleanup levels for the identified COCs are presented in Tables 8.5 to 8.10 for each AOC. For COCs where no MCP cleanup levels exist, the cleanup levels were calculated using the same procedures used for the MCP cleanup levels. Cleanup levels were calculated for nitrobenzene, manganese, copper, aluminum, and 1,2,3-trichlorobenzene. The calculations are presented in Appendix B.

8.3 PROPOSED SEDIMENT CLEANUP LEVELS

8.3.1 MUDDY COVE NEARSHORE/BANK SEDIMENTS

The Muddy Cove HHRA identified potential risks to a visitor or wader due to potential exposure to arsenic and PCBs in the Muddy Cove nearshore and bank sediments, particularly the areas that are adjacent to residential properties. These areas are potentially high frequency access and accessible in accordance with MassDEP definition for a S-1 soil exposure. Therefore, S-1 criteria are used as proposed cleanup levels for these areas. Proposed cleanup levels for the Muddy Cove nearshore/bank sediments adjacent to the residential areas are listed in Table 8.11.

8.3.2 OFF-SITE SEDIMENTS - ZENECA PROPERTY - PHRAGMITES AREA

The HHRA identified a potential risk due to exposure to arsenic, PCBs, and benzo(a)pyrene in the sediments in the phragmites area. This area is accessible but a child's frequency and intensity of use are both considered to be low. Therefore, S-2 criteria are used as proposed cleanup levels for these areas. Proposed cleanup levels for protection of human health for the phragmites area sediments are listed in Table 8.12.

Zeneca and USEPA have agreed in concept to enhance the phragmites marsh by eradicating the dense stand of phragmites, and restoring the area as a marsh with native plants. The results of the phragmites marsh ERA indicate that activities to restore the area of the phragmites marsh will remove sediment with concentrations of COCs that potentially pose risk to benthic invertebrates or other ecological receptors. Concentrations of COCs in the deeper sediments that are not removed (i.e., >2 ft bgs) and may be exposed following restoration will not pose risk to benthic invertebrates or other ecological receptors.

8.3.3 MUDDY COVE - SEDIMENTS

Since no pertinent MassDEP Method 1 cleanup levels exist for sediments, the Site-specific risk assessments are used to identify point of departure MCS for the Muddy Cove sediments.

Following the submittal of the MSC Proposal document by Zeneca in March 2008, USEPA and Zeneca have traded technical opinions regarding the appropriate means of evaluating the sediment data and the resulting conclusions regarding applicable MCS for the sediments. At the direction of USEPA, the proposed MCS for sediment of Muddy Cove is based on toxicity to benthic invertebrates, with total mercury as the indicator contaminant. Based on toxicity tests conducted in 2002 using *Leptocheirus plumlosus* as the test organism, the maximum concentration of total mercury at which no statistically significant effects on the endpoints of growth, reproduction, or survival were expressed is 12.3 ppm. This value is used as a guideline for defining the areas within Muddy Cove for sediment removal, which are identified on Figure 8.1. The area for sediment removal includes those areas where the concentration of total mercury in sediment is greater than 12.3 ppm, but also includes sample location SD-124, where the 2002 toxicity tests identified a statistically significant effect on the growth endpoint at a concentration of 8.99 ppm for total mercury. Cleanup of location SD-610, located in Muddy Cove Brook immediately upstream of Muddy Cove, is also proposed since this location has higher than average COC concentrations and is located in the channel where it is susceptible to erosion during storm surge events.

As agreed to by USEPA, the proposed MCS for the sediment is based on an area-wide concentration of total mercury rather than a single value for all areas of Muddy Cove. The average area-wide concentration of total mercury for current conditions is 23.06 ppm. Upon removal of sediment from the areas identified on Figure 8.3, the average area-wide concentration of total mercury will be 7.44 ppm.

To account for variability in the concentrations of mercury and other contaminants of concern in Muddy Cove, the area for sediment removal identified on Figure 8.3 includes a 1 m buffer around the limits defined by sediment concentrations.

8.4 DNAPL CLEANUP LEVELS

DNAPL was identified at the former MP Building and the Encapsulated Lagoon. The overall cleanup goal is to remove/treat recoverable DNAPL to the extent practicable. Residual DNAPL would be addressed the same as contaminated soil.

9.0 PROPOSED POINTS OF COMPLIANCE

The point of compliance (POC) is the location or locations at which media cleanup levels are achieved. Guidance for establishing POCs is provided in the May 1996, Corrective Action for Releases from Solid Waste Management Units at Hazardous Waste Management facilities: proposed Rule, 40 CFR Ch.1.

9.1 SOILS

The points of compliance for soils are generally selected to ensure protection of human and environmental receptors against direct exposure and to take into account protection of other media from cross media contamination (e.g., leaching to groundwater). The S-2 and S-3 cleanup levels are based on direct exposure to the soil, whereas, the S-2/GW-1, S-3/GW-1, S-2/GW-2, S-3/GW-2, S-2/GW-3, and S-3/GW-3 cleanup levels are based on direct exposure to the soils and potential leaching to the groundwater.

Soils are potentially accessible for direct contact at the ground surface and subsurface during excavation activities. Consistent with the HHRA, soils within the 0 to 10-foot depth range are considered to be potentially accessible for direct contact. Therefore the point of compliance for the S-2 and S-3 cleanup levels is over the depth range of 0 to 10 ft bgs for AOC1, AOC3, AOC4, and AOC5.

Soil at any depth could potentially leach COCs to the groundwater and therefore the soil cleanup levels of S-2/GW-1, S-3/GW-1, S-2/GW-2, S-3/GW-2, S-2/GW-3, and S-3/GW-3 would apply to all soils, depending upon the appropriate groundwater classification for the AOC.

The TSCA PCB point of compliance applies to any soil remediation at the Site.

9.2 GROUNDWATER

The points of compliance for the groundwater are based upon the potential exposure scenarios upon which the MCS were developed. The GW-3 cleanup criteria are based upon protection to surface water. The hydrogeologic information for the Site indicates that the shallow overburden groundwater discharges to surface water (Muddy Cove and Muddy Cove Brook). Therefore, the point of compliance for the GW-3 MCS is the shallow groundwater in AOC5 and the shallow groundwater adjacent to Muddy Cove. The deep overburden/weathered bedrock and bedrock groundwater does not discharge

directly to surface water but must first pass through the shallow overburden groundwater flow zone before discharging to the Brook or Cove.

GW-2 groundwater criteria are based on protection against migration of vapors of oil and/or hazardous material to indoor air. According to the MCP, the GW-2 criteria are applicable to groundwater within 30 feet of an existing occupied building or structure, and the average annual depth to groundwater in that area is 15 feet or less. Consistent with this potential exposure scenario, the GW-2 MCS point of compliance is the shallow overburden groundwater in any areas that have existing buildings or could have future buildings.

The GW-1 groundwater criteria are based on the groundwater being used as a drinking water source in the future. Currently, the groundwater at the Site and in the vicinity of the Site is not used as drinking water source. Zeneca currently owns the Site and any future remedy for the Site will include groundwater and land use restrictions that will ensure that the Site groundwater is never used as a potable water source. Therefore, the point of compliance for the GW-1 MCS is the off-Site overburden and deep overburden/weathered bedrock groundwater.

9.3 SEDIMENTS

As discussed in Section 8.3.1, the point of compliance for the sediments is the average areal concentration for the exposure area assumed in the exposure scenario. Hence, the point of compliance for MCS based on direct sediment exposure to the trespasser is the average concentration of bank and nearshore sediments. The point of compliance for MCS for indirect exposure due to bioaccumulation pathways is the average for all underwater sediments, not just the nearshore sediments and not including samples of the bank. The type of exposure also determines the point of compliance in terms of sediment/bank material depth. Exposures due to direct and indirect exposure pathways are dominated by chemicals in the surface layers of sediments and bank material (i.e., the benthos habitat). Consequently, the MCS for the Muddy Cove sediments should be applied to average concentrations in the top 2 or 3 inches of sediment and bank material. This is consistent with determination of the areas of Muddy Cove requiring sediment remediation as presented on Figure 8.3.

Zeneca and USEPA have agreed in concept to a program that would enhance the phragmites marsh by eradicating the dense stand of phragmites, and restoring the area as native marsh. The results of the phragmites marsh ERA indicate that activities to restore the area of the phragmites marsh as native marsh will remove sediment with

concentrations of COCs that potentially pose risk. The point of compliance for the phragmites marsh sediment is the average concentrations in the top 2 to 3 inches of sediment in the phragmites marsh that would be left and therefore exposed following implementation of the restoration program.

10.0 REFERENCES

Cantwell, M. G., J. King, and R. M. Burgess, 2006. Temporal trends of Aroclor 1268 in the Taunton River estuary: Evidence of early production, use and release to the environment. Baseline/Marine Pollution Bulletin 52, 1090-1117.

CRA, 2007. Draft Ecological Risk Assessment, Zeneca Inc. April 2007.

CRA, 2007. Human Health Risk Assessment, Zeneca Inc. July 2007.

CRA, 2010a. Supplemental RFI Interim Final Report, Zeneca Inc. August 2010.

CRA, 2010b. Supplemental RFI Interim Final Report Addendum, Zeneca Inc. October 2010.

ENSR, 1995. RCRA Facility Investigation (RFI) Report, Zeneca Facility, ENSR Document No. 3670-036-600. October 1995.

Heinz, G.H, 1979. Methylmercury: Reproduction and behavioral effects on three generations of mallard ducks. Journal of Wildlife Management 43, 394–401.

Johnson, P.C. and R.A. Ettinger, 1991. Heuristic Model for Predicting the Intrusion Rate of Contaminant Vapors into Buildings, Environmental Science and Technology, 25(8), pp. 1445-145.

Maryland DNR, 2007. Chesapeake Bay Fisheries Management Plan: White Perch. Available at http://www.dnr.state.md.us/fisheries/management/FMP/FMPWhitePerch04.pdf.

Menzie-Cura & Associates, 2005. Muddy Cove Ecological Risk Assessment. September 2005.

Menzie-Cura & Associates, 2006. Muddy Cove Human Health Risk Assessment. November 2006.

MCP GW2, 2009. Development of MCP Risk-Based Levels for Soils and Groundwater, Massachusetts Contingency Plan. December 2009.

NCP, 1990. National Contingency Plan, 55 FR 8709. March 8, 1990.

NAS, 2007. Sediment Dredging at Superfund Megasites: Assessing the effectiveness. National Academy Press, Washington, DC.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP) Preamble (55 FR 8910). 1990.

Sample, B.E., D.M. Opresko, and G.W. Suter II, 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. ES/ER/TM-86/R3. Oak Ridge National Laboratory, Oak Ridge, TN.

Smith, D.W., Henry, B., and Edwards, M., 2003. Fish Contaminant Monitoring Program: Review and Recommendations. Report prepared by Exponent, Inc., for the

Michigan Department of Environmental Quality. Available on the Internet at http://www.deq.state.mi.us/documents/deq-wd-fcmp-fcmpfinal.pdf.

Stehlik, L.L., P.G. Scarlett, and J. Dobarro, 1998. Status of the blue crab fisheries of New Jersey. Jour. Shell. Res. 17(2), 475-485.

U.S. Department of Energy, 1995. RCRA Corrective Action; Action Levels and Media Cleanup Standards. EH-231-050/0295.

USEPA Region I, 2005. Interim media protection goals proposal. Letter to Andrew Silfer, General Electric Company.

USEPA, 1993. Great Lakes water quality initiative criteria documents for the protection of wildlife (proposed): DDT, Mercury, 2,3,7,8-TCDD, PCBs. EPA/822/R-93-007. Office Science and Technology, Washington, D.C.

USEPA, 2002. 2000 National Water Quality Inventory. EPA 841-R-02-001. Washington DC: U.S. Environmental Protection Agency, Office of Water, August 2002.

USEPA, 2002. Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), EPA Report No. EPA 530-F-02-052, Office of Solid Waste and Emergency Response, November.

USEPA, 2004. User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings, Office of Emergency and Remedial Response, Washington, DC, February 22.

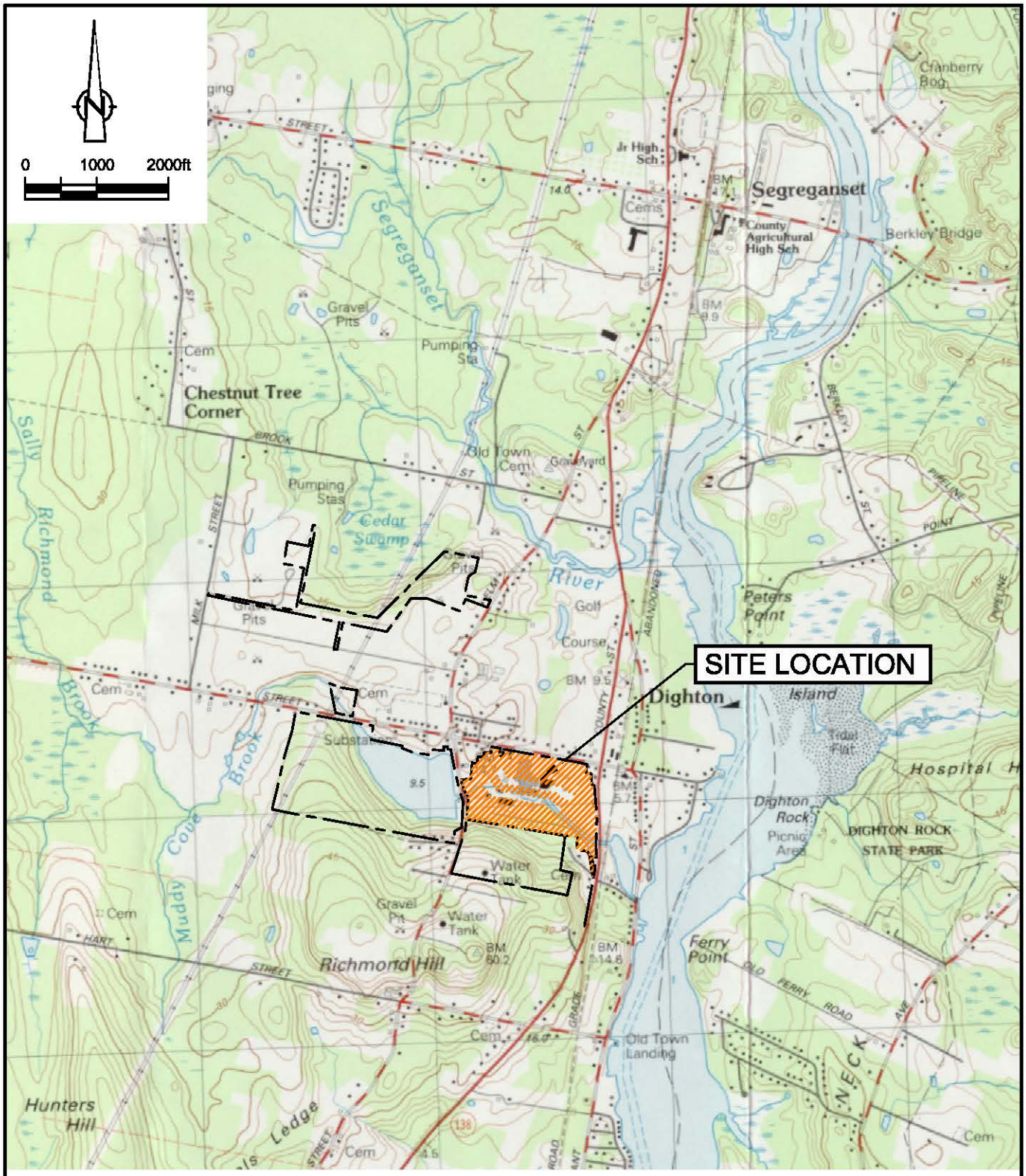
USEPA, 2005. Contaminated sediment remediation guidance for hazardous waste sites. EPA-540-R-05-012. December 2005.

USEPA SAB, 2006. Review of EPA's draft framework for inorganic metals risk assessment.

US Fish and Wildlife Service, 1983. Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic): White Perch. FWS/OBS-82/11.7.

Weston Solutions Inc, 2002. Subaqueous Cap Monitoring Report (Year 1). Muddy Cove Brook Sediment Removal Project, Zeneca Inc.

Woods Hole Group, 2006. Evaluation of Sediment and COPC Transport Processes in Muddy Cove: Input for Decision-making on Remedial Alternatives Draft). Prepared for Zeneca, Inc. October 2006.



SOURCE: SOMERSET MASSECHUSETTS QUADRANGLE MAP

LEGEND

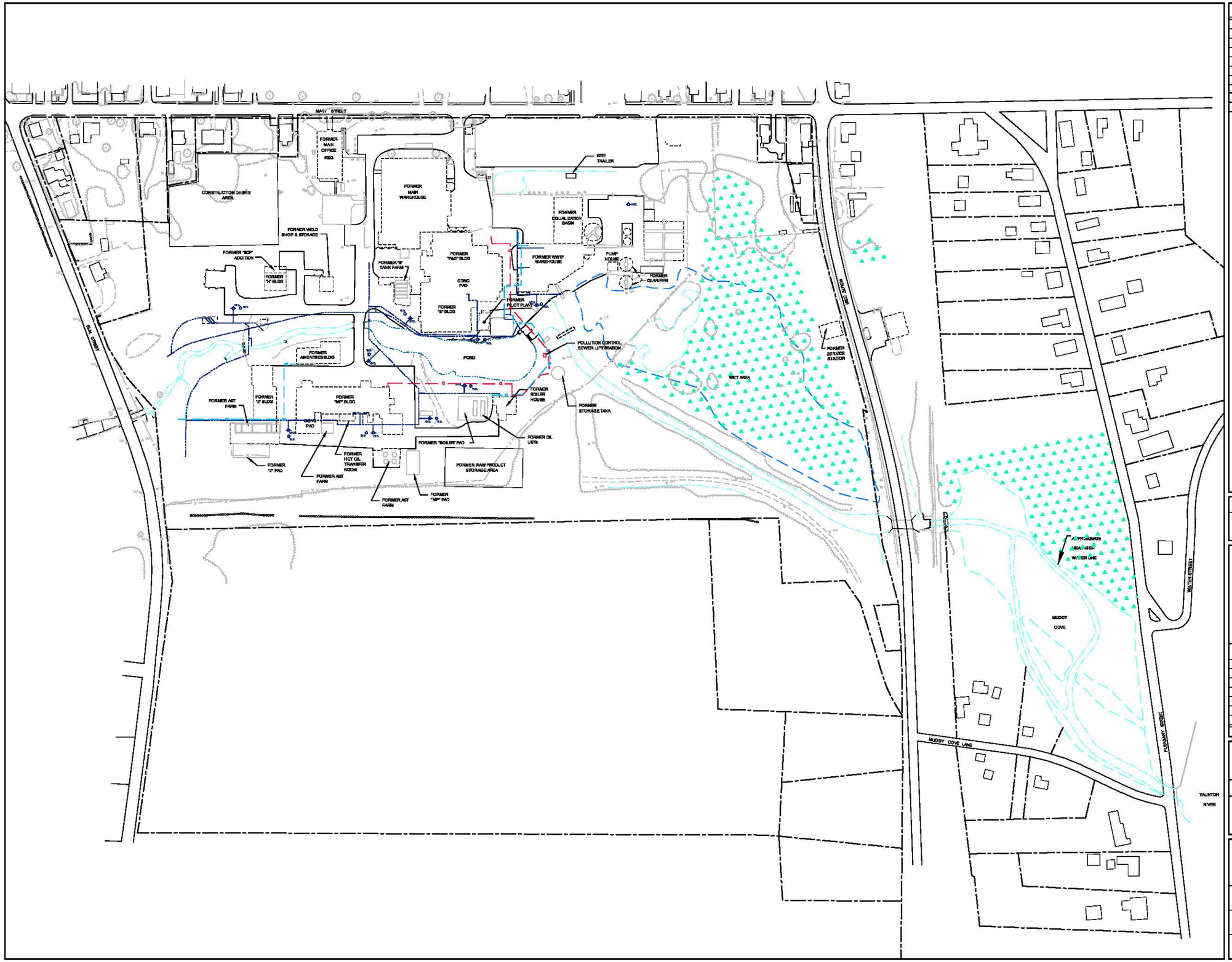
SITE LOCATION

PROPERTY BOUNDARY

figure 2.1

SITE LOCATION
MEDIA CLEANUP STANDARDS PROPOSAL
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA046 DEC 14/2010



No.	Revision	Date	Initial

0 40 120ft

LEGEND

- PROPERTY BOUNDARY
- WATERLINE
- WATERLINE AS OF JULY 2002
- FENCE LINE
- GRAVEL ROAD OR DRIVEWAY
- FORMER BUILDING FOUNDATION
- GAS LINE
- CITY WATERLINE
- FIRE SUPPRESSION WATERLINE
- TREE LINE
- SWAMP
- WATER VALVE
- FIRE HYDRANT
- EDGE OF ENCAPSULATED LAGOON (AS SHOWN ON PETITION BY ICI AMERICA)

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial

ZENECA Inc.
DIGHTON, MASSACHUSETTS

MEDIA CLEANUP STANDARDS PROPOSAL

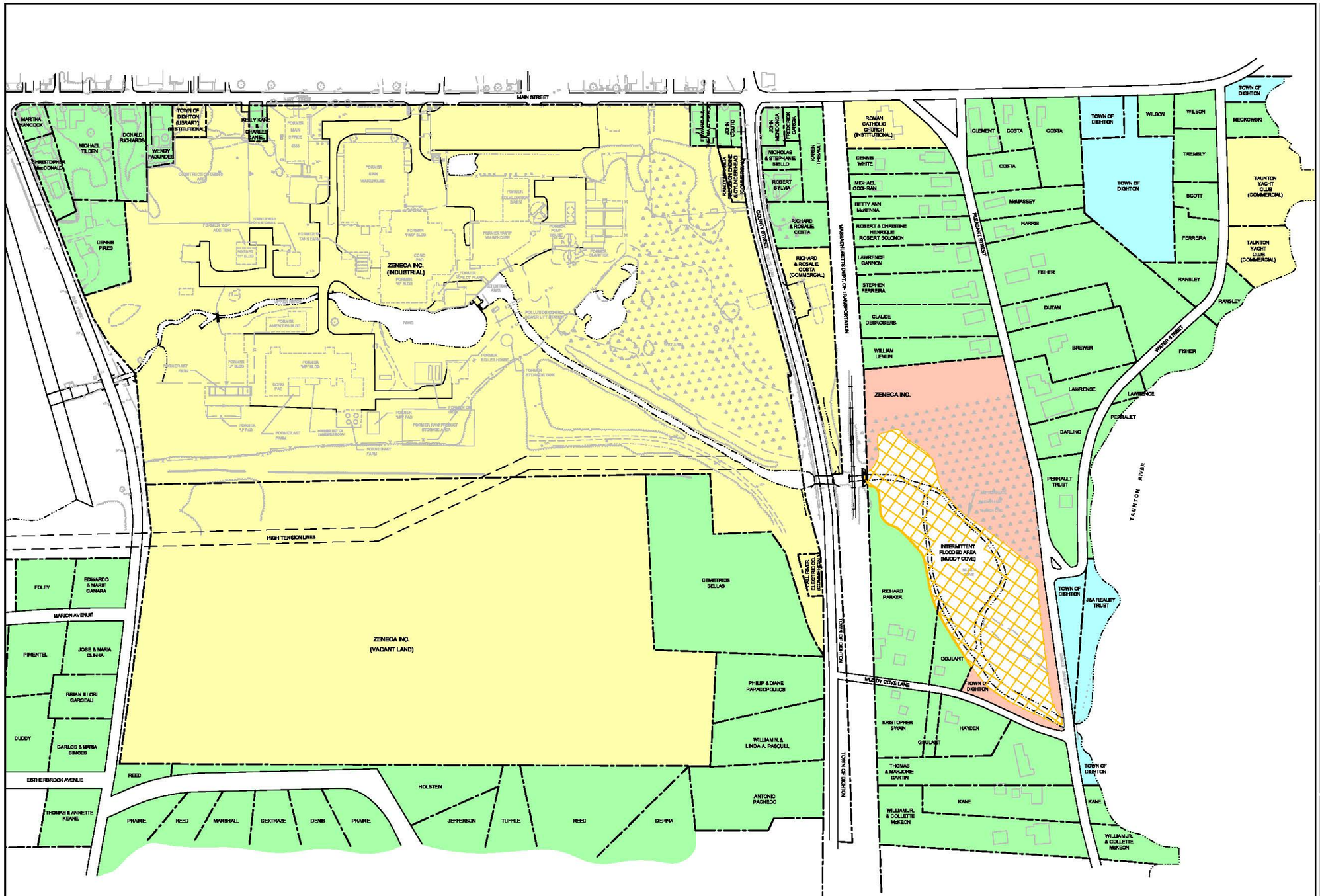
SITE PLAN

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	C.S.	MARCH 2008	
Scale: 1" = 100'	Project No: 15620-78	Report No: 020	Drawing No: 2.2

15620-78(020)GN-WA047 DEC 14/2010



No.	Revision	Date	Initial

0 70 140ft

LEGEND

- PROPERTY BOUNDARY
- WATERLINE
- WATERLINE AS OF JULY 2002
- FENCE LINE
- GRAVEL ROAD OR DRIVEWAY
- FORMER BUILDING FOUNDATION
- GAS LINE
- CITY WATERLINE
- FIRE SUPPRESSION WATERLINE
- TREE LINE
- SWAMP
- WATER VALVE
- FIRE HYDRANT
- EDGE OF ENCAPSULATED LAGOON (AS SHOWN ON PETITION BY ICI AMERICA)
- VACANT RESIDENCE AND AGRICULTURE ZONING
- EXISTING RESIDENCE
- COMMERCIAL / INDUSTRIAL / INSTITUTIONAL
- VACANT RECREATION / CONSERVATION ZONING

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial

ZENECA INC.
DIGHTON, MASSACHUSETTS

MEDIA CLEANUP STANDARDS PROPOSAL

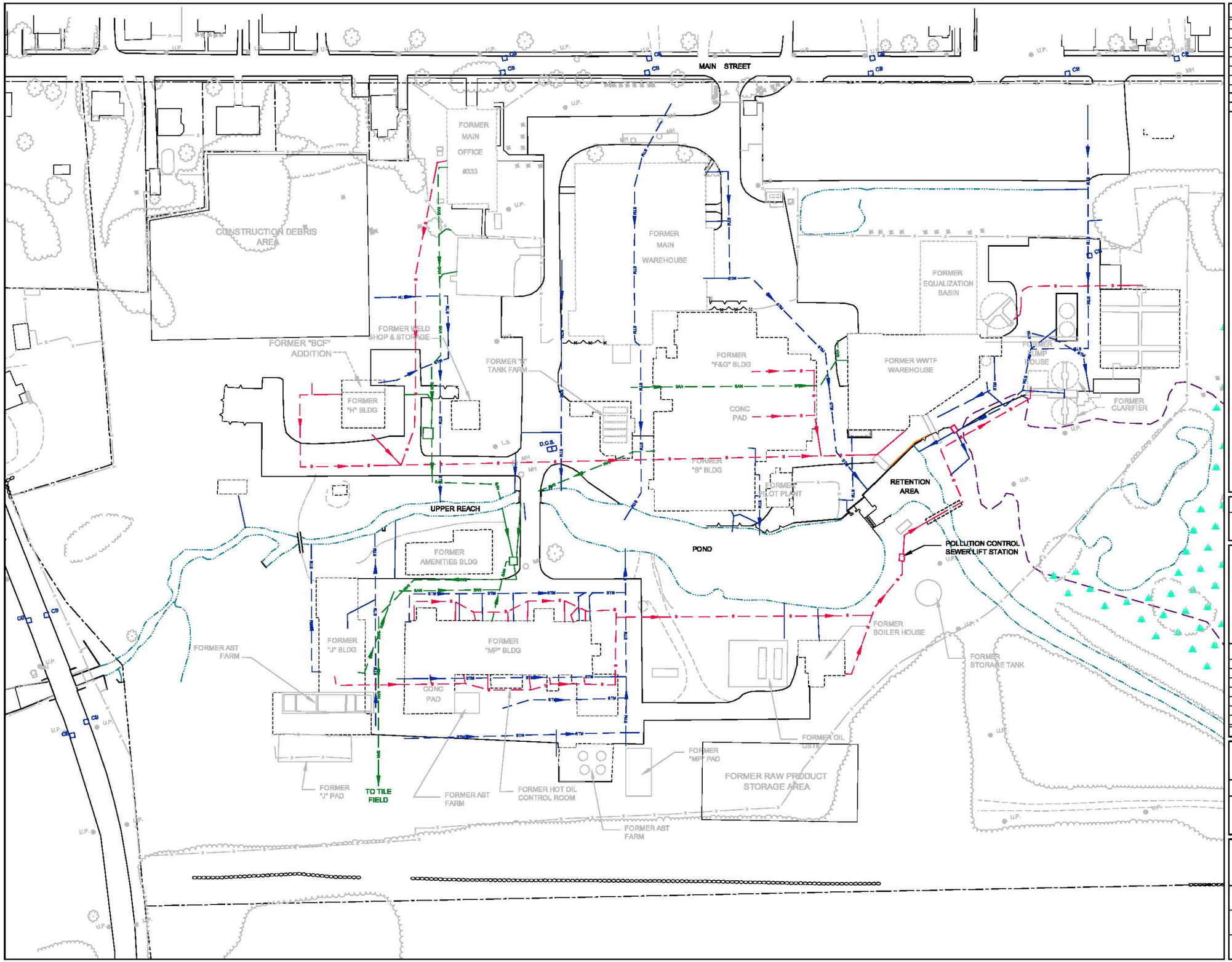
ADJACENT PROPERTY OWNERS AND LAND USE

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:
JOHN W. DELANO AND ASSOCIATES, INC. AUG. 8, 2000 JOB No. JN-6129

Project Manager:	Reviewed By:	Date:	
J.K.P.	C.S.	MARCH 2008	
Scale: AS SHOWN	Project No: 15620-78	Report No: 020	Drawing No: 2.3

15620-78(020)GN-WA048 DEC 14/2010



No.	Revision	Date	Initial

0 20 60ft

LEGEND

- PROPERTY BOUNDARY
- WATERLINE
- FENCE LINE
- GRAVEL ROAD OR DRIVEWAY
- FORMER BUILDING FOUNDATION
- TREE LINE
- SANITARY SEWER
- STORM SEWER
- POLLUTION CONTROL SEWER
- CB CATCHBASIN
- MH MANHOLE
- EDGE OF ENCAPSULATED LAGOON (AS SHOWN ON PETITION BY IG AMERICA)
- SWAMP

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

Approved

DRAWING STATUS

Status	Date	Initial

ZENECA INC.
DIGHTON, MASSACHUSETTS

MEDIA CLEANUP STANDARDS PROPOSAL

SEWER SYSTEMS

CONESTOGA-ROVERS & ASSOCIATES

Source References:

Project Manager:	Reviewed By:	Date:	
J.K.P.	C.S.	MARCH 2008	
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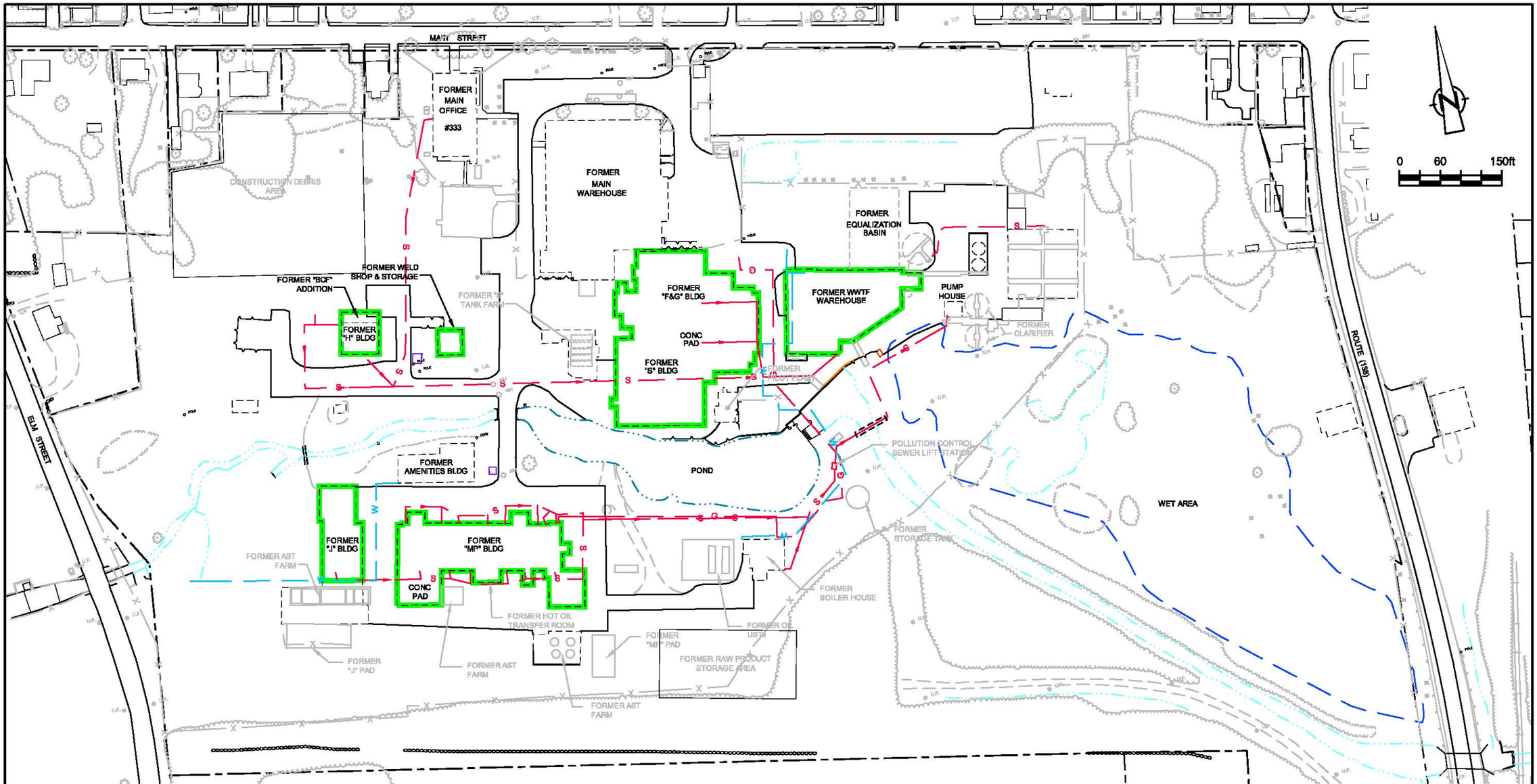
15620-78(020)GN-WA049 DEC 14/2010



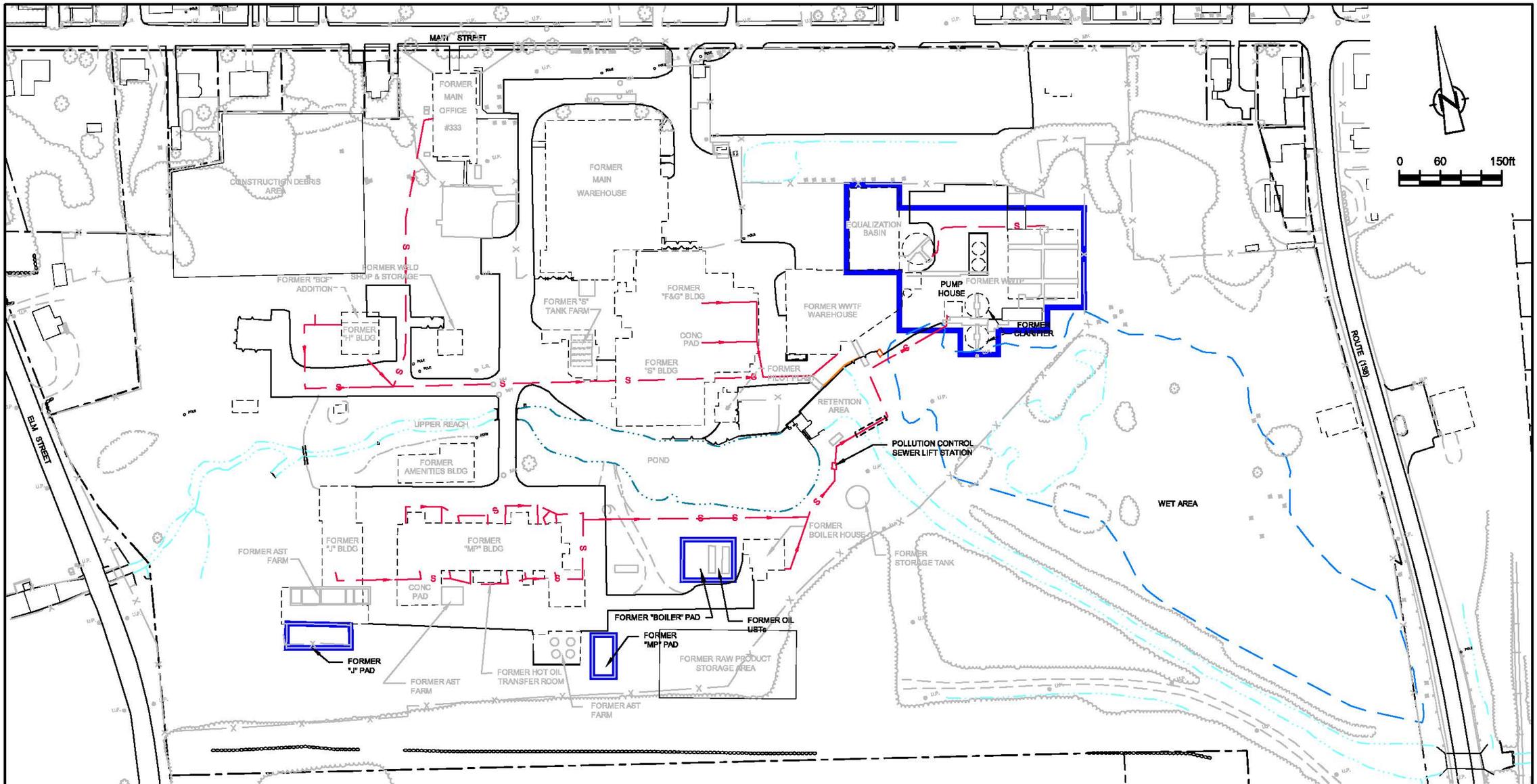
LEGEND

- PROPERTY BOUNDARY
- WATERLINE
- WATERLINE AS OF JULY 2002
- FENCE LINE
- GRAVEL ROAD OR DRIVEWAY
- FORMER BUILDING FOUNDATION
- S POLLUTION CONTROL SEWER
- G GAS LINE
- TREE LINE
- W CITY WATERLINE
- EDGE OF ENCAPSULATED LAGOON (AS SHOWN ON PETITION BY ICI AMERICA)
- FORMER MANUFACTURING AREAS

figure 3.1

FORMER MANUFACTURING AREAS
MEDIA CLEANUP STANDARDS PROPOSAL
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA050 DEC 14/2010



LEGEND

- PROPERTY BOUNDARY
- WATERLINE
- WATERLINE AS OF JULY 2002
- FENCE LINE
- GRAVEL ROAD OR DRIVEWAY
- FORMER BUILDING FOUNDATION
- POLLUTION CONTROL SEWER
- TREE LINE
- EDGE OF ENCAPSULATED LAGOON (AS SHOWN ON PETITION BY ICI AMERICA)
- WASTE TREATMENT AREAS POST 1980 AND WASTE STORAGE PADS

figure 3.2

WASTE MANAGEMENT AREAS - POST 1980
MEDIA CLEANUP STANDARDS PROPOSAL
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA051 DEC 14/2010

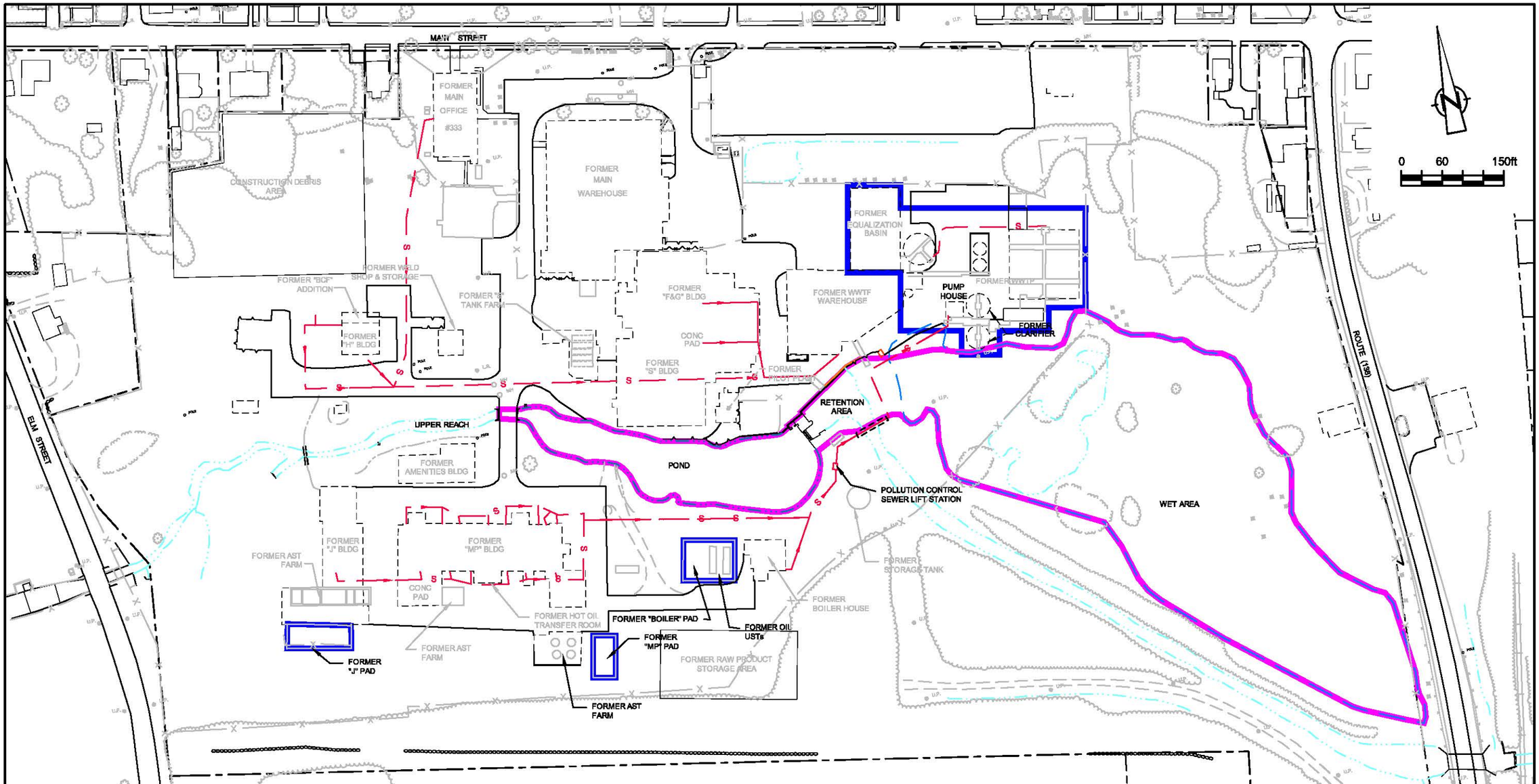


figure 3.3

WASTE MANAGEMENT AREAS - ENTIRE SITE HISTORY
MEDIA CLEANUP STANDARDS PROPOSAL
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA052 DEC 14/2010

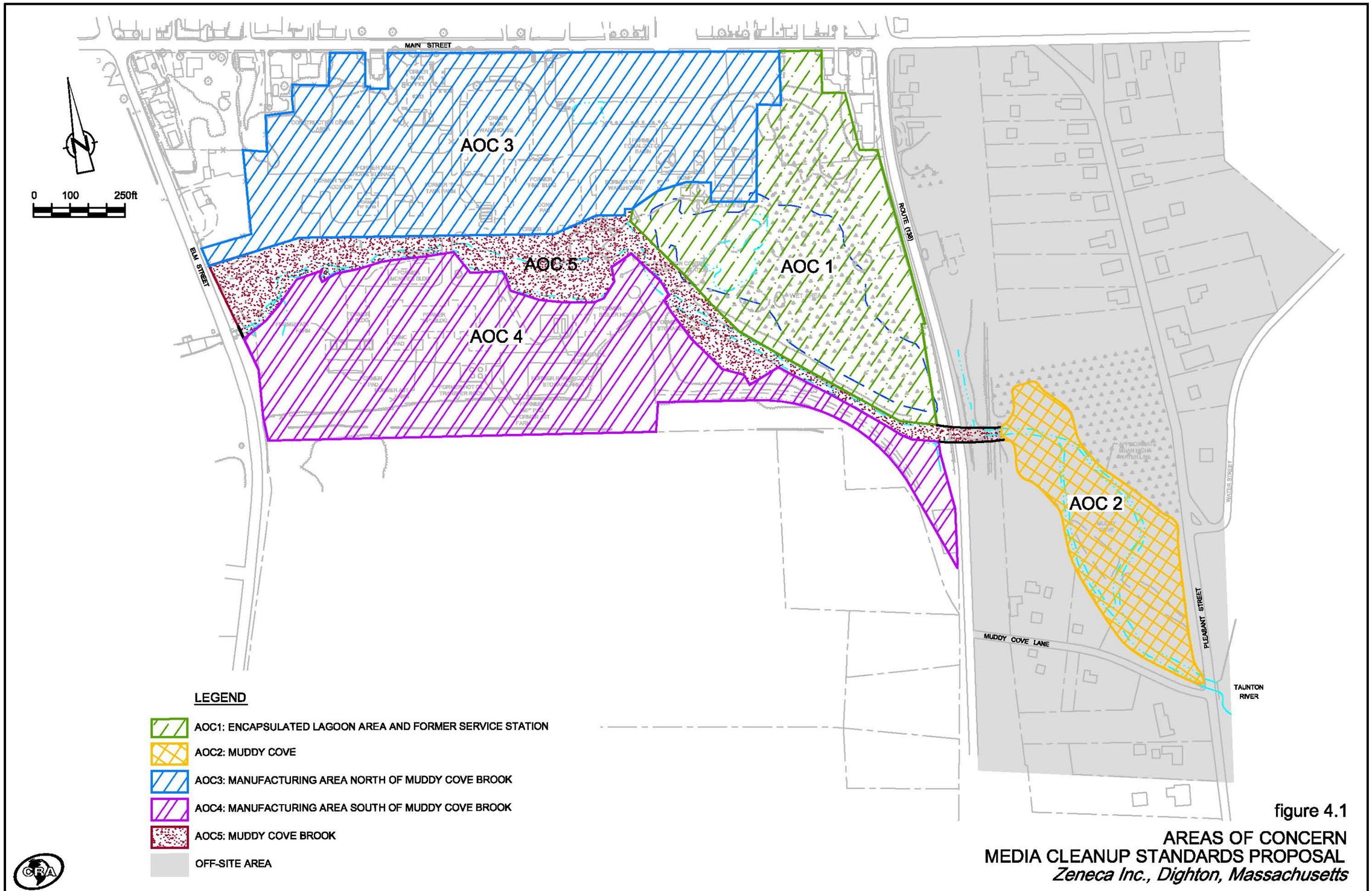


figure 4.1

AREAS OF CONCERN
MEDIA CLEANUP STANDARDS PROPOSAL
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA053 DEC 14/2010

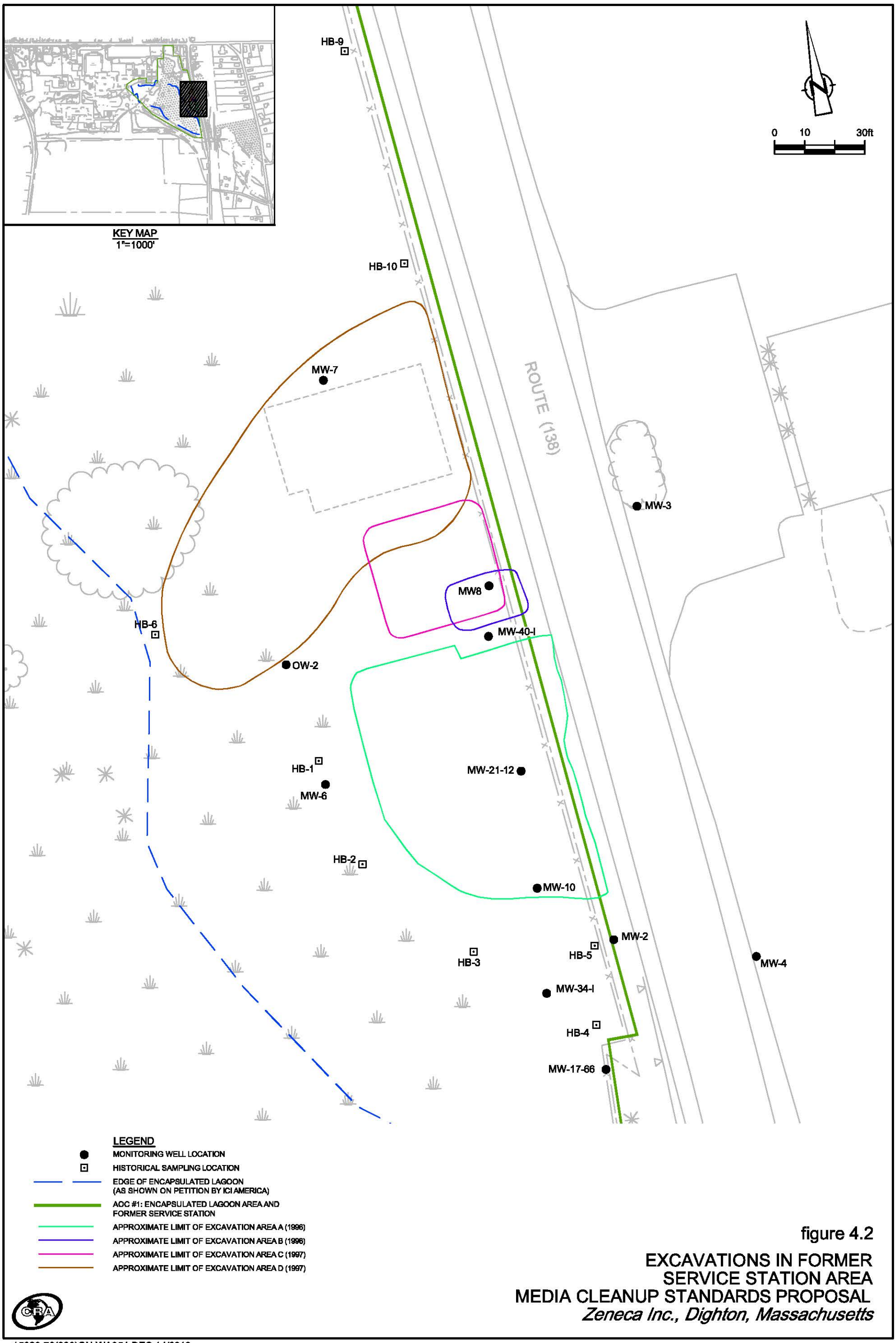


figure 4.2

EXCAVATIONS IN FORMER SERVICE STATION AREA
MEDIA CLEANUP STANDARDS PROPOSAL
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA054 DEC 14/2010

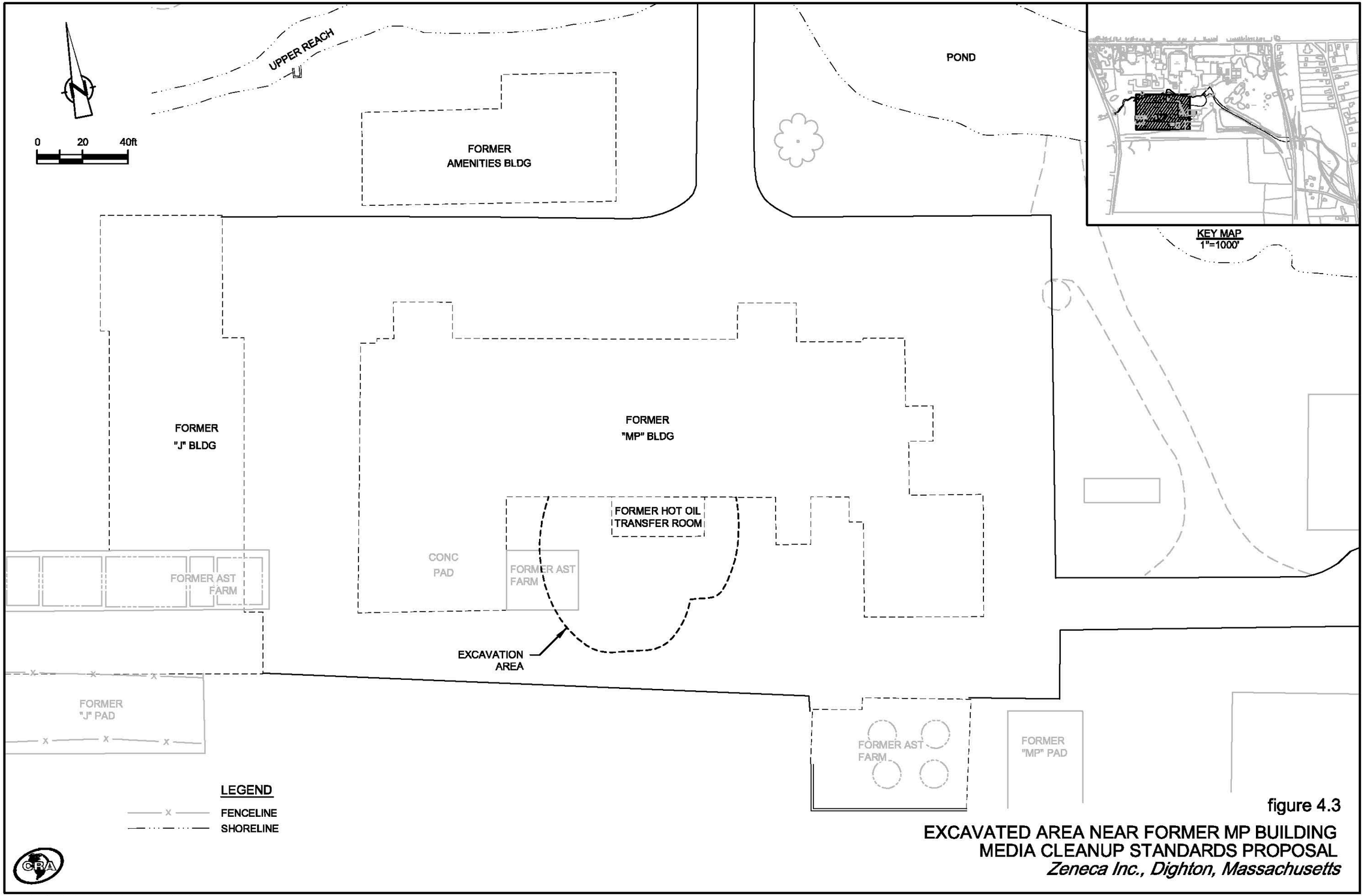


figure 4.3

EXCAVATED AREA NEAR FORMER MP BUILDING
MEDIA CLEANUP STANDARDS PROPOSAL
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA055 DEC 14/2010

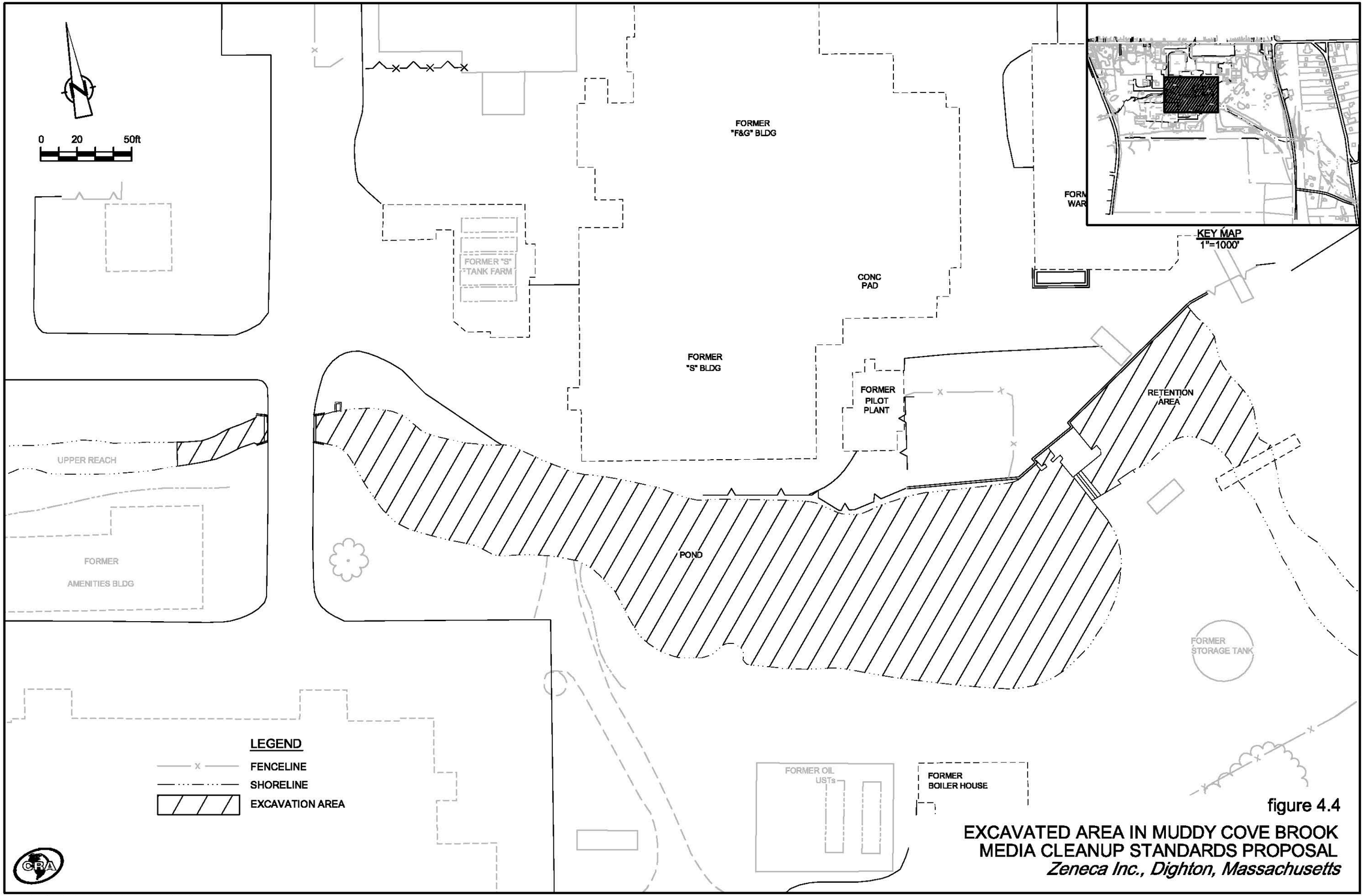


figure 4.4

EXCAVATED AREA IN MUDDY COVE BROOK
MEDIA CLEANUP STANDARDS PROPOSAL
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA056 DEC 14/2010

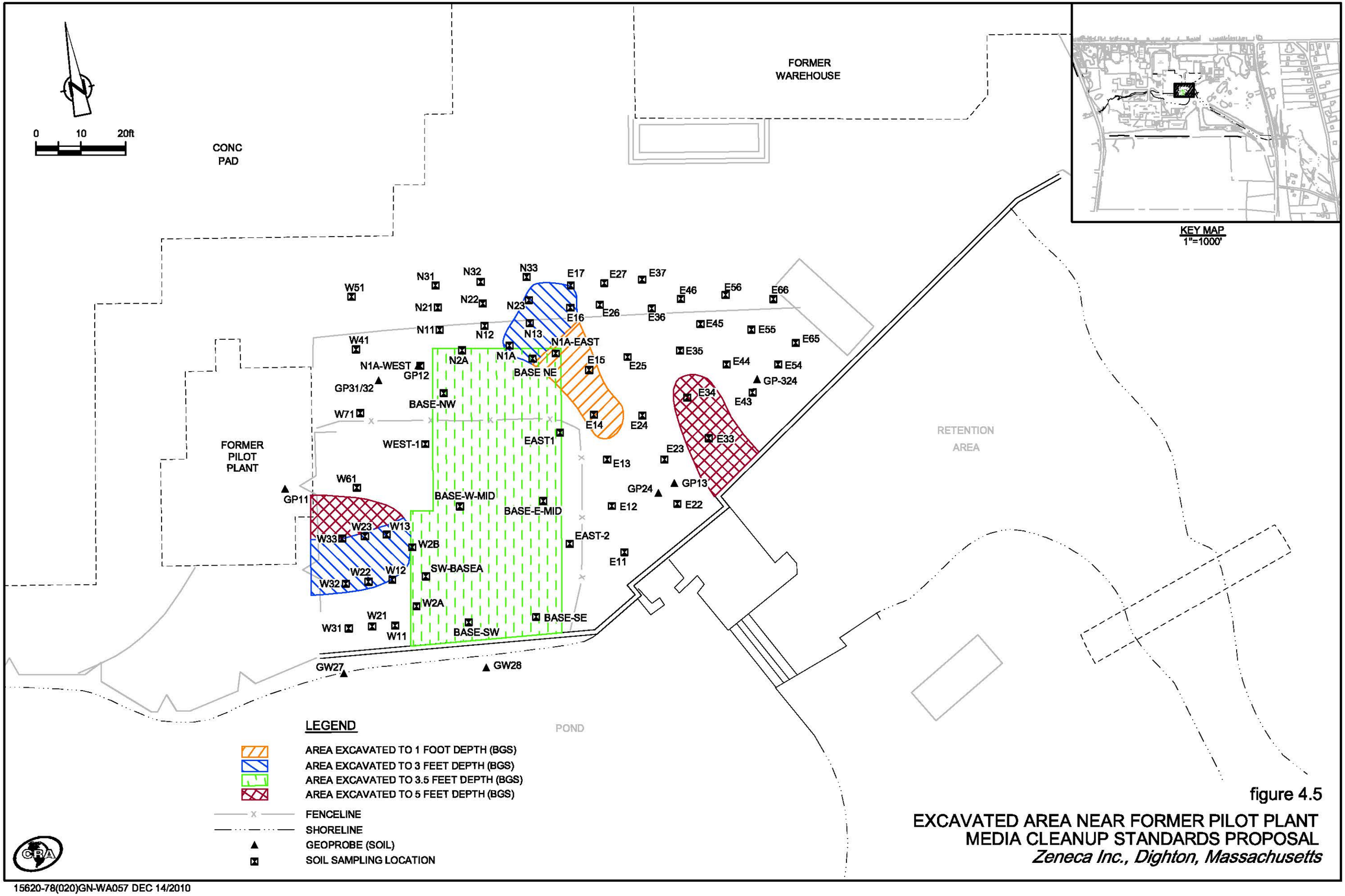


figure 4.5

EXCAVATED AREA NEAR FORMER PILOT PLANT
MEDIA CLEANUP STANDARDS PROPOSAL
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA057 DEC 14/2010

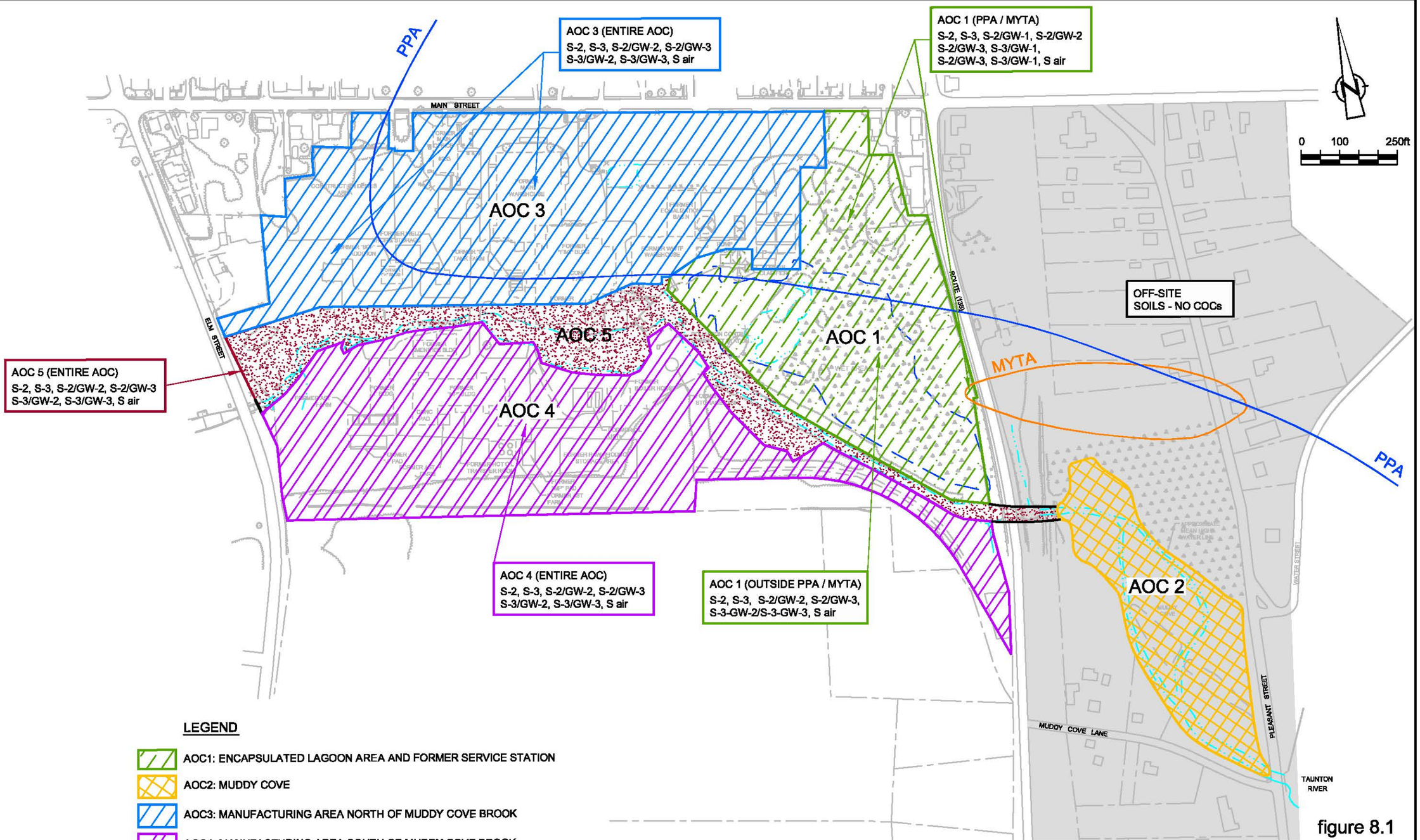


figure 8.1

APPLICABLE MassDEP METHOD 1 SOIL CRITERIA
BY AREA OF CONCERN (AOC)
SRFI ADDENDUM

Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA065 DEC 14/2010

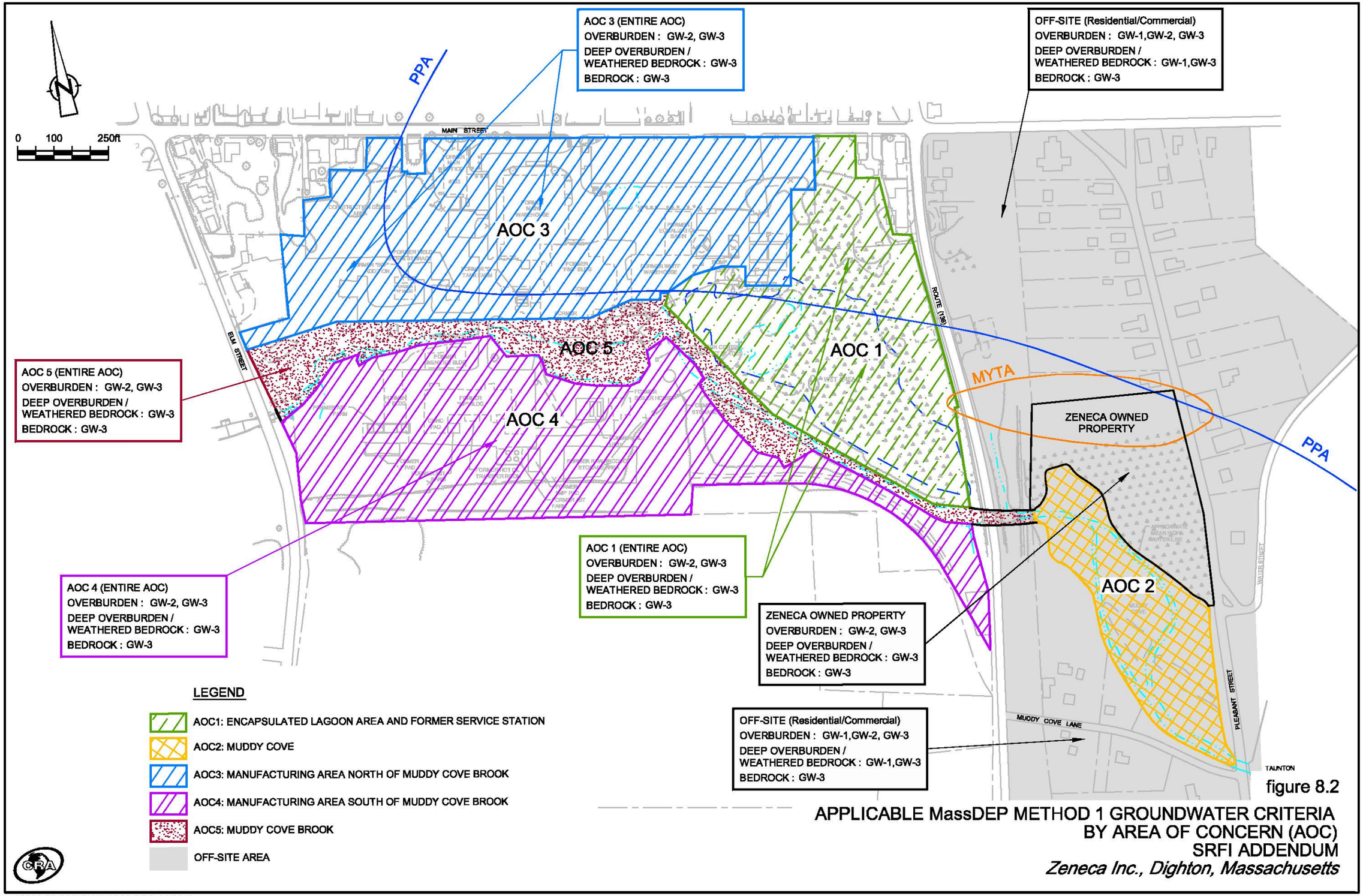
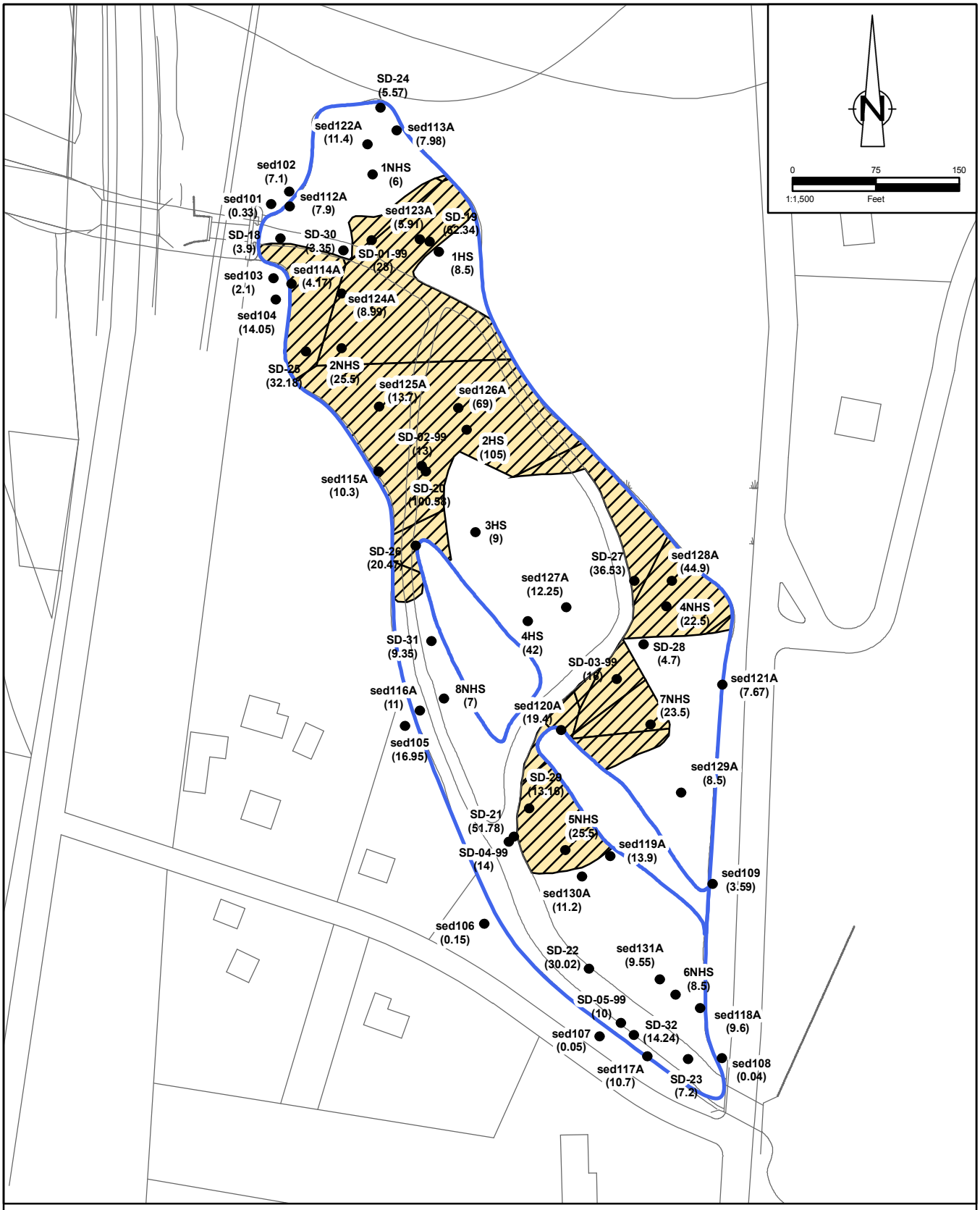


figure 8.2

APPLICABLE MassDEP METHOD 1 GROUNDWATER CRITERIA
BY AREA OF CONCERN (AOC)
SRFI ADDENDUM

Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA066 DEC 14/2010



Legend

- Mercury Locations
- Excavation Area
- Unexecavated Area
- Cove Boundary
- Base Features

figure 8.3

PROPOSED EXCAVATION AREA
IN MUDDY COVE
Dighton, Massachuetts

15620-00(REP020)GIS-WA001 December 3, 2010

TABLE 7.1

SUMMARY OF CHEMICALS OF CONCERN CONTRIBUTING TO EXCEEDANCE OF RISK AND/OR HAZARD INDEX
AOC1 - ENCAPSULATED LAGOON
ZENECA INC.
DIGHTON, MASSACHUSETTS

Chemical of Concern	*Maximum Concentration*		*Soil Trespasser*	*Soil Industrial Worker*	*Soil Construction Worker*	*Soil to Indoor Air Industrial Worker*	*Groundwater Construction Worker*	*Groundwater to Indoor Air Industrial Worker*
	Soil (mg/kg)	*Groundwater (µg/L)*						
Metals								
Arsenic	300		R	X	R			
Copper	249825			X	X			
Lead	9600				X			
Mercury	1846.73			X	X			
PCBs								
Aroclor-1016 (PCB-1016)	5.1			X				
Aroclor-1248 (PCB-1248)	48			X	R			
Aroclor-1254 (PCB-1254)	17			X				
Total Pentachlorobiphenyl	3.8			R				
Total Tetrachlorobiphenyl	13			X				
Total Trichlorobiphenyl	4.2			R				
SVOCs								
Benzo(a)pyrene	12 J			X				
Nitrobenzene	9900	260000		X	X	X	X	X
VOCs								
1,2,4-Trichlorobenzene	3500	1300			X	X	X	
Chlorobenzene	800	26000 J			X	X	X	

Notes:

J = Associated value is estimated.
X = Contributed (5% or greater) to overall Risk of 10^{-5} or HI of 1.
R = Calculated Risk of greater than 10^{-6} and did not contribute (5% or greater) to overall Risk of 10^{-5} or HI of 1.

TABLE 7.2

SUMMARY OF CHEMICALS OF CONCERN CONTRIBUTING TO EXCEEDANCE OF RISK AND/OR HAZARD INDEX
AOC1 - FORMER SERVICE STATION
ZENECA INC.
DIGHTON, MASSACHUSETTS

Chemical of Concern	*Maximum Concentration*		*Soil Industrial Worker*	*Soil Construction Worker*	*Soil to Indoor Air Industrial Worker*	*Groundwater Construction Worker*
	Soil (mg/kg)	*Groundwater (µg/L)*				
Metals						
Arsenic	106		X	R		
Iron	26900		X			
Lead	5790			X		
PCBs						
Aroclor-1248 (PCB-1248)	1.6		X			
SVOCs						
2-Methylnaphthalene	701		X			
Benzo(a)anthracene	16.1		X			
Benzo(a)pyrene	13.7		X	R		
Benzo(b)fluoranthene	12.6		X			
Dibenz(a,h)anthracene	0.7		X			
Naphthalene	230				X	
VOCs						
1,2,3-Trichlorobenzene	5.9			X		
1,2,4-Trichlorobenzene	9.3			X		
Benzene	12	1100	X	X	R	X
Chlorobenzene	4.4			X		
Methyl Tert Butyl Ether	14			R		
Xylene (total)	1400		X	X	X	

Notes:

X = Contributed (5% or greater) to overall Risk of 10^{-5} or HI of 1.

R = Calculated Risk of greater than 10^{-6} and did not contribute (5% or greater) to overall Risk of 10^{-5} or HI of 1.

TABLE 7.3

SUMMARY OF CHEMICALS OF CONCERN CONTRIBUTING TO EXCEEDANCE OF RISK AND/OR HAZARD INDEX
AOC3 - MANUFACTURING AREA NORTH OF MUDDY COVE BROOK
ZENECA INC.
DIGHTON, MASSACHUSETTS

Chemical of Concern	*Maximum Concentration Soil (mg/kg)*	*Soil Industrial Worker*	*Soil Construction Worker*	*Soil to Indoor Air Industrial Worker*
Metals				
Arsenic	180	X	R	
Lead	2010		X	
Manganese	3900		X	
PCBs				
Aroclor-1254 (PCB-1254)	18 J	R		
SVOCs				
Benzo(a)anthracene	56	R		
Benzo(a)pyrene	40	X		
Benzo(b)fluoranthene	36	R		
Dibenz(a,h)anthracene	2.5	X		
VOCs				
1,2,4-Trichlorobenzene	110		X	
Chlorobenzene	4.8		X	
Trichloroethene	5	X	X	X

Notes:

J = Associated value is estimated.
X = Contributed (5% or greater) to overall Risk of 10^{-5} or HI of 1.
R = Calculated Risk of greater than 10^{-6} and did not contribute (5% or greater) to overall Risk of 10^{-5} or HI of 1.

TABLE 7.4

SUMMARY OF CHEMICALS OF CONCERN CONTRIBUTING TO EXCEEDANCE OF RISK AND/OR HAZARD INDEX
AOC4 - MANUFACTURING AREA SOUTH OF MUDDY COVE BROOK
ZENECA INC.
DIGHTON, MASSACHUSETTS

Chemical of Concern	*Maximum Concentration*		*Surface Soil Trespasser*	*Surface Soil Maintenance Worker*	*Soil Trespasser*	*Soil Industrial Worker*	*Soil Construction Worker*	*Groundwater Construction Worker*
	Soil (mg/kg)	*Groundwater (µg/L)*						
Metals								
Arsenic	150 J		R	R		X	X	
PCBs								
Aroclor-1242 (PCB-1242)		24						X
Aroclor-1248 (PCB-1248)	350				R	X	X	
Aroclor-1260 (PCB-1260)	23					R		
Total Dichlorobiphenyl	6.26					R		
Total Heptachlorobiphenyl	2.65					R		
Total Hexachlorobiphenyl	7.44					R		
Total Pentachlorobiphenyl	62.29	0.129				X	X	X
Total Tetrachlorobiphenyl	184.89	0.549			R	X	X	X
Total Trichlorobiphenyl	64.64					X		
SVOCs								
Benzo(a)pyrene	1					R		
VOCs								
1,2,4-Trichlorobenzene		120 J						X
Chlorobenzene	12 J						X	

Notes:

J = Associated value is estimated.
X = Contributed (5% or greater) to overall Risk of 10^{-5} or HI of 1.
R = Calculated Risk of greater than 10^{-6} and did not contribute (5% or greater) to overall Risk of 10^{-5} or HI of 1.

TABLE 7.5

SUMMARY OF CHEMICALS OF CONCERN CONTRIBUTING TO EXCEEDANCE OF RISK AND/OR HAZARD INDEX
AOC5 - MUDDY COVE BROOK
ZENECA INC.
DIGHTON, MASSACHUSETTS

Chemical of Concern	*Maximum Concentration*			*Soil Trespasser*	*Soil Industrial Worker*	*Soil Construction Worker*	*Groundwater Construction Worker*	*Sediment Industrial Worker*
	Soil (mg/kg)	*Groundwater (µg/L)*	*Sediment (mg/kg)*					
Metals								
Arsenic	72		32.7		X			X
Lead	4510					X		
PCBs								
Aroclor-1248	12		6.5		X			X
Aroclor-1254 (PCB-1254)		0.47 J					X	
Total Pentachlorobiphenyl			1.94 J					X
Total Tetrachlorobiphenyl			6.76 J					X
Total Trichlorobiphenyl			1.65 J					X
SVOCs								
Benzo(a)anthracene	9.7				R			
Benzo(a)pyrene	9.2		0.38 J		X	R		X
Dibenz(a,h)anthracene	3.9 J				X			
Nitrobenzene		45000					X	
VOCs								
1,2,4-Trichlorobenzene	3000	2900 J				X	X	
1,4-Dichlorobenzene		1800 J					R	
Chlorobenzene		24000 J					X	
Trichloroethene	7.7	390			X	X	R	
Vinyl chloride	29			R	X	X		

Notes:

J = Associated value is estimated.

X = Contributed (5% or greater) to overall Risk of 10^{-5} or HI of 1.

R = Calculated Risk of greater than 10^{-6} and did not contribute (5% or greater) to overall Risk of 10^{-5} or HI of 1.

TABLE 7.6

SUMMARY OF CHEMICALS OF CONCERN CONTRIBUTING TO EXCEEDANCE OF RISK AND/OR HAZARD INDEX
OFF-SITE ZENECA PROPERTY
ZENECA INC.
DIGHTON, MASSACHUSETTS

Chemical of Concern	*Soil (mg/kg)*	*Groundwater (µg/L)*	*Sediment (mg/kg)*	*Soil Construction Worker*	*Groundwater Construction Worker*	*Sediment Trespasser*
Metals						
Arsenic			146			X
Manganese	281			X		
PCBs						
Aroclor-1248			7.7			X
Aroclor-1254			2.7			X
SVOCs						
Benzo(a)pyrene			0.45 J			X
Nitrobenzene		5500			X	
VOCs						
1,2,4-Trichlorobenzene		230 J			X	
Chlorobenzene		6200 J			X	

Notes:

J = Associated value is estimated.
X = Contributed (5% or greater) to overall Risk of 10^{-5} or HI of 1.
R = Calculated Risk of greater than 10^{-6} and did not contribute (5% or greater) to overall Risk of 10^{-5} or HI of 1.
[ ] = Concentration is within the range for site background and therefore, is not considered chemical of concern.

TABLE 7.7

SUMMARY OF CHEMICALS OF CONCERN CONTRIBUTING TO EXCEEDANCE OF RISK AND/OR HAZARD INDEX
OFF-SITE COMMERCIAL & RESIDENTIAL AREAS
ZENECA INC.
DIGHTON, MASSACHUSETTS

Chemical of Concern	*Maximum Concentration*				*Surface Soil Commercial Worker*	*Soil Commercial Worker*	*Soil Construction Worker*	*Groundwater Construction Worker*	*Groundwater (household use) Resident*
	Surface Soil (mg/kg)	*Soil (mg/kg)*	*Groundwater (µg/L)*	*Household[1] (µg/L)*					
Metals									
Arsenic	3.3	4.8 J		12.7	X	X			X
Iron				10800					X
Manganese	221			9300					X
Thallium				4.8					X
PCBs									
Aroclor-1242			31					X	
SVOCs									
4-Nitrophenol				0.76 J					X
Nitrobenzene			3500	32000 J				X	X
VOCs									
1,2,4-Trichlorobenzene			380 J	770 J				X	X
1,2-Dichlorobenzene			2100	2800				X	X
1,3-Dichlorobenzene				530					X
1,4-Dichlorobenzene				1700					X
Benzene				45 J					X
Chlorobenzene			9100	15000				X	X
Methylene chloride				35					X

Notes:

J = Associated value is estimated.
X = Contributed to overall Risk of 10^{-6} or HI of 1.
= Concentration of thallium of 4.8 µg/L at MW-27s appears to be anomalous as this parameter was typically not detected and therefore, is not considered to be a chemical of concern.
= Concentration is within the range for site background and therefore, is not considered a chemical of concern.
1 = Includes well MW34-I which is located within MYTA in AOC1.

TABLE 7.8

SUMMARY OF CHEMICALS OF CONCERN CONTRIBUTING TO EXCEEDANCE OF RISK AND/OR HAZARD INDEX
MUDDY COVE - VISITOR/WADER
ZENECA INC.
DIGHTON, MASSACHUSETTS

Chemical of Concern	*Maximum Sediment Concentration*			*Visitor Cove #1 Bank Sediment*	*Visitor Cove #2 Bank Sediment*	*Visitor/ Wader (#5) Near Shore and Bank Sediment*	*Visitor/ Wader (#5) Bank Sediment*	*Visitor/ Wader (#6) Near Shore and Bank Sediment*
	Bank (mg/kg)	*Near Shore (mg/kg)*	*Near Shore and Bank (mg/kg)*					
Metals								
Arsenic	140	180	180	X	X	X	X	X
PCBs								
PCBs	10	23	23	X	X	X	X	X
Dioxin-like PCB TEQ	0.00016	0.000303	0.000303	X				

Chemical of Concern	*Maximum Sediment Concentration*			*Visitor/ Wader (#6) Bank Sediment*	*Visitor/ Wader (#7) Near Shore and Bank Sediment*	*Visitor/ Wader (#7) Bank Sediment*	*Wader (#11) Near Shore Sediment*	*Wader (#12) Near Shore Sediment*
	Bank (mg/kg)	*Near Shore (mg/kg)*	*Near Shore and Bank (mg/kg)*					
Metals								
Arsenic	140	180	180	X	X	X	X	X
PCBs								
PCBs	10	23	23				X	
Dioxin-like PCB TEQ	0.00016	0.000303	0.000303		X			

Notes:

J = Associated value is estimated.
X = Contributed overall Risk of 10^{-6} or HI of 1.

TABLE 7.9

SUMMARY OF CHEMICALS OF CONCERN CONTRIBUTING TO EXCEEDANCE OF RISK AND/OR HAZARD INDEX
MUDDY COVE - ANGLER/NEARBY RESIDENT
ZENECA INC.
DIGHTON, MASSACHUSETTS

Chemical of Concern	*Maximum Concentration*			*Angler*	*Angler*	*Fish Consumer/Nearby Resident*	*Fish Consumer/Nearby Resident*
	Sediment Near Shore (mg/kg)	*Sediment/Surface Water to Fish Tissue - Blue Crab (mg/kg)*	*Sediment/Surface Water to Fish Tissue - White Perch (mg/kg)*	*Sediment/Surface Water to Fish Tissue (Blue Crab)*	*Sediment/Surface Water to Fish Tissue (White Perch)*	*Young Child Sediment/Surface Water to Fish Tissue (Blue Crab)*	*Young Child Sediment/Surface Water to Fish Tissue (White Perch)*
Metals							
Arsenic	180	0.3	0.037	X		X	
PCBs							
PCBs	23	0.034	0.56		X		X
Dioxin-like PCB TEQ	0.000303	0.00000108	0.0000131	X	X	X	X
SVOCs							
Benzo(a)pyrene	1.705						
Bis(2-ethylhexyl)phthalate			9.1		X		X
VOCs							
Methyl mercury		0.72	1.2		X	X	X

Note:

X = Contributed overall Risk of 10^{-6} or HI of 1.

TABLE 7.9

SUMMARY OF CHEMICALS OF CONCERN CONTRIBUTING TO EXCEEDANCE OF RISK AND/OR HAZARD INDEX
MUDDY COVE - ANGLER/NEARBY RESIDENT
ZENECA INC.
DIGHTON, MASSACHUSETTS

	Maximum Concentration			*Nearby Resident Adult*	*Nearby Resident Adult*	*Nearby Resident Adult*
Chemical of Concern	*Sediment Near Shore (mg/kg)*	*Sediment/Surface Water to Fish Tissue - Blue Crab (mg/kg)*	*Sediment/Surface Water to Fish Tissue - White Perch (mg/kg)*	*Near Shore Sediment*	*Sediment/Surface Water to Fish Tissue (Blue Crab)*	*Sediment/Surface Water to Fish Tissue (White Perch)*
Metals						
Arsenic	180	0.3	0.037	X	X	X
PCBs						
PCBs	23	0.034	0.56	X	X	X
Dioxin-like PCB TEQ	0.000303	0.00000108	0.0000131	X	X	X
SVOCs						
Benzo(a)pyrene	1.705			X		
Bis(2-ethylhexyl)phthalate			9.1			X
VOCs						
Methyl mercury		0.72	1.2		X	X

Notes:

X = Contributed overall Risk of 10^{-6} or HI of 1.

TABLE 7.10

BACKGROUND SURFACE SOIL SAMPLE RESULTS
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

AOC:										
AOC Sub:										
Sample Location:										
Sample ID:										
Unit:										
Sample Date:										
Sample Depth:										
Parameter	*Units*	*S-1/GW-2 Criteria*	*S-2/GW-1 Criteria*	*S-2/GW-2 Criteria*	*S-2/GW-3 Criteria*	*S-3/GW-1 Criteria*	*S-3/GW-2 Criteria*	*S-3/GW-3 Criteria*	*Industrial Region 9 Criteria a*	*Residential Region 9 Criteria b*
Metals										
Aluminum	mg/kg	-	-	-	-	-	-	-	100000	7600
Antimony	mg/kg	20	30	30	30	30	30	30	410	31
Arsenic	mg/kg	20	20	20	20	20	20	20	1.6	0.39
Barium	mg/kg	1000	3000	3000	3000	5000	5000	5000	67000	5400
Beryllium	mg/kg	0.7	0.8	0.8	0.8	3	3	3	1900	150
Cadmium	mg/kg	2	30	30	30	30	30	30	450	37
Calcium	mg/kg	-	-	-	-	-	-	-	-	-
Chromium Total	mg/kg	30	200	200	200	200	200	200	450	210
Cobalt	mg/kg	-	-	-	-	-	-	-	1900	900
Copper	mg/kg	-	-	-	-	-	-	-	41000	3100
Iron	mg/kg	-	-	-	-	-	-	-	100000	23000
Lead	mg/kg	300	300	300	300	300	300	300	800	400
Magnesium	mg/kg	-	-	-	-	-	-	-	-	-
Manganese	mg/kg	-	-	-	-	-	-	-	19000	1800
Mercury	mg/kg	20	30	30	30	30	30	30	310	23
Nickel	mg/kg	20	700	700	700	700	700	700	20000	1600
Potassium	mg/kg	-	-	-	-	-	-	-	-	-
Selenium	mg/kg	400	800	800	800	800	800	800	5100	390
Silver	mg/kg	100	200	200	200	200	200	200	5100	390
Sodium	mg/kg	-	-	-	-	-	-	-	-	-
Thallium	mg/kg	8	60	60	60	80	80	80	67	5.2
Vanadium	mg/kg	600	1000	1000	1000	1000	1000	1000	1000	78
Zinc	mg/kg	2500	3000	3000	3000	5000	5000	5000	100000	23000
General Chemistry										
Total Solids	%	-	-	-	-	-	-	-	-	-

Notes:

J - Estimated.
ND - Non-detect at associated value.
U - Not present at or above the associated value.
UJ - Estimated reporting limit.

TABLE 7.10

BACKGROUND SURFACE SOIL SAMPLE RESULTS
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

AOC:		*AOC3*	*AOC3*	*AOC4*	*AOC4*	*AOC4*	*AOC4*	*OFF*
AOC Sub:		*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
Sample Location:		*BK-1*	*BK-2*	*BK-3*	*BK-3*	*BK-4*	*BK-5*	*BK-6*
Sample ID:		*S-15620-072605-RR-054*	*S-15620-072605-RR-058*	*S-15620-080405-RR-100*	*S-15620-080405-RR-104*	*S-15620-072605-RR-050*	*S-15620-080405-RR-102*	*S-15620-072505-RR-030*
Unit:		*SUSO*	*SUSO*	*SUSO*	*SUSO*	*SUSO*	*SUSO*	*SUSO*
Sample Date:		*7/26/2005*	*7/26/2005*	*8/4/2005*	*8/4/2005*	*7/26/2005*	*8/4/2005*	*7/25/2005*
Sample Depth:		*0-1 ft BGS*	*0-1 ft BGS*	*0-1 ft BGS*	*0-1 ft BGS*	*0-1 ft BGS*	*0-1 ft BGS*	*0.25-1 ft BGS*
					Duplicate			
Parameter	*Units*							
Metals								
Aluminum	mg/kg	7220	6720	5060	5410	4900	5310	**9180[b]**
Antimony	mg/kg	ND (0.37) UJ	ND (0.33) UJ	ND (0.33)	ND (0.33)	ND (0.43) UJ	ND (0.33)	ND (0.39)
Arsenic	mg/kg	**3.7[ab]**	**4.1[ab]**	**2.9[ab]**	**2.9[ab]**	**1.9[ab]**	**2.8[ab]**	**4.5[ab]**
Barium	mg/kg	85.5	39.7	14.6 J	16.4 J	17.8 J	13.7 J	16.7 J
Beryllium	mg/kg	ND (0.47) U	ND (0.42) U	ND (0.25) U	ND (0.28) U	ND (0.45) U	ND (0.28) U	ND (0.44) U
Cadmium	mg/kg	0.18 J	0.19 J	ND (0.073)	ND (0.072)	0.16 J	ND (0.072)	0.12 J
Calcium	mg/kg	1230	701	747	894	941	439 J	320 J
Chromium Total	mg/kg	6.7	6.0	5.6	6.1	5.7	5.1	7.8
Cobalt	mg/kg	2.2 J	2.4 J	3.7 J	3.8 J	2.6 J	2.5 J	1.6 J
Copper	mg/kg	10.2	7.8	5.8	6.0	5.2	4.2	5.2
Iron	mg/kg	10200	8410	8080	8730	9690	6340	10200
Lead	mg/kg	22.9	50.4	9.0	11.3	11.0	8.1	29.8
Magnesium	mg/kg	1230	1050	1280	1380	1400	1060	934
Manganese	mg/kg	292	150	130	135	140	82.2	76.8
Mercury	mg/kg	0.086	0.092	0.036	0.037	ND (0.059) U	0.036	0.17
Nickel	mg/kg	5.8 J	5.5 J	5.7	6.1	6.5 J	5.0	5.4
Potassium	mg/kg	313 J	328 J	248 J	269 J	352 J	166 J	231 J
Selenium	mg/kg	0.62	ND (0.27)	0.65	0.82	ND (0.35)	0.77	0.60 J
Silver	mg/kg	ND (0.048) U	ND (0.046) U	ND (0.031)	ND (0.031)	ND (0.040)	ND (0.031)	ND (0.039) U
Sodium	mg/kg	ND (18.1)	ND (16.1)	ND (16.3)	ND (16.2)	ND (20.9)	ND (16.3)	ND (19.1)
Thallium	mg/kg	ND (0.53)	ND (0.47)	0.55 J	0.49 J	ND (0.61)	ND (0.47)	ND (0.56)
Vanadium	mg/kg	12.1	11.7	9.5	10.8	12.6	8.8	24.7
Zinc	mg/kg	29.0	39.9	19.0	22.6	24.4	17.3	20.4 J
General Chemistry								
Total Solids	%	86.7	97.4	95.9	96.7	75.0	96.2	81.8

Notes:

J - Estimated.
ND - Non-detect at associated value.
U - Not present at or above the associa
UJ - Estimated reporting limit.

TABLE 7.10

BACKGROUND SURFACE SOIL SAMPLE RESULTS
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

AOC:		*OFF*	*OFF*	*OFF*	*OFF*
AOC Sub:		*N/A*	*N/A*	*N/A*	*N/A*
Sample Location:		*BK-7*	*BK-8*	*BK-9*	*BK-10*
Sample ID:		*S-15620-072505-RR-034*	*S-15620-072605-RR-042*	*S-15620-072605-RR-046*	*S-15620-072505-RR-038*
Unit:		*SUSO*	*SUSO*	*SUSO*	*SUSO*
Sample Date:		*7/25/2005*	*7/26/2005*	*7/26/2005*	*7/25/2005*
Sample Depth:		*0.25-1 ft BGS*	*0-1 ft BGS*	*0-1 ft BGS*	*0-1 ft BGS*
Parameter	*Units*				
Metals					
Aluminum	mg/kg	6090	6270	**8350[b]**	**8140[b]**
Antimony	mg/kg	ND (0.37)	ND (0.33) UJ	ND (0.42) UJ	ND (0.36)
Arsenic	mg/kg	**3.7[ab]**	**3.3[ab]**	**4.7[ab]**	**4.9[ab]**
Barium	mg/kg	16.1 J	13.4 J	15.7 J	23.1
Beryllium	mg/kg	ND (0.30) U	ND (0.34) U	ND (0.46) U	ND (0.40) U
Cadmium	mg/kg	0.13 J	0.13 J	0.18 J	0.17 J
Calcium	mg/kg	534 J	389 J	403 J	484 J
Chromium Total	mg/kg	6.6	7.2	9.1	8.6
Cobalt	mg/kg	3.1 J	4.2 J	2.4 J	2.4 J
Copper	mg/kg	6.6	7.2	9.4	9.3
Iron	mg/kg	10100	10200	11300	9960
Lead	mg/kg	24.8	6.8	13.0	17.0
Magnesium	mg/kg	1550	1700	1350	1240
Manganese	mg/kg	163	177	116	129
Mercury	mg/kg	0.13	ND (0.063) U	0.23	0.11
Nickel	mg/kg	7.0	7.3 J	6.0 J	5.4
Potassium	mg/kg	430 J	420 J	293 J	283 J
Selenium	mg/kg	0.33 J	ND (0.27)	0.45 J	0.56
Silver	mg/kg	ND (0.035)	ND (0.031)	ND (0.039)	ND (0.033)
Sodium	mg/kg	ND (18.2)	ND (16.4)	ND (20.4)	ND (17.4)
Thallium	mg/kg	ND (0.53)	0.53 J	0.61 J	ND (0.51)
Vanadium	mg/kg	22.7	11.9	18.0	18.9
Zinc	mg/kg	20.9 J	20.0	23.4	22.8 J
General Chemistry					
Total Solids	%	85.9	95.6	76.6	89.8

Notes:

J - Estimated.
ND - Non-detect at associated value.
U - Not present at or above the associa
UJ - Estimated reporting limit.

TABLE 7.11

BACKGROUND SUBSURFACE SOIL SAMPLE RESULTS
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

AOC:									
AOC Sub:									
Sample Location:									
Sample ID:									
Unit:									
Sample Date:									
Sample Depth:									
Parameter	*Units*	*S-2/GW-1 Criteria*	*S-2/GW-2 Criteria*	*S-2/GW-3 Criteria*	*S-3/GW-1 Criteria*	*S-3/GW-2 Criteria*	*S-3/GW-3 Criteria*	*Industrial Region 9 Criteria a*	*Residential Region 9 Criteria b*
Metals									
Aluminum	mg/kg	-	-	-	-	-	-	100000	7600
Antimony	mg/kg	30	30	30	30	30	30	410	31
Arsenic	mg/kg	20	20	20	20	20	20	1.6	0.39
Barium	mg/kg	3000	3000	3000	5000	5000	5000	67000	5400
Beryllium	mg/kg	0.8	0.8	0.8	3	3	3	1900	150
Cadmium	mg/kg	30	30	30	30	30	30	450	37
Calcium	mg/kg	-	-	-	-	-	-	-	-
Chromium Total	mg/kg	200	200	200	200	200	200	450	210
Cobalt	mg/kg	-	-	-	-	-	-	1900	900
Copper	mg/kg	-	-	-	-	-	-	41000	3100
Iron	mg/kg	-	-	-	-	-	-	100000	23000
Lead	mg/kg	300	300	300	300	300	300	800	400
Magnesium	mg/kg	-	-	-	-	-	-	-	-
Manganese	mg/kg	-	-	-	-	-	-	19000	1800
Mercury	mg/kg	30	30	30	30	30	30	310	23
Nickel	mg/kg	700	700	700	700	700	700	20000	1600
Potassium	mg/kg	-	-	-	-	-	-	-	-
Selenium	mg/kg	800	800	800	800	800	800	5100	390
Silver	mg/kg	200	200	200	200	200	200	5100	390
Sodium	mg/kg	-	-	-	-	-	-	-	-
Thallium	mg/kg	60	60	60	80	80	80	67	5.2
Vanadium	mg/kg	1000	1000	1000	1000	1000	1000	1000	78
Zinc	mg/kg	3000	3000	3000	5000	5000	5000	100000	23000
General Chemistry									
Total Solids	%	-	-	-	-	-	-	-	-

Notes:

J - Estimated.
ND - Non-detect at associated value.
U - Not present at or above the associated value.
UJ - Estimated reporting limit.

TABLE 7.11

BACKGROUND SUBSURFACE SOIL SAMPLE RESULTS
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

AOC:		*AOC3*	*AOC3*	*AOC4*	*AOC4*	*AOC4*	*OFF*	*OFF*
AOC Sub:		*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
Sample Location:		*BK-1*	*BK-2*	*BK-3*	*BK-4*	*BK-5*	*BK-6*	*BK-7*
Sample ID:		*S-15620-072605-RR-056*	*S-15620-072605-RR-060*	*S-15620-080405-RR-101*	*S-15620-072605-RR-052*	*S-15620-080405-RR-103*	*S-15620-072505-RR-032*	*S-15620-072505-RR-036*
Unit:		*SUBSO*	*SUBSO*	*SUBSO*	*SUBSO*	*SUBSO*	*SUBSO*	*SUBSO*
Sample Date:		*7/26/2005*	*7/26/2005*	*8/4/2005*	*7/26/2005*	*8/4/2005*	*7/25/2005*	*7/25/2005*
Sample Depth:		*3-4 ft BGS*	*2-3 ft BGS*	*1-2 ft BGS*	*1-2 ft BGS*	*1-2 ft BGS*	*2-2.5 ft BGS*	*3-3.7 ft BGS*
Parameter	***Units***							
Metals								
Aluminum	mg/kg	**9340[b]**	4670	5080	5250	4900	7530	5420
Antimony	mg/kg	ND (0.39) UJ	ND (0.33) UJ	ND (0.34)	ND (0.39) UJ	ND (0.33)	ND (0.37)	ND (0.35)
Arsenic	mg/kg	**2.5[ab]**	**2.5[ab]**	**2.5[ab]**	**2.3[ab]**	**1.4[b]**	**4.0[ab]**	**3.1[ab]**
Barium	mg/kg	20.9 J	15.9 J	15.7 J	24.3	10.6 J	20.4 J	13.9 J
Beryllium	mg/kg	ND (0.45) U	ND (0.35) U	ND (0.27) U	ND (0.36) U	ND (0.21) U	ND (0.44) U	ND (0.34) U
Cadmium	mg/kg	0.11 J	0.091 J	ND (0.073)	0.13 J	ND (0.073)	0.090 J	0.10 J
Calcium	mg/kg	684	529	727	1090	558	381 J	506 J
Chromium Total	mg/kg	8.0	5.1	5.8	6.3	5.7	10.8	6.9
Cobalt	mg/kg	2.5 J	2.8 J	3.5 J	2.6 J	2.6 J	2.7 J	4.2 J
Copper	mg/kg	4.6	8.6	5.2	4.4	2.6	4.3	6.9
Iron	mg/kg	10500	7540	7810	10500	6700	11600	9040
Lead	mg/kg	7.2	11.9	7.6	7.1	5.4	10.8	5.4
Magnesium	mg/kg	1400	1060	1190	1530	1010	1440	1500
Manganese	mg/kg	115	116	131	163	101	130	166
Mercury	mg/kg	ND (0.039) U	ND (0.056) U	0.027 J	ND (0.038) U	0.023 J	ND (0.065) U	ND (0.030) U
Nickel	mg/kg	5.7 J	5.5 J	5.2	6.6 J	3.6 J	7.0	7.2
Potassium	mg/kg	358 J	297 J	240 J	492 J	197 J	372 J	484 J
Selenium	mg/kg	0.35 J	ND (0.27)	0.80	ND (0.32)	0.65	0.59	ND (0.28)
Silver	mg/kg	ND (0.037)	ND (0.030)	ND (0.031)	ND (0.036)	ND (0.031)	ND (0.035)	ND (0.032)
Sodium	mg/kg	ND (19.3)	ND (15.9)	ND (16.4)	ND (20.5) U	ND (16.4)	ND (18.3)	ND (16.9)
Thallium	mg/kg	ND (0.56)	ND (0.46)	ND (0.48)	ND (0.55)	ND (0.48)	ND (0.53)	ND (0.49)
Vanadium	mg/kg	14.4	8.5	8.8	11.1	10.1	17.8	10.5
Zinc	mg/kg	16.3	20.2	18.7	20.0	12.7	19.0 J	19.1 J
General Chemistry								
Total Solids	%	81.0	98.3	95.3	82.8	95.8	85.6	92.6

Notes:

J - Estimated.
ND - Non-detect at associated valu
U - Not present at or above the ass
UJ - Estimated reporting limit.

TABLE 7.11

BACKGROUND SUBSURFACE SOIL SAMPLE RESULTS
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

AOC:		*OFF*	*OFF*	*OFF*
AOC Sub:		*N/A*	*N/A*	*N/A*
Sample Location:		*BK-8*	*BK-9*	*BK-10*
Sample ID:		*S-15620-072605-RR-044*	*S-15620-072605-RR-048*	*S-15620-072505-RR-040*
Unit:		*SUBSO*	*SUBSO*	*SUBSO*
Sample Date:		*7/26/2005*	*7/26/2005*	*7/25/2005*
Sample Depth:		*2-2.8 ft BGS*	*2-3 ft BGS*	*2-2.7 ft BGS*
Parameter	***Units***			
Metals				
Aluminum	mg/kg	6270	6900	6480
Antimony	mg/kg	ND (0.33) UJ	ND (0.36) UJ	ND (0.35)
Arsenic	mg/kg	**3.7[ab]**	**3.4[ab]**	**3.8[ab]**
Barium	mg/kg	19.2 J	22.6 J	17.1 J
Beryllium	mg/kg	ND (0.40) U	ND (0.41) U	ND (0.37) U
Cadmium	mg/kg	0.12 J	0.16 J	0.097 J
Calcium	mg/kg	431 J	708	331 J
Chromium Total	mg/kg	6.9	7.2	8.2
Cobalt	mg/kg	4.3 J	5.6 J	2.4 J
Copper	mg/kg	8.5	9.1	5.9
Iron	mg/kg	9970	11300	9150
Lead	mg/kg	5.9	6.3	10.9
Magnesium	mg/kg	1630	2000	1360
Manganese	mg/kg	197	236	132
Mercury	mg/kg	ND (0.030) U	ND (0.028) U	0.081
Nickel	mg/kg	7.2 J	9.1 J	5.9
Potassium	mg/kg	515 J	778	252 J
Selenium	mg/kg	ND (0.27)	ND (0.30)	ND (0.28)
Silver	mg/kg	ND (0.031)	ND (0.034)	ND (0.032)
Sodium	mg/kg	ND (16.3)	ND (17.8)	ND (16.9)
Thallium	mg/kg	ND (0.47)	ND (0.52)	ND (0.49)
Vanadium	mg/kg	12.7	10.4	14.1
Zinc	mg/kg	19.7	25.4	19.3 J
General Chemistry				
Total Solids	%	96.0	87.9	92.5

Notes:

J - Estimated.
ND - Non-detect at associated valu
U - Not present at or above the ass
UJ - Estimated reporting limit.

TABLE 7.12

SUMMARY OF CHEMICALS OF CONCERN FOR SOILS
ZENECA INC.
DIGHTON, MASSACHUSETTS

Chemical of Concern	*AOC 1*		*AOC 3*	*AOC 4*	*AOC 5*
	Former Service Station	*Encapsulated Lagoon*			
Metals					
Arsenic	X	X	X	X	X
Copper		X			
Lead	X	X	X		X
Manganese			X		
Mercury		X			
PCBs					
PCBs	X	X	X	X	X
SVOCs					
2-Methylnaphthalene	X				
Benzo(a)anthracene	X		X		X
Benzo(a)pyrene	X	X	X	X	X
Benzo(b)fluoranthane	X		X		
Dibenz(a,h)anthracene	X		X		X
Naphthalene	X				
Nitrobenzene		X			
VOCs					
1,2,3-Thrichlorobenzene	X				
1,2,4-Trichlorobenzene	X	X	X		X
Benzene	X				
Chlorobenzene	X	X	X	X	
Methyl Tert Butyl Ether	X				
Trichloroethene			X		X
Vinyl chloride					X
Xylenes	X				

TABLE 7.13

SUMMARY OF CHEMICALS OF CONCERN FOR GROUNDWATER
ZENECA INC.
DIGHTON, MASSACHUSETTS

Chemical of Concern	*AOC 1*		*AOC 3*	*AOC 4*	*AOC 5*	*Off-Site Zeneca Property*	*Off-Site Commercial/Residential*
	Encapsulated Lagoon	*Former Service Station*					
Metals							
Arsenic	X		X				X
Cadmium	X	X					X
Iron							X
Lead	X	X	X	X	X	X	X
Manganese		X					X
PCBs							
PCBs	X	X	X	X	X		X
SVOCs							
1,2-Dichlorobenzene	X	X		X	X	X	X
1,2,4-Trichlorobenzene	X						X
1,3-Dichlorobenzene							X
1,4-Dichlorobenzene					X		
4-Nitrophenol							X
Nitrobenzene	X	X			X	X	X
Phenol	X						
VOCs							
1,2,4-Trichlorobenzene	X			X	X	X	X
Benzene		X					X
Chlorobenzene	X	X	X	X	X	X	X
Methylene chloride							X
Toluene	X						
Trichloroethene					X		
Ethylbenzene							X

TABLE 7.14

SUMMARY OF CHEMICALS OF CONCERN FOR SEDIMENTS - ZENECA OFF-SITE AREA
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

Chemicals of Concern	*Off-Site Area (owned by Zeneca)*
Metals	
Arsenic	X
PCBs	
Total PCBs	X
SVOCs	
Benzo(a)pyrene	X

TABLE 7.15

SUMMARY OF CHEMICALS OF CONCERN FOR NEARSHORE/BANK SEDIMENTS - MUDDY COVE ZENECA INC. SITE DIGHTON, MASSACHUSETTS

Chemicals of Concern	*Muddy Cove Nearshore/Bank Sediments*
Metals	
Arsenic	X
PCBs	
Total PCBs	X

TABLE 8.1

SOIL CLEANUP LEVELS FOR AOC1
ENCAPSULATED LAGOON AND SERVICE STATION
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

Parameter	*Soil Cleanup Levels (mg/kg)*								
	S2	*S3*	*S2/GW1*	*S2/GW2*	*S2/GW3*	*S3/GW1*	*S3/GW2*	*S3/GW3*	*Sair*
Arsenic	20	20	20	20	20	20	20	20	
Copper	3,000	5,000	3,000	3,000	3,000	5,000	5,000	5,000	
Mercury	30	30	30	30	30	30	30	30	
Lead	300	300	300	300	300	300	300	300	
Total PCBs (1)	3	3	3	3	3	3	3	3	
Benzo(a)anthracene	40	300	40	40	40	300	300	300	
Benzo(a)pyrene	4	30	4	4	4	30	30	30	
Benzo(b)fluoranthene	40	300	40	40	40	300	300	300	
Dibenz(a,h)anthracene	4	30	4	4	4	30	30	30	
2-Methylnaphthalene	500	500	0.7	1,000	500	0.7	500	500	
Naphthalene	1,000	3,000	4	40	1,000	4	40	3,000	1.03
Nitrobenzene	40.5	40.5	40	40	40	40	40	40	0.4
1,2,3-Trichlorobenzene	900	900	160	66	900	160	66	900	
1,2,4-Trichlorobenzene	900	900	2	70	900	2	70	900	11.9
Benzene	200	900	2	200	200	2	700	900	
Chlorobenzene	1,000	3,000	1	3	100	1	3	100	0.07
Xylenes	3,000	5,000	400	300	1,000	400	300	3,000	0.198
Methyl Tert Butyl Ether	-	-	0.1	100	500	0.1	100	500	

Note:

(1) TSCA cleanup levels would also apply.

TABLE 8.2

SOIL CLEANUP LEVELS FOR AOC3
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

Parameter	*Soil Cleanup Levels (mg/kg)*						
	S2	*S3*	*S2/GW2*	*S2/GW3*	*S3/GW2*	*S3/GW3*	*Sair*
Arsenic	20	20	20	20	20	20	
Manganese	888	888	888	888	888	888	
Lead	300	300	300	300	300	300	
Total PCBs (1)	3	3	3	3	3	3	
Benzo(a)anthracene	40	300	40	40	300	300	
Benzo(a)pyrene	4	30	4	4	30	30	
Benzo(b)fluoranthene	40	300	40	40	300	300	
Dibenz(a,h)anthracene	4	30	4	4	30	30	
1,2,4-Trichlorobenzene	900	900	70	900	70	900	
Chlorobenzene	1,000	3,000	3	100	3	100	
Trichloroethene	700	2,000	2	700	2	2,000	0.0034

Note:

(1) TSCA cleanup levels would also apply.

TABLE 8.3

SOIL CLEANUP LEVELS FOR AOC4
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

Parameter	*Soil Cleanup Levels (mg/kg)*					
	S2	*S3*	*S2/GW2*	*S2/GW3*	*S3/GW2*	*S3/GW3*
Arsenic	20	20	20	20	20	20
Total PCBs [(1)]	3	3	3	3	3	3
Benzo(a)pyrene	4	30	4	4	30	30
Chlorobenzene	1,000	3,000	3	100	3	100

Note:

(1) TSCA cleanup levels would also apply.

TABLE 8.4

SOIL CLEANUP LEVELS FOR AOC5
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

Parameter	*Soil Cleanup Levels (mg/kg)*					
	S2	*S3*	*S2/GW2*	*S2/GW3*	*S3/GW2*	*S3/GW3*
Arsenic	20	20	20	20	20	20
Lead	300	300	300	300	300	300
Total PCBs (1)	3	3	3	3	3	3
Benzo(a)anthracene	40	300	40	40	300	300
Benzo(a)pyrene	4	30	4	4	30	30
Dibenz(a,h)anthracene	4	30	4	4	30	30
1,2,4-Trichlorobenzene	900	900	70	900	70	900
Trichloroethene	700	2,000	2	700	2	1,000
Vinyl Chloride	4	30	0.7	4	0.7	30

Note:

(1) TSCA cleanup levels would also apply.

TABLE 8.5

GROUNDWATER CLEANUP LEVELS FOR AOC1
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

Chemicals of Concern	*GW-2 (µg/L)*	*GW-3 (µg/L)*
Metals		
Lead	NA	10
Arsenic	NA	900
Cadmium	NA	4
Managanese[1]	NA	50,000
PCBs		
Total PCBs	5	10
SVOCs		
1,2-Dichlorobenzene	2,000	2,000
Phenol	50,000	2,000
Nitrobenzene[1]	1,407	5,500
VOCs		
1,2,4-Trichlorobenzene	2,000	50,000
Chlorobenzene	200	1,000
Toluene	50,000	40,000
Benzene	2,000	10,000

Notes:

(1) - GW-3 values for manganese and nitrobenzene are calculated values (see Appendix B).

TABLE 8.6

GROUNDWATER CLEANUP LEVELS FOR AOC3
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

Chemicals of Concern	*GW-2* (*µg/L*)	*GW-3* (*µg/L*)
Metals		
Arsenic	NA	900
Lead	NA	10
PCBs		
Total PCBs	5	10
VOCs		
Chlorobenzene	200	1,000

TABLE 8.7

GROUNDWATER CLEANUP LEVELS FOR AOC4
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

Chemicals of Concern	*GW-2 (µg/L)*	*GW-3 (µg/L)*
Metals		
Lead	NA	10
PCBs		
Total PCBs	5	10
SVOCs		
1,2-Dichlorobenzene	2,000	2,000
VOCs		
1,2,4-Trichlorobenzene	2,000	50,000
Chlorobenzene	200	1,000

TABLE 8.8

GROUNDWATER CLEANUP LEVELS FOR AOC5
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

Chemicals of Concern	*GW-2* *(µg/L)*	*GW-3* *(µg/L)*
Metals		
Lead	NA	10
PCBs		
Total PCBs	5	10
SVOCs		
1,4-Dichlorobenzene	200	8,000
1,2-Dichlorobenzene	2,000	2,000
Nitrobenzene(1)	1,407	5,500
VOCs		
1,2,4-Trichlorobenzene	2,000	50,000
Chlorobenzene	200	1,000
Trichloroethene	30	5,000

Note:

(1) - GW-2 and GW-3 values for nitrobenzene are calculated values (see Appendix B).

TABLE 8.9

GROUNDWATER CLEANUP LEVELS FOR OFF-SITE AREA (ZENECA PROPERTY)
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

Chemicals of Concern	*GW-2* *(µg/L)*	*GW-3* *(µg/L)*
Metals		
Lead	NA	10
SVOCs		
1,2-Dichlorobenzene	2,000	2,000
Nitrobenzene[1]	1,407	5,500
VOCs		
1,2,4-Trichlorobenzene	20,000	50,000
Chlorobenzene	200	1,000

Note:

(1) - GW values for nitrobenzene are calculated values (see Appendix B).

TABLE 8.10

GROUNDWATER CLEANUP LEVELS FOR OFF-SITE AREA (COMMERCIAL/RESIDENTIAL) ZENECA INC. SITE DIGHTON, MASSACHUSETTS

Chemicals of Concern	*GW-1 (µg/L)*	*GW-2 (µg/L)*	*GW-3 (µg/L)*
Metals			
Arsenic	10	NA	900
Lead	15	NA	10
Manganese(1)	50	NA	50,000
Cadmium	5	NA	4
Iron(1)	300	NA	25
PCBs			
Total PCBs	0.5	5	10
SVOCs			
1,2-Dichlorobenzene	600	2,000	2,000
1,3-Dichlorobenzene	40	2,000	50,000
1,4-Dichlorobenzene	5	200	8,000
Nitrobenzene(1)	3.9	1,407	5,500
4-Nitrophenol(1)	434	NA	2.07
VOCs			
1,2,4-Trichlorobenzene	70	20,000	50,000
Benzene	5	2,000	10,000
Chlorobenzene	100	200	1,000

Notes:

(1) - GW values for nitrobenzene, manganese, iron, and 4-nitrophenol are calculated values (see Appendix B).

TABLE 8.11

MUDDY COVE NEARSHORE/BANK SEDIMENT CLEANUP LEVELS
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

Chemicals of Concern	*Sediment Cleanup Level (S-1) (mg/kg)*
Metals	
Arsenic	20
PCBs	
Total PCBs	2

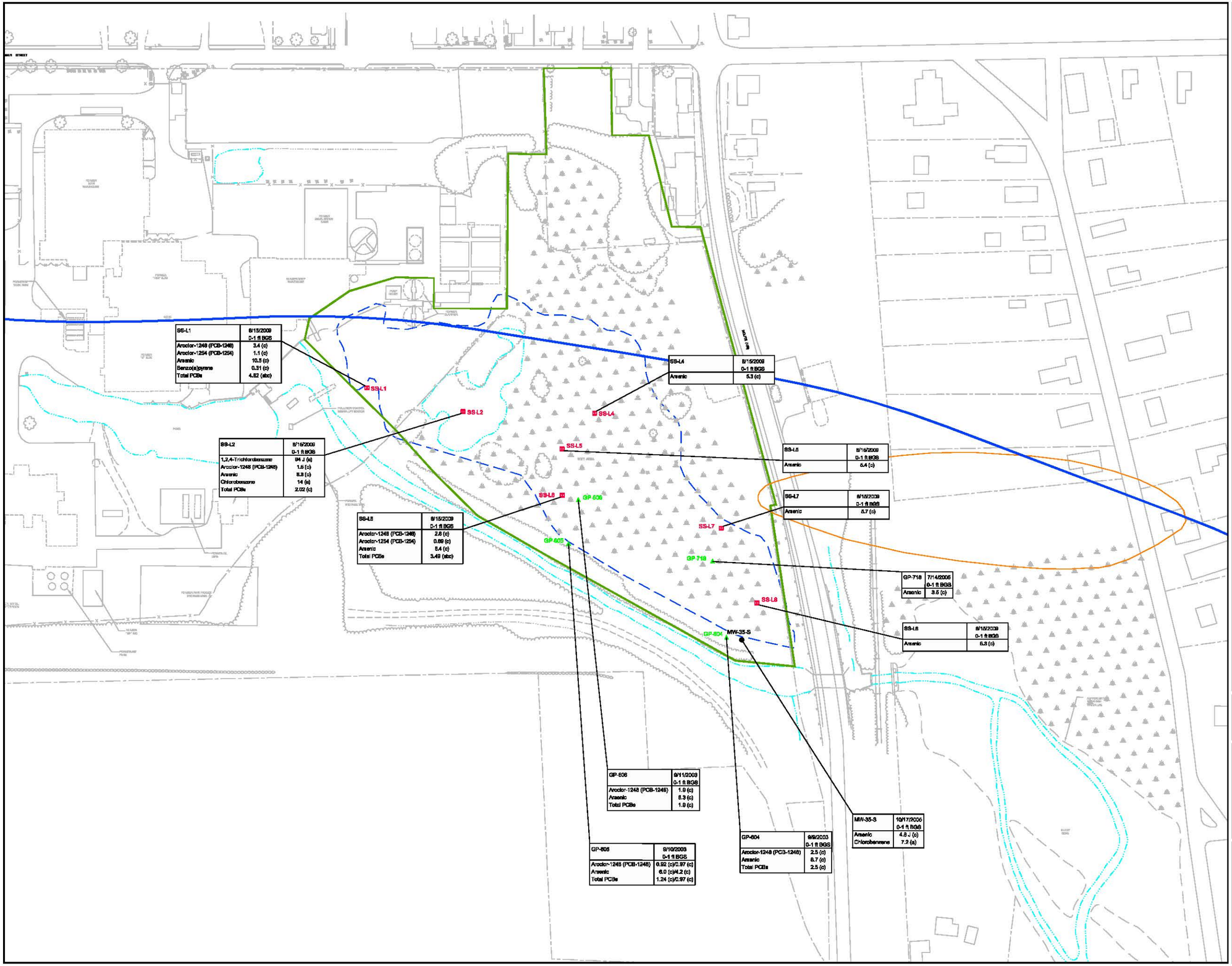
TABLE 8.12

SEDIMENT CLEANUP LEVELS FOR PHRAGMITES AREA SEDIMENT
ZENECA INC. SITE
DIGHTON, MASSACHUSETTS

Chemicals of Concern	*S-2* *(mg/kg)*
Metals	
Arsenic	20
PCBs	
Total PCBs	3
SVOCs	
Benzo(a)pyrene	4

APPENDIX A

CONTAMINANT DISTRIBUTION FIGURES



0 40 80 ft

LEGEND

- MW-22-D — MONITORING WELL LOCATION
- GP-709 — GEOPROBE LOCATION
- AOC1 ENCAPSULATED LAGOON AREA AND FORMER SERVICE STATION
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- ESTIMATED EXTENT OF MYTA
- J — ESTIMATED VALUE

GP-709	8/23/09	SAMPLE LOCATION
	0-1 ft BGS	SAMPLE DATE
Arsenic	4.8 (c)	SAMPLE DEPTH
Benzo(a)pyrene	0.26 J (c)	RESULT (mg/kg)
		PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA.

Parameter	S2/GW2 Criteria (a)	S2/GW3 Criteria (b)	Industrial Region 9 Criteria (c)
1,2,4-Trichlorobenzene	70	900	99
Aroclor-1248 (PCB-1248)	-	-	0.74
Aroclor-1254 (PCB-1254)	-	-	0.74
Arsenic	20	20	1.6
Benzo(a)pyrene	4	4	0.21
Chlorobenzene	3	100	1400
Total PCBs	3	3	0.74

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

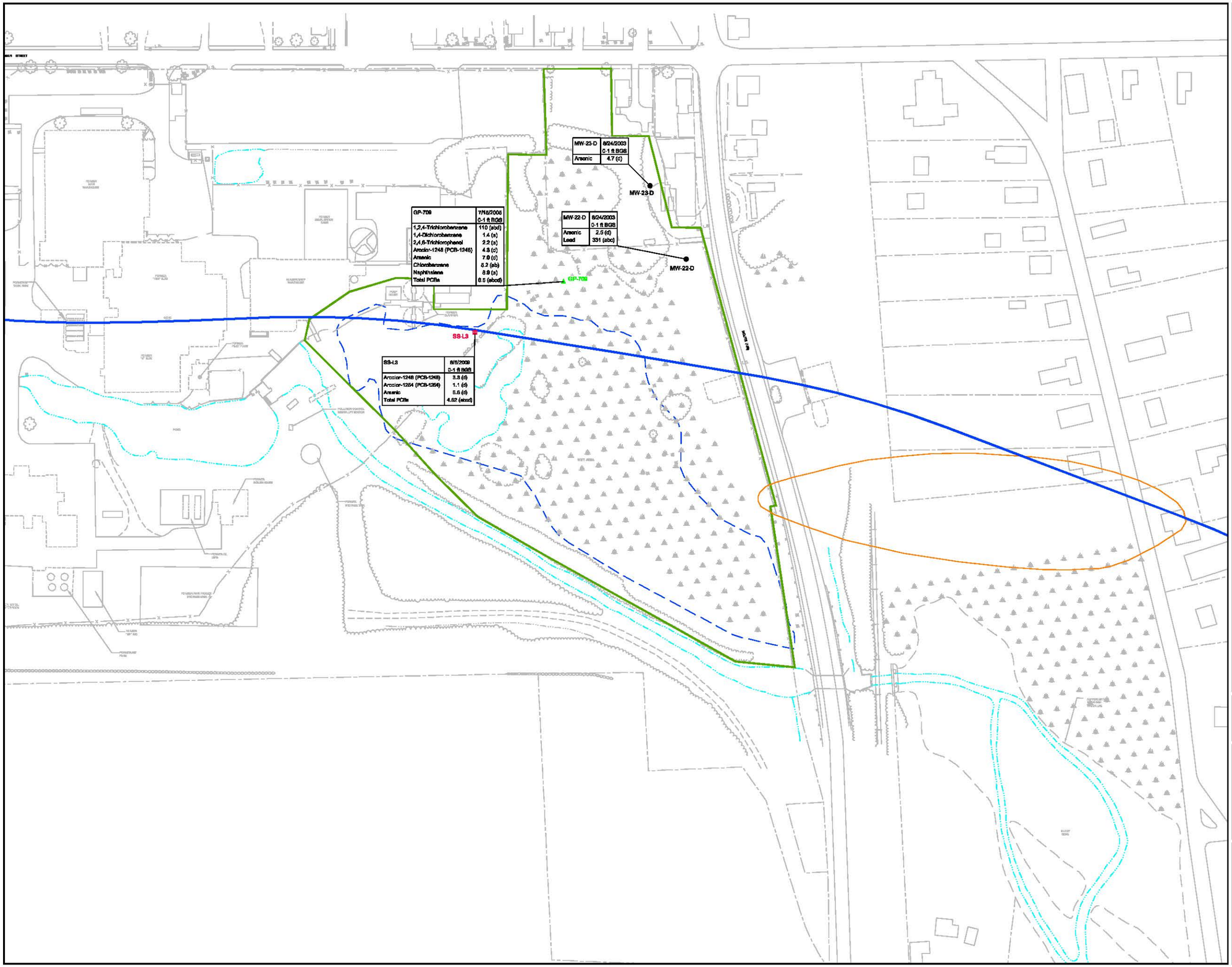
AOC1 - LAGOON -SURFACE SOIL - NOT PAVED - DATA SUMMARY

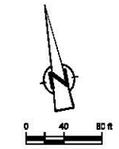
CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale: 1"=80'	Project N°: 15620-78	Report N°: 020	Drawing N°: A.1

15620-78(020)GN-WA001 DEC 14/2010





LEGEND

- MW-22-D — MONITORING WELL LOCATION
- GP-709 — GEOPROBE LOCATION
- AOC1 ENCAPSULATED LAGOON AREA AND FORMER SERVICE STATION
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- ESTIMATED EXTENT OF MYTA
- J — ESTIMATED VALUE

GP-709	8/23/03	SAMPLE LOCATION
	0-1 ft BGS	SAMPLE DATE
Arsenic	4.8 (c)	SAMPLE DEPTH
Benzo(a)pyrene	0.26 J (c)	RESULT (mg/kg)
		PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA.

Parameter	S2/GW1 Criteria (a)	S2/GW2 Criteria (b)	S2/GW3 Criteria (c)	Industrial Region 9 Criteria (d)
1,2,4-Trichlorobenzene	2	70	600	99
1,4-Dichlorobenzene	0.7	4	300	12
2,4,5-Trichlorophenol	0.7	20	20	180
Aroclor-1248 (PCB-1248)	-	-	-	0.74
Aroclor-1254 (PCB-1254)	-	-	-	0.74
Arsenic	20	20	20	1.6
Chlorobenzene	1	3	100	1400
Lead	500	500	500	800
Naphthalene	4	40	1000	18
Total PCBs	3	3	3	0.74

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

AOC1 - LAGOON -SURFACE SOIL - NOT PAVED - PPA/MYTA - DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale: 1"=80'	Project No: 15620-78	Report No: 020	Drawing No: A.2

15620-78(020)GN-WA002 DEC 14/2010

0 30 60 ft

LEGEND

- MW-22D — MONITORING WELL LOCATION
- GP-709 — GEOPROBE LOCATION
- ACC1 ENCAPSULATED LAGOON AREA AND FORMER SERVICE STATION
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- ESTIMATED EXTENT OF MYTA
- J — ESTIMATED VALUE

GP-709	6/23/09	SAMPLE LOCATION
	0-1 ft BGS	SAMPLE DATE
Arsenic	4.8 (c)	SAMPLE DEPTH
Benzo(a)pyrene	0.26 J (c)	RESULT (mg/kg)

PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA.

Parameter	S3/GW1 Criteria (a)	S3/GW2 Criteria (b)	S3/GW3 Criteria (c)	Industrial Region 9 Criteria (d)
1,2,4-Trichlorobenzene	2	70	900	99
1,3-Dichlorobenzene	1	40	500	-
Arsenic	20	20	20	1.6
Benzo(a)pyrene	30	30	30	0.21
Lead	300	300	300	800

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

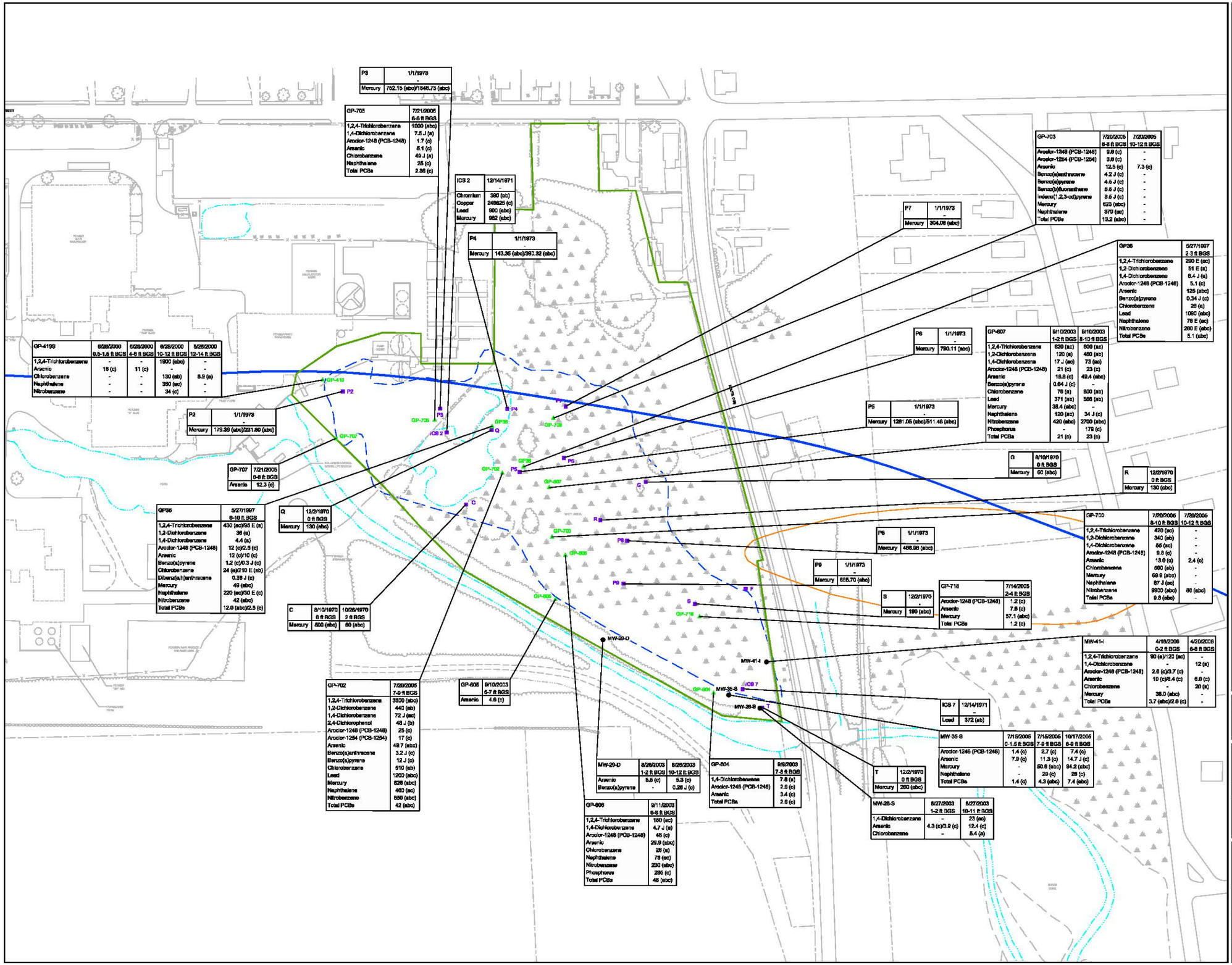
AOC1 - LAGOON SURFACE SOIL - PAVED - PPA/MYTA - DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source References:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale: 1"=60'	Project No: 15620-78	Report No: 020	Drawing No: A.3

15620-78(020)GN-WA003 DEC 14/2010



LEGEND

- MW-22-D — MONITORING WELL LOCATION
- GP-700 — GEOPROBE LOCATION
- C — BOREHOLE LOCATION
- AOC1 ENCAPSULATED LAGOON AREA AND FORMER SERVICE STATION
- APPROXIMATE BOUNDARY OF MEDIUM YIELD FPA (POTENTIALLY PRODUCTIVE AQUIFER)
- ESTIMATED EXTENT OF MYTA
- J — ESTIMATED VALUE
- - — NOT DETECTED ABOVE CRITERIA

GP-607	8/23/03	— SAMPLE LOCATION
	0-1 ft BGS	— SAMPLE DATE
Arsenic	4.8 (c)	— SAMPLE DEPTH
Benzo(a)pyrene	0.25 J (c)	— RESULT (mg/kg)

— PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA

Parameter	S3/GW2 Criteria (a)	S3/GW3 Criteria (b)	Industrial Region 9 Criteria (c)
1,2,4-Trichlorobenzene	70	900	99
1,2-Dichlorobenzene	30	300	9800
1,4-Dichlorobenzene	4	2000	12
2,4-Dichlorophenol	80	40	1800
Aroclor-1248 (PCB-1248)	-	-	0.74
Aroclor-1254 (PCB-1254)	-	-	0.74
Arsenic	20	20	1.6
Benzo(a)anthracene	300	300	2.1
Benzo(a)pyrene	30	30	0.21
Benzo(b)fluoranthene	300	300	2.1
Chlorobenzene	3	100	1400
Chromium	200	200	-
Copper	-	-	41000
Dibenz(a,h)anthracene	30	30	0.21
Indeno(1,2,3-cd)pyrene	300	300	2.1
Lead	300	300	800
Mercury	30	30	34
Naphthalene	40	3000	18
Nitrobenzene	40 (1)	40 (1)	24
Phosphorus	-	-	20
Total PCBs	3	3	0.74

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

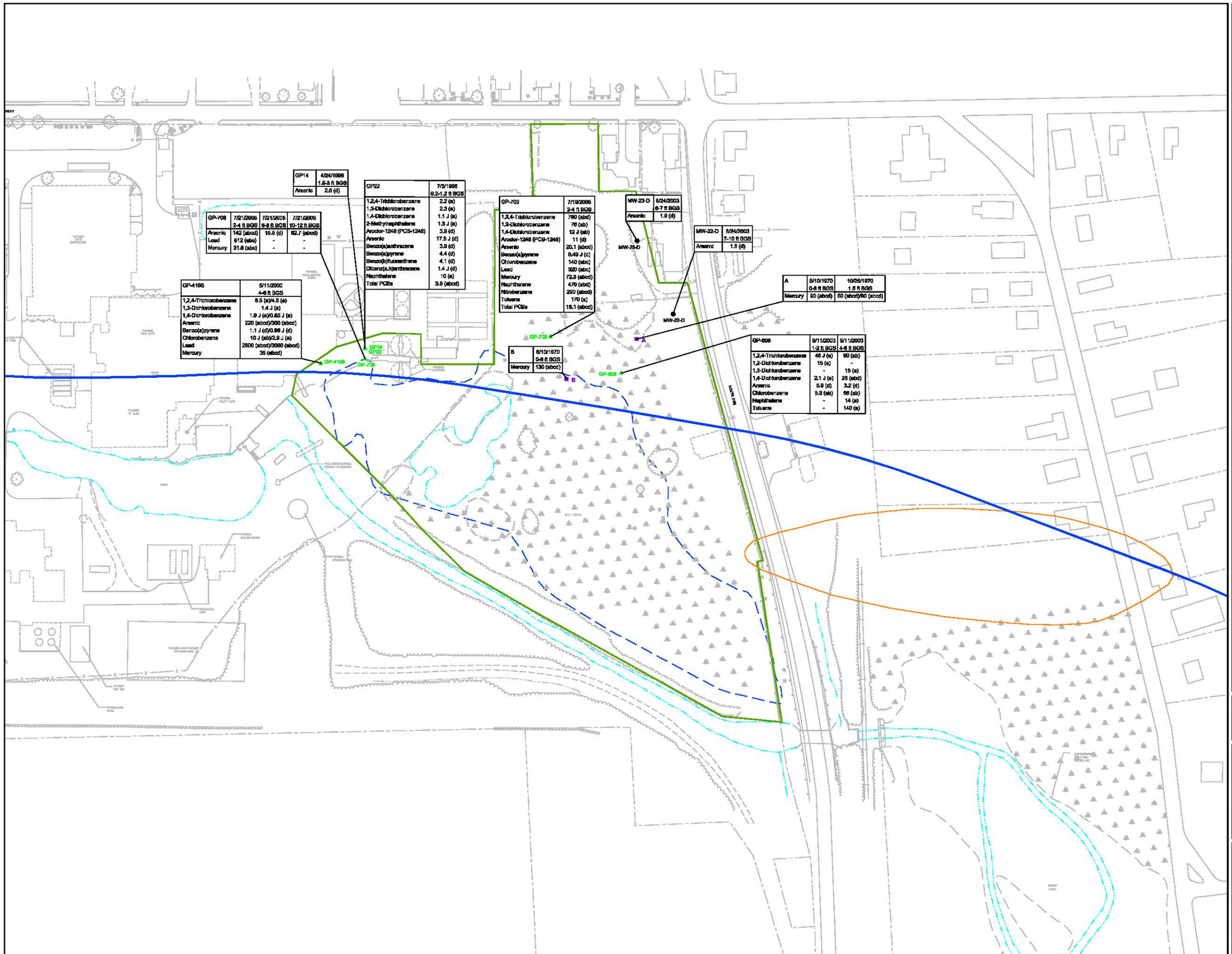
AOC1 - LAGOON SUBSURFACE SOIL - DATA SUMMARY

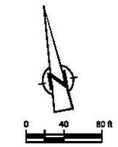
CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale:	Project No:	Report No:	Drawing No:
1"=80'	15620-78	020	A.4

15620-78(020)GN-WA204 DEC 14/2010





LEGEND

- MW-22-D — MONITORING WELL LOCATION
- GP-708 — GEOPROBE LOCATION
- C — BOREHOLE LOCATION
- AOC1 ENCAPSULATED LAGOON AREA AND FORMER SERVICE STATION
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- ESTIMATED EXTENT OF MYTA
- J — ESTIMATED VALUE
- \- — NOT DETECTED ABOVE CRITERIA

GP-807	8/23/03
	0-1 ft BGS
Arsenic	4.8 (c)
Benzo(a)pyrene	0.25 J (c)

SAMPLE LOCATION
SAMPLE DATE
SAMPLE DEPTH
RESULT (mg/kg)
PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA.

Parameter	S3/GW1 Criteria (a)	S3/GW2 Criteria (b)	S3/GW3 Criteria (c)	Industrial Region 9 Criteria (d)
1,2,4-Trichlorobenzene	2	70	900	99
1,2-Dichlorobenzene	9	30	300	9800
1,3-Dichlorobenzene	1	40	500	-
1,4-Dichlorobenzene	0.7	4	2000	12
2-Methylnaphthalene	0.7	80	500	4100
Aroclor-1248 (PCB-1248)	-	-	-	0.74
Arsenic	20	20	20	1.6
Benzo(a)anthracene	300	300	300	2.1
Benzo(a)pyrene	30	30	30	0.21
Benzo(b)fluoranthene	300	300	300	2.1
Chlorobenzene	1	3	100	1400
Dibenz(a,h)anthracene	30	30	30	0.21
Lead	300	300	300	600
Mercury	30	30	30	34
Naphthalene	4	40	3000	18
Nitrobenzene	40 (1)	40 (1)	40 (1)	24
Toluene	30	2000	3000	45000
Total PCBs	3	3	3	0.74

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

AOC1 - LAGOON - SUBSURFACE SOIL - PPA/MYTA - DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale:	Project No:	Report No:	Drawing No:
1"=80'	15620-78	020	A.5

16620-78(020)GN-WA005 DEC 14/2010

0 30 60 ft

LEGEND

- MW-34-I — MONITORING WELL LOCATION
- EXCAVATED AREAS
- AOC1 ENCAPSULATED LAGOON AREA AND FORMER SERVICE STATION
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- ESTIMATED EXTENT OF MYTA
- SAMPLE LOCATION

MW-34-I	7/14/06	SAMPLE DATE
	0-1 ft BGS	SAMPLE DEPTH
Arsenic	4.2 (d)	RESULT (mg/kg)
PARAMETER		

Parameter	S2/GW1 Criteria (a)	S2/GW2 Criteria (b)	S2/GW3 Criteria (c)	Industrial Region 2 Criteria (d)
Arsenic	20	20	20	1.6

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

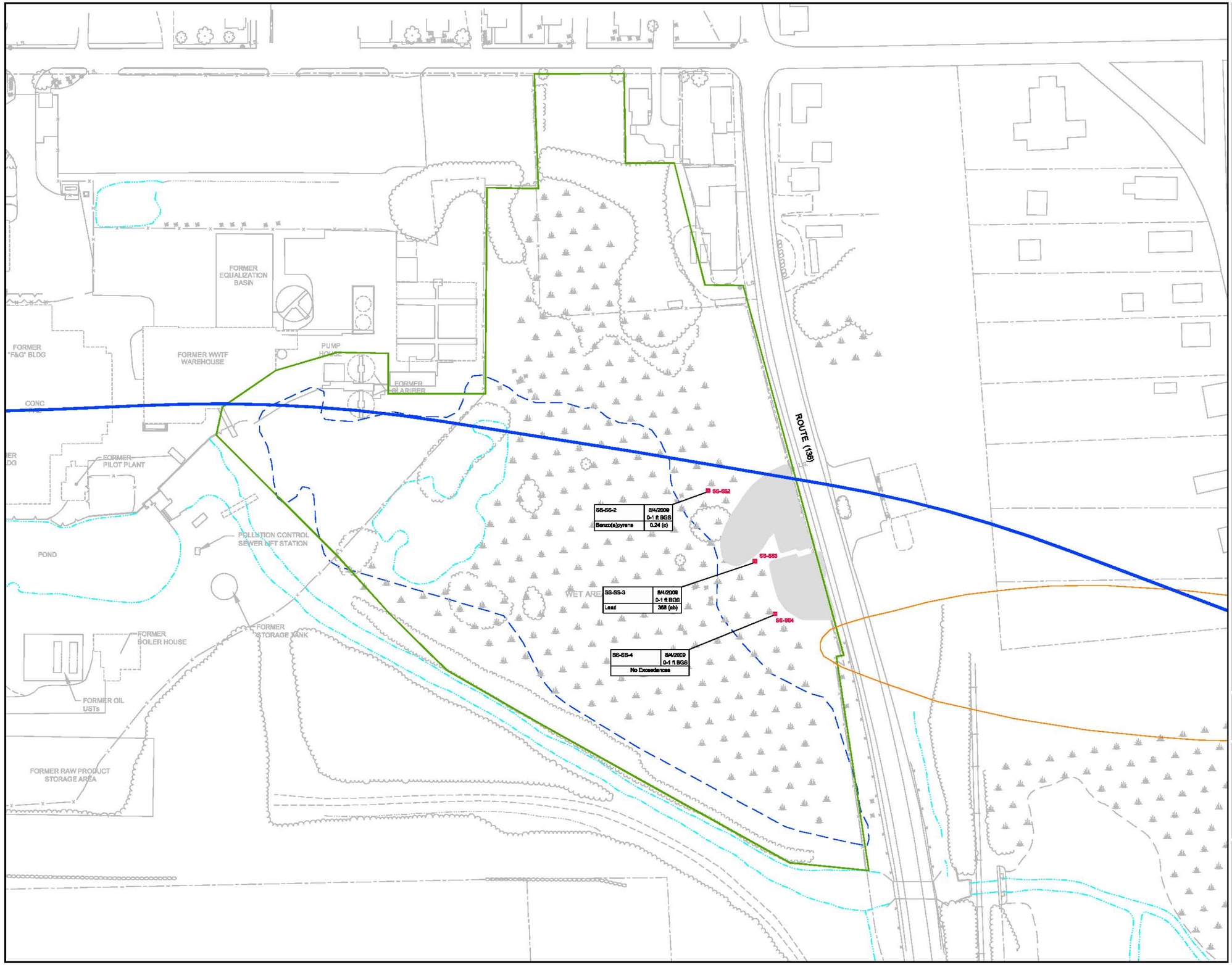
AOC1 - SERVICE STATION - NOT PAVED - PPA/MYTA - SURFACE SOIL DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source References:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale: 1"=60'	Project No: 15620-78	Report No: 020	Drawing No: A.6

15620-78(020)GN-WA008 DEC 14/2010



0 30 60 ft

LEGEND

- MW-34-1 MONITORING WELL LOCATION
- EXCAVATED AREAS
- AOC1 ENCAPSULATED LAGOON AREA AND FORMER SERVICE STATION
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- ESTIMATED EXTENT OF MYTA

SS-SS-2	8/4/2009	SAMPLE LOCATION
	0-1 ft BGS	SAMPLE DATE
Benzo(a)pyrene	0.24 (c)	SAMPLE DEPTH
		RESULT (mg/kg)
		PARAMETER

Parameter	S2/GW2 Criteria (a)	S2/GW3 Criteria (b)	Industrial Region 9 Criteria (c)
Benzo(a)pyrene	4	4	0.21
Lead	300	300	800

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

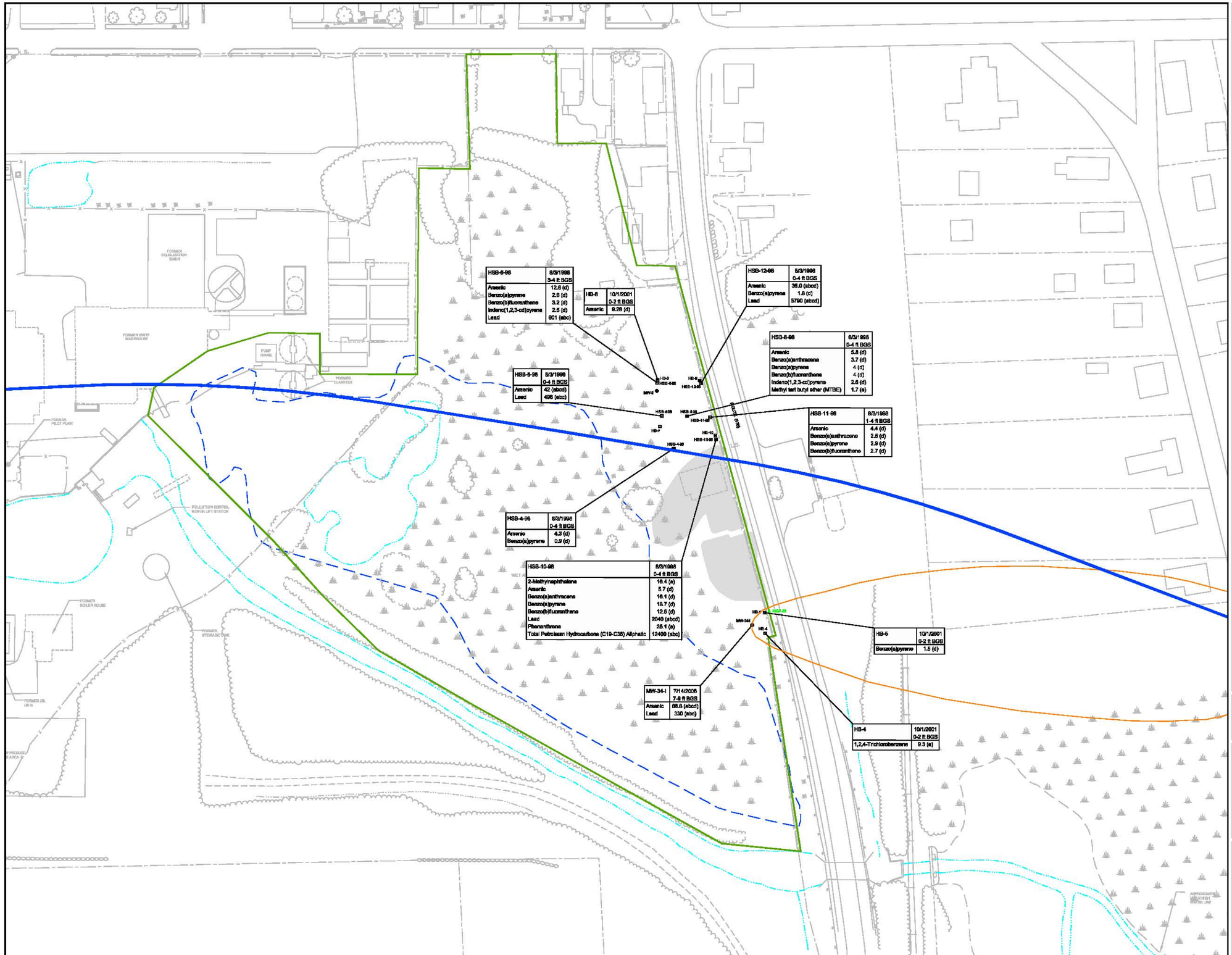
AOC1 - SERVICE STATION - NOT PAVED - - SURFACE SOIL DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale: 1"=60'	Project N.º: 15620-78	Report N.º: 020	Drawing N.º: A.7

15620-78(020)GN-WA007 DEC 14/2010



0 30 60 ft

LEGEND

- MW-34-I — MONITORING WELL LOCATION
- HGP-25 — GEOPROBE LOCATION
- EXC-5 — POST EXCAVATION SOIL SAMPLE LOCATION
- HB-4 — BOREHOLE SAMPLING LOCATION (HANDDIG)
- EXCAVATED AREAS
- AOC1 ENCAPSULATED LAGOON AREA AND FORMER SERVICE STATION
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- ESTIMATED EXTENT OF MYTA

HB-5	10/1/01	SAMPLE DATE
	0-2 ft BGS	SAMPLE DEPTH
Benzo(a)pyrene	1.5 (d)	RESULT (mg/kg)

SAMPLE LOCATION

PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA.

Parameter	S3/GW/1 Criteria (a)	S3/GW2 Criteria (b)	S3/GW3 Criteria (c)	Industrial Region 9 Criteria (d)
1,2,4-Trichlorobenzene	2	70	900	99
2-Methylnaphthalene	0.7	80	500	4100
Arsenic	20	20	20	1.6
Benzo(a)anthracene	300	300	300	2.1
Benzo(a)pyrene	30	30	30	0.21
Benzo(b)fluoranthene	300	300	300	2.1
Indeno(1,2,3-cd)pyrene	300	300	300	2.1
Lead	300	300	300	600
Methyl tert butyl ether (MTBE)	0.1	100	500	220
Phenanthrene	10	3000	3000	-
Total Petroleum Hydrocarbons (C19-C36) Aliphatic	5000	5000	5000	-

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

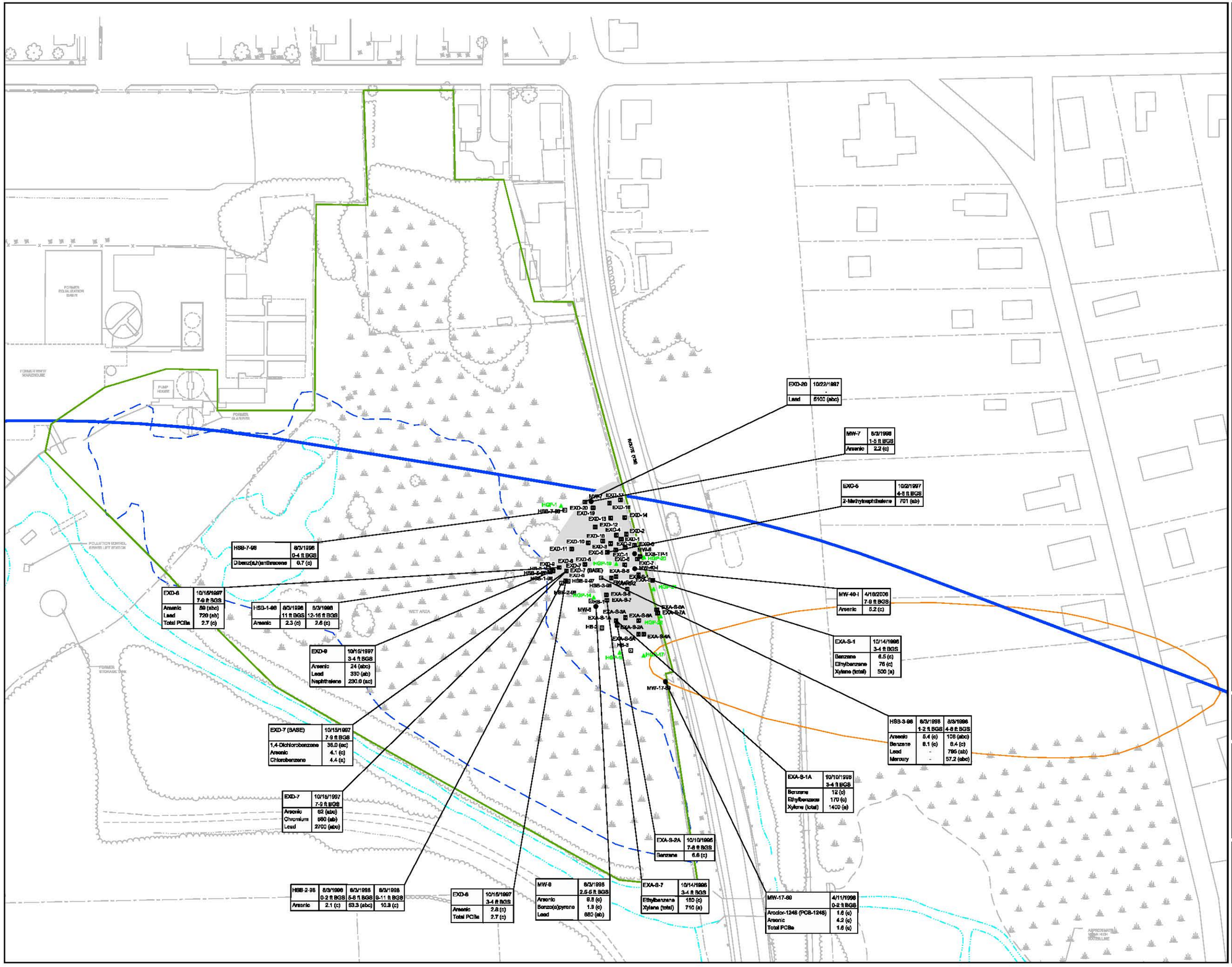
AOC1 - SERVICE STATION - PPA/MYTA - SUBSURFACE SOIL - DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale: 1"=60'	Project N°: 15620-78	Report N°: 020	Drawing N°: A.8

15620-78(020)GN-WA008 DEC 14/2010



0 30 60 ft

LEGEND

- MW-5 — MONITORING WELL LOCATION
- HGP-1 — GEOPROBE LOCATION
- EXD-6 — POST EXCAVATION SOIL SAMPLE LOCATION
- HS-7 — BOREHOLE SAMPLING LOCATION (HANDEX)
- EXCAVATED AREAS
- AOC1 ENCAPSULATED LAGOON AREA AND FORMER SERVICE STATION
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- ESTIMATED EXTENT OF MYTA
- \- NOT DETECTED ABOVE CRITERIA

HGP-1	10/1/01	SAMPLE LOCATION
	0-2 ft BGS	SAMPLE DATE
Benzo(a)pyrene	1.5 (c)	SAMPLE DEPTH
		RESULT (mg/kg)
		PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA

Parameter	53/GW2 Criteria (a)	53/GW3 Criteria (b)	Industrial Region 9 Criteria (c)
1,4-Dichlorobenzene	4	2000	12
2-Methylnaphthalene	60	500	4100
Aroclor-1248 (PCB-1248)	-	-	0.74
Arsenic	20	20	1.6
Benzene	700	800	6.4
Benzo(a)pyrene	30	30	0.21
Chlorobenzene	3	100	1400
Chromium	200	200	-
Dibenz(a,h)anthracene	30	30	0.21
Ethylbenzene	1000	3000	27
Lead	300	300	800
Mercury	30	30	34
Naphthalene	40	3000	18
Total PCBs	3	3	0.74
Xylene (total)	300	3000	2700

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

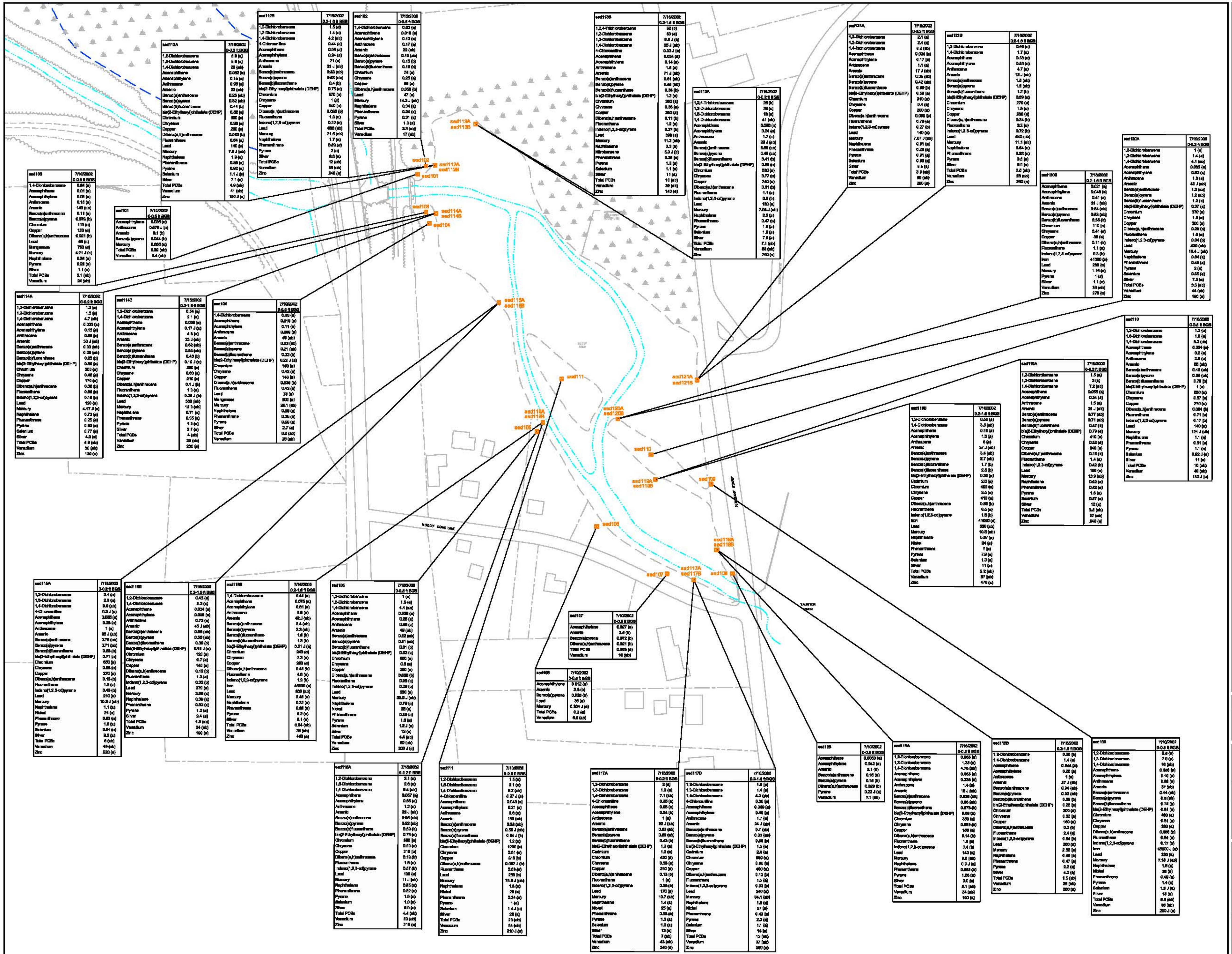
AOC1 - SERVICE STATION - SUBSURFACE SOIL - DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale: 1"=80'	Project No.: 15620-78	Report No.: 020	Drawing No.: A.9

15620-78(020)GN-WA009 DEC 14/2010



sed112A	7/15/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	5.9 (a)
1,3-Dichlorobenzene	5.9 (a)
1,4-Dichlorobenzene	20 (ab)
Acenaphthene	0.052 (a)
Acenaphthylene	0.15 (a)
Anthracene	0.93 (a)
Arsenic	22 (ab)
Benzo(a)anthracene	0.25 (ab)
Benzo(a)pyrene	0.32 (ab)
Benzo(b)fluoranthene	0.44 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.82 (a)
Chromium	300 (a)
Chrysene	0.85 (a)
Copper	230 (a)
Dibenz(a,h)anthracene	0.033 (b)
Fluoranthene	0.84 (a)
Lead	140 (a)
Mercury	7.9 J (ab)
Naphthalene	1.9 (a)
Phenanthrene	0.86 (a)
Pyrene	0.92 (a)
Selenium	1.1 J (a)
Silver	7.1 (a)
Total PCBs	4.9 (ab)
Vanadium	41 (ab)
Zinc	180 J (a)

sed112B	7/15/2002 0.2-1.5 ft BGS
1,2-Dichlorobenzene	1.5 (a)
1,3-Dichlorobenzene	1.4 (a)
1,4-Dichlorobenzene	4.2 (ab)
4-Chloroaniline	0.44 (a)
Acenaphthene	0.05 (a)
Acenaphthylene	0.24 (a)
Anthracene	21 (a)
Arsenic	21 J (ab)
Benzo(a)anthracene	9.83 (ab)
Benzo(a)pyrene	5.83 (ab)
Benzo(b)fluoranthene	0.4 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.75 (a)
Chromium	370 (a)
Chrysene	1 (a)
Copper	340 (a)
Dibenz(a,h)anthracene	0.092 (b)
Fluoranthene	1.8 (a)
Indeno(1,2,3-cd)pyrene	0.22 (b)
Lead	660 (ab)
Mercury	21.6 (ab)
Naphthalene	1.7 (a)
Phenanthrene	0.89 (a)
Pyrene	2 (a)
Silver	8.6 (a)
Total PCBs	12 (ab)
Vanadium	38 (ab)
Zinc	240 (a)

sed102	7/10/2002 0-0.5 ft BGS
1,4-Dichlorobenzene	0.83 (a)
Acenaphthene	0.019 (a)
Acenaphthylene	0.13 (a)
Anthracene	0.17 (a)
Arsenic	22 (ab)
Benzo(a)anthracene	0.18 (ab)
Benzo(a)pyrene	0.15 (b)
Benzo(b)fluoranthene	0.18 (b)
Chromium	74 (a)
Chrysene	0.25 (a)
Copper	58 (a)
Dibenz(a,h)anthracene	0.058 (b)
Lead	47 (a)
Mercury	14.2 J (ab)
Naphthalene	0.94 (a)
Phenanthrene	0.24 (a)
Pyrene	0.91 (a)
Silver	1.9 (a)
Total PCBs	2.3 (ab)
Vanadium	17 (ab)

sed103	7/10/2002 0-0.5 ft BGS
1,4-Dichlorobenzene	0.84 (a)
Acenaphthene	0.01 (a)
Acenaphthylene	0.06 (a)
Anthracene	0.15 (a)
Arsenic	140 (ab)
Benzo(a)anthracene	0.11 (a)
Benzo(a)pyrene	0.076 (b)
Chromium	110 (a)
Copper	120 (a)
Dibenz(a,h)anthracene	0.021 (b)
Lead	66 (a)
Manganese	760 (a)
Mercury	4.21 J (a)
Naphthalene	0.24 (a)
Pyrene	0.22 (a)
Silver	1.1 (a)
Total PCBs	2.1 (ab)
Vanadium	24 (ab)

sed101	7/10/2002 0-0.5 ft BGS
Acenaphthylene	0.026 (a)
Anthracene	0.076 J (a)
Arsenic	8.1 (b)
Benzo(a)pyrene	0.044 (b)
Mercury	0.666 (a)
Total PCBs	0.39 (ab)
Vanadium	8.4 (ab)

sed114A	7/16/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	1.3 (a)
1,3-Dichlorobenzene	1.5 (a)
1,4-Dichlorobenzene	4.7 (ab)
Acenaphthene	0.035 (a)
Acenaphthylene	0.13 (a)
Anthracene	0.66 (a)
Arsenic	30 J (ab)
Benzo(a)anthracene	0.33 (ab)
Benzo(a)pyrene	0.26 (ab)
Benzo(b)fluoranthene	0.25 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.39 (a)
Chromium	200 (a)
Chrysene	0.46 (a)
Copper	170 (a)
Dibenz(a,h)anthracene	0.06 (b)
Fluoranthene	0.66 (a)
Indeno(1,2,3-cd)pyrene	0.16 (b)
Lead	190 (a)
Mercury	4.17 J (a)
Naphthalene	0.73 (a)
Phenanthrene	0.25 (a)
Pyrene	0.82 (a)
Selenium	0.77 (a)
Silver	4.0 (a)
Total PCBs	4.9 (ab)
Vanadium	30 (ab)
Zinc	130 (a)

sed114B	7/16/2002 0.2-1.5 ft BGS
1,2-Dichlorobenzene	0.54 (a)
1,4-Dichlorobenzene	3.1 (a)
Acenaphthene	0.039 (a)
Acenaphthylene	0.17 J (a)
Anthracene	4.5 (a)
Arsenic	35 J (ab)
Benzo(a)anthracene	0.62 (ab)
Benzo(a)pyrene	0.53 (ab)
Benzo(b)fluoranthene	0.49 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.19 J (a)
Chromium	200 (a)
Chrysene	0.63 (a)
Copper	210 (a)
Dibenz(a,h)anthracene	0.1 J (b)
Fluoranthene	1.3 (a)
Indeno(1,2,3-cd)pyrene	0.28 J (b)
Lead	560 (ab)
Mercury	12.3 (ab)
Naphthalene	0.71 (a)
Phenanthrene	0.35 (a)
Pyrene	1.2 (a)
Silver	2.7 (a)
Total PCBs	4 (ab)
Vanadium	29 (ab)
Zinc	200 (a)

sed104	7/10/2002 0-0.5 ft BGS
1,4-Dichlorobenzene	0.83 (a)
Acenaphthene	0.019 (a)
Acenaphthylene	0.11 (a)
Anthracene	0.086 (a)
Arsenic	49 (ab)
Benzo(a)anthracene	0.23 (ab)
Benzo(a)pyrene	0.21 (ab)
Benzo(b)fluoranthene	0.33 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.22 J (a)
Chromium	150 (a)
Chrysene	0.42 (a)
Copper	140 (a)
Dibenz(a,h)anthracene	0.035 (b)
Fluoranthene	0.43 (a)
Lead	73 (a)
Manganese	800 (a)
Mercury	26.1 (ab)
Naphthalene	0.59 (a)
Phenanthrene	0.35 (a)
Pyrene	0.55 (a)
Silver	2.7 (a)
Total PCBs	8.2 (ab)
Vanadium	28 (ab)

sed113B	7/16/2002 0.2-1.6 ft BGS
1,2,4-Trichlorobenzene	32 (b)
1,2-Dichlorobenzene	60 (a)
1,3-Dichlorobenzene	9.5 J (a)
1,4-Dichlorobenzene	25 J (ab)
4-Chloroaniline	0.33 J (a)
Acenaphthene	0.034 (a)
Acenaphthylene	0.14 (a)
Anthracene	1.5 (a)
Arsenic	71 J (ab)
Benzo(a)anthracene	0.61 (ab)
Benzo(a)pyrene	0.45 (ab)
Benzo(b)fluoranthene	0.34 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	1.3 (a)
Chromium	360 (a)
Chrysene	0.86 (a)
Copper	260 (a)
Dibenz(a,h)anthracene	0.11 (b)
Fluoranthene	1.2 (a)
Indeno(1,2,3-cd)pyrene	0.27 (b)
Lead	399 (a)
Mercury	11.3 (ab)
Naphthalene	3.3 (a)
Nitrobenzene	5.3 J (b)
Phenanthrene	0.26 (a)
Pyrene	1.3 (a)
Selenium	1.1 (a)
Silver	11 (a)
Total PCBs	10 (ab)
Vanadium	39 (ab)
Zinc	140 (a)

sed113A	7/16/2002 0-0.2 ft BGS
1,2,4-Trichlorobenzene	26 (b)
1,2-Dichlorobenzene	29 (a)
1,3-Dichlorobenzene	13 (a)
1,4-Dichlorobenzene	41 (ab)
Acenaphthene	0.068 (a)
Acenaphthylene	0.24 (a)
Anthracene	1.2 (a)
Arsenic	22 J (ab)
Benzo(a)anthracene	0.69 (ab)
Benzo(a)pyrene	0.46 (ab)
Benzo(b)fluoranthene	0.41 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.86 (a)
Chromium	330 (a)
Chrysene	0.77 (a)
Copper	240 (a)
Dibenz(a,h)anthracene	0.11 (b)
Fluoranthene	1.1 (a)
Indeno(1,2,3-cd)pyrene	0.5 (b)
Lead	180 (a)
Mercury	7.06 J (ab)
Naphthalene	2.2 (a)
Phenanthrene	0.47 (a)
Pyrene	1.5 (a)
Selenium	1.0 (a)
Silver	7.9 (a)
Total PCBs	7.1 (ab)
Vanadium	88 (ab)
Zinc	200 (a)

sed121A	7/16/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	2.1 (a)
1,3-Dichlorobenzene	2.4 (a)
1,4-Dichlorobenzene	8.2 (ab)
Acenaphthene	0.036 (a)
Acenaphthylene	0.17 (a)
Anthracene	1.1 (a)
Arsenic	17 J (ab)
Benzo(a)anthracene	0.35 (ab)
Benzo(a)pyrene	0.42 (ab)
Benzo(b)fluoranthene	0.99 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.59 (a)
Chromium	310 (a)
Chrysene	0.4 (a)
Copper	200 (a)
Dibenz(a,h)anthracene	0.095 (b)
Fluoranthene	0.79 (a)
Indeno(1,2,3-cd)pyrene	0.27 (b)
Lead	140 (a)
Mercury	7.87 J (ab)
Naphthalene	0.91 (a)
Phenanthrene	0.28 (a)
Pyrene	0.91 (a)
Selenium	0.90 (a)
Silver	6.5 (a)
Total PCBs	3.9 (ab)
Vanadium	90 (ab)
Zinc	200 (a)

sed121B	7/16/2002 0.2-1.6 ft BGS
1,2-Dichlorobenzene	0.46 (a)
1,4-Dichlorobenzene	1.7 (a)
Acenaphthene	0.13 (a)
Acenaphthylene	0.63 (a)
Anthracene	4.7 (a)
Arsenic	13 J (ab)
Benzo(a)anthracene	1.8 (ab)
Benzo(a)pyrene	1.2 (ab)
Benzo(b)fluoranthene	1.2 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.39 (a)
Chromium	270 (a)
Chrysene	1.6 (a)
Copper	230 (a)
Dibenz(a,h)anthracene	0.24 (b)
Fluoranthene	3.2 (a)
Indeno(1,2,3-cd)pyrene	0.72 (b)
Lead	840 (ab)
Mercury	11.1 (ab)
Naphthalene	8.64 (a)
Phenanthrene	8.88 (a)
Pyrene	3.6 (a)
Silver	9.0 (a)
Total PCBs	2.8 (ab)
Vanadium	28 (ab)
Zinc	260 (a)

sed120B	7/16/2002 0.2-1.6 ft BGS
Acenaphthene	0.021 (a)
Acenaphthylene	0.048 (a)
Anthracene	0.41 (a)
Arsenic	21 J (ab)
Benzo(a)anthracene	0.84 (ab)
Benzo(a)pyrene	0.88 (ab)
Benzo(b)fluoranthene	0.58 (b)
Chromium	110 (a)
Chrysene	0.41 (a)
Copper	88 (a)
Dibenz(a,h)anthracene	0.11 (b)
Fluoranthene	1.1 (a)
Indeno(1,2,3-cd)pyrene	0.5 (b)
Iron	41000 (a)
Lead	280 (a)
Mercury	1.18 (a)
Pyrene	1 (a)
Silver	1.1 (a)
Vanadium	33 (ab)
Zinc	270 (a)

sed120A	7/16/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	1 (a)
1,3-Dichlorobenzene	1.4 (a)
1,4-Dichlorobenzene	4.1 (ab)
Acenaphthene	0.085 (a)
Acenaphthylene	0.52 (a)
Anthracene	1.8 (a)
Arsenic	40 J (ab)
Benzo(a)anthracene	1.2 (ab)
Benzo(a)pyrene	1.2 (ab)
Benzo(b)fluoranthene	1.2 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.37 (a)
Chromium	370 (a)
Chrysene	1.5 (a)
Copper	300 (a)
Dibenz(a,h)anthracene	0.29 (b)
Fluoranthene	1.8 (a)
Indeno(1,2,3-cd)pyrene	0.84 (b)
Lead	420 (ab)
Mercury	19.4 J (ab)
Naphthalene	0.84 (a)
Phenanthrene	0.48 (a)
Pyrene	2 (a)
Selenium	0.65 (a)
Silver	7.5 (a)
Total PCBs	3.5 (ab)
Vanadium	44 (ab)
Zinc	190 (a)

sed110	7/10/2002 0-0.5 ft BGS
1,2-Dichlorobenzene	1.2 (a)
1,3-Dichlorobenzene	1.9 (a)
1,4-Dichlorobenzene	6.2 (ab)
Acenaphthene	0.024 (a)
Acenaphthylene	0.2 (a)
Anthracene	2.8 (a)
Arsenic	88 (ab)
Benzo(a)anthracene	0.48 (ab)
Benzo(a)pyrene	0.58 (ab)
Benzo(b)fluoranthene	0.78 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	1 (a)
Chromium	880 (a)
Chrysene	0.87 (a)
Copper	270 (a)
Dibenz(a,h)anthracene	0.084 (b)
Fluoranthene	0.71 (a)
Indeno(1,2,3-cd)pyrene	0.17 (b)
Lead	140 (a)
Mercury	124 J (ab)
Naphthalene	1.1 (a)
Phenanthrene	0.31 (a)
Pyrene	1.1 (a)
Selenium	0.82 J (a)
Silver	11 (a)
Total PCBs	10 (ab)
Vanadium	40 (ab)
Zinc	180 J (a)

sed119A	7/15/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	1.5 (a)
1,3-Dichlorobenzene	2 (a)
1,4-Dichlorobenzene	7.2 (ab)
Acenaphthene	0.055 (a)
Acenaphthylene	0.34 (a)
Anthracene	1.5 (a)
Arsenic	21 J (ab)
Benzo(a)anthracene	0.77 (ab)
Benzo(a)pyrene	0.71 (ab)
Benzo(b)fluoranthene	0.47 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.79 (a)
Chromium	410 (a)
Chrysene	0.82 (a)
Copper	240 (a)
Dibenz(a,h)anthracene	0.15 (b)
Fluoranthene	1.4 (a)
Indeno(1,2,3-cd)pyrene	0.42 (b)
Lead	150 (a)
Mercury	13.9 (ab)
Naphthalene	0.82 (a)
Phenanthrene	0.42 (a)
Pyrene	1.6 (a)
Selenium	0.87 (a)
Silver	12 (a)
Total PCBs	3.6 (ab)
Vanadium	37 (ab)
Zinc	240 (a)

sed119B	7/16/2002 0.2-1.6 ft BGS
1,2-Dichlorobenzene	0.52 (a)
1,4-Dichlorobenzene	3.5 (ab)
Acenaphthene	0.19 (a)
Acenaphthylene	1.3 (a)
Anthracene	5 (a)
Arsenic	37 J (ab)
Benzo(a)anthracene	3.4 (ab)
Benzo(a)pyrene	2.7 (ab)
Benzo(b)fluoranthene	1.7 (b)
Benzo(k)fluoranthene	2.5 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.33 (a)
Cadmium	2.0 (a)
Chromium	490 (a)
Chrysene	3.5 (a)
Copper	410 (a)
Dibenz(a,h)anthracene	0.58 (b)
Fluoranthene	6.5 (a)
Indeno(1,2,3-cd)pyrene	1.8 (b)
Iron	41000 (a)
Lead	530 (ab)
Mercury	10.3 (ab)
Naphthalene	0.87 (a)
Nickel	24 (a)
Phenanthrene	7 (a)
Pyrene	7.9 (a)
Selenium	1.0 (a)
Silver	11 (a)
Total PCBs	2.2 (ab)
Vanadium	37 (ab)
Zinc	470 (a)

sed115A	7/15/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	2.4 (a)
1,3-Dichlorobenzene	2.9 (a)
1,4-Dichlorobenzene	9.9 (ab)
4-Chloroaniline	0.3 J (a)
Acenaphthene	0.058 (a)
Acenaphthylene	0.25 (a)
Anthracene	1 (a)
Arsenic	26 J (ab)
Benzo(a)anthracene	0.78 (ab)
Benzo(a)pyrene	0.71 (ab)
Benzo(b)fluoranthene	0.68 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.71 (a)
Chromium	680 (a)
Chrysene	0.96 (a)
Copper	270 (a)
Dibenz(a,h)anthracene	0.15 (b)
Fluoranthene	1.8 (a)
Indeno(1,2,3-cd)pyrene	0.45 (b)
Lead	210 (a)
Mercury	10.3 J (ab)
Naphthalene	1.1 (a)
Nickel	24 (a)
Phenanthrene	0.63 (a)
Pyrene	1.5 (a)
Selenium	0.94 (a)
Silver	9.2 (a)
Total PCBs	6 (ab)
Vanadium	49 (ab)
Zinc	220 (a)

sed115B	7/16/2002 0.2-1.5 ft BGS
1,2-Dichlorobenzene	0.45 (a)
1,4-Dichlorobenzene	2.2 (a)
Acenaphthene	0.034 (a)
Acenaphthylene	0.098 (a)
Anthracene	0.72 (a)
Arsenic	45 J (ab)
Benzo(a)anthracene	0.66 (ab)
Benzo(a)pyrene	0.56 (ab)
Benzo(b)fluoranthene	0.39 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.16 J (a)
Chromium	120 (a)
Chrysene	0.7 (a)
Copper	140 (a)
Dibenz(a,h)anthracene	0.12 (b)
Fluoranthene	1.3 (a)
Indeno(1,2,3-cd)pyrene	0.32 (b)
Lead	270 (a)
Mercury	3.58 (a)
Naphthalene	0.39 (a)
Phenanthrene	0.32 (a)
Pyrene	1.2 (a)
Silver	2.4 (a)
Total PCBs	1.9 (ab)
Vanadium	24 (ab)
Zinc	190 (a)

sed118B	7/16/2002 0.2-1.6 ft BGS
1,4-Dichlorobenzene	0.44 (a)
Acenaphthene	0.075 (a)
Acenaphthylene	0.81 (a)
Anthracene	0.8 (a)
Arsenic	42 J (ab)
Benzo(a)anthracene	3.4 (ab)
Benzo(a)pyrene	2.3 (ab)
Benzo(b)fluoranthene	1.6 (b)
Benzo(k)fluoranthene	1.8 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.21 J (a)
Chromium	240 (a)
Chrysene	2.3 (a)
Copper	290 (a)
Dibenz(a,h)anthracene	0.45 (b)
Fluoranthene	4.6 (a)
Indeno(1,2,3-cd)pyrene	1.3 (b)
Iron	46000 (a)
Lead	600 (ab)
Mercury	3.46 (a)
Naphthalene	0.32 (a)
Phenanthrene	0.86 (a)
Pyrene	6.2 (a)
Silver	6.1 (a)
Total PCBs	0.54 (ab)
Vanadium	34 (ab)
Zinc	440 (a)

sed105	7/10/2002 0-0.5 ft BGS
1,2-Dichlorobenzene	1 (a)
1,3-Dichlorobenzene	1.5 (a)
1,4-Dichlorobenzene	4.4 (ab)
Acenaphthene	0.038 (a)
Acenaphthylene	0.25 (a)
Anthracene	0.69 (a)
Arsenic	49 (ab)
Benzo(a)anthracene	0.82 (ab)
Benzo(a)pyrene	0.81 (ab)
Benzo(b)fluoranthene	0.81 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.62 (a)
Chromium	680 (a)
Chrysene	0.8 (a)
Copper	290 (a)
Dibenz(a,h)anthracene	0.088 (b)
Fluoranthene	0.99 (a)
Indeno(1,2,3-cd)pyrene	0.29 (b)
Lead	290 (a)
Mercury	35.9 J (ab)
Naphthalene	0.79 (a)
Nickel	23 (a)
Phenanthrene	0.39 (a)
Pyrene	1.6 (a)
Selenium	1.2 J (a)
Silver	12 (a)
Total PCBs	4.4 (ab)
Vanadium	60 (ab)
Zinc	200 J (a)

sed118A	7/15/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	2.1 (a)
1,3-Dichlorobenzene	2.6 (a)
1,4-Dichlorobenzene	9.4 (ab)
Acenaphthene	0.057 (a)
Acenaphthylene	0.56 (a)
Anthracene	1.2 (a)
Arsenic	28 J (ab)
Benzo(a)anthracene	0.95 (ab)
Benzo(a)pyrene	0.92 (ab)
Benzo(b)fluoranthene	0.59 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.75 (a)
Chromium	380 (a)
Chrysene	0.69 (a)
Copper	210 (a)
Dibenz(a,h)anthracene	0.19 (b)
Fluoranthene	1.6 (a)
Indeno(1,2,3-cd)pyrene	0.57 (b)
Lead	190 (a)
Mercury	11 J (ab)
Naphthalene	0.85 (a)
Phenanthrene	0.82 (a)
Pyrene	1.9 (a)
Selenium	1.0 (a)
Silver	9.0 (a)
Total PCBs	4.4 (ab)
Vanadium	39 (ab)
Zinc	210 (a)

sed111	7/10/2002 0-0.5 ft BGS
1,2-Dichlorobenzene	1.5 (a)
1,3-Dichlorobenzene	2.1 (a)
1,4-Dichlorobenzene	8.2 (ab)
4-Chloroaniline	0.27 J (a)
Acenaphthene	0.043 (a)
Acenaphthylene	0.21 (a)
Anthracene	3.6 (a)
Arsenic	180 (ab)
Benzo(a)anthracene	0.28 (ab)
Benzo(a)pyrene	0.55 J (ab)
Benzo(b)fluoranthene	0.84 J (b)
bis(2-Ethylhexyl)phthalate (DEHP)	1.2 (a)
Chromium	1200 (a)
Chrysene	0.61 (a)
Copper	810 (a)
Dibenz(a,h)anthracene	0.082 J (b)
Fluoranthene	0.69 (a)
Lead	280 (a)
Mercury	76.8 J (ab)
Naphthalene	1.5 (a)
Nickel	29 (a)
Phenanthrene	0.34 (a)
Pyrene	1 (a)
Selenium	1.4 J (a)
Silver	28 (a)
Total PCBs	23 (ab)
Vanadium	64 (ab)
Zinc	210 J (a)

sed107	7/10/2002 0-0.5 ft BGS
Acenaphthylene	0.027 (a)
Arsenic	2.6 (b)
Benzo(a)pyrene	0.072 (b)
Dibenz(a,h)anthracene	0.021 (b)
Total PCBs	0.063 (a)
Vanadium	10 (ab)

sed106	7/10/2002 0-0.5 ft BGS
Acenaphthylene	0.012 (a)
Arsenic	3.5 (b)
Benzo(a)pyrene	0.026 (b)
Lead	36 (a)
Mercury	0.304 J (a)
Total PCBs	0.2 (a)
Vanadium	6.6 (ab)

sed117A	7/15/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	2 (a)
1,3-Dichlorobenzene	1.9 (a)
1,4-Dichlorobenzene	7.1 (ab)
4-Chloroaniline	0.35 (a)
Acenaphthene	0.05 (a)
Acenaphthylene	0.24 (a)
Anthracene	1 (a)
Arsenic	22 J (ab)
Benzo(a)anthracene	0.63 (ab)
Benzo(a)pyrene	0.69 (ab)
Benzo(b)fluoranthene	0.43 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	1.3 (a)
Cadmium	1.2 (a)
Chromium	430 (a)
Chrysene	0.58 (a)
Copper	310 (a)
Dibenz(a,h)anthracene	0.13 (b)
Fluoranthene	1 (a)
Indeno(1,2,3-cd)pyrene	0.35 (b)
Lead	170 (a)
Mercury	10.7 (ab)
Naphthalene	1.4 (a)
Nickel	25 (a)
Phenanthrene	0.58 (a)
Pyrene	1.9 (a)
Selenium	1.2 (a)
Silver	13 (a)
Total PCBs	7 (ab)
Vanadium	43 (ab)
Zinc	340 (a)

sed117B	7/16/2002 0.2-1.6 ft BGS
1,2-Dichlorobenzene	1.9 (a)
1,3-Dichlorobenzene	1.4 (a)
1,4-Dichlorobenzene	4.2 (ab)
4-Chloroaniline	0.36 (a)
Acenaphthene	0.039 (a)
Acenaphthylene	0.46 (a)
Anthracene	1.7 (a)
Arsenic	24 J (ab)
Benzo(a)anthracene	0.7 (ab)
Benzo(a)pyrene	0.83 (ab)
Benzo(b)fluoranthene	0.56 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	1.5 (a)
Cadmium	2.9 (a)
Chromium	660 (a)
Chrysene	0.86 (a)
Copper	460 (a)
Dibenz(a,h)anthracene	0.12 (b)
Fluoranthene	1.5 (a)
Indeno(1,2,3-cd)pyrene	0.33 (b)
Lead	240 (a)
Mercury	34.1 (ab)
Naphthalene	1.8 (a)
Nickel	27 (a)
Phenanthrene	0.43 (a)
Pyrene	2.3 (a)
Selenium	1.1 (a)
Silver	15 (a)
Total PCBs	12 (ab)
Vanadium	37 (ab)
Zinc	380 (a)

sed108	7/10/2002 0-0.5 ft BGS
Acenaphthene	0.0063 (a)
Acenaphthylene	0.042 (a)
Arsenic	2.1 (b)
Benzo(a)anthracene	0.16 (a)
Benzo(a)pyrene	0.16 (b)
Dibenz(a,h)anthracene	0.029 (b)
Pyrene	0.22 J (a)
Vanadium	7.1 (ab)

sed116A	7/16/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	0.665 (a)
1,3-Dichlorobenzene	1.35 (a)
1,4-Dichlorobenzene	4.75 (ab)
Acenaphthene	0.063 (a)
Acenaphthylene	0.355 (a)
Anthracene	1.4 (a)
Arsenic	18 J (ab)
Benzo(a)anthracene	0.525 (ab)
Benzo(a)pyrene	0.66 (ab)
Benzo(b)fluoranthene	0.675 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.89 (a)
Chromium	350 (a)
Chrysene	0.985 (a)
Copper	165 (a)
Dibenz(a,h)anthracene	0.14 (b)
Fluoranthene	1.8 (a)
Indeno(1,2,3-cd)pyrene	0.4 (b)
Lead	140 (a)
Mercury	9.6 (ab)
Naphthalene	0.9 J (a)
Phenanthrene	0.865 (a)
Pyrene	1.65 (a)
Silver	9.0 (a)
Total PCBs	8.1 (ab)
Vanadium	34 (ab)
Zinc	190 (a)

sed116B	7/16/2002 0.2-1.6 ft BGS
1,2-Dichlorobenzene	0.36 (a)
1,4-Dichlorobenzene	1.4 (a)
Acenaphthene	0.044 (a)
Acenaphthylene	0.26 (a)
Anthracene	1 (a)
Arsenic	27 J (ab)
Benzo(a)anthracene	0.94 (ab)
Benzo(a)pyrene	0.92 (ab)
Benzo(b)fluoranthene	0.59 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.26 (a)
Chromium	300 (a)
Chrysene	0.83 (a)
Copper	160 (a)
Dibenz(a,h)anthracene	0.2 (b)
Fluoranthene	2.4 (a)
Indeno(1,2,3-cd)pyrene	0.54 (b)
Lead	360 (a)
Mercury	2.82 (a)
Naphthalene	0.45 (a)
Phenanthrene	0.47 (a)
Pyrene	2.2 (a)
Silver	4.2 (a)
Total PCBs	1.5 (ab)
Vanadium	25 (ab)
Zinc	260 (a)

sed109	7/10/2002 0-0.5 ft BGS
1,2-Dichlorobenzene	3.6 (a)
1,3-Dichlorobenzene	2.6 (a)
1,4-Dichlorobenzene	10 (ab)
Acenaphthene	0.066 (a)
Acenaphthylene	0.16 (a)
Anthracene	0.66 (a)
Arsenic	37 (ab)
Benzo(a)anthracene	0.44 (ab)
Benzo(a)pyrene	0.5 (ab)
Benzo(b)fluoranthene	0.74 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.61 (a)
Chromium	460 (a)
Chrysene	0.61 (a)
Copper	330 (a)
Dibenz(a,h)anthracene	0.066 (b)
Fluoranthene	0.64 (a)
Indeno(1,2,3-cd)pyrene	0.17 (b)
Iron	46000 J (a)
Lead	220 (a)
Mercury	7.16 J (ab)
Naphthalene	1.6 (a)
Nickel	26 (a)
Phenanthrene	0.49 (a)
Pyrene	1.4 (a)
Selenium	1.3 J (a)
Silver	13 (a)
Total PCBs	6.8 (ab)
Vanadium	66 (ab)
Zinc	230 J (a)

0 40 80ft

LEGEND

SD-26 SEDIMENT SAMPLE LOCATION

- NOT DETECTED ABOVE CRITERIA

SD-10a	10/4/99 0-5 cm
Mercury	7 (b)
Total PCBs	0.63 (b)

SAMPLE LOCATION
SAMPLE DATE
SAMPLE DEPTH
RESULT (mg/kg)
PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA

Parameter	ESV Criteria (a)	Residential Region 9 Criteria (b)
1,2,4-Trichlorobenzene	-	22
1,2-Dichlorobenzene	0.294	1600
1,3-Dichlorobenzene	1.315	-
1,4-Dichlorobenzene	0.318	2.4
4-Chloroaniline	0.146	2.4
Acenaphthene	0.00671	3400
Acenaphthylene	0.00587	-
Anthracene	0.0572	17000
Arsenic	9.79	0.39
Benzo(a)anthracene	0.108	0.15
Benzo(a)pyrene	0.15	0.015
Benzo(b)fluoranthene	10.4	0.15
Benzo(k)fluoranthene	-	1.5
bis(2-Ethylhexyl)phthalate (DEHP)	0.182	35
Cadmium	0.99	70
Chromium	43.4	-
Chrysene	0.166	15
Copper	31.6	3100
Dibenz(a,h)anthracene	-	0.015
Fluoranthene	0.423	2300
Indeno(1,2,3-cd)pyrene	-	0.15
Iron	40000	55000
Lead	35.8	400
Manganese	460	1800
Mercury	0.18	5.6
Naphthalene	0.176	3.6
Nickel	22.7	1500
Nitrobenzene	-	4.8
Phenanthrene	0.204	-
Pyrene	0.195	1700
Selenium	0.72	390
Silver	0.5	390
Total PCBs	0.0598	0.22
Vanadium	0.72	5.5
Zinc	121	23000

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

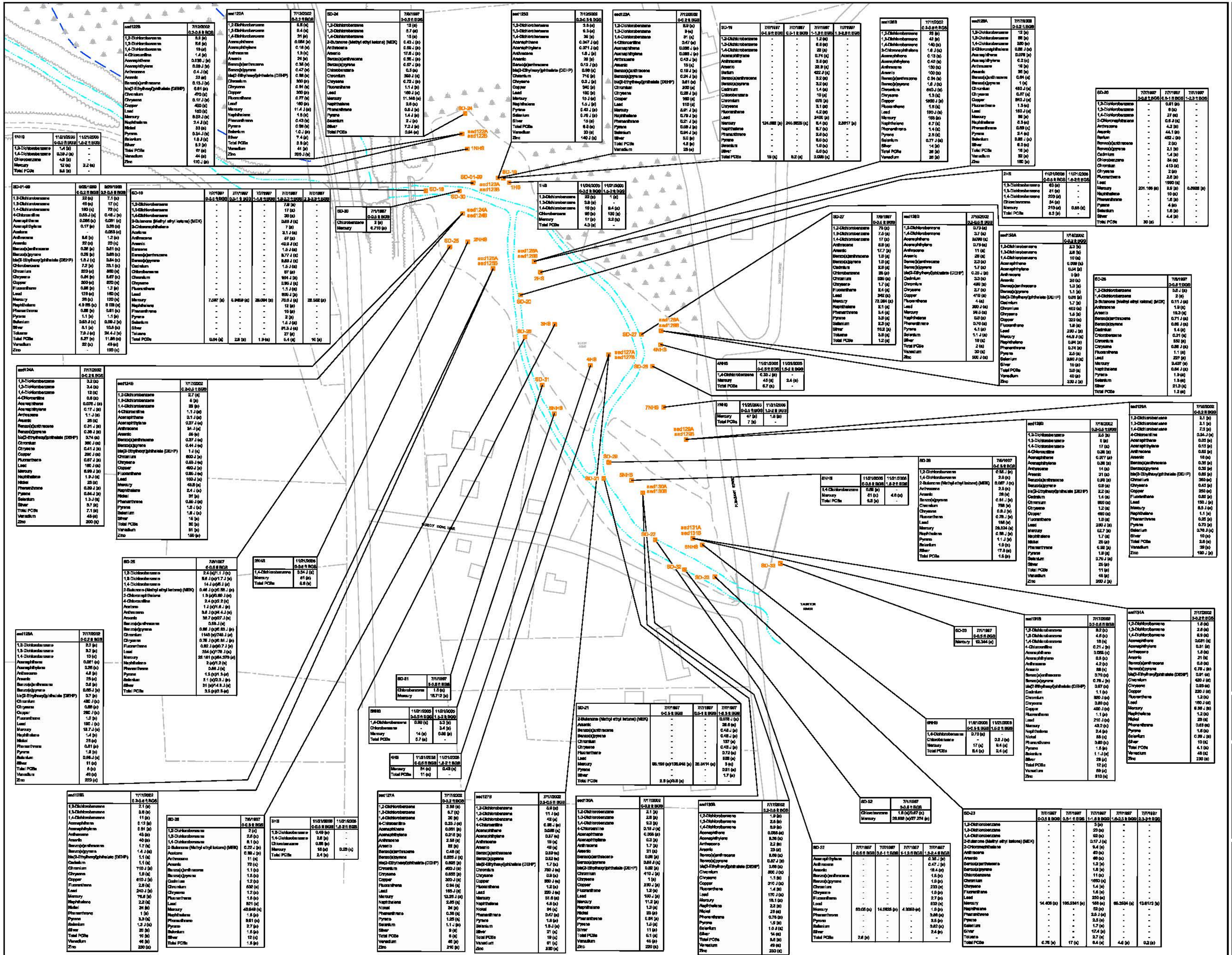
AOC2 - SEDIMENT DATA SUMMARY
NEAR SHORE AND BANK

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager: J.K.P.	Reviewed By: J.V.	Date: JULY 2010	
Scale: 1"=80'	Project Nº: 15620-78	Report Nº: 020	Drawing Nº: A.10

15620-78(020)GN-WA010 DEC 14/2010



sed122B	7/12/2002 0.2-0.6 ft BGS
1,2-Dichlorobenzene	5.6 (a)
1,3-Dichlorobenzene	5.6 (a)
1,4-Dichlorobenzene	19 (a)
4-Chloroaniline	1.4 (a)
Acenaphthene	0.038 J (a)
Acenaphthylene	0.09 J (a)
Anthracene	0.4 J (a)
Arsenic	22 (a)
Benzo(a)anthracene	0.13 J (a)
bis(2-Ethylhexyl)phthalate (DEHP)	0.61 (a)
Chromium	470 (a)
Chrysene	0.17 J (a)
Copper	400 (a)
Lead	160 (a)
Mercury	8.02 J (a)
Naphthalene	2.4 J (a)
Nickel	33 (a)
Pyrene	0.34 J (a)
Selenium	1.6 J (a)
Silver	8.2 (a)
Total PCBs	17 (a)
Vanadium	44 (a)
Zinc	170 J (a)

sed122A	7/12/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	5.5 (a)
1,3-Dichlorobenzene	9.4 (a)
1,4-Dichlorobenzene	31 (a)
Acenaphthene	0.054 (a)
Acenaphthylene	0.16 (a)
Anthracene	1.3 (a)
Arsenic	24 (a)
Benzo(a)anthracene	0.35 (a)
Benzo(a)pyrene	0.47 (a)
bis(2-Ethylhexyl)phthalate (DEHP)	0.86 (a)
Chromium	300 (a)
Chrysene	0.51 (a)
Copper	200 (a)
Fluoranthene	0.77 (a)
Lead	160 (a)
Mercury	11.4 J (a)
Naphthalene	1.6 (a)
Phenanthrene	0.43 (a)
Pyrene	0.98 (a)
Selenium	1.0 J (a)
Silver	7.4 (a)
Total PCBs	3.6 (a)
Vanadium	41 (a)
Zinc	200 J (a)

SD-24	7/8/1997 0-0.5 ft BGS
1,2-Dichlorobenzene	12 (a)
1,3-Dichlorobenzene	5.7 (a)
1,4-Dichlorobenzene	15 (a)
2-Butanone (Methyl ethyl ketone) (MEK)	0.43 J (a)
Anthracene	0.59 J (a)
Arsenic	17.6 J (a)
Benzo(a)anthracene	0.55 J (a)
Benzo(a)pyrene	0.57 J (a)
Chlorobenzene	0.5 (a)
Chromium	369 J (a)
Chrysene	0.72 J (a)
Fluoranthene	1.1 J (a)
Lead	169 J (a)
Mercury	11.146 (a)
Naphthalene	2.6 (a)
Phenanthrene	0.5 J (a)
Pyrene	1.4 J (a)
Selenium	2 J (a)
Silver	7.2 J (a)
Total PCBs	0.64 (a)

sed123B	7/12/2002 0.2-0.5 ft BGS
1,2-Dichlorobenzene	3.5 (a)
1,3-Dichlorobenzene	9.3 (a)
1,4-Dichlorobenzene	39 (a)
Acenaphthene	0.047 J (a)
Acenaphthylene	0.071 J (a)
Anthracene	1.6 J (a)
Arsenic	29 (a)
Benzo(a)anthracene	0.12 J (a)
bis(2-Ethylhexyl)phthalate (DEHP)	0.99 (a)
Chromium	710 (a)
Chrysene	0.2 J (a)
Copper	340 (a)
Lead	180 (a)
Mercury	15 J (a)
Naphthalene	1.5 J (a)
Pyrene	0.42 J (a)
Selenium	0.76 J (a)
Silver	15 (a)
Total PCBs	6.8 (a)
Vanadium	33 (a)
Zinc	140 J (a)

sed123A	7/12/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	8.9 (a)
1,3-Dichlorobenzene	9 (a)
1,4-Dichlorobenzene	31 (a)
4-Chloroaniline	0.47 (a)
Acenaphthene	0.036 J (a)
Acenaphthylene	0.063 J (a)
Anthracene	0.43 J (a)
Arsenic	15 (a)
Benzo(a)anthracene	0.19 J (a)
Benzo(a)pyrene	0.24 J (a)
bis(2-Ethylhexyl)phthalate (DEHP)	0.61 (a)
Chromium	200 (a)
Chrysene	0.28 J (a)
Copper	180 (a)
Lead	110 (a)
Mercury	5.91 J (a)
Naphthalene	0.79 J (a)
Phenanthrene	0.21 J (a)
Pyrene	0.59 J (a)
Selenium	0.94 J (a)
Silver	5.0 (a)
Total PCBs	4.8 (a)
Vanadium	28 (a)

SD-19	7/7/1997 0-0.5 ft BGS	7/7/1997 0.5-1 ft BGS	7/7/1997 1-1.3 ft BGS	7/7/1997 1.3-2.5 ft BGS
1,2-Dichlorobenzene	-	-	1.2 (a)	-
1,3-Dichlorobenzene	-	-	6.8 (a)	-
1,4-Dichlorobenzene	-	-	22 (a)	-
Acenaphthylene	-	-	0.74 (a)	-
Anthracene	-	-	3.3 (a)	-
Arsenic	-	-	33.9 (a)	-
Barium	-	-	422 J (a)	-
Benzo(a)anthracene	-	-	3.2 (a)	-
Benzo(a)pyrene	-	-	3.2 (a)	-
Cadmium	-	-	1.4 (a)	-
Chlorobenzene	-	-	10 (a)	-
Chromium	-	-	675 (a)	-
Chrysene	-	-	3.1 (a)	-
Fluoranthene	-	-	4.2 (a)	-
Lead	-	-	2400 (a)	-
Mercury	124.082 (a)	246.8625 (a)	8.4 (a)	2.3617 (a)
Naphthalene	-	-	8.7 (a)	-
Phenanthrene	-	-	2.8 (a)	-
Pyrene	-	-	8.5 (a)	-
Selenium	-	-	1.6 (a)	-
Silver	-	-	5.6 (a)	-
Total PCBs	15 (a)	8.2 (a)	0.095 (a)	-

sed126B	7/17/2002 0.2-0.6 ft BGS
1,2-Dichlorobenzene	23 (a)
1,3-Dichlorobenzene	42 (a)
1,4-Dichlorobenzene	140 (a)
2-Chloronaphthalene	1.6 J (a)
Acenaphthene	0.13 (a)
Acenaphthylene	0.42 (a)
Anthracene	130 (a)
Arsenic	100 (a)
Benzo(a)anthracene	0.94 (a)
Benzo(a)pyrene	1.6 J (a)
Chromium	840 J (a)
Chrysene	1.3 (a)
Copper	1600 J (a)
Fluoranthene	1.5 (a)
Lead	160 J (a)
Mercury	193 (a)
Naphthalene	6.7 (a)
Phenanthrene	1.4 (a)
Pyrene	2.5 (a)
Selenium	0.77 J (a)
Silver	14 (a)
Total PCBs	28 (a)
Vanadium	26 (a)

sed126A	7/17/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	12 (a)
1,3-Dichlorobenzene	56 (a)
1,4-Dichlorobenzene	250 (a)
2-Chloronaphthalene	0.86 J (a)
Acenaphthene	0.076 (a)
Acenaphthylene	0.2 (a)
Anthracene	16 (a)
Arsenic	36 (a)
Benzo(a)anthracene	0.64 (a)
Benzo(a)pyrene	1 (a)
Chromium	480 J (a)
Chrysene	0.87 (a)
Copper	840 J (a)
Fluoranthene	1.3 (a)
Lead	160 J (a)
Mercury	59 (a)
Naphthalene	8.3 (a)
Phenanthrene	0.69 (a)
Pyrene	2.4 (a)
Selenium	0.85 J (a)
Silver	6.0 (a)
Total PCBs	16 (a)
Vanadium	32 (a)
Zinc	180 (a)

SD-20	7/7/1997 0-0.5 ft BGS	7/7/1997 0.5-1 ft BGS	7/7/1997 1-2.3 ft BGS
1,2-Dichlorobenzene	-	0.61 (a)	-
1,3-Dichlorobenzene	-	6 (a)	-
1,4-Dichlorobenzene	-	27 (a)	-
2-Chloronaphthalene	-	0.6 J (a)	-
Anthracene	-	4.2 (a)	-
Arsenic	-	44.1 (a)	-
Barium	-	452 J (a)	-
Benzo(a)anthracene	-	2 (a)	-
Benzo(a)pyrene	-	2.1 (a)	-
Cadmium	-	1.4 (a)	-
Chlorobenzene	-	34 (a)	-
Chromium	-	413 (a)	-
Chrysene	-	2 (a)	-
Fluoranthene	-	2.8 (a)	-
Lead	-	1990 (a)	-
Mercury	201.166 (a)	9.9 (a)	0.6926 (a)
Naphthalene	-	10 (a)	-
Phenanthrene	-	1.6 (a)	-
Pyrene	-	4 (a)	-
Selenium	-	1.6 (a)	-
Silver	-	4.4 (a)	-
Total PCBs	30 (a)	-	-

1NHS	11/21/2005 0-0.5 ft BGS	11/21/2005 1.5-2 ft BGS
1,2-Dichlorobenzene	1.4 (a)	-
1,4-Dichlorobenzene	0.39 J (a)	-
Chlorobenzene	4.5 (a)	-
Mercury	12 (a)	2.2 (a)
Total PCBs	9.5 (a)	-

SD-01-99	9/28/1999 0-0.2 ft BGS	9/29/1999 0.2-0.5 ft BGS
1,2-Dichlorobenzene	22 (a)	7.1 (a)
1,3-Dichlorobenzene	49 (a)	17 (a)
1,4-Dichlorobenzene	180 (a)	72 (a)
4-Chloroaniline	0.63 J (a)	0.46 J (a)
Acenaphthene	0.065 (a)	0.061 (a)
Acenaphthylene	0.17 (a)	0.26 (a)
Acetone	-	0.053 (a)
Anthracene	8.8 (a)	1.2 (a)
Arsenic	22 (a)	20 (a)
Benzo(a)anthracene	0.36 (a)	0.61 (a)
Benzo(a)pyrene	0.29 (a)	0.66 (a)
bis(2-Ethylhexyl)phthalate (DEHP)	1.8 J (a)	0.84 (a)
Chlorobenzene	7.2 (a)	23.1 (a)
Chromium	320 (a)	360 (a)
Chrysene	0.34 (a)	0.67 (a)
Copper	300 (a)	320 (a)
Fluoranthene	0.56 (a)	1.2 (a)
Lead	128 (a)	160 (a)
Mercury	26 (a)	120 (a)
Naphthalene	4.9 E6 (a)	3 E6 (a)
Phenanthrene	0.58 (a)	0.61 (a)
Pyrene	1.1 (a)	1.1 (a)
Selenium	0.63 J (a)	0.99 J (a)
Silver	8.1 (a)	10.6 (a)
Toluene	7.9 J (a)	24.4 J (a)
Total PCBs	6.27 (a)	11.86 (a)
Vanadium	32 (a)	49 (a)
Zinc	-	190 (a)

SD-18	7/7/1997 0-0.5 ft BGS	7/7/1997 0.5-1 ft BGS	7/7/1997 1-1.8 ft BGS	7/7/1997 1.8-2.3 ft BGS	7/7/1997 2.3-2.9 ft BGS
1,2-Dichlorobenzene	-	-	-	7.9 (a)	-
1,3-Dichlorobenzene	-	-	-	17 (a)	-
1,4-Dichlorobenzene	-	-	-	30 (a)	-
2-Butanone (Methyl ethyl ketone) (MEK)	-	-	-	0.59 J (a)	-
2-Chloronaphthalene	-	-	-	7 (a)	-
Acetone	-	-	-	3.1 J (a)	-
Anthracene	-	-	-	57 (a)	-
Arsenic	-	-	-	40.9 J (a)	-
Benzene	-	-	-	1.5 J (a)	-
Benzo(a)anthracene	-	-	-	8.77 J (a)	-
Benzo(a)pyrene	-	-	-	8.89 J (a)	-
Cadmium	-	-	-	1.5 J (a)	-
Chlorobenzene	-	-	-	97 (a)	-
Chromium	-	-	-	904 J (a)	-
Chrysene	-	-	-	8.95 J (a)	-
Fluoranthene	-	-	-	1.1 J (a)	-
Lead	-	-	-	805 J (a)	-
Mercury	7.597 (a)	5.9459 (a)	29.094 (a)	78.6 J (a)	28.552 (a)
Naphthalene	-	-	-	12 (a)	-
Phenanthrene	-	-	-	16 (a)	-
Pyrene	-	-	-	2 (a)	-
Selenium	-	-	-	1.5 J (a)	-
Silver	-	-	-	91.3 J (a)	-
Toluene	-	-	-	27 (a)	-
Total PCBs	0.94 (a)	2.9 (a)	1.9 (a)	5.4 (a)	10 (a)

SD-30	7/1/1997 0-0.5 ft BGS
Chlorobenzene	2 (a)
Mercury	6.718 (a)

1HS	11/21/2005 0-0.5 ft BGS	11/21/2005 1.5-2 ft BGS
1,2-Dichlorobenzene	22 (a)	1 (a)
1,3-Dichlorobenzene	3.9 (a)	-
1,4-Dichlorobenzene	19 (a)	9.4 (a)
Chlorobenzene	90 (a)	100 (a)
Mercury	17 (a)	2.2 (a)
Total PCBs	4.3 (a)	-

2HS	11/21/2005 0-0.5 ft BGS	11/21/2005 1.5-2 ft BGS
1,2-Dichlorobenzene	63 (a)	-
1,3-Dichlorobenzene	81 (a)	-
1,4-Dichlorobenzene	220 (a)	-
Chlorobenzene	34 (a)	-
Mercury	210 (a)	0.65 (a)
Total PCBs	8.3 (a)	-

SD-27	7/8/1997 0-0.5 ft BGS
1,2-Dichlorobenzene	73 (a)
1,3-Dichlorobenzene	7.5 (a)
1,4-Dichlorobenzene	17 (a)
Anthracene	8.8 (a)
Arsenic	17.7 (a)
Benzo(a)anthracene	1.8 (a)
Benzo(a)pyrene	1.8 (a)
Cadmium	2.8 (a)
Chlorobenzene	35 (a)
Chromium	595 (a)
Chrysene	1.7 (a)
Fluoranthene	2.4 (a)
Lead	342 (a)
Mercury	73.064 (a)
Naphthalene	2.1 (a)
Phenanthrene	3.4 (a)
Pyrene	3.8 (a)
Selenium	2.3 (a)
Silver	16.2 (a)
Toluene	3.8 (a)
Total PCBs	1.2 (a)

sed128B	7/18/2002 0.2-0.5 ft BGS
1,2-Dichlorobenzene	0.73 (a)
1,4-Dichlorobenzene	3.7 (a)
Acenaphthene	0.098 (a)
Acenaphthylene	0.79 (a)
Anthracene	11 (a)
Arsenic	28 (a)
Benzo(a)anthracene	2.3 (a)
Benzo(a)pyrene	1.7 (a)
bis(2-Ethylhexyl)phthalate (DEHP)	0.25 J (a)
Cadmium	3.3 (a)
Chromium	480 (a)
Chrysene	2.7 (a)
Copper	410 (a)
Fluoranthene	4 (a)
Lead	380 J (a)
Mercury	59.5 (a)
Naphthalene	0.9 (a)
Phenanthrene	0.76 (a)
Pyrene	4.1 (a)
Selenium	1.1 J (a)
Silver	19 (a)
Total PCBs	2 (a)
Vanadium	30 (a)
Zinc	500 J (a)

sed128A	7/18/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	2.3 (a)
1,3-Dichlorobenzene	2.8 (a)
1,4-Dichlorobenzene	10 (a)
Acenaphthene	0.099 (a)
Acenaphthylene	0.54 (a)
Anthracene	5 (a)
Arsenic	20 (a)
Benzo(a)anthracene	1.3 (a)
Benzo(a)pyrene	1.1 (a)
bis(2-Ethylhexyl)phthalate (DEHP)	0.61 (a)
Cadmium	1.7 (a)
Chromium	460 (a)
Chrysene	1.5 (a)
Copper	320 (a)
Fluoranthene	1.9 (a)
Lead	280 J (a)
Mercury	44.9 J (a)
Naphthalene	0.94 (a)
Phenanthrene	0.74 (a)
Pyrene	2.5 (a)
Selenium	0.90 J (a)
Silver	16 (a)
Total PCBs	3.6 (a)
Vanadium	40 (a)
Zinc	330 J (a)

SD-26	7/8/1997 0-0.5 ft BGS
1,2-Dichlorobenzene	0.5 J (a)
1,4-Dichlorobenzene	2 (a)
2-Butanone (Methyl ethyl ketone) (MEK)	0.11 J (a)
Anthracene	1.9 (a)
Arsenic	19.3 (a)
Benzo(a)anthracene	0.71 J (a)
Benzo(a)pyrene	0.65 J (a)
Cadmium	1.4 (a)
Chlorobenzene	0.31 (a)
Chromium	552 (a)
Chrysene	0.86 J (a)
Fluoranthene	1.1 (a)
Lead	227 (a)
Mercury	9.407 (a)
Naphthalene	0.84 J (a)
Pyrene	1.9 (a)
Selenium	1.5 (a)
Silver	21.3 (a)
Total PCBs	1.2 (a)

4NHS	11/21/2005 0-0.5 ft BGS	11/21/2005 1.5-2 ft BGS
1,4-Dichlorobenzene	0.33 J (a)	-
Mercury	45 (a)	2.4 (a)
Total PCBs	6.7 (a)	-

7NHS	11/21/2005 0-0.5 ft BGS	11/21/2005 1.5-2 ft BGS
Mercury	47 (a)	1.8 (a)
Total PCBs	7 (a)	-

sed124A	7/17/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	3.2 (a)
1,3-Dichlorobenzene	3.4 (a)
1,4-Dichlorobenzene	12 (a)
4-Chloroaniline	0.6 (a)
Acenaphthene	0.076 J (a)
Acenaphthylene	0.17 J (a)
Anthracene	1.1 J (a)
Arsenic	26 (a)
Benzo(a)anthracene	0.31 J (a)
Benzo(a)pyrene	0.38 J (a)
bis(2-Ethylhexyl)phthalate (DEHP)	0.74 (a)
Chromium	380 J (a)
Chrysene	0.41 J (a)
Copper	290 J (a)
Fluoranthene	0.67 J (a)
Lead	160 J (a)
Mercury	6.99 J (a)
Naphthalene	1.9 J (a)
Nickel	25 (a)
Phenanthrene	0.39 J (a)
Pyrene	0.84 J (a)
Selenium	1.3 J (a)
Silver	5.7 (a)
Total PCBs	7.1 (a)
Vanadium	45 (a)
Zinc	200 (a)

sed124B	7/17/2002 0.2-0.5 ft BGS
1,2-Dichlorobenzene	2.7 (a)
1,3-Dichlorobenzene	5 (a)
1,4-Dichlorobenzene	22 (a)
4-Chloroaniline	1.1 J (a)
Acenaphthene	0.1 J (a)
Acenaphthylene	0.27 J (a)
Anthracene	24 J (a)
Arsenic	56 (a)
Benzo(a)anthracene	0.37 J (a)
Benzo(a)pyrene	0.44 J (a)
bis(2-Ethylhexyl)phthalate (DEHP)	1 J (a)
Chromium	600 J (a)
Chrysene	0.53 J (a)
Copper	490 J (a)
Fluoranthene	0.95 J (a)
Lead	160 J (a)
Mercury	43.8 (a)
Naphthalene	2.4 J (a)
Nickel	31 (a)
Phenanthrene	0.55 J (a)
Pyrene	1.2 J (a)
Selenium	1.8 J (a)
Silver	15 (a)
Total PCBs	30 (a)
Vanadium	51 (a)
Zinc	150 (a)

SD-25	7/8/1997 0-0.5 ft BGS
1,2-Dichlorobenzene	2.4 (a)/1.1 J (a)
1,3-Dichlorobenzene	5.6 J (a)/1.7 J (a)
1,4-Dichlorobenzene	14 J (a)/5 J (a)
2-Butanone (Methyl ethyl ketone) (MEK)	0.46 J (a)/0.58 J (a)
2-Chloronaphthalene	1.9 (a)/0.89 J (a)
4-Chloroaniline	2.4 (a)/2.2 (a)
Acetone	1 J (a)/1.6 J (a)
Anthracene	9.6 J (a)/4.4 J (a)
Arsenic	38.7 (a)/27 J (a)
Benzo(a)anthracene	0.58 J (a)
Benzo(a)pyrene	0.86 J (a)/0.63 J (a)
Chromium	1140 (a)/748 J (a)
Chrysene	0.76 J (a)/0.81 J (a)
Fluoranthene	0.82 J (a)/0.7 J (a)
Lead	284 (a)/178 J (a)
Mercury	28.161 (a)/64.379 (a)
Naphthalene	2 (a)/1.2 (a)
Phenanthrene	0.66 J (a)
Pyrene	1.5 (a)/1.3 (a)
Selenium	3.1 (a)/2.3 J (a)
Silver	21 (a)/14.8 J (a)
Total PCBs	3.3 (a)/2.8 (a)

2NHS	11/21/2005 0-0.5 ft BGS
1,4-Dichlorobenzene	0.34 J (a)
Mercury	61 (a)
Total PCBs	6.6 (a)

sed125A	7/17/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	2.2 (a)
1,3-Dichlorobenzene	3.2 (a)
1,4-Dichlorobenzene	10 (a)
Acenaphthene	0.061 (a)
Acenaphthylene	0.26 (a)
Anthracene	4.8 (a)
Arsenic	25 (a)
Benzo(a)anthracene	0.6 (a)
Benzo(a)pyrene	0.65 J (a)
bis(2-Ethylhexyl)phthalate (DEHP)	0.7 (a)
Chromium	480 J (a)
Chrysene	0.68 (a)
Copper	280 J (a)
Fluoranthene	1.2 (a)
Lead	190 J (a)
Mercury	13.7 J (a)
Naphthalene	1.4 (a)
Nickel	28 (a)
Phenanthrene	0.61 (a)
Pyrene	1.8 (a)
Selenium	0.96 J (a)
Silver	11 (a)
Total PCBs	5 (a)
Vanadium	49 (a)
Zinc	220 (a)

SD-31	7/1/1997 0-0.5 ft BGS
Chlorobenzene	1.8 (a)
Mercury	18.712 (a)

8NHS	11/21/2005 0-0.5 ft BGS	11/21/2005 1.5-2 ft BGS
1,4-Dichlorobenzene	0.99 (a)	3.3 (a)
Chlorobenzene	-	3.4 (a)
Mercury	14 (a)	0.86 (a)
Total PCBs	5.7 (a)	-

4HS	11/21/2005 0-0.5 ft BGS	11/21/2005 1.5-2 ft BGS
Mercury	54 (a)	0.43 (a)
Total PCBs	11 (a)	-

sed125B	7/17/2002 0.2-0.6 ft BGS
1,2-Dichlorobenzene	2.1 (a)
1,3-Dichlorobenzene	3.6 (a)
1,4-Dichlorobenzene	11 (a)
Acenaphthene	0.12 (a)
Acenaphthylene	0.61 (a)
Anthracene	43 (a)
Arsenic	40 (a)
Benzo(a)anthracene	1.7 (a)
Benzo(a)pyrene	1.4 J (a)
bis(2-Ethylhexyl)phthalate (DEHP)	1.1 (a)
Cadmium	1.1 (a)
Chromium	710 J (a)
Chrysene	1.9 (a)
Copper	610 J (a)
Fluoranthene	2.8 (a)
Lead	240 J (a)
Mercury	76.8 (a)
Naphthalene	2.2 (a)
Nickel	24 (a)
Phenanthrene	1 (a)
Pyrene	3.3 (a)
Selenium	1.3 J (a)
Silver	20 (a)
Total PCBs	10 (a)
Vanadium	46 (a)
Zinc	230 (a)

SD-28	7/6/1997 0-0.5 ft BGS
1,2-Dichlorobenzene	2 (a)
1,3-Dichlorobenzene	2.6 (a)
1,4-Dichlorobenzene	8.1 (a)
2-Butanone (Methyl ethyl ketone) (MEK)	0.22 J (a)
Acetone	0.89 J (a)
Anthracene	11 (a)
Arsenic	72 (a)
Benzo(a)anthracene	1.1 (a)
Benzo(a)pyrene	1.5 (a)
Cadmium	1.2 (a)
Chromium	602 (a)
Chrysene	1.2 (a)
Fluoranthene	1.5 (a)
Lead	521 (a)
Mercury	42.649 (a)
Naphthalene	1.5 (a)
Phenanthrene	8.91 (a)
Pyrene	2.7 (a)
Selenium	1.5 (a)
Silver	12 (a)
Total PCBs	1.5 (a)

3HS	11/21/2005 0-0.5 ft BGS	11/21/2005 1.5-2 ft BGS
1,2-Dichlorobenzene	0.49 (a)	-
1,4-Dichlorobenzene	2.6 (a)	-
Chlorobenzene	0.86 (a)	-
Mercury	18 (a)	0.29 (a)
Total PCBs	2.4 (a)	-

sed127A	7/17/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	3.56 (a)
1,3-Dichlorobenzene	6.7 (a)
1,4-Dichlorobenzene	20 (a)
4-Chloroaniline	0.23 J (a)
Acenaphthene	0.051 (a)
Acenaphthylene	0.215 (a)
Anthracene	2.55 (a)
Arsenic	22 (a)
Benzo(a)anthracene	0.46 (a)
Benzo(a)pyrene	0.535 J (a)
bis(2-Ethylhexyl)phthalate (DEHP)	0.695 (a)
Chromium	400 J (a)
Chrysene	0.655 (a)
Copper	300 J (a)
Fluoranthene	0.94 (a)
Lead	165 J (a)
Mercury	12.25 J (a)
Naphthalene	2.85 (a)
Nickel	24 (a)
Phenanthrene	0.56 (a)
Pyrene	1.25 (a)
Selenium	1.1 J (a)
Silver	9 (a)
Total PCBs	6 (a)
Vanadium	46 (a)
Zinc	210 (a)

sed127B	7/17/2002 0.2-0.5 ft BGS
1,2-Dichlorobenzene	5.9 (a)
1,3-Dichlorobenzene	11 J (a)
1,4-Dichlorobenzene	42 (a)
4-Chloroaniline	0.96 J (a)
Acenaphthene	0.095 (a)
Acenaphthylene	0.37 (a)
Anthracene	15 (a)
Arsenic	48 (a)
Benzo(a)anthracene	0.59 (a)
Benzo(a)pyrene	0.82 (a)
bis(2-Ethylhexyl)phthalate (DEHP)	1.7 (a)
Chromium	750 J (a)
Chrysene	0.9 (a)
Copper	530 J (a)
Fluoranthene	1.2 (a)
Lead	220 J (a)
Mercury	51.6 (a)
Naphthalene	4.6 (a)
Nickel	34 (a)
Phenanthrene	0.47 (a)
Pyrene	1.6 (a)
Selenium	1.5 J (a)
Silver	21 (a)
Total PCBs	19 (a)
Vanadium	61 (a)
Zinc	230 (a)

SD-21	7/7/1997 0-0.5 ft BGS	7/7/1997 0.5-1 ft BGS	7/7/1997 1-3.3 ft BGS
2-Butanone (Methyl ethyl ketone) (MEK)	-	-	0.078 J (a)
Arsenic	-	-	28.8 (a)
Benzo(a)anthracene	-	-	0.48 J (a)
Benzo(a)pyrene	-	-	0.48 J (a)
Chromium	-	-	137 (a)
Chrysene	-	-	0.43 J (a)
Fluoranthene	-	-	0.72 (a)
Lead	-	-	928 (a)
Mercury	98.199 (a)/106.945 (a)	26.5414 (a)	3 (a)
Pyrene	-	-	0.91 (a)
Silver	-	-	1.7 (a)
Total PCBs	2.9 (a)/3.8 (a)	-	-

sed130A	7/17/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	2.1 (a)
1,3-Dichlorobenzene	2.8 (a)
1,4-Dichlorobenzene	9.3 (a)
4-Chloroaniline	0.18 J (a)
Acenaphthene	0.068 (a)
Acenaphthylene	0.3 (a)
Anthracene	1.7 (a)
Arsenic	21 (a)
Benzo(a)anthracene	0.86 (a)
Benzo(a)pyrene	0.66 J (a)
bis(2-Ethylhexyl)phthalate (DEHP)	0.82 (a)
Chromium	410 J (a)
Chrysene	1 (a)
Copper	230 J (a)
Fluoranthene	1.2 (a)
Lead	150 J (a)
Mercury	11.2 (a)
Naphthalene	1.3 (a)
Nickel	25 (a)
Phenanthrene	0.64 (a)
Pyrene	1.5 (a)
Silver	11 (a)
Total PCBs	6.1 (a)
Vanadium	45 (a)
Zinc	220 (a)

sed130B	7/17/2002 0.2-0.6 ft BGS
1,2-Dichlorobenzene	1.9 (a)
1,3-Dichlorobenzene	2.6 (a)
1,4-Dichlorobenzene	8.9 (a)
Acenaphthene	0.068 (a)
Acenaphthylene	0.36 (a)
Anthracene	2.2 (a)
Arsenic	23 (a)
Benzo(a)anthracene	0.89 (a)
Benzo(a)pyrene	0.87 J (a)
bis(2-Ethylhexyl)phthalate (DEHP)	0.68 (a)
Chromium	500 J (a)
Chrysene	1.1 (a)
Copper	310 J (a)
Fluoranthene	1.4 (a)
Lead	170 J (a)
Mercury	18.1 (a)
Naphthalene	2.3 (a)
Nickel	29 (a)
Phenanthrene	0.75 (a)
Pyrene	1.9 (a)
Selenium	1.0 J (a)
Silver	14 (a)
Total PCBs	5.5 (a)
Vanadium	49 (a)
Zinc	230 (a)

SD-32	7/1/1997 0-0.5 ft BGS
Chlorobenzene	1.8 (a)/0.67 (a)
Mercury	28.692 (a)/27.274 (a)

SD-22	7/7/1997 0-0.5 ft BGS	7/7/1997 0.5-1 ft BGS	7/7/1997 1-1.3 ft BGS	7/7/1997 1.3-2.4 ft BGS
Acenaphthylene	-	-	-	0.35 J (a)
Anthracene	-	-	-	0.47 J (a)
Arsenic	-	-	-	18.4 (a)
Benzo(a)anthracene	-	-	-	1.5 (a)
Benzo(a)pyrene	-	-	-	1.9 (a)
Chromium	-	-	-	233 (a)
Chrysene	-	-	-	1.9 (a)
Fluoranthene	-	-	-	2.7 (a)
Lead	-	-	-	802 (a)
Mercury	60.05 (a)	14.0635 (a)	4.9069 (a)	1.9 (a)
Phenanthrene	-	-	-	0.88 (a)
Pyrene	-	-	-	3.5 (a)
Selenium	-	-	-	0.62 (a)
Silver	-	-	-	2.4 (a)
Total PCBs	2.6 (a)	-	-	-

SD-33	7/1/1997 0-0.5 ft BGS
Mercury	12.344 (a)

6NHS	11/21/2005 0-0.5 ft BGS	11/21/2005 1.5-2 ft BGS
1,4-Dichlorobenzene	0.73 (a)	-
Chlorobenzene	-	0.2 J (a)
Mercury	17 (a)	9.4 (a)
Total PCBs	8.4 (a)	2.4 (a)

SD-29	7/6/1997 0-0.5 ft BGS
1,2-Dichlorobenzene	0.55 J (a)
1,4-Dichlorobenzene	2.9 (a)
2-Butanone (Methyl ethyl ketone) (MEK)	0.087 J (a)
Anthracene	2.8 (a)
Arsenic	28 (a)
Benzo(a)pyrene	0.81 J (a)
Chromium	758 (a)
Chrysene	0.8 J (a)
Fluoranthene	0.78 J (a)
Lead	188 (a)
Mercury	26.124 (a)
Naphthalene	0.58 J (a)
Pyrene	1.1 J (a)
Selenium	1.9 (a)
Silver	17.8 (a)
Total PCBs	1.5 (a)

5NHS	11/21/2005 0-0.5 ft BGS	11/21/2005 1.5-2 ft BGS
1,4-Dichlorobenzene	0.69 (a)	-
Mercury	61 (a)	4.6 (a)
Total PCBs	9.3 (a)	-

sed129B	7/18/2002 0.2-0.5 ft BGS
1,2-Dichlorobenzene	2.5 (a)
1,3-Dichlorobenzene	5 (a)
1,4-Dichlorobenzene	17 (a)
4-Chloroaniline	0.38 (a)
Acenaphthene	0.077 (a)
Acenaphthylene	0.38 (a)
Anthracene	14 (a)
Arsenic	31 (a)
Benzo(a)anthracene	0.93 (a)
Benzo(a)pyrene	0.8 (a)
bis(2-Ethylhexyl)phthalate (DEHP)	2.2 (a)
Cadmium	1.4 (a)
Chromium	800 (a)
Chrysene	1.2 (a)
Copper	490 (a)
Fluoranthene	1.8 (a)
Lead	280 J (a)
Mercury	62.7 (a)
Naphthalene	1.7 (a)
Nickel	25 (a)
Phenanthrene	0.92 (a)
Pyrene	1.9 (a)
Selenium	0.75 J (a)
Silver	25 (a)
Total PCBs	11 (a)
Vanadium	48 (a)
Zinc	260 J (a)

sed129A	7/18/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	2.1 (a)
1,3-Dichlorobenzene	2.1 (a)
1,4-Dichlorobenzene	7.3 (a)
4-Chloroaniline	0.34 J (a)
Acenaphthene	0.05 (a)
Acenaphthylene	0.13 (a)
Anthracene	0.62 (a)
Arsenic	16 (a)
Benzo(a)anthracene	0.35 (a)
Benzo(a)pyrene	0.33 (a)
bis(2-Ethylhexyl)phthalate (DEHP)	0.63 (a)
Chromium	360 (a)
Chrysene	0.45 (a)
Copper	250 (a)
Fluoranthene	0.62 (a)
Lead	150 J (a)
Mercury	8.5 J (a)
Naphthalene	1.1 (a)
Phenanthrene	0.25 (a)
Pyrene	0.73 (a)
Selenium	0.76 J (a)
Silver	10 (a)
Total PCBs	2.6 (a)
Vanadium	39 (a)
Zinc	190 J (a)

sed131B	7/17/2002 0.2-0.5 ft BGS
1,2-Dichlorobenzene	8.2 (a)
1,3-Dichlorobenzene	4.6 (a)
1,4-Dichlorobenzene	16 (a)
4-Chloroaniline	0.21 J (a)
Acenaphthene	0.065 (a)
Acenaphthylene	0.5 (a)
Anthracene	4.2 (a)
Arsenic	58 (a)
Benzo(a)anthracene	0.79 (a)
Benzo(a)pyrene	0.78 J (a)
bis(2-Ethylhexyl)phthalate (DEHP)	0.57 (a)
Cadmium	1.1 (a)
Chromium	920 J (a)
Chrysene	0.89 (a)
Copper	480 J (a)
Fluoranthene	1.1 (a)
Lead	210 J (a)
Mercury	43.2 (a)
Naphthalene	2.4 (a)
Nickel	35 (a)
Phenanthrene	0.89 (a)
Pyrene	1.6 (a)
Selenium	1.1 J (a)
Silver	28 (a)
Total PCBs	12 (a)
Vanadium	69 (a)
Zinc	310 (a)

sed131A	7/17/2002 0-0.2 ft BGS
1,2-Dichlorobenzene	1.6 (a)
1,3-Dichlorobenzene	2.6 (a)
1,4-Dichlorobenzene	6.9 (a)
Acenaphthene	0.031 (a)
Acenaphthylene	0.31 (a)
Anthracene	1.8 (a)
Arsenic	21 (a)
Benzo(a)anthracene	0.8 (a)
Benzo(a)pyrene	0.78 J (a)
bis(2-Ethylhexyl)phthalate (DEHP)	0.91 (a)
Chromium	420 J (a)
Chrysene	0.93 (a)
Copper	220 J (a)
Fluoranthene	1.2 (a)
Lead	160 J (a)
Mercury	6.56 J (a)
Naphthalene	1.2 (a)
Nickel	28 (a)
Phenanthrene	0.65 (a)
Pyrene	1.6 (a)
Selenium	0.39 J (a)
Silver	10 (a)
Total PCBs	4.1 (a)
Vanadium	46 (a)
Zinc	230 (a)

SD-23	7/7/1997 0-0.5 ft BGS	7/7/1997 0.5-1 ft BGS	7/7/1997 1-1.6 ft BGS	7/7/1997 1.6-2.3 ft BGS	7/7/1997 2.3-3 ft BGS
1,2-Dichlorobenzene	-	-	3 (a)	-	-
1,3-Dichlorobenzene	-	-	23 (a)	-	-
1,4-Dichlorobenzene	-	-	92 (a)	-	-
2-Butanone (Methyl ethyl ketone) (MEK)	-	-	0.17 J (a)	-	-
2-Chloronaphthalene	-	-	9.4 (a)	-	-
Anthracene	-	-	63 (a)	-	-
Arsenic	-	-	66 (a)	-	-
Benzo(a)anthracene	-	-	1.2 (a)	-	-
Benzo(a)pyrene	-	-	1.6 (a)	-	-
Chlorobenzene	-	-	11 (a)	-	-
Chromium	-	-	1650 (a)	-	-
Chrysene	-	-	1.4 (a)	-	-
Fluoranthene	-	-	1.6 (a)	-	-
Lead	-	-	250 (a)	-	-
Mercury	14.405 (a)	166.2841 (a)	188 (a)	69.3384 (a)	13.6173 (a)
Naphthalene	-	-	52 (a)	-	-
Phenanthrene	-	-	2.6 J (a)	-	-
Pyrene	-	-	2.5 (a)	-	-
Selenium	-	-	1.7 (a)	-	-
Silver	-	-	17.4 (a)	-	-
Toluene	-	-	2.7 (a)	-	-
Total PCBs	0.76 (a)	17 (a)	8.4 (a)	4.6 (a)	0.2 (a)

0 40 80ft

LEGEND

SD-26 SEDIMENT SAMPLE LOCATION

\- NOT DETECTED ABOVE CRITERIA

SD-10a	10/4/99 0-5 cm
Mercury	7 (b)
Total PCBs	0.63 (b)

SAMPLE LOCATION; SAMPLE DATE; SAMPLE DEPTH; RESULT (mg/kg); PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA

Parameter	ESV Criteria (a)
1,2-Dichlorobenzene	0.294
1,3-Dichlorobenzene	1.315
1,4-Dichlorobenzene	0.318
2-Butanone (Methyl ethyl ketone) (MEK)	0.0424
2-Chloronaphthalene	0.417
4-Chloroaniline	0.146
Acenaphthene	0.00671
Acenaphthylene	0.00587
Acetone	0.0099
Anthracene	0.0572
Arsenic	9.79
Barium	157
Benzene	0.142
Benzo(a)anthracene	0.108
Benzo(a)pyrene	0.15
bis(2-Ethylhexyl)phthalate (DEHP)	0.182
Cadmium	0.99
Chlorobenzene	0.291
Chromium	43.4
Chrysene	0.166
Copper	31.6
Fluoranthene	0.423
Lead	35.8
Mercury	0.18
Naphthalene	0.176
Nickel	22.7
Phenanthrene	0.204
Pyrene	0.195
Selenium	0.72
Silver	0.5
Toluene	1.22
Total PCBs	0.0598
Vanadium	0.72
Zinc	121

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

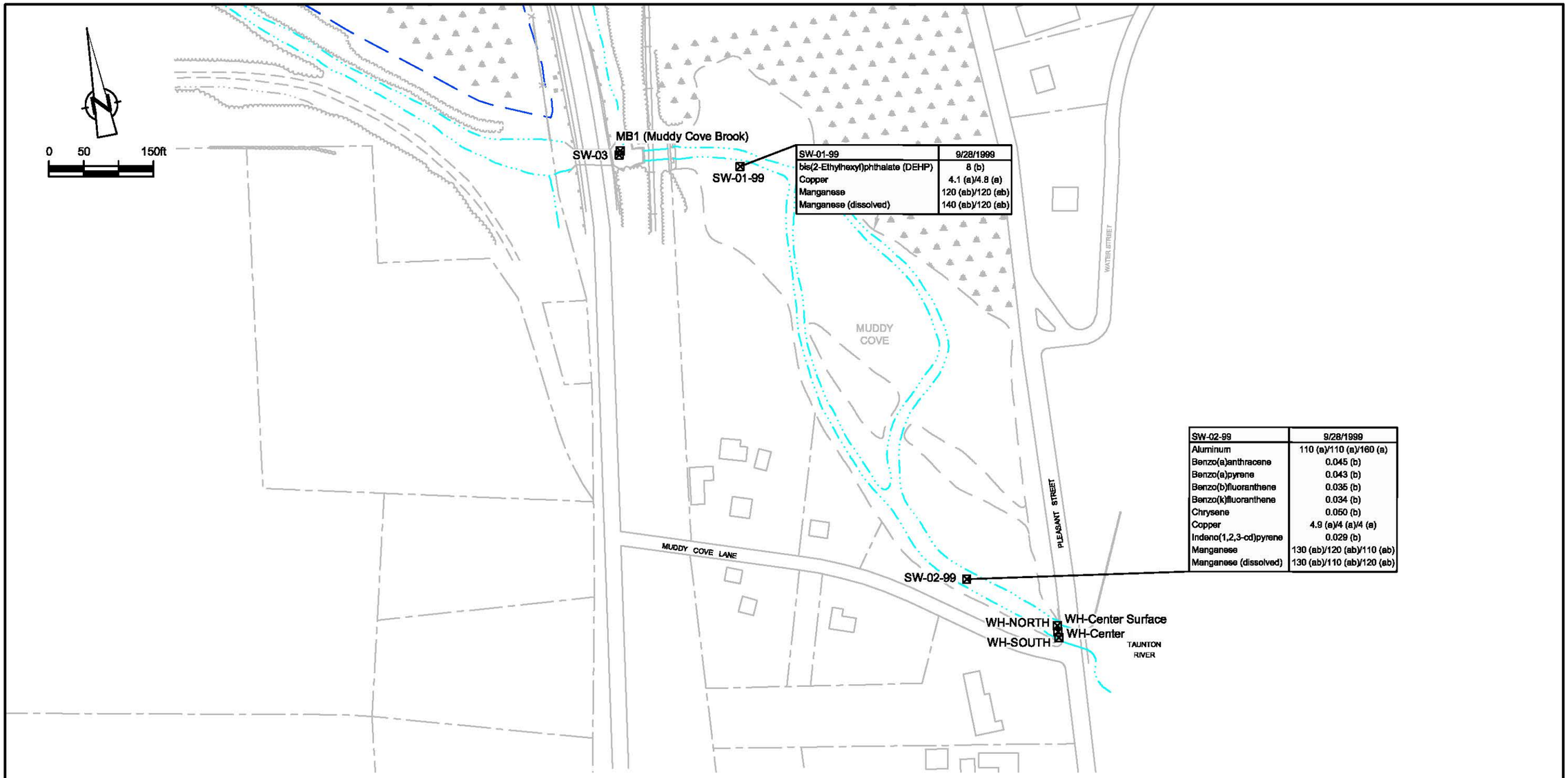
AOC2 - SEDIMENT DATA SUMMARY OFF-SHORE SAMPLES

CRA CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager: J.K.P.	Reviewed By: J.V.	Date: JULY 2010	
Scale: 1"=80'	Project Nº: 15620-78	Report Nº: 020	Drawing Nº: A.11

15620-78(020)GN-WA011 DEC 14/2010



SW-01-99	9/28/1999
bis(2-Ethylhexyl)phthalate (DEHP)	8 (b)
Copper	4.1 (a)/4.8 (a)
Manganese	120 (ab)/120 (ab)
Manganese (dissolved)	140 (ab)/120 (ab)

SW-02-99	9/28/1999
Aluminum	110 (a)/110 (a)/160 (a)
Benzo(a)anthracene	0.045 (b)
Benzo(a)pyrene	0.043 (b)
Benzo(b)fluoranthene	0.035 (b)
Benzo(k)fluoranthene	0.034 (b)
Chrysene	0.050 (b)
Copper	4.9 (a)/4 (a)/4 (a)
Indeno(1,2,3-cd)pyrene	0.029 (b)
Manganese	130 (ab)/120 (ab)/110 (ab)
Manganese (dissolved)	130 (ab)/110 (ab)/120 (ab)

LEGEND

SW-03 ⊠ SURFACE WATER SAMPLE LOCATION

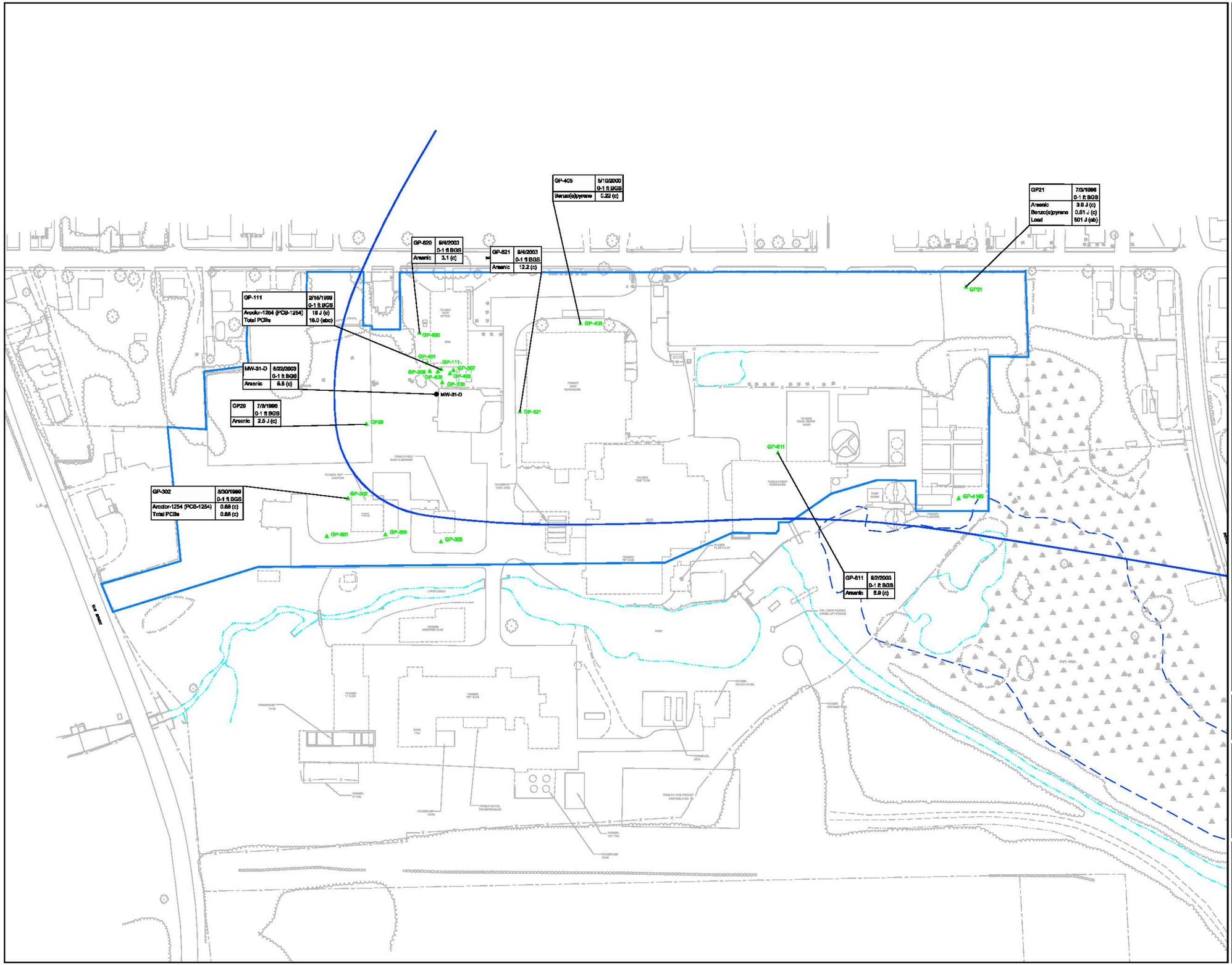
NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA.

Parameter	ESV Criteria (a)	USEPA Human Health Organism Only Criteria (b)
Aluminum	87	-
Benzo(a)anthracene	-	0.018
Benzo(a)pyrene	-	0.018
Benzo(b)fluoranthene	-	0.018
Benzo(k)fluoranthene	-	0.018
bis(2-Ethylhexyl)phthalate (DEHP)	-	2.2
Chrysene	-	0.018
Copper	3.33	-
Indeno(1,2,3-cd)pyrene	-	0.018
Manganese	80	100
Manganese (dissolved)	80	100

figure A.12

AOC2 - SURFACE WATER DATA SUMMARY
SRFI REPORT
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA012 DEC 14/2010



0 40 80 ft

LEGEND

- MW-31-D — MONITORING WELL LOCATION
- GP21 — GEOPROBE LOCATION
- AOC3 MANUFACTURING AREA NORTH OF MUDDY COVE BROOK
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- J — ESTIMATED VALUE

GP-811	8/2/03	SAMPLE DATE
	0-1 ft BGS	SAMPLE DEPTH
Arsenic	5.9 (c)	RESULT (mg/kg)

SAMPLE LOCATION

PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA.

Parameter	S2/GW2 Criteria (a)	S2/GW3 Criteria (b)	Industrial Region 9 Criteria (c)
Aroclor-1254 (PCB-1254)	-	-	0.74
Arsenic	20	20	1.6
Benzo(a)pyrene	4	4	0.21
Lead	300	300	800
Total PCBs	3	3	0.74

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

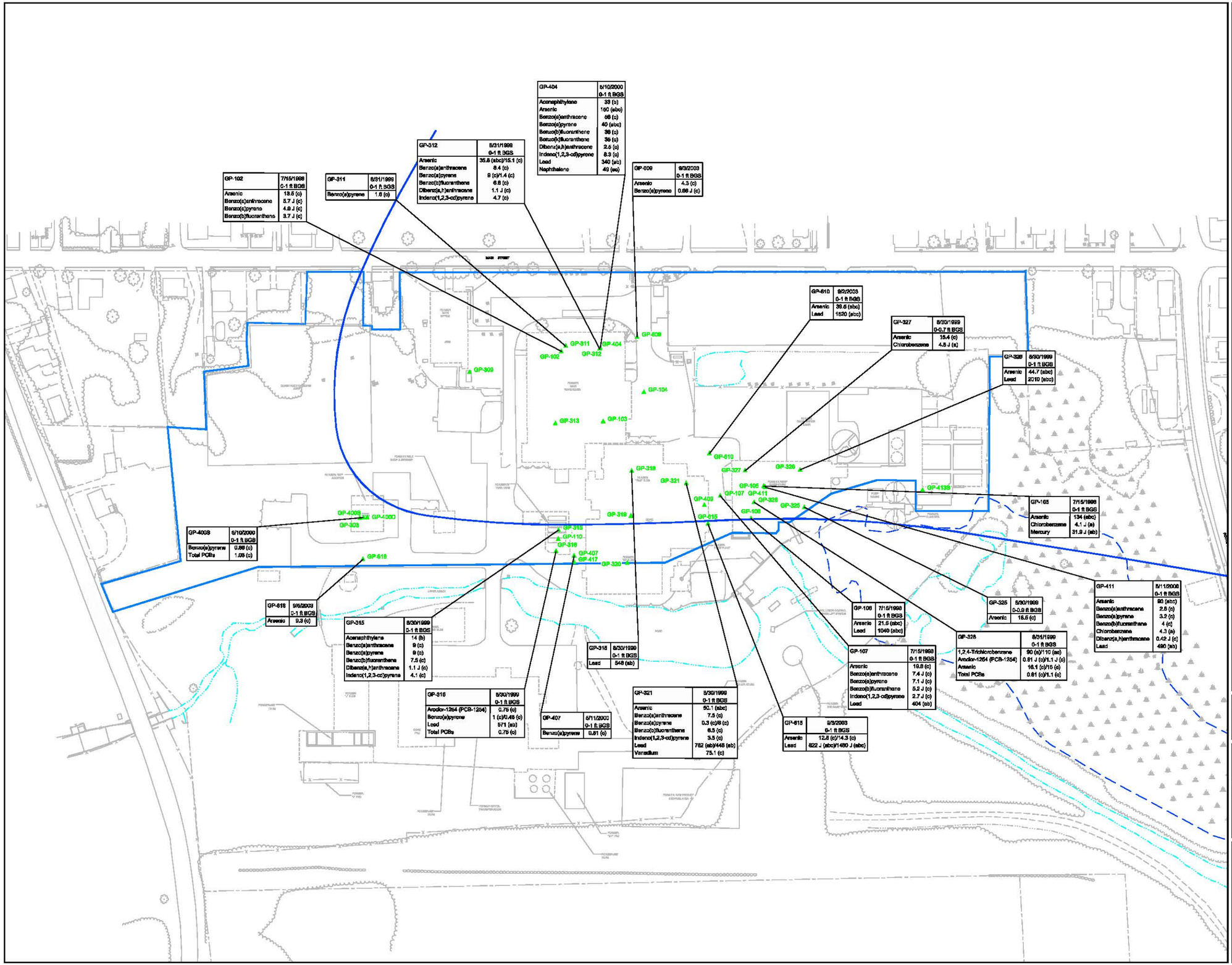
AOC3 - SURFACE SOIL - NOT PAVED
DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager: J.K.P.	Reviewed By: J.V.	Date: JUNE 2010	
Scale: 1"=80'	Project No.: 15620-78	Report No.: 020	Drawing No.: A.13

15620-78(020)GN-WA013 DEC 14/2010



GP-102	7/15/1999 0-1 ft BGS
Arsenic	19.5 (c)
Benzo(a)anthracene	5.7 J (c)
Benzo(a)pyrene	4.9 J (c)
Benzo(b)fluoranthene	3.7 J (c)

GP-311	8/31/1999 0-1 ft BGS
Benzo(a)pyrene	1.6 (c)

GP-312	8/31/1999 0-1 ft BGS
Arsenic	35.8 (abc)/15.1 (c)
Benzo(a)anthracene	8.4 (c)
Benzo(a)pyrene	9 (c)/1.4 (c)
Benzo(b)fluoranthene	6.8 (c)
Dibenz(a,h)anthracene	1.1 J (c)
Indeno(1,2,3-cd)pyrene	4.7 (c)

GP-404	6/10/2000 0-1 ft BGS
Acenaphthylene	33 (b)
Arsenic	160 (abc)
Benzo(a)anthracene	68 (c)
Benzo(a)pyrene	40 (abc)
Benzo(b)fluoranthene	38 (c)
Benzo(k)fluoranthene	36 (c)
Dibenz(a,h)anthracene	2.6 (c)
Indeno(1,2,3-cd)pyrene	8.3 (c)
Lead	340 (abc)
Naphthalene	49 (ab)

GP-609	9/3/2003 0-1 ft BGS
Arsenic	4.3 (c)
Benzo(a)pyrene	0.66 J (c)

GP-610	9/2/2003 0-1 ft BGS
Arsenic	36.5 (abc)
Lead	1520 (abc)

GP-327	8/30/1999 0-0.7 ft BGS
Arsenic	15.4 (c)
Chlorobenzene	4.5 J (a)

GP-326	8/30/1999 0-1 ft BGS
Arsenic	44.7 (abc)
Lead	2010 (abc)

GP-105	7/15/1999 0-1 ft BGS
Arsenic	134 (abc)
Chlorobenzene	4.1 J (a)
Mercury	31.9 J (ab)

GP-4009	6/10/2000 0-1 ft BGS
Benzo(a)pyrene	0.66 (c)
Total PCBs	1.09 (c)

GP-618	9/5/2003 0-1 ft BGS
Arsenic	9.3 (c)

GP-315	8/30/1999 0-1 ft BGS
Acenaphthylene	14 (b)
Benzo(a)anthracene	9 (c)
Benzo(a)pyrene	9 (c)
Benzo(b)fluoranthene	7.5 (c)
Dibenz(a,h)anthracene	1.1 J (c)
Indeno(1,2,3-cd)pyrene	4.1 (c)

GP-316	8/30/1999 0-1 ft BGS
Aroclor-1254 (PCB-1254)	0.76 (c)
Benzo(a)pyrene	1 (c)/0.46 (c)
Lead	571 (ab)
Total PCBs	0.76 (c)

GP-318	8/30/1999 0-1 ft BGS
Lead	548 (ab)

GP-407	6/11/2000 0-1 ft BGS
Benzo(a)pyrene	0.81 (c)

GP-321	8/30/1999 0-1 ft BGS
Arsenic	50.1 (abc)
Benzo(a)anthracene	7.5 (c)
Benzo(a)pyrene	0.3 (c)/8 (c)
Benzo(b)fluoranthene	6.5 (c)
Indeno(1,2,3-cd)pyrene	3.5 (c)
Lead	762 (ab)/448 (ab)
Vanadium	75.1 (c)

GP-615	9/3/2003 0-1 ft BGS
Arsenic	12.8 (c)/14.3 (c)
Lead	822 J (abc)/1400 J (abc)

GP-108	7/15/1999 0-1 ft BGS
Arsenic	21.6 (abc)
Lead	1040 (abc)

GP-107	7/15/1999 0-1 ft BGS
Arsenic	19.8 (c)
Benzo(a)anthracene	7.4 J (c)
Benzo(a)pyrene	7.1 J (c)
Benzo(b)fluoranthene	5.2 J (c)
Indeno(1,2,3-cd)pyrene	2.7 J (c)
Lead	404 (ab)

GP-325	8/30/1999 0-0.8 ft BGS
Arsenic	16.6 (c)

GP-328	8/31/1999 0-1 ft BGS
1,2,4-Trichlorobenzene	90 (a)/110 (ac)
Aroclor-1254 (PCB-1254)	0.81 J (c)/1.1 J (c)
Arsenic	16.1 (c)/15 (c)
Total PCBs	0.81 (c)/1.1 (c)

GP-411	8/11/2000 0-1 ft BGS
Arsenic	90 (abc)
Benzo(a)anthracene	2.6 (c)
Benzo(a)pyrene	3.2 (c)
Benzo(b)fluoranthene	4 (c)
Chlorobenzene	4.3 (a)
Dibenz(a,h)anthracene	0.42 J (c)
Lead	490 (ab)

0 40 80 ft

LEGEND

- GP-325 — GEOPROBE LOCATION
- AOC3 MANUFACTURING AREA NORTH OF MUDDY COVE BROOK
- APPROXIMATE BOUNDARY OF MEDIUM YIELD FPA (POTENTIALLY PRODUCTIVE AQUIFER)
- J — ESTIMATED VALUE

GP-609	9/3/03	SAMPLE LOCATION
	0-1 ft BGS	SAMPLE DATE
Arsenic	4.3 (c)	SAMPLE DEPTH
Benzo(a)pyrene	0.66 J (c)	RESULT (mg/kg)

PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA

Parameter	S3/GW2 Criteria (a)	S3/GW3 Criteria (b)	Industrial Region 9 Criteria (c)
1,2,4-Trichlorobenzene	70	900	99
Acenaphthylene	500	10	-
Aroclor-1254 (PCB-1254)	-	-	0.74
Arsenic	20	20	1.6
Benzo(a)anthracene	300	300	2.1
Benzo(a)pyrene	30	30	0.21
Benzo(b)fluoranthene	300	300	2.1
Benzo(k)fluoranthene	3000	3000	21
Chlorobenzene	3	100	1400
Dibenz(a,h)anthracene	30	30	0.21
Indeno(1,2,3-cd)pyrene	300	300	2.1
Lead	300	300	600
Mercury	30	30	34
Naphthalene	40	3000	18
Total PCBs	3	3	0.74
Vanadium	1000	1000	72

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

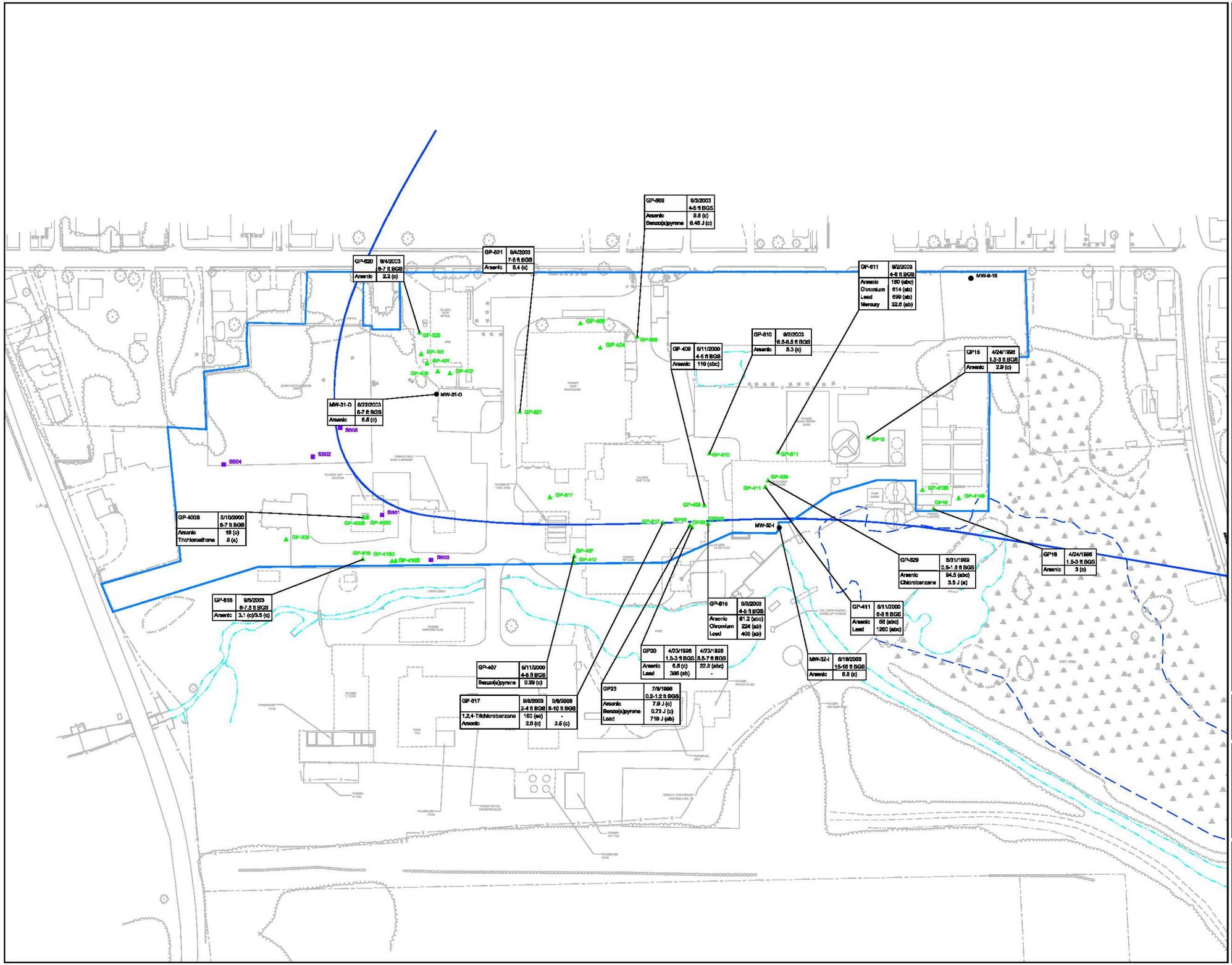
AOC3 - SURFACE SOIL - PAVED DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale: 1"=80'	Project No.: 15620-78	Report No.: 020	Drawing No.: A.14

15620-78(020)GN-WA014 DEC 14/2010



0 40 80 ft

LEGEND

- MW-9-15 — MONITORING WELL LOCATION
- GP-15 — GEOPROBE LOCATION
- S502 — BOREHOLE LOCATION
- AOC3 MANUFACTURING AREA NORTH OF MUDDY COVE BROOK
- APPROXIMATE BOUNDARY OF MEDIUM YIELD FPA (POTENTIALLY PRODUCTIVE AQUIFER)
- J — ESTIMATED VALUE

GP-615	9/3/03	SAMPLE LOCATION
	4-5 ft BGS	SAMPLE DATE
Arsenic	61.2 (abc)	SAMPLE DEPTH
Chromium Total	224 (ab)	RESULT (mg/kg)
Lead	405 (ab)	PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA

Parameter	S3/GW2 Criteria (a)	S3/GW3 Criteria (b)	Industrial Region 3 Criteria (c)
1,2,4-Trichlorobenzene	70	900	99
Arsenic	20	20	1.6
Benzo(a)pyrene	30	30	0.21
Chlorobenzene	3	100	1400
Chromium	200	200	-
Lead	300	300	800
Mercury	30	30	34
Trichloroethene	2	2000	14

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

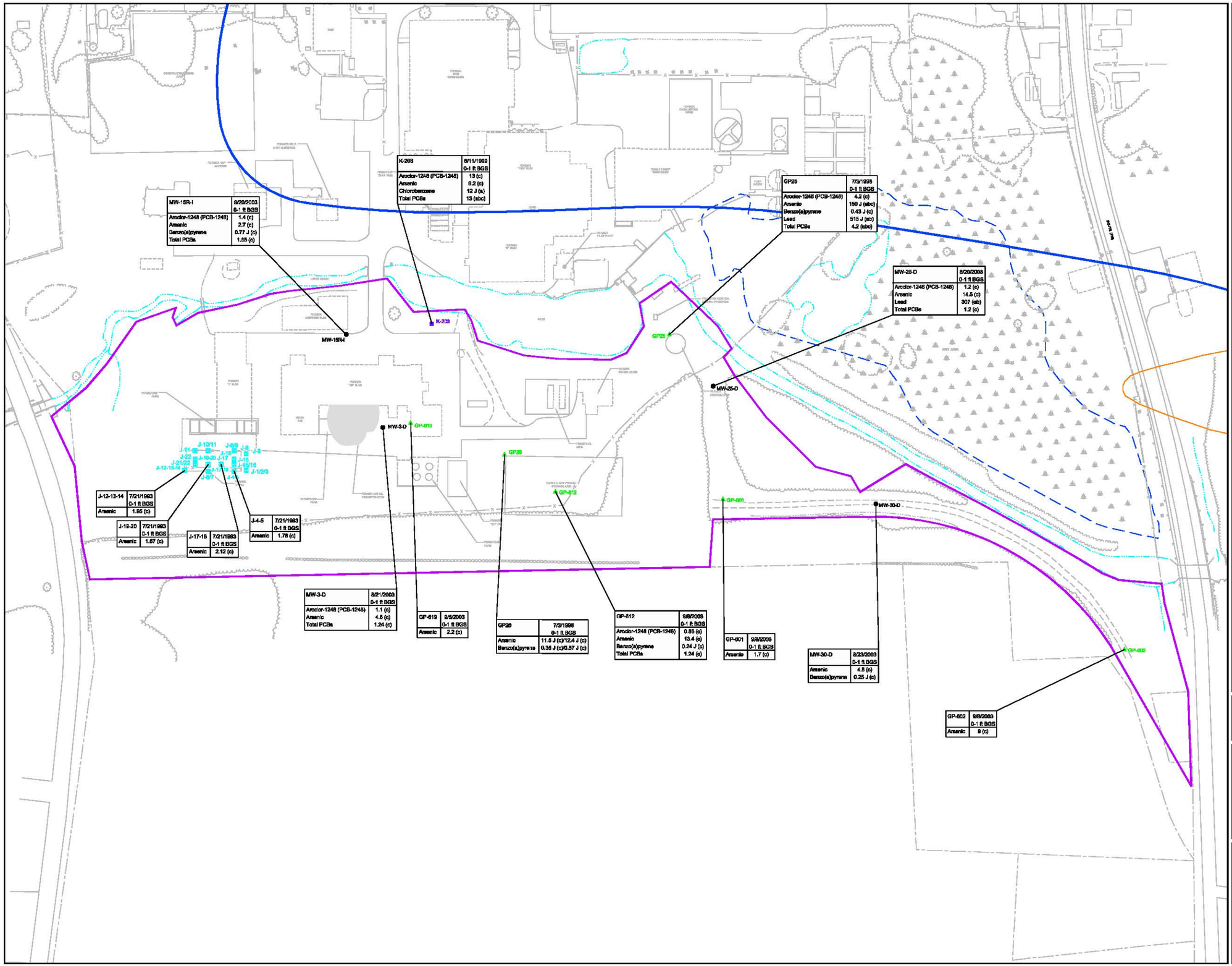
AOC3 - SUBSURFACE SOIL DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source References:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale: 1"=80'	Project N #: 15620-78	Report N #: 020	Drawing N #: A.15

15620-78(020)GN-WA015 DEC 14/2010



0 40 80 ft

LEGEND

- MW-30-D — MONITORING WELL LOCATION
- GP26 — GEOPROBE LOCATION
- K-203 — BOREHOLE LOCATION
- J-2 — SOIL SAMPLE LOCATION
- EXCAVATED AREA
- AOC4 MANUFACTURING AREA SOUTH OF MUDDY COVE BROOK
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PIFA (POTENTIALLY PRODUCTIVE AQUIFER)
- ESTIMATED EXTENT OF MYTA
- J — ESTIMATED VALUE

MW-30-D		SAMPLE LOCATION
	8/23/03	SAMPLE DATE
	0-1 ft BGS	SAMPLE DEPTH
Arsenic	4.8 (c)	RESULT (mg/kg)
Benzo(a)pyrene	0.25 J (c)	PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA.

Parameter	S2/GW2 Criteria (a)	S2/GW3 Criteria (b)	Industrial Region 9 Criteria (c)
Aroclor-1248 (PCB-1248)	-	-	0.74
Arsenic	20	20	1.6
Benzo(a)pyrene	4	4	0.21
Chlorobenzene	5	100	1400
Lead	300	300	800
Total PCBs	3	3	0.74

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

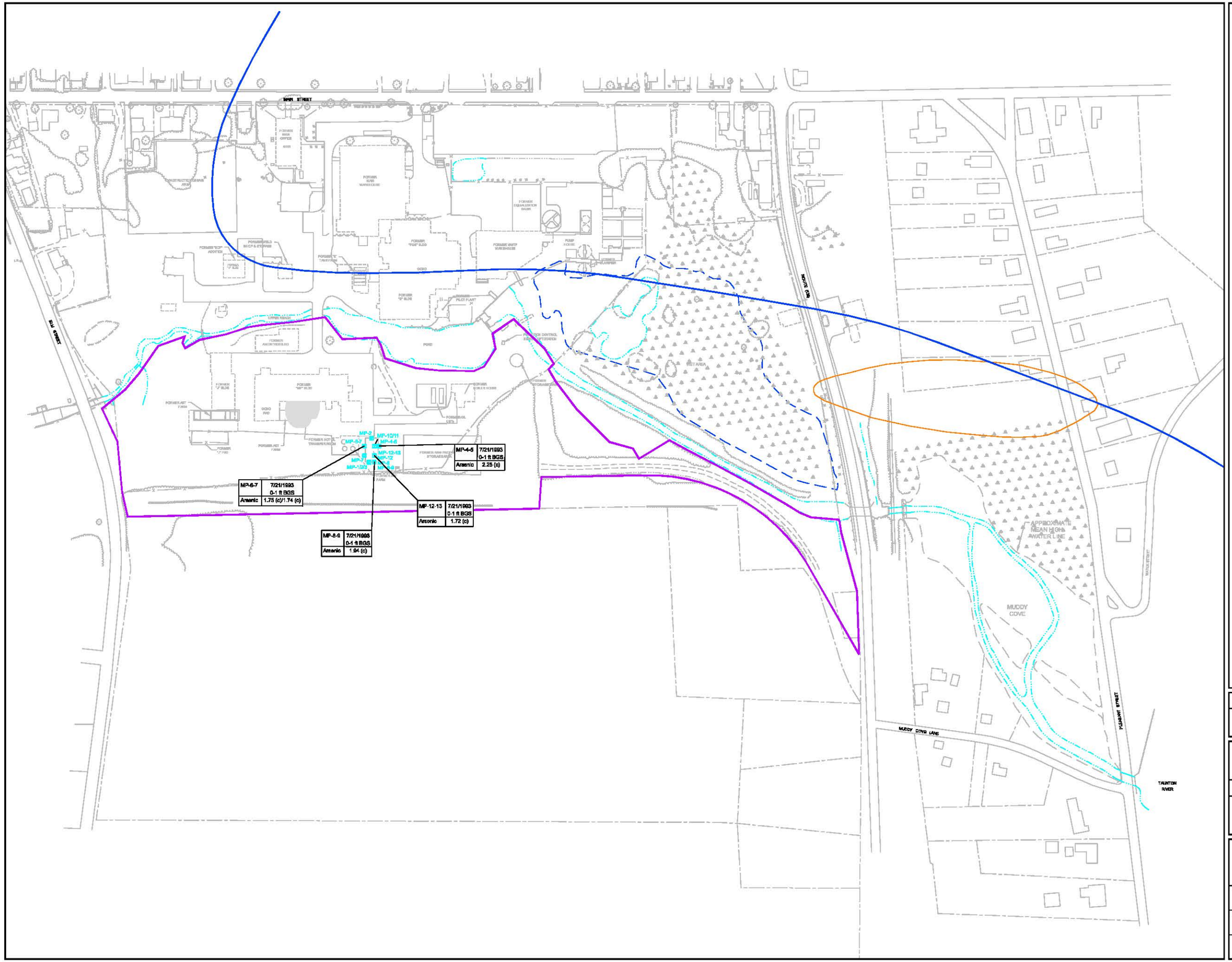
AOC4 - SURFACE SOIL - NOT PAVED
DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source References:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale: 1"=80'	Project N #: 15620-78	Report N #: 020	Drawing N #: A.16

15620-78(020)GN-WA018 DEC 14/2010



0 60 120 ft

LEGEND

- MP-7 — SOIL SAMPLE LOCATION
- EXCAVATED AREA
- AOC4 MANUFACTURING AREA SOUTH OF MUDDY COVE BROOK
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- ESTIMATED EXTENT OF MYTA

MP-4-5	7/21/93	0-1 ft BGS
Arsenic	2.25 (c)	

- SAMPLE LOCATION
- SAMPLE DATE
- SAMPLE DEPTH
- RESULT (mg/kg)
- PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA.

Parameter	S3/GW2 Criteria (a)	S3/GW3 Criteria (b)	Industrial Region 9 Criteria (c)
Arsenic	20	20	1.8

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

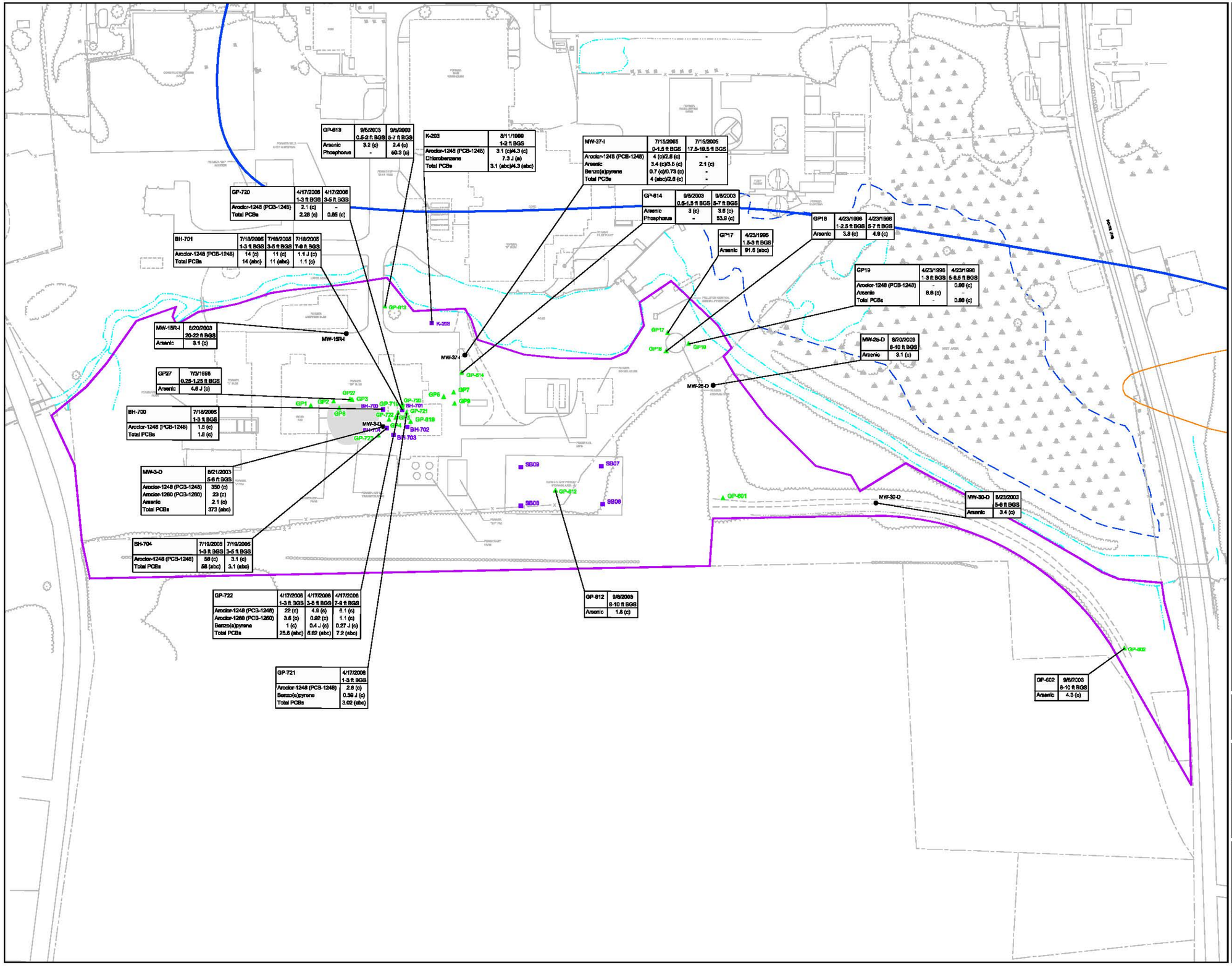
AOC4 - SURFACE SOIL - PAVED - DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale: 1"=120'	Project N°: 15620-78	Report N°: 020	Drawing N°: A.17

15620-78(020)GN-WA017 DEC 14/2010



GP-813	9/5/2003 0.5-2 ft BGS	9/5/2003 5-7 ft BGS
Arsenic	3.2 (c)	2.4 (c)
Phosphorus	-	60.3 (c)

K-203	8/11/1998 1-2 ft BGS
Aroclor-1248 (PCB-1248)	3.1 (c)/4.3 (c)
Chlorobenzene	7.3 J (a)
Total PCBs	3.1 (abc)/4.3 (abc)

MW-37-I	7/15/2005 0-1.5 ft BGS	7/15/2005 17.5-19.5 ft BGS
Aroclor-1248 (PCB-1248)	4 (c)/2.6 (c)	-
Arsenic	3.4 (c)/3.6 (c)	2.1 (c)
Benzo(a)pyrene	0.7 (c)/0.73 (c)	-
Total PCBs	4 (abc)/2.6 (c)	-

GP-720	4/17/2006 1-3 ft BGS	4/17/2006 3-5 ft BGS
Aroclor-1248 (PCB-1248)	2.1 (c)	-
Total PCBs	2.28 (c)	0.65 (c)

GP-814	9/5/2003 0.5-1.5 ft BGS	9/5/2003 5-7 ft BGS
Arsenic	3 (c)	3.6 (c)
Phosphorus	-	53.9 (c)

BH-701	7/18/2005 1-3 ft BGS	7/18/2005 3-5 ft BGS	7/18/2005 7-9 ft BGS
Aroclor-1248 (PCB-1248)	14 (c)	11 (c)	1.1 J (c)
Total PCBs	14 (abc)	11 (abc)	1.1 (c)

GP17	4/23/1998 1.5-3 ft BGS
Arsenic	91.6 (abc)

GP16	4/23/1998 1-2.5 ft BGS	4/23/1998 5-7 ft BGS
Arsenic	3.8 (c)	4.9 (c)

GP19	4/23/1998 1-3 ft BGS	4/23/1998 5-6.5 ft BGS
Aroclor-1248 (PCB-1248)	-	0.86 (c)
Arsenic	6.6 (c)	-
Total PCBs	-	0.86 (c)

MW-15R-I	8/20/2003 20-22 ft BGS
Arsenic	3.1 (c)

MW-25-D	8/20/2003 8-10 ft BGS
Arsenic	3.1 (c)

GP27	7/3/1998 0.25-1.25 ft BGS
Arsenic	4.8 J (c)

BH-700	7/18/2005 1-3 ft BGS
Aroclor-1248 (PCB-1248)	1.8 (c)
Total PCBs	1.8 (c)

MW-3-D	8/21/2003 5-6 ft BGS
Aroclor-1248 (PCB-1248)	350 (c)
Aroclor-1260 (PCB-1260)	23 (c)
Arsenic	2.1 (c)
Total PCBs	373 (abc)

MW-30-D	8/23/2003 5-6 ft BGS
Arsenic	3.4 (c)

BH-704	7/19/2005 1-3 ft BGS	7/19/2005 3-5 ft BGS
Aroclor-1248 (PCB-1248)	58 (c)	3.1 (c)
Total PCBs	58 (abc)	3.1 (abc)

GP-722	4/17/2006 1-3 ft BGS	4/17/2006 3-5 ft BGS	4/17/2006 7-9 ft BGS
Aroclor-1248 (PCB-1248)	22 (c)	4.9 (c)	6.1 (c)
Aroclor-1260 (PCB-1260)	3.6 (c)	0.92 (c)	1.1 (c)
Benzo(a)pyrene	1 (c)	0.4 J (c)	0.27 J (c)
Total PCBs	25.6 (abc)	5.82 (abc)	7.2 (abc)

GP-812	9/6/2003 6-10 ft BGS
Arsenic	1.8 (c)

GP-721	4/17/2006 1-3 ft BGS
Aroclor-1248 (PCB-1248)	2.6 (c)
Benzo(a)pyrene	0.39 J (c)
Total PCBs	3.02 (abc)

GP-602	9/6/2003 8-10 ft BGS
Arsenic	4.3 (c)

0 40 80 ft

LEGEND

- MW-30-D — MONITORING WELL LOCATION
- GP-601 — GEOPROBE LOCATION
- SB07 — BOREHOLE LOCATION
- EXCAVATED AREA (BASE DEPTH 10ft BGS)
- AOC4 MANUFACTURING AREA SOUTH OF MUDDY COVE BROOK
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- ESTIMATED EXTENT OF MYTA
- J — ESTIMATED VALUE
- - — NOT DETECTED ABOVE CRITERIA

MW-25-D	8/20/03	SAMPLE LOCATION
	8-10 ft BGS	SAMPLE DATE
Arsenic	3.1 (c)	SAMPLE DEPTH
		RESULT (mg/kg)
		PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA.

Parameter	S3/GW2 Criteria (a)	S3/GW3 Criteria (b)	Industrial Region 9 Criteria (c)
Aroclor-1248 (PCB-1248)	-	-	0.74
Aroclor-1260 (PCB-1260)	-	-	0.74
Arsenic	20	20	1.6
Benzo(a)pyrene	20	20	0.21
Chlorobenzene	3	100	1400
Phosphorus	-	-	20
Total PCBs	3	3	0.74

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

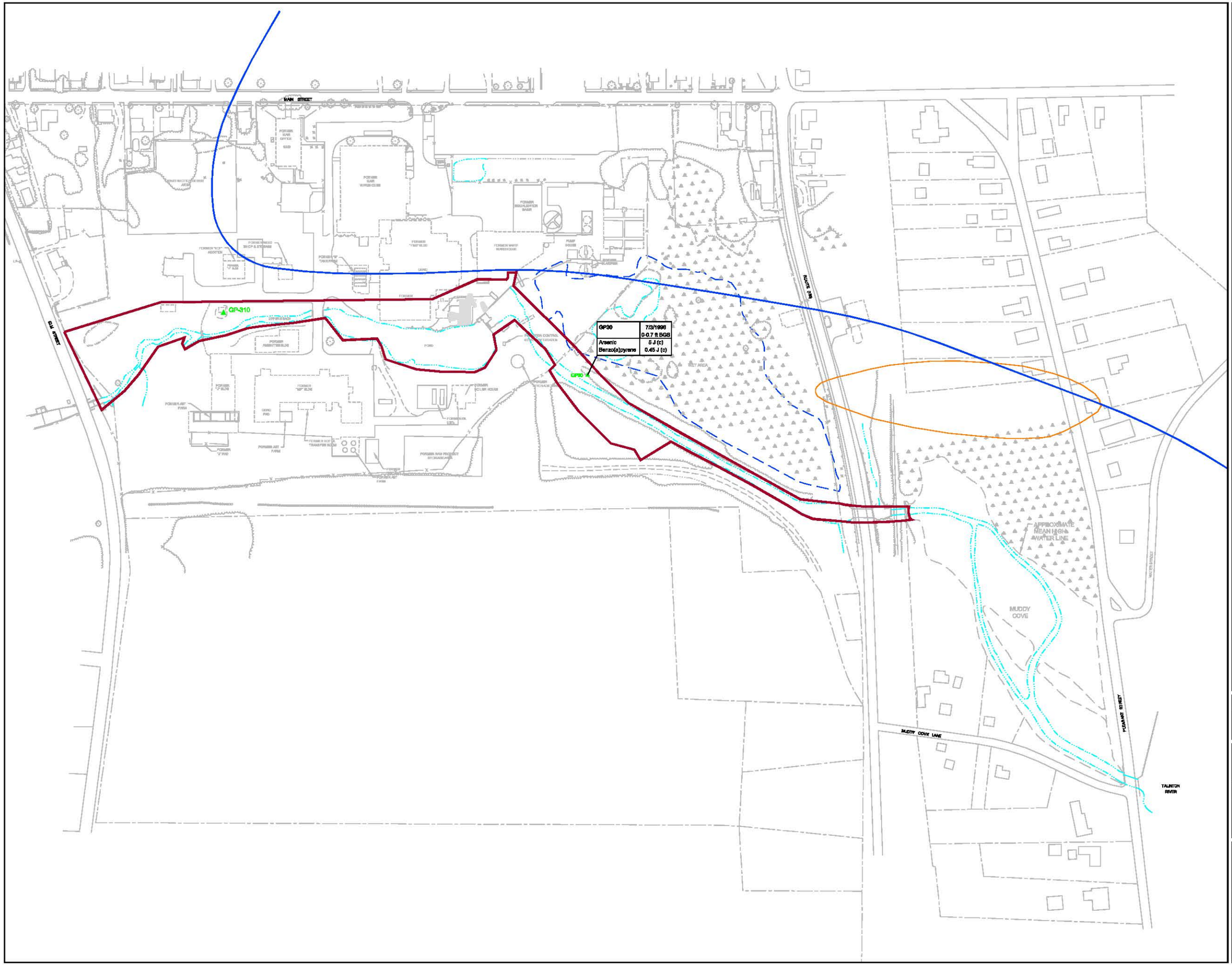
AOC4 - SUBSURFACE SOIL
DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale: 1"=80'	Project N.#: 15620-78	Report N.#: 020	Drawing N.#: A.18

15620-78(020)GN-WA018 DEC 14/2010



0 60 120 ft

LEGEND

- GP-310 — GEOPROBE LOCATION
- EXCAVATED AREA
- AOC5: MUDDY COVE BROOK
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- ESTIMATED EXTENT OF MYTA
- J — ESTIMATED VALUE

GP30	7/3/98
	0-0.7 ft BGS
Arsenic	5 J (c)
Benzo(a)pyrene	0.45 J (c)

SAMPLE LOCATION
SAMPLE DATE
SAMPLE DEPTH
RESULT (mg/kg)
PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA.

Parameter	S2/GW2 Criteria (a)	S2/GW3 Criteria (b)	Industrial Region 9 Criteria (c)
Arsenic	20	20	1.6
Benzo(a)pyrene	4	4	0.21

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

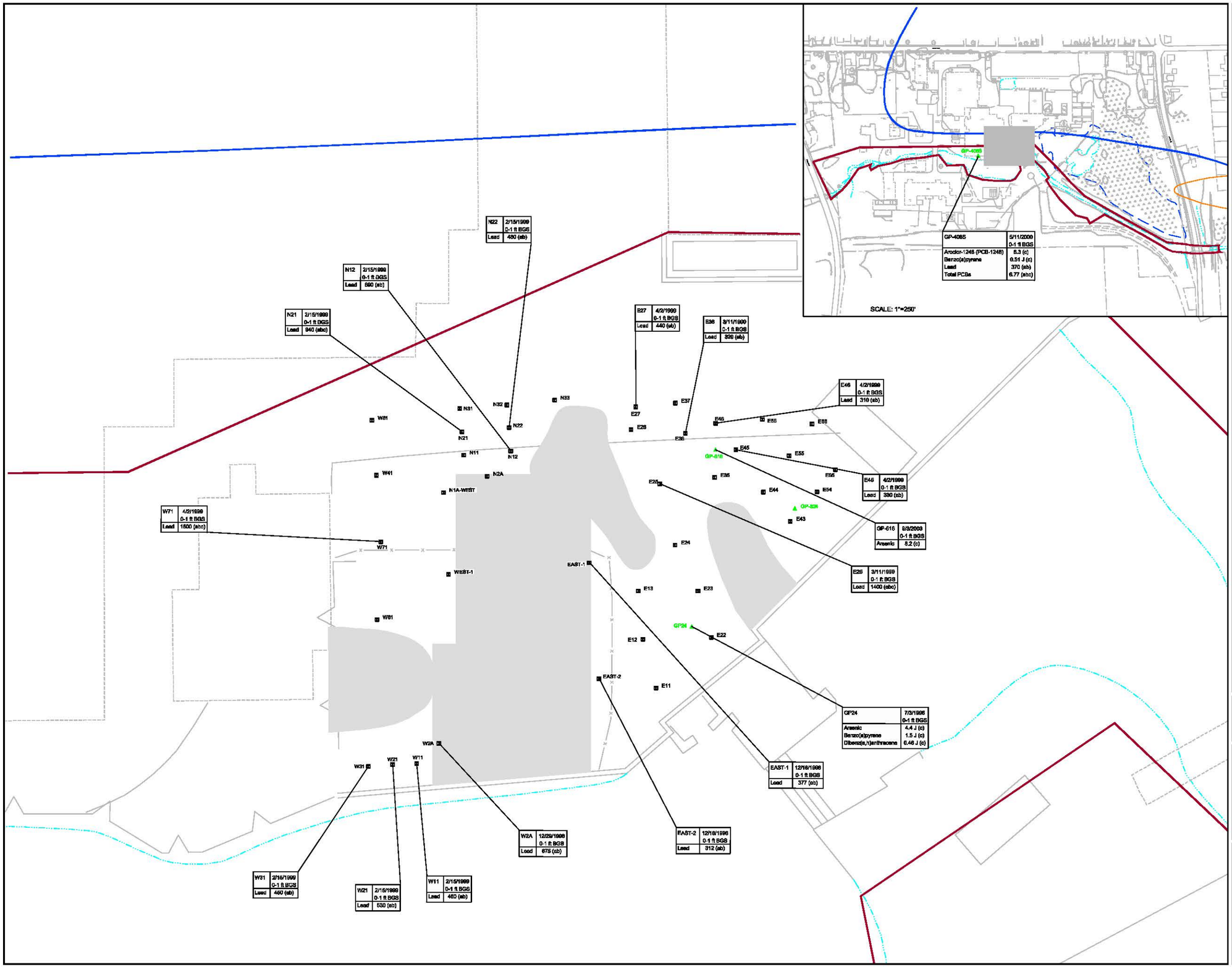
AOC5 - SURFACE SOIL - NOT PAVED - DATA SUMMARY

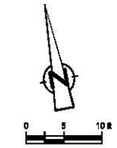
CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale: 1"= 120'	Project N #: 15620-78	Report N #: 020	Drawing N #: A.19

15620-78(020)GN-WA019 DEC 14/2010





LEGEND

- GEOPROBE LOCATION
- SOIL SAMPLE LOCATION
- EXCAVATED AREA
- AOC2: MUDDY COVE BROOK
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PFA (POTENTIALLY PRODUCTIVE AQUIFER)
- ESTIMATED EXTENT OF MYTA
- ESTIMATED VALUE

GP24	9/3/03	SAMPLE LOCATION
	0-1 ft BGS	SAMPLE DATE
Arsenic	6.2 (c)	SAMPLE DEPTH
		RESULT (mg/kg)
		PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA.

Parameter	S3/GW2 Criteria (a)	S3/GW3 Criteria (b)	Industrial Region 6 Criteria (c)
Aroclor-1248 (PCB-1248)	-	-	0.74
Arsenic	20	20	1.6
Benzo(a)pyrene	30	30	0.21
Dibenz(a,h)anthracene	30	30	0.21
Lead	300	300	800
Total PCBs	3	3	0.74

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

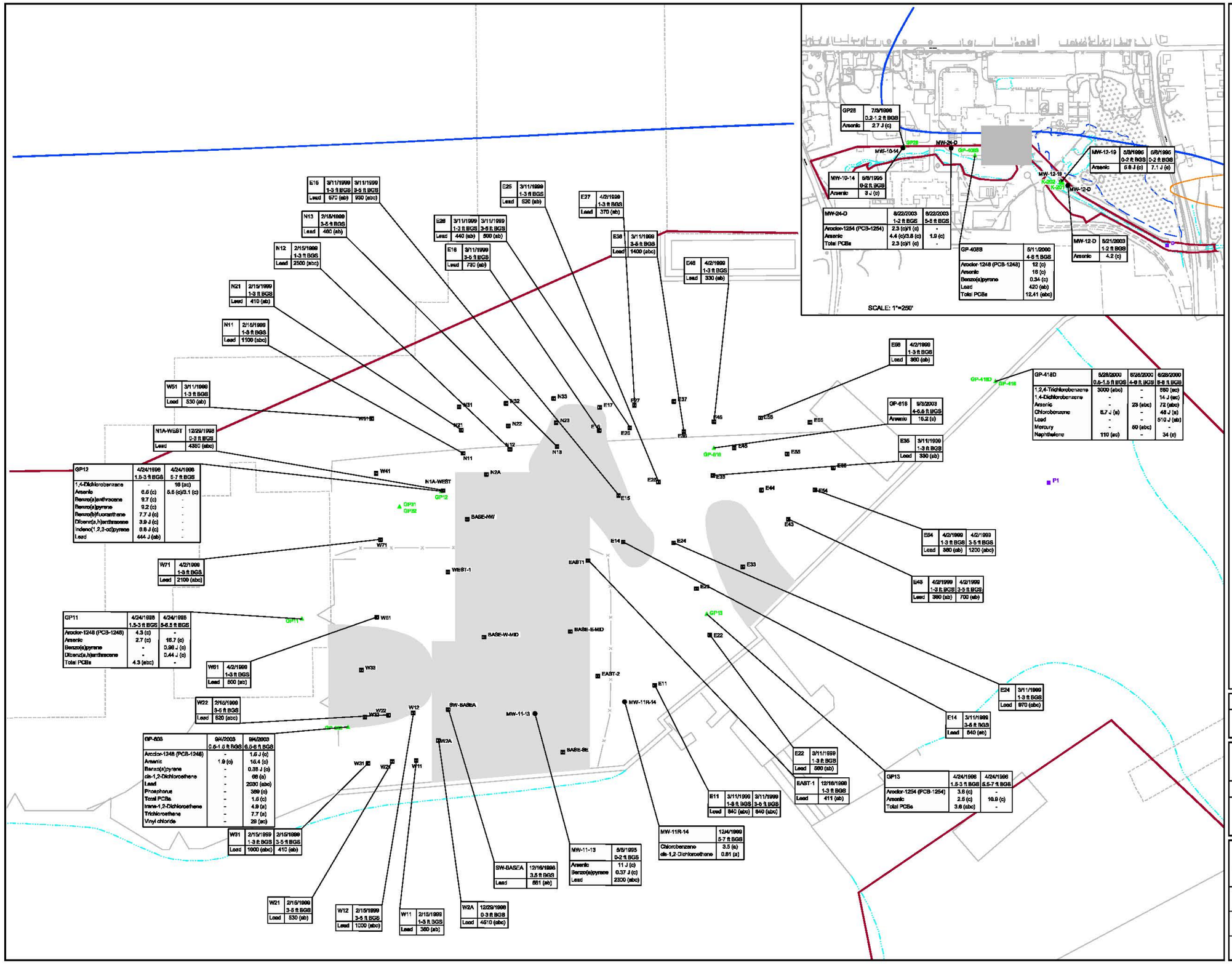
AOC5 - SURFACE SOIL - PAVED
DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale: 1"=10'	Project N #: 15620-78	Report N #: 020	Drawing N #: A.20

15620-78(020)GN-WA020 DEC 14/2010



LEGEND

- MW-12-D — MONITORING WELL LOCATION
- GP-608 — GEOPROBE LOCATION
- P1 — BOREHOLE LOCATION
- E54 — SOIL SAMPLE LOCATION
- EXCAVATED AREA
- AOCS: MUDDY COVE BROOK
- APPROXIMATE BOUNDARY OF MEDIUM YIELD FPA (POTENTIALLY PRODUCTIVE AQUIFER)
- ESTIMATED EXTENT OF MYTA
- J — ESTIMATED VALUE
- - — NOT DETECTED ABOVE CRITERIA

E35 | 4/2/99 | 0-1 ft BGS | Lead | 330 (ab)

SAMPLE LOCATION
SAMPLE DATE
SAMPLE DEPTH
RESULT (mg/kg)
PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA.

Parameter	S3/GW2 Criteria (a)	S3/GW3 Criteria (b)	Industrial Region 9 Criteria (c)
1,2,4-Trichlorobenzene	70	900	99
1,4-Dichlorobenzene	4	2000	12
Aroclor-1248 (PCB-1248)	-	-	0.74
Aroclor-1254 (PCB-1254)	-	-	0.74
Arsenic	20	20	1.6
Benzo(a)anthracene	300	300	2.1
Benzo(a)pyrene	30	30	0.21
Benzo(b)fluoranthene	300	300	2.1
Chlorobenzene	3	100	1400
cis-1,2-Dichloroethene	0.4	500	10000
Dibenz(a,h)anthracene	30	30	0.21
Indeno(1,2,3-cd)pyrene	300	300	2.1
Lead	300	300	600
Mercury	30	30	34
Naphthalene	40	3000	16
Phosphorus	-	-	20
Total PCBs	3	3	0.74
trans-1,2-Dichloroethene	1	3000	690
Trichloroethene	2	2000	14
Vinyl chloride	0.7	30	1.7

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

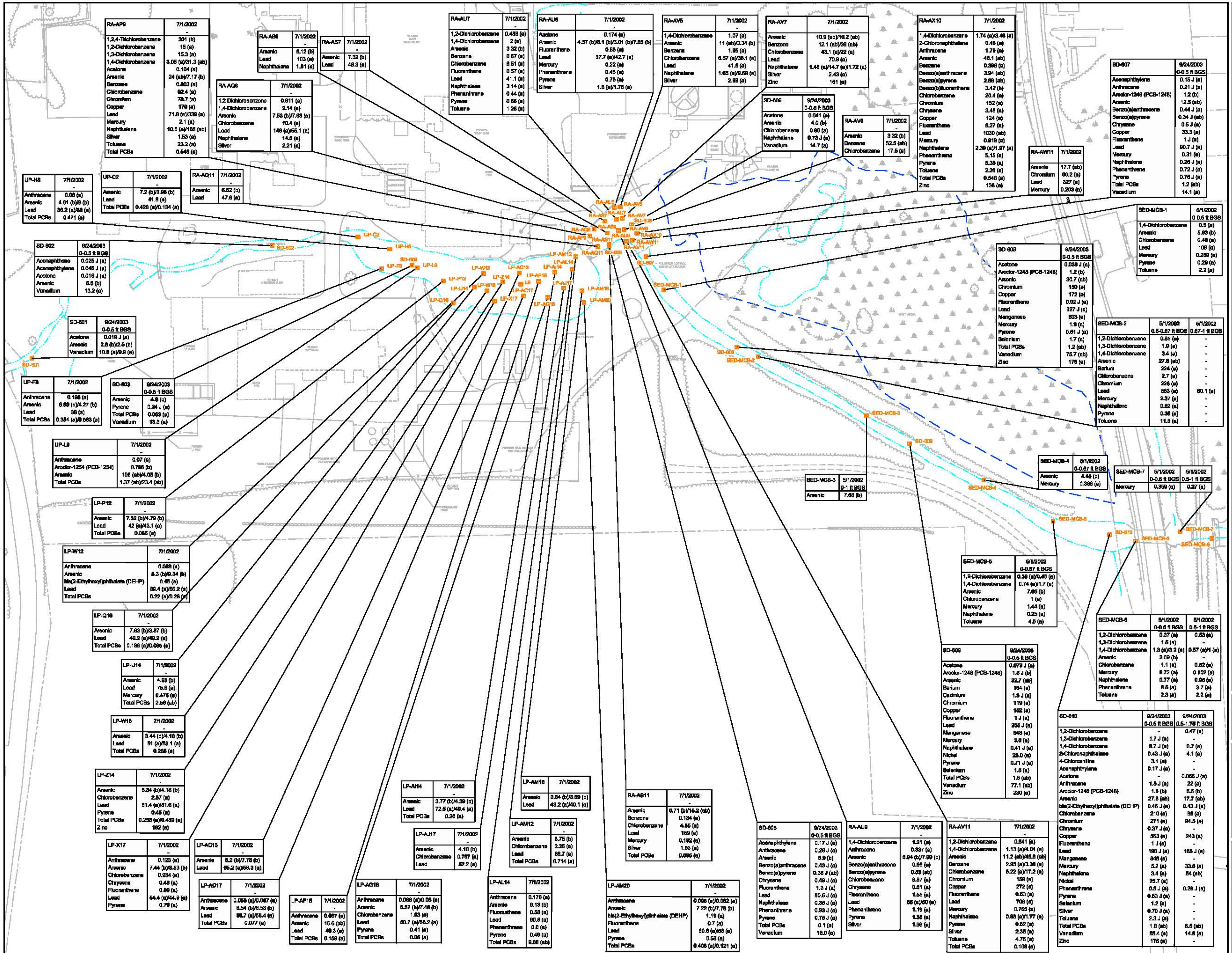
AOC5 - SUBSURFACE SOIL DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale: 1"=10'	Project No: 15620-78	Report No: 020	Drawing No: A.21

15620-78(020)GN-WA021 DEC 14/2010



RA-AP9	7/1/2002 -
1,2,4-Trichlorobenzene	301 (b)
1,2-Dichlorobenzene	15 (a)
1,3-Dichlorobenzene	15.3 (a)
1,4-Dichlorobenzene	3.05 (a)/31.3 (ab)
Acetone	0.104 (a)
Arsenic	24 (ab)/7.17 (b)
Benzene	0.803 (a)
Chlorobenzene	92.4 (a)
Chromium	78.7 (a)
Copper	179 (a)
Lead	71.8 (a)/339 (a)
Mercury	2.1 (a)
Naphthalene	10.5 (a)/166 (ab)
Silver	1.53 (a)
Toluene	23.2 (a)
Total PCBs	0.546 (a)

RA-AS9	7/1/2002 -
Arsenic	6.12 (b)
Lead	103 (a)
Naphthalene	1.91 (a)

RA-AS7	7/1/2002 -
Arsenic	7.32 (b)
Lead	49.3 (a)

RA-AQ8	7/1/2002 -
1,2-Dichlorobenzene	0.911 (a)
1,4-Dichlorobenzene	2.14 (a)
Arsenic	7.53 (b)/7.68 (b)
Chlorobenzene	10.4 (a)
Lead	148 (a)/55.1 (a)
Naphthalene	14.5 (a)
Silver	2.21 (a)

RA-AU7	7/1/2002 -
1,2-Dichlorobenzene	0.488 (a)
1,4-Dichlorobenzene	2 (a)
Arsenic	3.32 (b)
Benzene	0.67 (a)
Chlorobenzene	8.51 (a)
Fluoranthene	0.57 (a)
Lead	41.1 (a)
Naphthalene	3.14 (a)
Phenanthrene	0.44 (a)
Pyrene	0.66 (a)
Toluene	1.26 (a)

RA-AU5	7/1/2002 -
Acetone	0.174 (a)
Arsenic	4.57 (b)/8.1 (b)/3.01 (b)/7.65 (b)
Fluoranthene	0.65 (a)
Lead	37.7 (a)/42.7 (a)
Mercury	0.22 (a)
Phenanthrene	0.45 (a)
Pyrene	0.75 (a)
Silver	1.5 (a)/1.76 (a)

RA-AV5	7/1/2002 -
1,4-Dichlorobenzene	1.07 (a)
Arsenic	11 (ab)/3.34 (b)
Benzene	1.95 (a)
Chlorobenzene	6.57 (a)/38.1 (a)
Lead	41.6 (a)
Naphthalene	1.65 (a)/9.69 (a)
Silver	2.89 (a)

RA-AV7	7/1/2002 -
Arsenic	10.9 (ab)/10.2 (ab)
Benzene	12.1 (ab)/36 (ab)
Chlorobenzene	43.1 (a)/22 (a)
Lead	70.9 (a)
Naphthalene	1.48 (a)/14.7 (a)/1.72 (a)
Silver	2.43 (a)
Zinc	161 (a)

SD-606	9/24/2003 0-0.5 ft BGS
Acetone	0.041 (a)
Arsenic	4.0 (b)
Chlorobenzene	0.66 (a)
Naphthalene	0.73 J (a)
Vanadium	14.7 (a)

RA-AV9	7/1/2002 -
Arsenic	3.32 (b)
Benzene	52.5 (ab)
Chlorobenzene	17.5 (a)

RA-AX10	7/1/2002 -
1,4-Dichlorobenzene	1.74 (a)/3.48 (a)
2-Chloronaphthalene	0.48 (a)
Anthracene	1.79 (a)
Arsenic	48.1 (ab)
Benzene	0.396 (a)
Benzo(a)anthracene	3.94 (ab)
Benzo(a)pyrene	2.68 (ab)
Benzo(b)fluoranthene	3.42 (b)
Chlorobenzene	20.4 (a)
Chromium	152 (a)
Chrysene	3.48 (a)
Copper	124 (a)
Fluoranthene	6.27 (a)
Lead	1030 (ab)
Mercury	0.919 (a)
Naphthalene	2.39 (a)/1.97 (a)
Phenanthrene	5.15 (a)
Pyrene	6.38 (a)
Toluene	2.26 (a)
Total PCBs	0.546 (a)
Zinc	136 (a)

RA-AW11	7/1/2002 -
Arsenic	17.7 (ab)
Chromium	60.2 (a)
Lead	327 (a)
Mercury	0.203 (a)

SD-607	9/24/2003 0-0.5 ft BGS
Acenaphthylene	0.15 J (a)
Anthracene	0.21 J (a)
Aroclor-1248 (PCB-1248)	1.2 (b)
Arsenic	12.5 (ab)
Benzo(a)anthracene	0.44 J (a)
Benzo(a)pyrene	0.34 J (ab)
Chrysene	0.5 J (a)
Copper	33.3 (a)
Fluoranthene	1 J (a)
Lead	90.7 J (a)
Mercury	0.31 (a)
Naphthalene	0.28 J (a)
Phenanthrene	0.72 J (a)
Pyrene	0.76 J (a)
Total PCBs	1.2 (ab)
Vanadium	14.1 (a)

UP-H6	7/1/2002 -
Anthracene	0.06 (a)
Arsenic	4.61 (b)/9 (b)
Lead	36.2 (a)/38 (a)
Total PCBs	0.471 (a)

UP-C2	7/1/2002 -
Arsenic	7.2 (b)/3.96 (b)
Lead	41.8 (a)
Total PCBs	0.426 (a)/0.134 (a)

RA-AQ11	7/1/2002 -
Arsenic	6.82 (b)
Lead	47.6 (a)

SD-602	9/24/2003 0-0.5 ft BGS
Acenaphthene	0.025 J (a)
Acenaphthylene	0.045 J (a)
Acetone	0.016 J (a)
Arsenic	5.6 (b)
Vanadium	13.2 (a)

SD-601	9/24/2003 0-0.5 ft BGS
Acetone	0.019 J (a)
Arsenic	2.8 (b)/2.5 (b)
Vanadium	10.8 (a)/9.9 (a)

UP-F8	7/1/2002 -
Anthracene	0.198 (a)
Arsenic	6.69 (b)/4.27 (b)
Lead	38 (a)
Total PCBs	0.354 (a)/0.563 (a)

SD-603	9/24/2003 0-0.5 ft BGS
Arsenic	4.8 (b)
Pyrene	0.24 J (a)
Total PCBs	0.063 (a)
Vanadium	13.3 (a)

UP-L9	7/1/2002 -
Anthracene	0.07 (a)
Aroclor-1254 (PCB-1254)	0.786 (b)
Arsenic	106 (ab)/4.05 (b)
Total PCBs	1.37 (ab)/23.4 (ab)

LP-P12	7/1/2002 -
Arsenic	7.32 (b)/4.79 (b)
Lead	42 (a)/43.1 (a)
Total PCBs	0.065 (a)

LP-W12	7/1/2002 -
Anthracene	0.083 (a)
Arsenic	8.3 (b)/9.34 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	0.45 (a)
Lead	89.4 (a)/56.2 (a)
Total PCBs	0.22 (a)/0.28 (a)

LP-Q16	7/1/2002 -
Arsenic	7.63 (b)/3.37 (b)
Lead	49.2 (a)/49.2 (a)
Total PCBs	0.186 (a)/0.085 (a)

LP-U14	7/1/2002 -
Arsenic	4.93 (b)
Lead	75.8 (a)
Mercury	0.476 (a)
Total PCBs	2.56 (ab)

LP-W15	7/1/2002 -
Arsenic	3.44 (b)/4.16 (b)
Lead	51 (a)/53.1 (a)
Total PCBs	0.268 (a)

LP-Z14	7/1/2002 -
Arsenic	5.84 (b)/4.18 (b)
Chlorobenzene	2.57 (a)
Lead	51.4 (a)/61.6 (a)
Pyrene	0.45 (a)
Total PCBs	0.258 (a)/0.439 (a)
Zinc	162 (a)

LP-X17	7/1/2002 -
Anthracene	0.123 (a)
Arsenic	7.44 (b)/6.53 (b)
Chlorobenzene	0.934 (a)
Chrysene	0.43 (a)
Fluoranthene	0.89 (a)
Lead	54.4 (a)/44.9 (a)
Pyrene	0.79 (a)

LP-AC13	7/1/2002 -
Arsenic	6.2 (b)/7.78 (b)
Lead	65.2 (a)/58.3 (a)

LP-AC17	7/1/2002 -
Anthracene	0.058 (a)/0.067 (a)
Arsenic	6.54 (b)/6.53 (b)
Lead	66.7 (a)/58.4 (a)
Total PCBs	0.077 (a)

LP-AF15	7/1/2002 -
Anthracene	0.067 (a)
Arsenic	16.6 (ab)
Lead	49.3 (a)
Total PCBs	0.159 (a)

LP-AG18	7/1/2002 -
Anthracene	0.066 (a)/0.06 (a)
Arsenic	6.62 (b)/7.48 (b)
Chlorobenzene	1.93 (a)
Lead	60.7 (a)/56.2 (a)
Pyrene	0.41 (a)
Total PCBs	0.06 (a)

LP-AI14	7/1/2002 -
Arsenic	3.77 (b)/4.39 (b)
Lead	72.5 (a)/49.4 (a)
Total PCBs	0.26 (a)

LP-AJ17	7/1/2002 -
Arsenic	4.16 (b)
Chlorobenzene	0.767 (a)
Lead	62.2 (a)

LP-AL14	7/1/2002 -
Anthracene	0.176 (a)
Arsenic	9.13 (b)
Fluoranthene	0.53 (a)
Lead	90.6 (a)
Phenanthrene	0.6 (a)
Pyrene	0.49 (a)
Total PCBs	9.88 (ab)

LP-AM16	7/1/2002 -
Arsenic	3.84 (b)/3.69 (b)
Lead	49.2 (a)/40.1 (a)

LP-AM12	7/1/2002 -
Arsenic	6.75 (b)
Chlorobenzene	2.26 (a)
Lead	66.7 (a)
Total PCBs	0.714 (a)

LP-AM20	7/1/2002 -
Anthracene	0.095 (a)/0.082 (a)
Arsenic	7.22 (b)/7.78 (b)
bis(2-Ethylhexyl)phthalate (DEHP)	1.19 (a)
Fluoranthene	0.7 (a)
Lead	80.6 (a)/58 (a)
Pyrene	0.58 (a)
Total PCBs	0.408 (a)/0.121 (a)

RA-AS11	7/1/2002 -
Arsenic	6.71 (b)/16.2 (ab)
Benzene	0.184 (a)
Chlorobenzene	4.85 (a)
Lead	169 (a)
Mercury	0.182 (a)
Silver	1.93 (a)
Total PCBs	0.685 (a)

SD-605	9/24/2003 0-0.5 ft BGS
Acenaphthylene	0.17 J (a)
Anthracene	0.28 J (a)
Arsenic	6.9 (b)
Benzo(a)anthracene	0.43 J (a)
Benzo(a)pyrene	0.38 J (ab)
Chrysene	0.49 J (a)
Fluoranthene	1.3 J (a)
Lead	80.5 J (a)
Naphthalene	0.86 J (a)
Phenanthrene	0.93 J (a)
Pyrene	0.75 J (a)
Total PCBs	0.1 (a)
Vanadium	15.0 (a)

RA-AU9	7/1/2002 -
1,4-Dichlorobenzene	1.21 (a)
Anthracene	0.337 (a)
Arsenic	6.94 (b)/7.99 (b)
Benzo(a)anthracene	0.66 (a)
Benzo(a)pyrene	0.53 (ab)
Chlorobenzene	9.87 (a)
Chrysene	0.61 (a)
Fluoranthene	1.55 (a)
Lead	55 (a)/50 (a)
Phenanthrene	1.19 (a)
Pyrene	1.38 (a)
Silver	1.93 (a)

RA-AV11	7/1/2002 -
1,2-Dichlorobenzene	0.541 (a)
1,4-Dichlorobenzene	1.13 (a)/4.04 (a)
Arsenic	11.2 (ab)/46.6 (ab)
Benzene	2.85 (a)/3.36 (a)
Chlorobenzene	5.22 (a)/17.2 (a)
Chromium	189 (a)
Copper	272 (a)
Fluoranthene	0.63 (a)
Lead	706 (a)
Mercury	0.765 (a)
Naphthalene	0.88 (a)/1.77 (a)
Pyrene	0.62 (a)
Silver	2.35 (a)
Toluene	4.76 (a)
Total PCBs	0.109 (a)

SED-MCB-1	5/1/2002 0-0.5 ft BGS
1,4-Dichlorobenzene	0.5 (a)
Arsenic	5.83 (b)
Chlorobenzene	0.48 (a)
Lead	106 (a)
Mercury	0.269 (a)
Pyrene	0.29 (a)
Toluene	2.2 (a)

SD-608	9/24/2003 0-0.5 ft BGS
Acetone	0.038 J (a)
Aroclor-1248 (PCB-1248)	1.2 (b)
Arsenic	30.7 (ab)
Chromium	150 (a)
Copper	172 (a)
Fluoranthene	0.92 J (a)
Lead	327 J (a)
Manganese	603 (a)
Mercury	1.9 (a)
Pyrene	0.81 J (a)
Selenium	1.7 (a)
Total PCBs	1.2 (ab)
Vanadium	75.7 (ab)
Zinc	178 (a)

SED-MCB-2	5/1/2002 0.5-0.67 ft BGS	5/1/2002 0.67-1 ft BGS
1,2-Dichlorobenzene	0.85 (a)	-
1,3-Dichlorobenzene	1.9 (a)	-
1,4-Dichlorobenzene	3.4 (a)	-
Arsenic	27.8 (ab)	-
Barium	224 (a)	-
Chlorobenzene	2.7 (a)	-
Chromium	228 (a)	-
Lead	583 (a)	60.1 (a)
Mercury	2.37 (a)	-
Naphthalene	0.82 (a)	-
Pyrene	0.36 (a)	-
Toluene	11.3 (a)	-

SED-MCB-3	5/1/2002 0-1 ft BGS
Arsenic	7.88 (b)

SED-MCB-4	5/1/2002 0-0.67 ft BGS
Arsenic	4.45 (b)
Mercury	0.398 (a)

SED-MCB-7	5/1/2002 0-0.5 ft BGS	5/1/2002 0.5-1 ft BGS
Mercury	0.359 (a)	0.27 (a)

SED-MCB-5	5/1/2002 0-0.67 ft BGS
1,2-Dichlorobenzene	0.38 (a)/0.46 (a)
1,4-Dichlorobenzene	0.74 (a)/1.7 (a)
Arsenic	7.66 (b)
Chlorobenzene	1 (a)
Mercury	1.44 (a)
Naphthalene	0.25 (a)
Toluene	4.5 (a)

SED-MCB-6	5/1/2002 0-0.5 ft BGS	5/1/2002 0.5-1 ft BGS
1,2-Dichlorobenzene	0.37 (a)	0.53 (a)
1,3-Dichlorobenzene	1.6 (a)	-
1,4-Dichlorobenzene	1.9 (a)/3.2 (a)	0.57 (a)/1 (a)
Arsenic	3.09 (b)	-
Chlorobenzene	1.1 (a)	0.62 (a)
Mercury	6.72 (a)	0.502 (a)
Naphthalene	0.77 (a)	0.96 (a)
Phenanthrene	8.5 (a)	3.7 (a)
Toluene	2.3 (a)	2.2 (a)

SD-609	9/24/2003 0-0.5 ft BGS
Acetone	0.073 J (a)
Aroclor-1248 (PCB-1248)	1.8 J (b)
Arsenic	32.7 (ab)
Barium	164 (a)
Cadmium	1.3 J (a)
Chromium	119 (a)
Copper	162 (a)
Fluoranthene	1 J (a)
Lead	255 J (a)
Manganese	848 (a)
Mercury	3.9 (a)
Naphthalene	0.41 J (a)
Nickel	23.0 (a)
Pyrene	0.71 J (a)
Selenium	1.5 (a)
Total PCBs	1.8 (ab)
Vanadium	77.1 (ab)
Zinc	230 (a)

SD-610	9/24/2003 0-0.5 ft BGS	9/24/2003 0.5-1.75 ft BGS
1,2-Dichlorobenzene	-	0.47 (a)
1,3-Dichlorobenzene	1.7 J (a)	-
1,4-Dichlorobenzene	8.7 J (a)	0.7 (a)
2-Chloronaphthalene	0.43 J (a)	4.1 (a)
4-Chloroaniline	3.1 (a)	-
Acenaphthylene	0.17 J (a)	-
Acetone	-	0.066 J (a)
Anthracene	1.8 J (a)	22 (a)
Aroclor-1248 (PCB-1248)	1.8 (b)	6.5 (b)
Arsenic	27.8 (ab)	17.7 (ab)
bis(2-Ethylhexyl)phthalate (DEHP)	0.46 J (a)	0.43 J (a)
Chlorobenzene	210 (a)	89 (a)
Chromium	271 (a)	94.5 (a)
Chrysene	0.37 J (a)	-
Copper	563 (a)	243 (a)
Fluoranthene	1 J (a)	-
Lead	198 J (a)	165 J (a)
Manganese	848 (a)	-
Mercury	5.2 (a)	33.8 (a)
Naphthalene	3.4 (a)	54 (ab)
Nickel	25.7 (a)	-
Phenanthrene	0.5 J (a)	0.29 J (a)
Pyrene	0.63 J (a)	-
Selenium	1.2 (a)	-
Silver	0.70 J (a)	-
Toluene	2.3 J (a)	-
Total PCBs	1.8 (ab)	6.6 (ab)
Vanadium	55.4 (a)	14.8 (a)
Zinc	176 (a)	-

LEGEND

SD-602 — SEDIMENT SAMPLE LOCATION

\- — NOT DETECTED ABOVE CRITERIA

J — ESTIMATED

SED-MCB-8	5/1/02 0-1 ft BGS
Arsenic	7.88 (c)

SAMPLE LOCATION — SAMPLE DATE — SAMPLE DEPTH — RESULT (mg/kg) — PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA

Parameter	ESV Criteria (a)	Industrial Region 9 Criteria (b)
1,2,4-Trichlorobenzene	-	99
1,2-Dichlorobenzene	0.294	9800
1,3-Dichlorobenzene	1.315	-
1,4-Dichlorobenzene	0.318	12
2-Chloronaphthalene	0.417	82000
4-Chloroaniline	0.146	8.6
Acenaphthene	0.00671	33000
Acenaphthylene	0.00587	-
Acetone	0.0099	630000
Anthracene	0.0572	170000
Aroclor-1248 (PCB-1248)	-	0.74
Aroclor-1254 (PCB-1254)	-	0.74
Arsenic	9.79	1.6
Barium	167	190000
Benzene	0.142	5.4
Benzo(a)anthracene	0.108	2.1
Benzo(a)pyrene	0.15	0.21
Benzo(b)fluoranthene	10.4	2.1
bis(2-Ethylhexyl)phthalate (DEHP)	0.182	120
Cadmium	0.99	800
Chlorobenzene	0.291	1400
Chromium	43.4	-
Chrysene	0.166	210
Copper	31.6	41000
Fluoranthene	0.423	22000
Lead	35.8	800
Manganese	460	23000
Mercury	0.18	34
Naphthalene	0.176	18
Nickel	22.7	20000
Phenanthrene	0.204	-
Pyrene	0.195	17000
Selenium	0.72	5100
Silver	0.5	5100
Toluene	1.22	45000
Total PCBs	0.0598	0.74
Vanadium	0.72	72
Zinc	121	310000

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

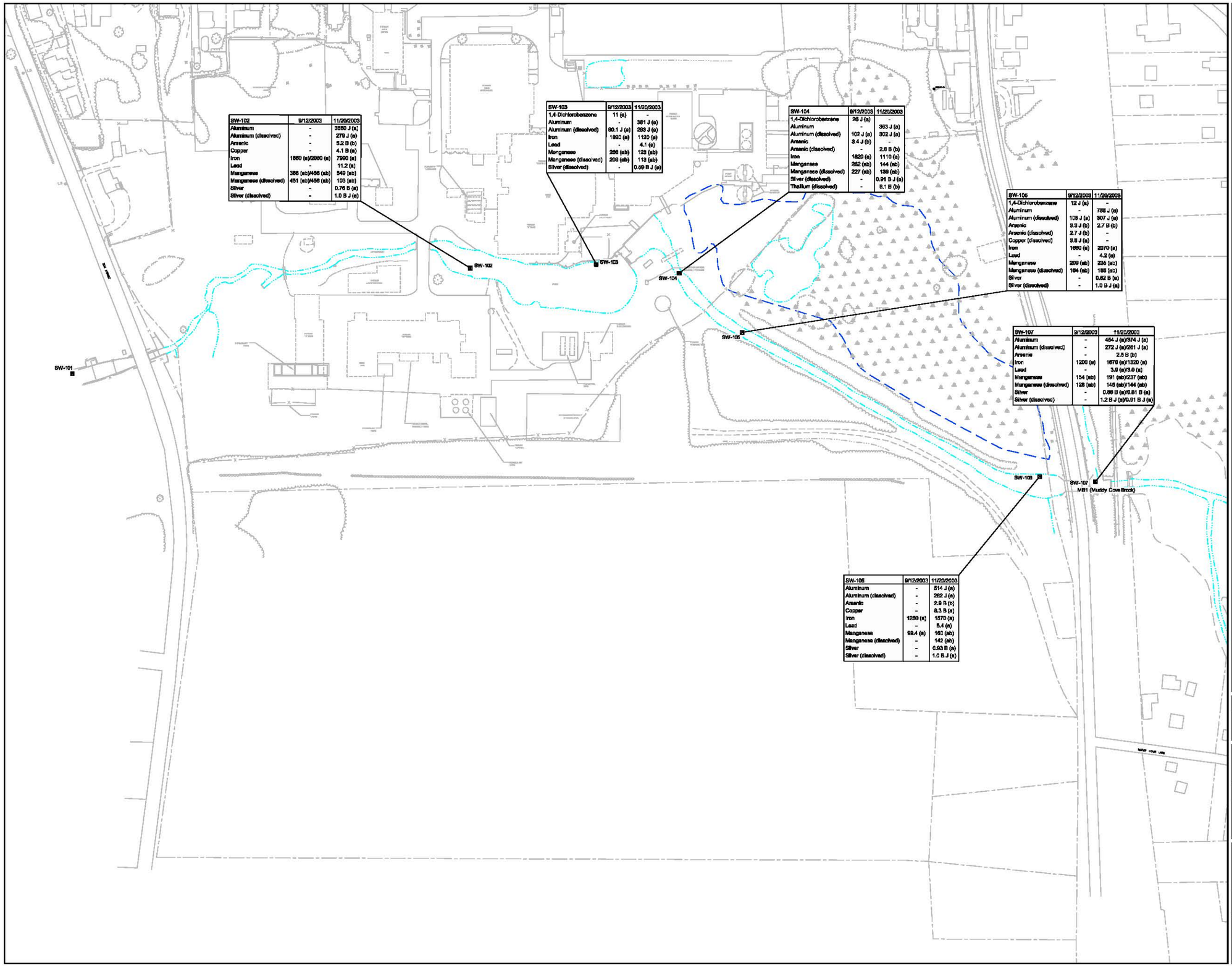
AOC5 - SEDIMENT DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager: J.K.P.	Reviewed By: J.V.	Date: JULY 2010	
Scale: 1"=80'	Project Nº: 15620-78	Report Nº: 020	Drawing Nº: A.22

15620-78(020)GN-WA022 DEC 14/2010



SW-102	9/12/2003	11/20/2003
Aluminum	-	3550 J (a)
Aluminum (dissolved)	-	279 J (a)
Arsenic	-	5.2 B (b)
Copper	-	4.1 B (a)
Iron	1860 (a)/2080 (a)	7990 (a)
Lead	-	11.2 (a)
Manganese	386 (ab)/456 (ab)	549 (ab)
Manganese (dissolved)	451 (ab)/456 (ab)	103 (ab)
Silver	-	0.76 B (a)
Silver (dissolved)	-	1.0 B J (a)

SW-103	9/12/2003	11/20/2003
1,4-Dichlorobenzene	11 (a)	-
Aluminum	-	381 J (a)
Aluminum (dissolved)	80.1 J (a)	293 J (a)
Iron	1860 (a)	1120 (a)
Lead	-	4.1 (a)
Manganese	298 (ab)	123 (ab)
Manganese (dissolved)	209 (ab)	113 (ab)
Silver (dissolved)	-	0.69 B J (a)

SW-104	9/12/2003	11/20/2003
1,4-Dichlorobenzene	26 J (a)	-
Aluminum	-	363 J (a)
Aluminum (dissolved)	102 J (a)	302 J (a)
Arsenic	3.4 J (b)	-
Arsenic (dissolved)	-	2.6 B (b)
Iron	1820 (a)	1110 (a)
Manganese	262 (ab)	144 (ab)
Manganese (dissolved)	227 (ab)	139 (ab)
Silver (dissolved)	-	0.91 B J (a)
Thallium (dissolved)	-	5.1 B (b)

SW-106	9/12/2003	11/20/2003
1,4-Dichlorobenzene	12 J (a)	-
Aluminum	-	788 J (a)
Aluminum (dissolved)	108 J (a)	307 J (a)
Arsenic	3.3 J (b)	2.7 B (b)
Arsenic (dissolved)	2.7 J (b)	-
Copper (dissolved)	3.8 J (a)	-
Iron	1660 (a)	2070 (a)
Lead	-	4.2 (a)
Manganese	209 (ab)	236 (ab)
Manganese (dissolved)	184 (ab)	188 (ab)
Silver	-	0.62 B (a)
Silver (dissolved)	-	1.0 B J (a)

SW-107	9/12/2003	11/20/2003
Aluminum	-	454 J (a)/374 J (a)
Aluminum (dissolved)	-	272 J (a)/281 J (a)
Arsenic	-	2.5 B (b)
Iron	1200 (a)	1670 (a)/1320 (a)
Lead	-	3.9 (a)/3.0 (a)
Manganese	154 (ab)	191 (ab)/237 (ab)
Manganese (dissolved)	128 (ab)	145 (ab)/144 (ab)
Silver	-	0.88 B (a)/0.81 B (a)
Silver (dissolved)	-	1.2 B J (a)/0.91 B J (a)

SW-108	9/12/2003	11/20/2003
Aluminum	-	514 J (a)
Aluminum (dissolved)	-	262 J (a)
Arsenic	-	2.8 B (b)
Copper	-	8.3 B (a)
Iron	1250 (a)	1570 (a)
Lead	-	5.4 (a)
Manganese	59.4 (a)	160 (ab)
Manganese (dissolved)	-	142 (ab)
Silver	-	0.93 B (a)
Silver (dissolved)	-	1.0 B J (a)

0 50 100ft

LEGEND

SW-108 ■ SURFACE WATER SAMPLE LOCATION

J ESTIMATED VALUE

B ANALYTE DETECTED IN BLANK

SW-101	7/1/02	SAMPLE LOCATION / SAMPLE DATE
	-	SAMPLE DEPTH
Arsenic	5.12 (c)	RESULT (ug/L) EXCEPT pH (S.U.)
Lead	103 (b)	
Naphthalene	1.81 (b)	PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA.

Parameter	ESV Criteria (a)	USEPA Human Health Organism Only Criteria (b)
1,4-Dichlorobenzene	9.4	190
Aluminum	87	-
Aluminum (dissolved)	87	-
Arsenic	150	0.14
Arsenic (dissolved)	150	0.14
bis(2-Ethylhexyl)phthalate (DEHP)	-	2.2
Chlorobenzene	47	1600
Copper	3.33	-
Copper (dissolved)	3.33	-
Iron	1000	-
Lead	0.58	-
Manganese	80	100
Manganese (dissolved)	80	100
Selenium	5	4200
Selenium (dissolved)	5	4200
Silver	0.12	-
Silver (dissolved)	0.12	-
Thallium (dissolved)	10	0.47

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

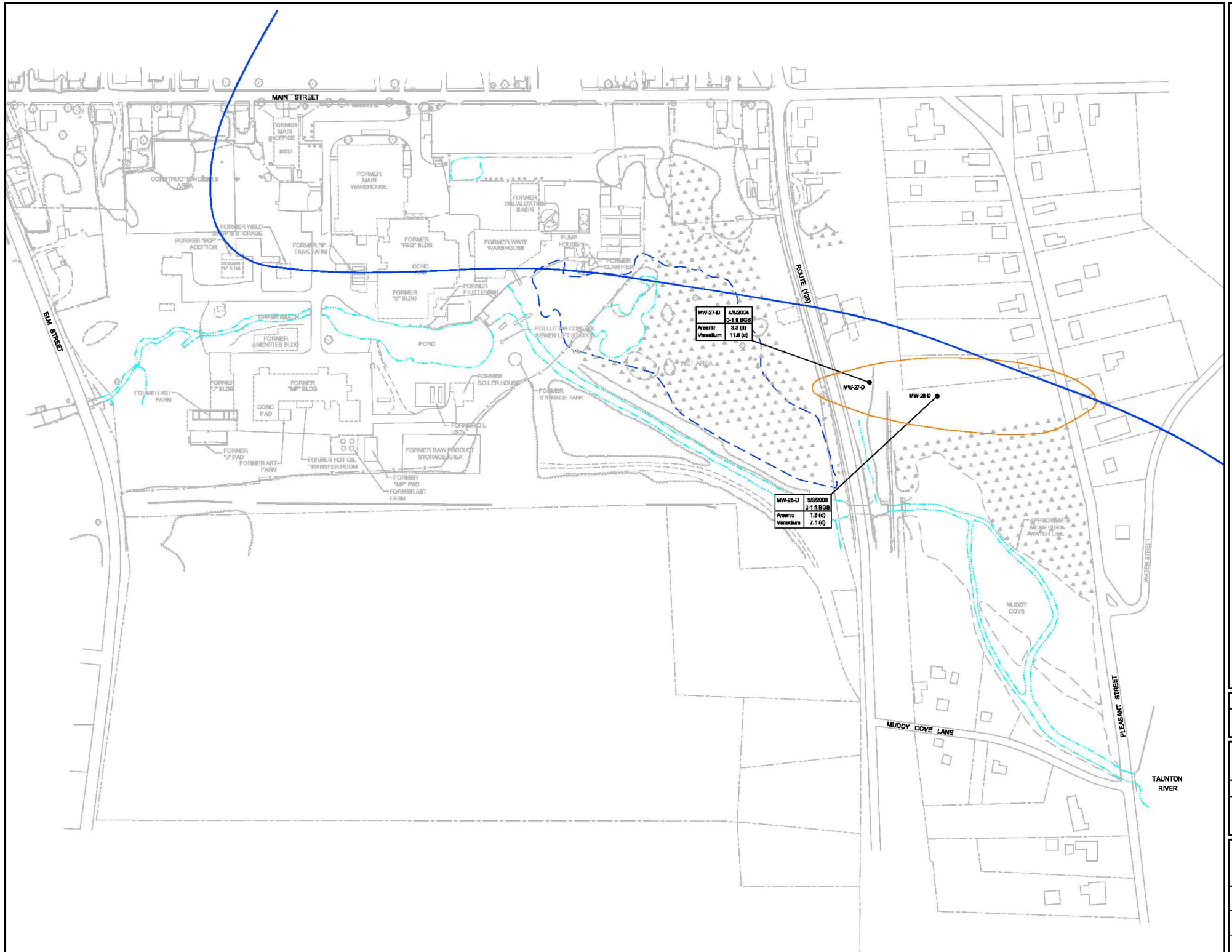
AOC5 - SURFACE WATER DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JULY 2010	
Scale: 1"=100'	Project No.: 15620-78	Report No.: 020	Drawing No.: A.23

15620-78(020)GN-WA023 DEC 14/2010



0 60 120 ft

LEGEND

MW-27-D ● MONITORING WELL LOCATION

APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)

ESTIMATED EXTENT OF MYTA

MW-27-D	4/8/04	SAMPLE LOCATION
	0-1 ft BGS	SAMPLE DATE
Aluminum	7820 (d)	SAMPLE DEPTH
Arsenic	3.3 (d)	RESULT (mg/kg)
		PARAMETER

Parameter	S1/GW1 Criteria (a)	S1/GW2 Criteria (b)	S1/GW3 Criteria (c)	Residential Region 9 Criteria (d)
Arsenic	20	20	20	0.39
Vanadium	800	800	800	5.5

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

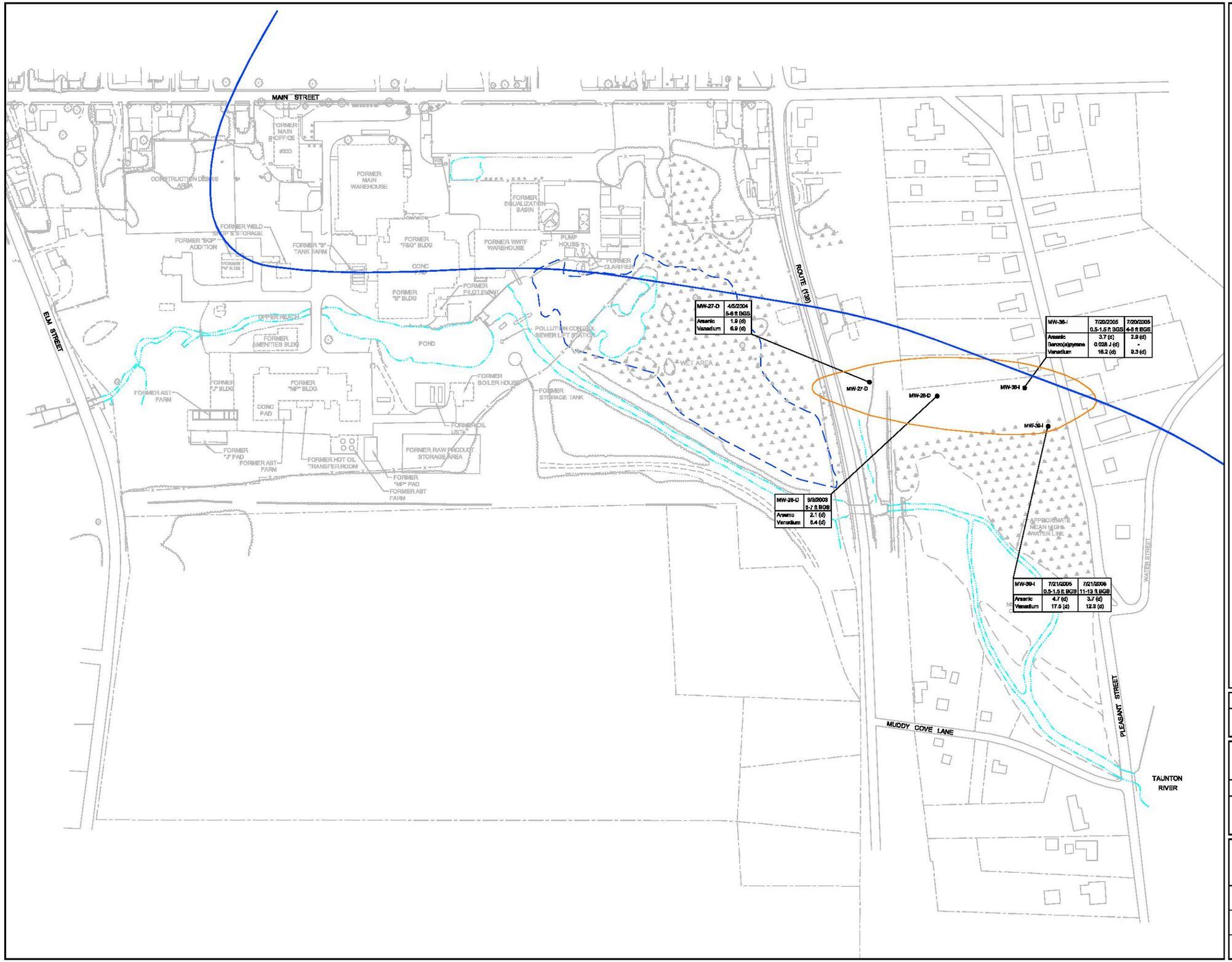
OFF-SITE - PPA/MYTA -UNPAVED SURFACE SOIL DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale:	Project No:	Report No:	Drawing No:
1"=120'	15620-78	020	A.24

15620-78(020)GN-WA024 DEC 14/2010



MW-27-D	4/5/2004
	5-6 ft BGS
Arsenic	1.9 (d)
Vanadium	6.9 (d)

MW-38-I	7/20/2005	7/20/2005
	0.5-1.5 ft BGS	4-6 ft BGS
Arsenic	3.7 (d)	2.9 (d)
Benzo(a)pyrene	0.025 J (d)	-
Vanadium	16.2 (d)	9.3 (d)

MW-28-D	9/3/2003
	5-7 ft BGS
Arsenic	2.1 (d)
Vanadium	8.4 (d)

MW-39-I	7/21/2005	7/21/2005
	0.5-1.5 ft BGS	11-13 ft BGS
Arsenic	4.7 (d)	3.7 (d)
Vanadium	17.5 (d)	12.3 (d)

0 60 120 ft

LEGEND

MW-38-I ● MONITORING WELL LOCATION

APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)

ESTIMATED EXTENT OF MYTA

SAMPLE LOCATION

MW-39-I	7/21/05	SAMPLE DATE
	11-13 ft BGS	SAMPLE DEPTH
Arsenic	3.7 (d)	RESULT (mg/kg)
		PARAMETER

Parameter	S2/GW1 Criteria (a)	S2/GW2 Criteria (b)	S2/GW3 Criteria (c)	Residential Region 9 Criteria (d)
Arsenic	20	20	20	0.38
Benzo(a)pyrene	4	4	4	0.015
Vanadium	1000	1000	1000	5.8

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

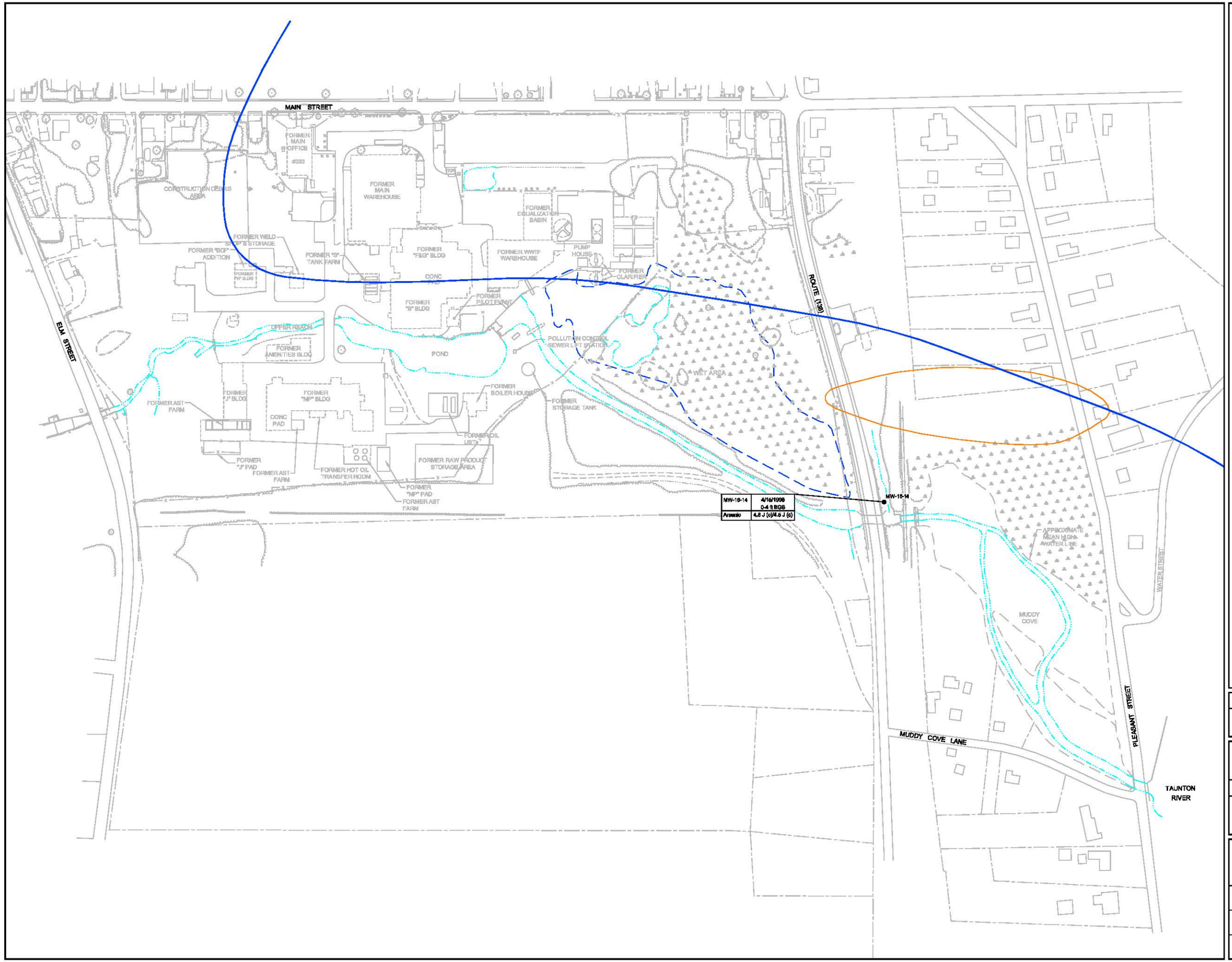
OFF-SITE - PPA/MYTA -
SUBSURFACE SOIL DATA SUMMARY

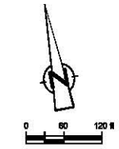
CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale:	Project No:	Report No:	Drawing No:
1"=120'	15620-78	020	A.25

15620-78(020)GN-WA025 DEC 14/2010





LEGEND

MW-18-14 ● MONITORING WELL LOCATION

HP-1 ▲ GEOPROBE LOCATION

APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)

ESTIMATED EXTENT OF MYTA

SAMPLE LOCATION

MW-18-14	4/16/96	SAMPLE DATE
	0-4 ft BGS	SAMPLE DEPTH
Arsenic	4.8 J (c)/4.5 J (c)	RESULT (mg/kg)

PARAMETER

Parameter	S2/GW/2 Criteria (a)	S2/GW/3 Criteria (b)	Residential Region 9 Criteria (d)
Arsenic	20	20	0.39

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

OFF-SITE - OUTSIDE PPA/MYTA - SUBSURFACE SOIL DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source References:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JUNE 2010	
Scale: 1"=120'	Project N.º: 15620-78	Report N.º: 020	Drawing N.º: A.26

15620-78(020)GN-WA028 DEC 14/2010

SB02-SED	11/2/2005 0-0.5 ft BGS	11/2/2005 1-2 ft BGS	11/2/2005 2-3 ft BGS
Acenaphthylene	0.15 J (a)	0.051 J (a)	-
Acetone	0.096 J (a)	0.039 J (a)	0.012 J (a)
Anthracene	0.21 J (a)	0.061 J (a)	-
Arsenic	146 (ab)	35.6 (ab)	3.8 (b)
Benzo(a)anthracene	0.4 J (ab)	0.16 J (ab)	-
Benzo(a)pyrene	0.42 J (ab)	0.19 J (ab)	-
Benzo(b)fluoranthene	0.47 J (b)	0.22 J (b)	-
Chromium	241 (a)	76.2 (a)	-
Chrysene	0.44 J (a)	0.17 J (a)	-
Copper	294 (a)	84.7 (a)	-
Dibenz(a,h)anthracene	0.093 J (b)	-	-
Fluoranthene	0.88 J (a)	-	-
Indeno(1,2,3-cd)pyrene	0.3 J (b)	-	-
Iron	81200 (ab)	-	-
Lead	1200 (ab)	244 (a)	-
Mercury	9.0 (ab)	2.9 (a)	-
Naphthalene	0.33 J (a)	-	-
Nickel	38.7 (a)	-	-
Phenanthrene	0.32 J (a)	-	-
Pyrene	0.88 J (a)	0.29 J (a)	-
Selenium	4.8 (a)	2.2 (a)	0.75 (a)
Silver	4.1 (a)	0.88 (a)	-
Vanadium	37.7 (ab)	25.1 (ab)	8.0 (ab)
Zinc	341 (a)	132 (a)	-

SB03-SED	11/2/2005 0-0.5 ft BGS	11/2/2005 1-2 ft BGS	11/2/2005 2-3 ft BGS
Acetone	0.051 J (a)	0.13 J (a)	0.08 J (a)
Aroclor-1248 (PCB-1248)	7.7 (b)	0.77 (b)	-
Aroclor-1254 (PCB-1254)	2.7 (b)	-	-
Arsenic	68.8 (ab)	49.5 (ab)	6.0 (b)
Benzo(a)anthracene	0.31 J (ab)	0.11 J (a)	-
Benzo(a)pyrene	0.45 J (ab)	0.13 J (a)	-
Benzo(b)fluoranthene	0.49 J (b)	-	-
Chromium	186 (a)	76.8 (a)	-
Chrysene	0.46 J (a)	-	-
Copper	160 (a)	78.5 (a)	-
Dibenz(a,h)anthracene	-	0.048 J (b)	-
Fluoranthene	0.45 J (a)	-	-
Indeno(1,2,3-cd)pyrene	0.27 J (b)	-	-
Lead	204 (a)	182 (a)	-
Mercury	250 (ac)	17.3 (ab)	1.1 (a)
Naphthalene	0.39 J (a)	-	-
Pyrene	0.42 J (a)	-	-
Selenium	1.5 (a)	2.1 (a)	1.3 (a)
Silver	2.2 (a)	0.81 (a)	-
Total PCBs	10.4 (ab)	0.77 (ab)	-
Vanadium	26.1 (ab)	24.9 (ab)	19.7 (ab)

SB04-SED	11/2/2005 0-0.5 ft BGS	11/2/2005 1-2 ft BGS	11/2/2005 2-3 ft BGS
2-Butanone (Methyl ethyl ketone) (MEK)	-	0.12 (a)	-
Acetone	0.11 J (c)	0.092 J (a)	0.014 J (a)
Aroclor-1248 (PCB-1248)	2.2 (b)	-	-
Aroclor-1254 (PCB-1254)	1 (c)	-	-
Arsenic	26.4 (ab)	10.8 (ab)	4.3 (b)
Benzo(a)anthracene	0.22 J (ab)	-	-
Benzo(a)pyrene	0.22 J (ab)	-	-
Chromium	534 (a)	-	-
Chrysene	0.27 J (a)	-	-
Copper	400 (a)	-	-
Lead	84.8 (a)	-	-
Mercury	55.9 (ab)	1.4 (a)	0.25 (a)
Pyrene	0.31 J (a)	-	-
Selenium	3.0 (a)	1.4 (a)	-
Silver	11.1 (a)	-	-
Total PCBs	3.2 (ab)	-	-
Vanadium	35.4 (ab)	20.9 (ab)	8.8 (ab)

SB01-SED	11/1/2005 0-0.5 ft BGS	11/1/2005 1-2 ft BGS	11/1/2005 2-3 ft BGS	11/2/2005 3.5-4.5 ft BGS
2-Butanone (Methyl ethyl ketone) (MEK)	-	-	0.11 (a)	-
Acetone	-	0.18 J (a)	0.17 (a)	0.031 J (a)
Arsenic	23.1 (ab)	17.8 (ab)	56.9 (ab)	19.8 (ab)
Benzo(a)anthracene	0.12 J (a)	0.14 J (a)	-	-
Benzo(a)pyrene	0.13 J (b)	0.17 J (ab)	-	-
Benzo(b)fluoranthene	-	0.2 J (b)	-	-
Chromium	343 (a)	181 (a)	-	-
Chrysene	-	0.17 J (a)	-	-
Copper	464 (a)	307 (a)	-	-
Lead	157 (a)	120 (a)	49.7 (a)	124 (a)
Mercury	23.7 (ab)	15.2 (ab)	3.8 (a)	1.1 (a)
Nickel	22.8 (a)	-	-	-
Pyrene	0.2 J (a)	0.24 J (a)	-	-
Selenium	2.0 (a)	2.2 (a)	-	1.0 (a)
Silver	4.1 (a)	2.2 (a)	-	-
Vanadium	52.0 (ac)	51.6 (ab)	26.9 (ab)	14.3 (ab)

LEGEND

MW-8 — SEDIMENT SAMPLE LOCATION

\- — NOT DETECTED ABOVE CRITERIA

SD-10a	10/4/99
	0-5 cm
Mercury	7 (b)
Total PCBs	0.53 (b)

SAMPLE LOCATION
SAMPLE DATE
SAMPLE DEPTH
RESULT (mg/kg)
PARAMETER

NOTE: SAMPLE LOCATIONS WITHOUT ASSOCIATED DATA DID NOT HAVE ANY PARAMETERS EXCEEDING CRITERIA

Parameter	ESV Criteria (a)	Residential Region 9 Criteria (b)
2-Butanone (Methyl ethyl ketone) (MEK)	0.0424	28000
Acenaphthylene	0.00587	-
Acetone	0.0099	61000
Anthracene	0.0572	17000
Aroclor-1248 (PCB-1248)	-	0.22
Aroclor-1254 (PCB-1254)	-	0.22
Arsenic	9.79	0.39
Benzo(a)anthracene	0.108	0.15
Benzo(a)pyrene	0.15	0.015
Benzo(b)fluoranthene	10.4	0.15
Chromium	43.4	-
Chrysene	0.166	15
Copper	31.6	3100
Dibenz(a,h)anthracene	-	0.015
Fluoranthene	0.423	2300
Indeno(1,2,3-cd)pyrene	-	0.15
Iron	40000	55000
Lead	35.8	400
Mercury	0.18	5.6
Naphthalene	0.176	3.6
Nickel	22.7	1500
Phenanthrene	0.204	-
Pyrene	0.195	1700
Selenium	0.72	390
Silver	0.5	390
Total PCBs	0.0598	0.22
Vanadium	0.72	5.5
Zinc	121	23000

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

ZENECA INC.
DIGHTON, MASSACHUSETTS

SRFI REPORT

OFF-SITE SEDIMENT DATA SUMMARY

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:	
J.K.P.	J.V.	JULY 2010	
Scale: 1:80	Project N #: 15620-78	Report N #: 020	Drawing N #: A.27

16620-78(020)GN-WA027 DEC 14/2010

MCP Method 1	Groundwater Standards (µg/liter)
GW-1	10
GW-2	NA
GW-3	900

LEGEND

- MW-4-18 — OVERBURDEN MONITORING WELL LOCATION
- GP-406 — PIEZOMETER LOCATION
- 1.4 — ARSENIC CONCENTRATION (µg/L) - MOST RECENT DATA SHOWN FOR EACH LOCATION
  - J = ESTIMATED
  - ND = NOT DETECTED AT ASSOCIATED VALUE
  - U = QUALIFIED AS NOT DETECTED
  - NS = NOT SAMPLED
- 10 — ISOCONCENTRATION CONTOUR - TOTAL ARSENIC (µg/L)
- ESTIMATED EXTENT OF MYTA
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- MW-2 — WELL IS DESTROYED

0 100 250ft

SRFI DATA
SOURCE: Table 8.3, SRFI REPORT, AUGUST 2010

figure A.28

OVERBURDEN TOTAL ARSENIC GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA028 DEC 14/2010

MCP Method 1	Groundwater Standards (µg/liter)
GW-1	15
GW-2	NA
GW-3	10

NA - NOT APPLICABLE

LEGEND

- MW-4-18 — EXISTING OVERBURDEN MONITORING WELL LOCATION
- GP-406 — EXISTING PIEZOMETER LOCATION
- 1.4 — LEAD CONCENTRATION (µg/L) - MOST RECENT DATA SHOWN FOR EACH LOCATION 2007 - 2009
  - J = ESTIMATED
  - ND = NOT DETECTED AT ASSOCIATED VALUE
  - U = QUALIFIED AS NOT DETECTED
  - NS = NOT SAMPLED
- 10 — ISOCONCENTRATION CONTOUR - LEAD (µg/L)
- ESTIMATED EXTENT OF MYTA
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- MW-2 — WELL IS DESTROYED

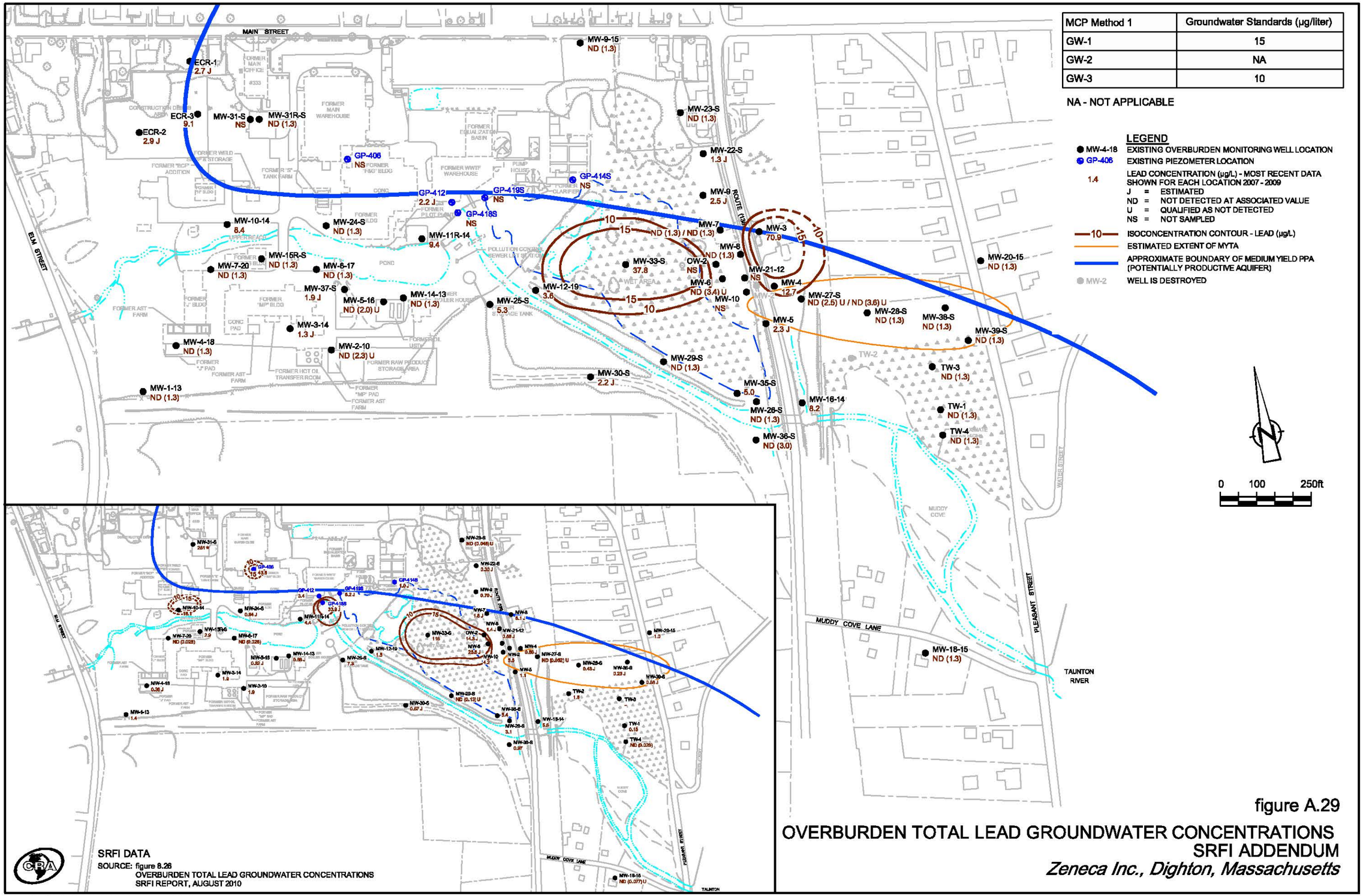


figure A.29

OVERBURDEN TOTAL LEAD GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM

Zeneca Inc., Dighton, Massachusetts

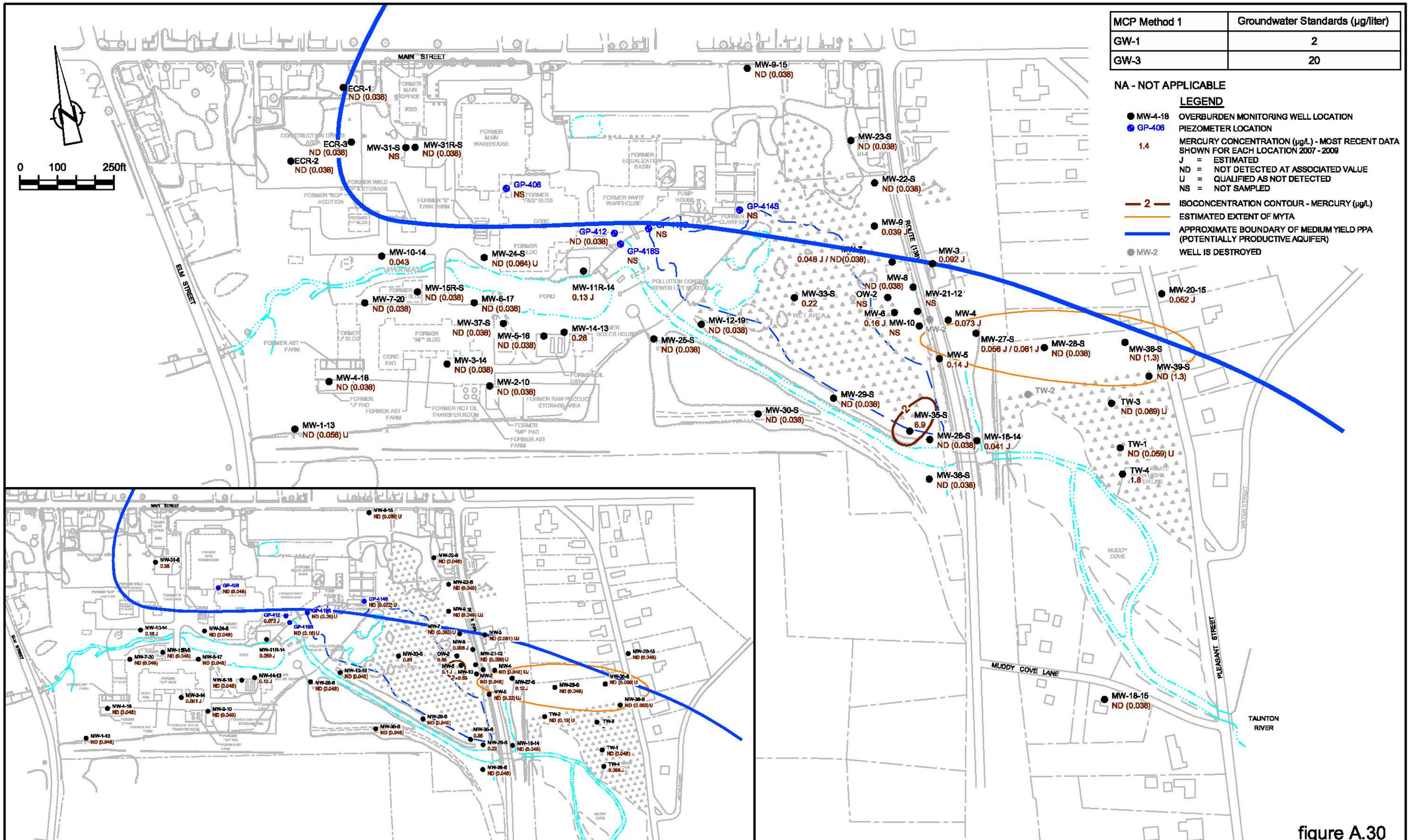
15620-78(020)GN-WA029 DEC 14/2010

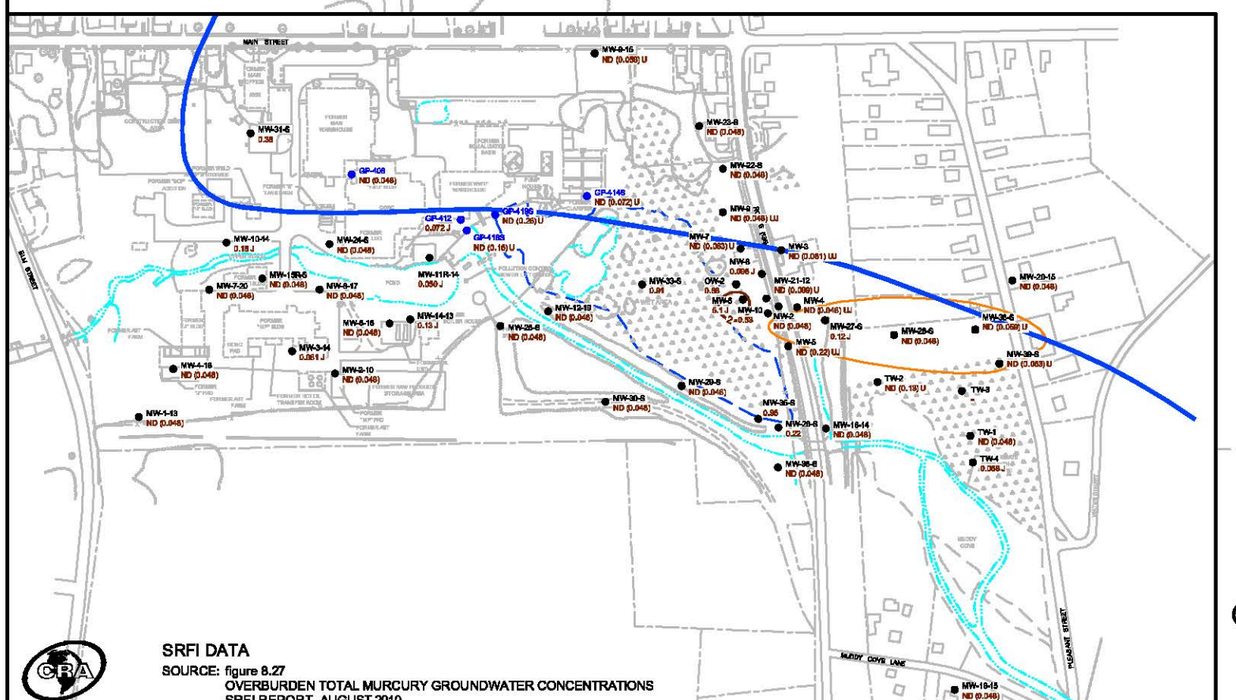
MCP Method 1	Groundwater Standards (µg/liter)
GW-1	2
GW-3	20

NA - NOT APPLICABLE

LEGEND

- MW-4-18 — OVERBURDEN MONITORING WELL LOCATION
- GP-406 — PIEZOMETER LOCATION
- 1.4 — MERCURY CONCENTRATION (µg/L) - MOST RECENT DATA SHOWN FOR EACH LOCATION 2007 - 2009
  - J = ESTIMATED
  - ND = NOT DETECTED AT ASSOCIATED VALUE
  - U = QUALIFIED AS NOT DETECTED
  - NS = NOT SAMPLED
- 2 — ISOCONCENTRATION CONTOUR - MERCURY (µg/L)
- ESTIMATED EXTENT OF MYTA
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- MW-2 — WELL IS DESTROYED





SRFI DATA
SOURCE: figure 8.27
OVERBURDEN TOTAL MURCURY GROUNDWATER CONCENTRATIONS
SRFI REPORT, AUGUST 2010

figure A.30

OVERBURDEN TOTAL MERCURY GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA030 DEC 14/2010

MCP Method 1	Groundwater Standards (µg/liter)
GW-1	100
GW-2	200
GW-3	1,000

LEGEND

- MW-4-18 — OVERBURDEN MONITORING WELL LOCATION
- GP-406 — PIEZOMETER LOCATION
- 1.4 — CHLOROBENZENE CONCENTRATION (µg/L) - MOST RECENT DATA SHOWN FOR EACH LOCATION 2007 - 2009
  - J = ESTIMATED
  - ND = NOT DETECTED AT ASSOCIATED VALUE
  - NS = NOT SAMPLED
- 100 — ISOCONCENTRATION CONTOUR - CHLOROBENZENE (µg/L)
- ESTIMATED EXTENT OF MYTA
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- MW-2 — WELL IS DESTROYED

0 100 250ft

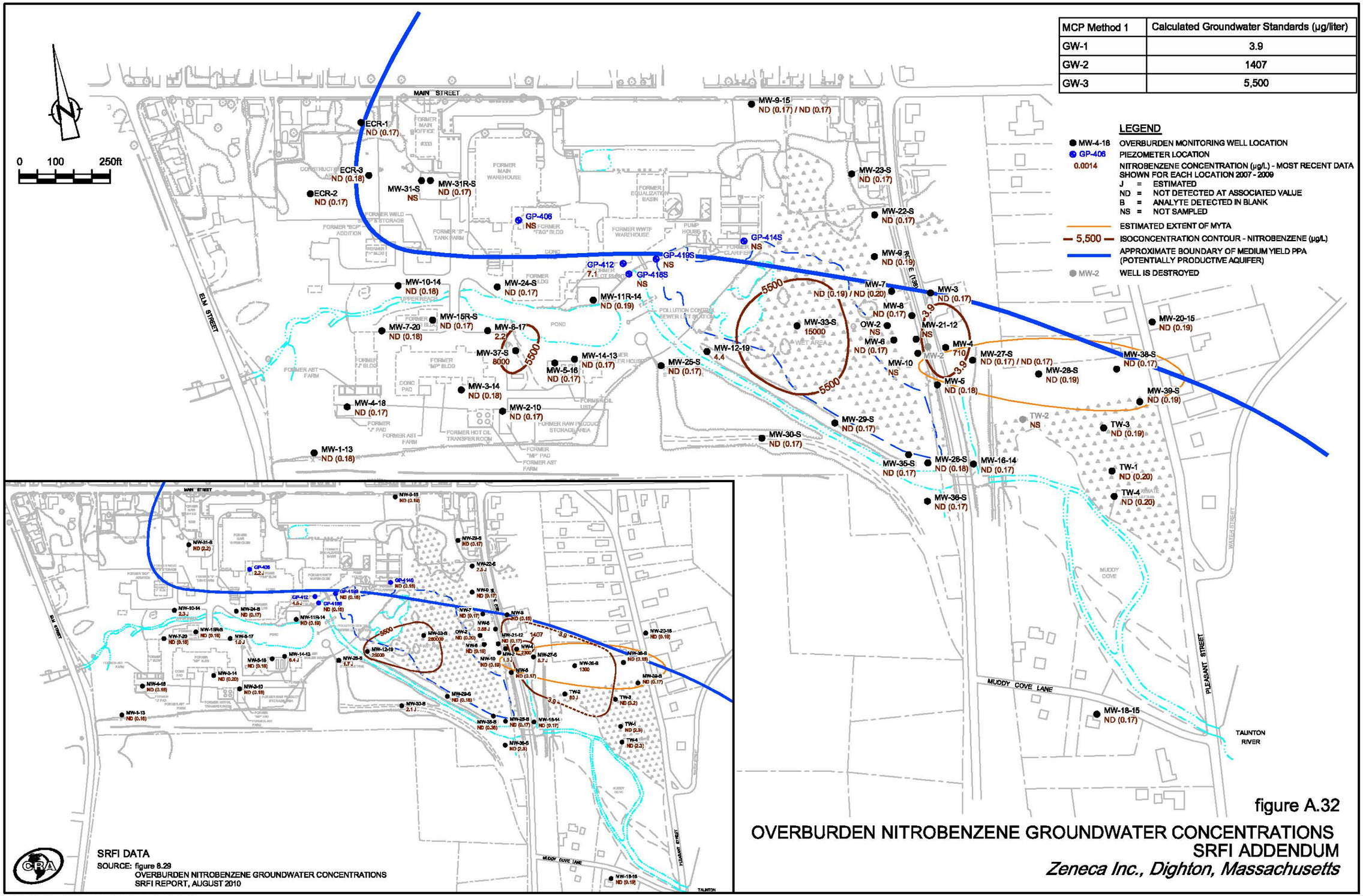
SRFI DATA
SOURCE: figure 8.28
OVERBURDEN CHLOROBENZENE GROUNDWATER CONCENTRATIONS
SRFI REPORT, AUGUST 2010

figure A.31

OVERBURDEN CHLOROBENZENE GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA031 DEC 14/2010

MCP Method 1	Calculated Groundwater Standards (µg/liter)
GW-1	3.9
GW-2	1407
GW-3	5,500



SRFI DATA
SOURCE: figure 8.29
OVERBURDEN NITROBENZENE GROUNDWATER CONCENTRATIONS
SRFI REPORT, AUGUST 2010

figure A.32

OVERBURDEN NITROBENZENE GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA032 DEC 14/2010

MCP Method 1	Groundwater Standards (µg/liter)
GW-1	70
GW-2	2,000
GW-3	50,000

NA - NOT APPLICABLE

LEGEND

- MW-4-18 — EXISTING OVERBURDEN MONITORING WELL LOCATION
- GP-406 — EXISTING PIEZOMETER LOCATION
- 1.4 — 1,2,4-TRICHLOROBENZENE CONCENTRATION (µg/L)-MOST RECENT DATA SHOWN FOR EACH LOCATION 2007 - 2009
  - J = ESTIMATED
  - ND = NOT DETECTED AT ASSOCIATED VALUE
  - U = QUALIFIED AS NOT DETECTED
  - NS = NOT SAMPLED
- 70 — ISOCONCENTRATION CONTOUR - 1,2,4-TRICHLOROBENZENE (µg/L)
- ESTIMATED EXTENT OF MYTA
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- MW-2 — WELL IS DESTROYED

0 100 250ft

SRFI DATA
SOURCE: figure 8.30
OVERBURDEN 1,2,4-TRICHLOROBENZENE GROUNDWATER CONCENTRATIONS
SRFI REPORT, AUGUST 2010

figure A.33

OVERBURDEN 1,2,4-TRICHLOROBENZENE GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA033 DEC 14/2010

MCP Method 1	Groundwater Standards (µg/liter)
GW-1	5
GW-2	30
GW-3	5,000

LEGEND

- MW-4-18 — MONITORING WELL LOCATION
- GP-406 — PIEZOMETER LOCATION
- 1.4 — TRICHLOROETHENE CONCENTRATION (µg/L) - MOST RECENT DATA SHOWN FOR EACH LOCATION 2007 - 2009
  - J = ESTIMATED
  - ND = NOT DETECTED AT ASSOCIATED VALUE
  - B = ANALYTE DETECTED IN BLANK
  - U = QUALIFIED AS NOT DETECTED
  - NS = NOT SAMPLED
- 5 — TRICHLOROETHENE CONCENTRATION CONTOUR (µg/L)
- ESTIMATED EXTENT OF MYTA
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- MW-2 — WELL IS DESTROYED

0 100 250ft

SRFI DATA

SOURCE - figure 8.31
OVERBURDEN TRICHLOROETHENE GROUNDWATER CONCENTRATIONS
SFRI REPORT, AUGUST 2010

figure A.34

OVERBURDEN TRICHLOROETHENE GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM

Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA034 DEC 14/2010

MCP Method 1	Groundwater Standards (µg/liter)
GW-1	0.5
GW-2	5
GW-3	10

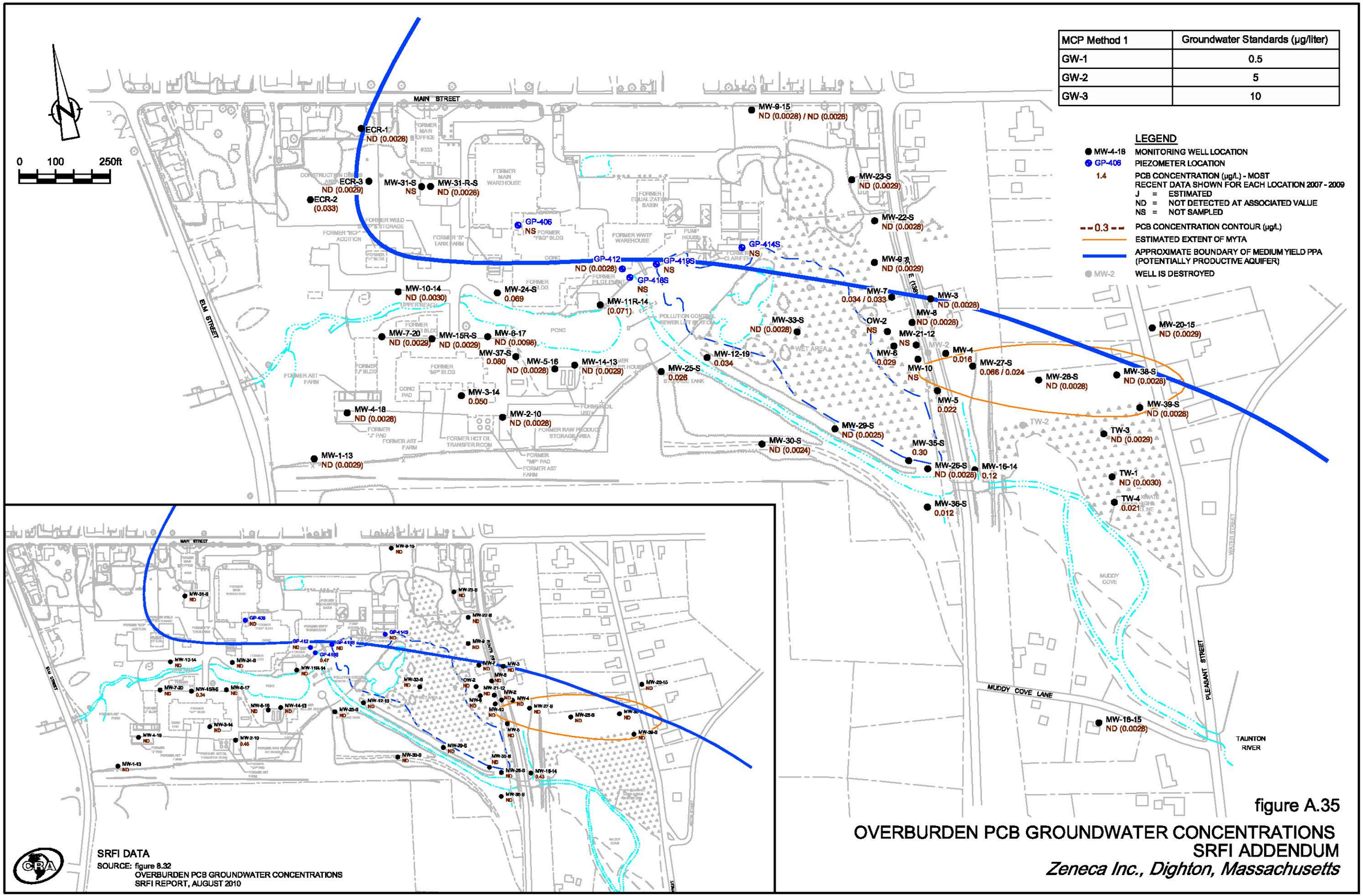


figure A.35

OVERBURDEN PCB GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM

Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA035 DEC 14/2010

MCP Method 1	Groundwater Standards (µg/liter)
GW-1	10
GW-2	NA
GW-3	900

NA - NOT APPLICABLE

LEGEND

- MW-3-I — DEEP OVERBURDEN / WEATHERED BEDROCK MONITORING WELL LOCATION
- GP-418D — PIEZOMETER LOCATION
- 0.14 — LEAD CONCENTRATION (µg/L) - MOST RECENT DATA SHOWN FOR EACH LOCATION
  - J = ESTIMATED
  - ND = NOT DETECTED AT ASSOCIATED VALUE
  - U = QUALIFIED AS NOT DETECTED
  - NS = NOT SAMPLED
- 10 — ISOCONCENTRATION CONTOUR - LEAD (µg/L)
- ESTIMATED EXTENT OF MYTA
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- MW-2 — WELL IS DESTORYED

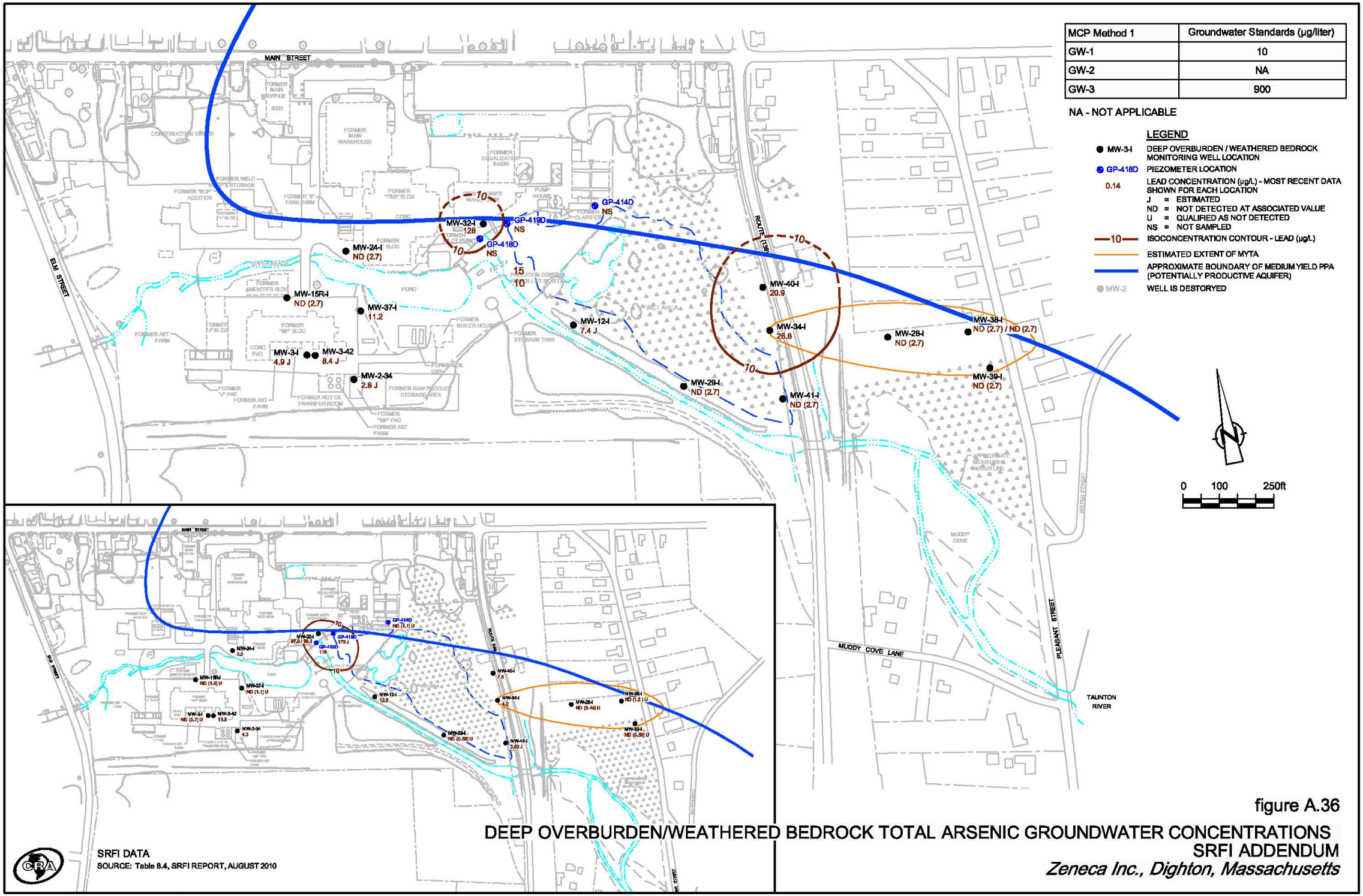


figure A.36

DEEP OVERBURDEN/WEATHERED BEDROCK TOTAL ARSENIC GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA036 DEC 14/2010

MCP Method 1	Groundwater Standards (µg/liter)
GW-1	15
GW-3	10

NA - NOT APPLICABLE

LEGEND

- MW-3-I — DEEP OVERBURDEN / WEATHERED BEDROCK MONITORING WELL LOCATION
- GP-418D — PIEZOMETER LOCATION
- 0.14 — LEAD CONCENTRATION (µg/L) - MOST RECENT DATA SHOWN FOR EACH LOCATION 2007 - 2009
  - J = ESTIMATED
  - ND = NOT DETECTED AT ASSOCIATED VALUE
  - U = QUALIFIED AS NOT DETECTED
  - NS = NOT SAMPLED
- 10 — ISOCONCENTRATION CONTOUR - LEAD (µg/L)
- ESTIMATED EXTENT OF MYTA
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- MW-2 — WELL IS DESTROYED

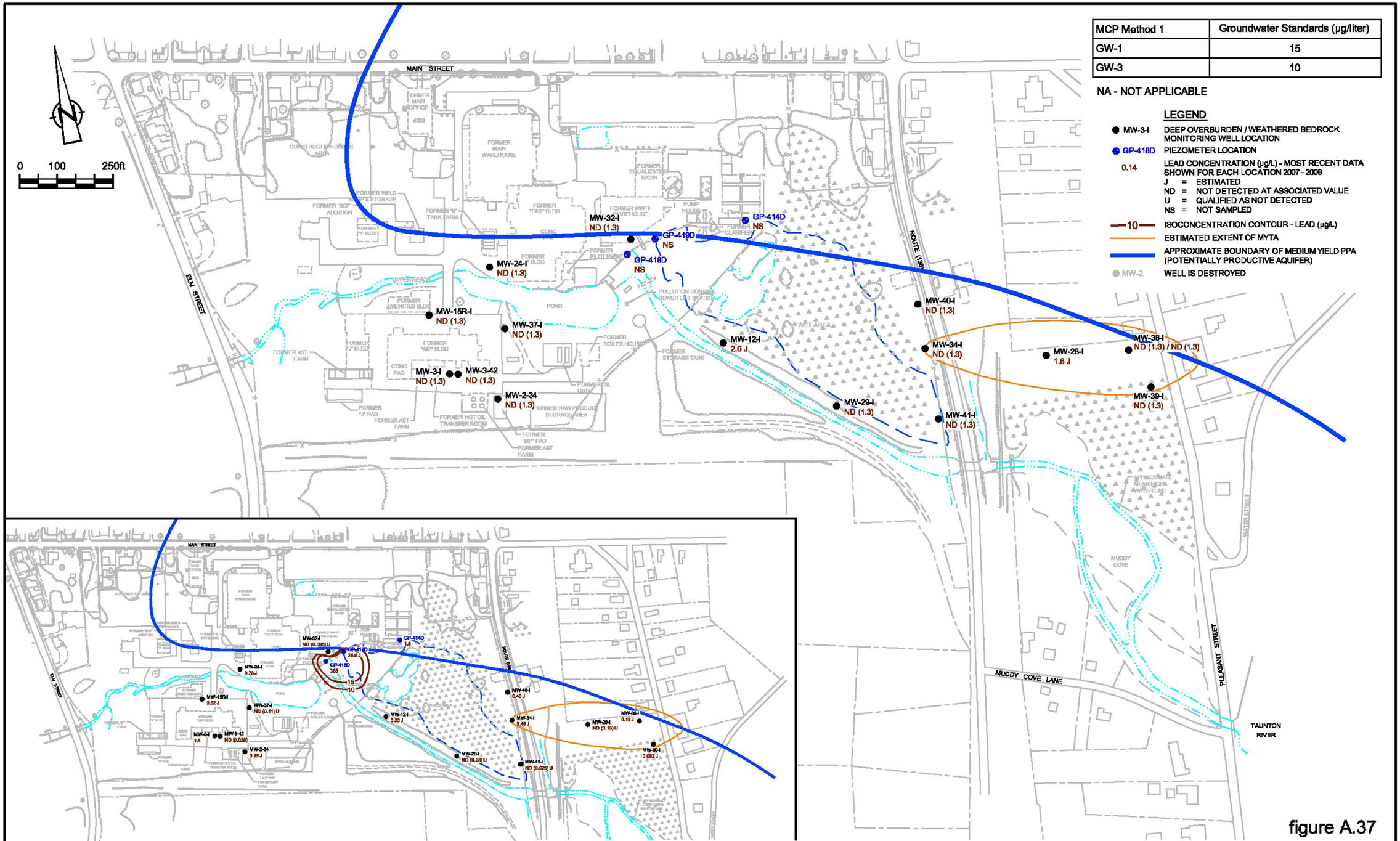


figure A.37

DEEP OVERBURDEN/WEATHERED BEDROCK TOTAL LEAD GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM
Zeneca Inc., Dighton, Massachusetts

SRFI DATA
SOURCE: figure 8.33
DEEP OVERBURDEN/WEATHERED BEDROCK TOTAL LEAD GROUNDWATER CONCENTRATIONS
SRFI REPORT, AUGUST 2010

15620-78(020)GN-WA037 DEC 14/2010

MCP Method 1	Groundwater Standards (µg/liter)
GW-1	2
GW-3	20

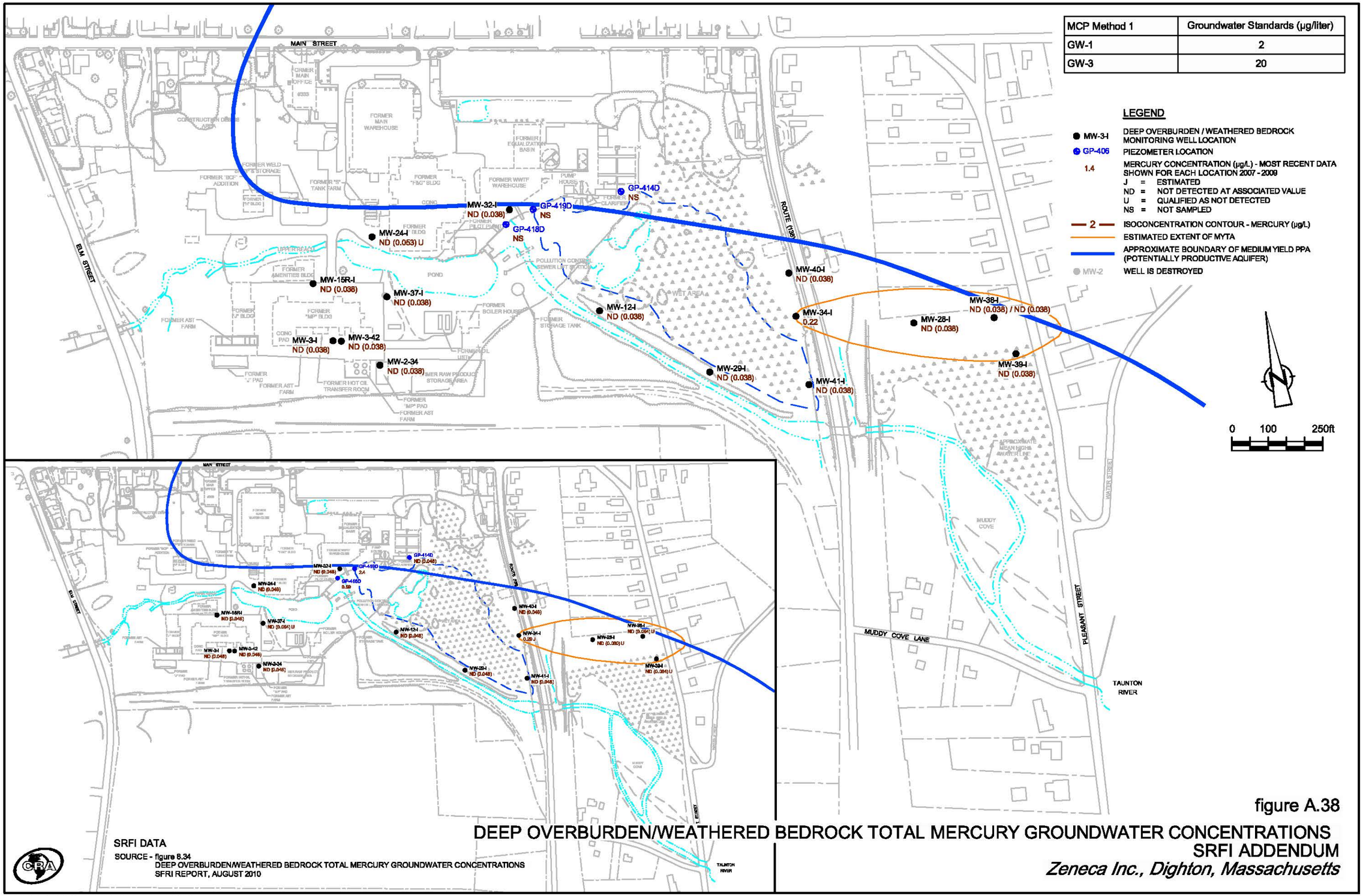
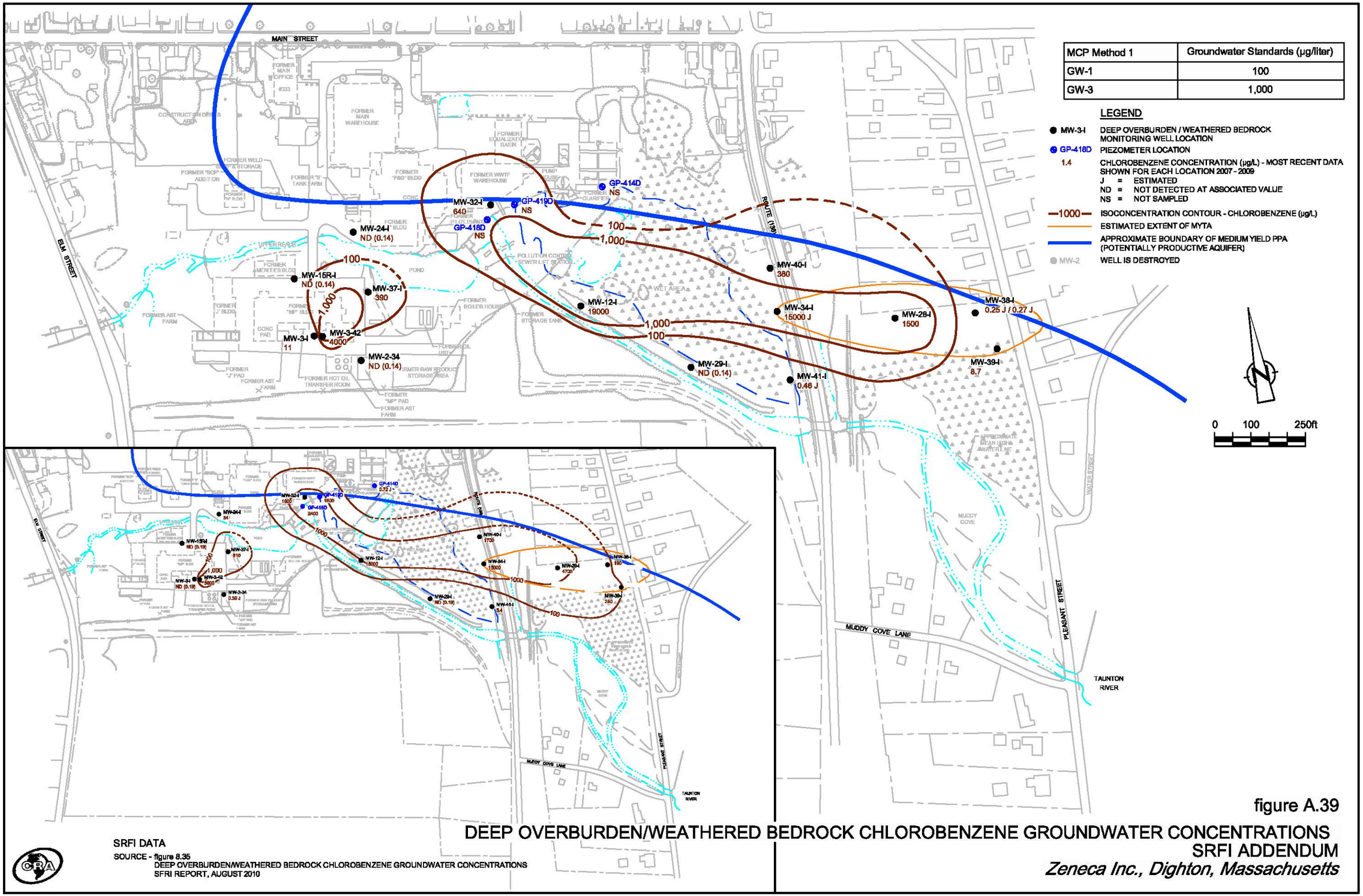


figure A.38

DEEP OVERBURDEN/WEATHERED BEDROCK TOTAL MERCURY GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA038 DEC 14/2010



MCP Method 1	Groundwater Standards (µg/liter)
GW-1	100
GW-3	1,000

LEGEND

- MW-3-I — DEEP OVERBURDEN / WEATHERED BEDROCK MONITORING WELL LOCATION
- GP-418D — PIEZOMETER LOCATION
- 1.4 — CHLOROBENZENE CONCENTRATION (µg/L) - MOST RECENT DATA SHOWN FOR EACH LOCATION 2007 - 2009
  - J = ESTIMATED
  - ND = NOT DETECTED AT ASSOCIATED VALUE
  - NS = NOT SAMPLED
- 1000 — ISOCONCENTRATION CONTOUR - CHLOROBENZENE (µg/L)
- ESTIMATED EXTENT OF MYTA
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- MW-2 — WELL IS DESTROYED

SRFI DATA

SOURCE - figure 8.35
DEEP OVERBURDEN/WEATHERED BEDROCK CHLOROBENZENE GROUNDWATER CONCENTRATIONS
SFRI REPORT, AUGUST 2010

figure A.39

DEEP OVERBURDEN/WEATHERED BEDROCK CHLOROBENZENE GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA039 DEC 14/2010

MCP Method 1	Calculated Groundwater Standards (µg/liter)
GW-1	3.9
GW-3	5,500

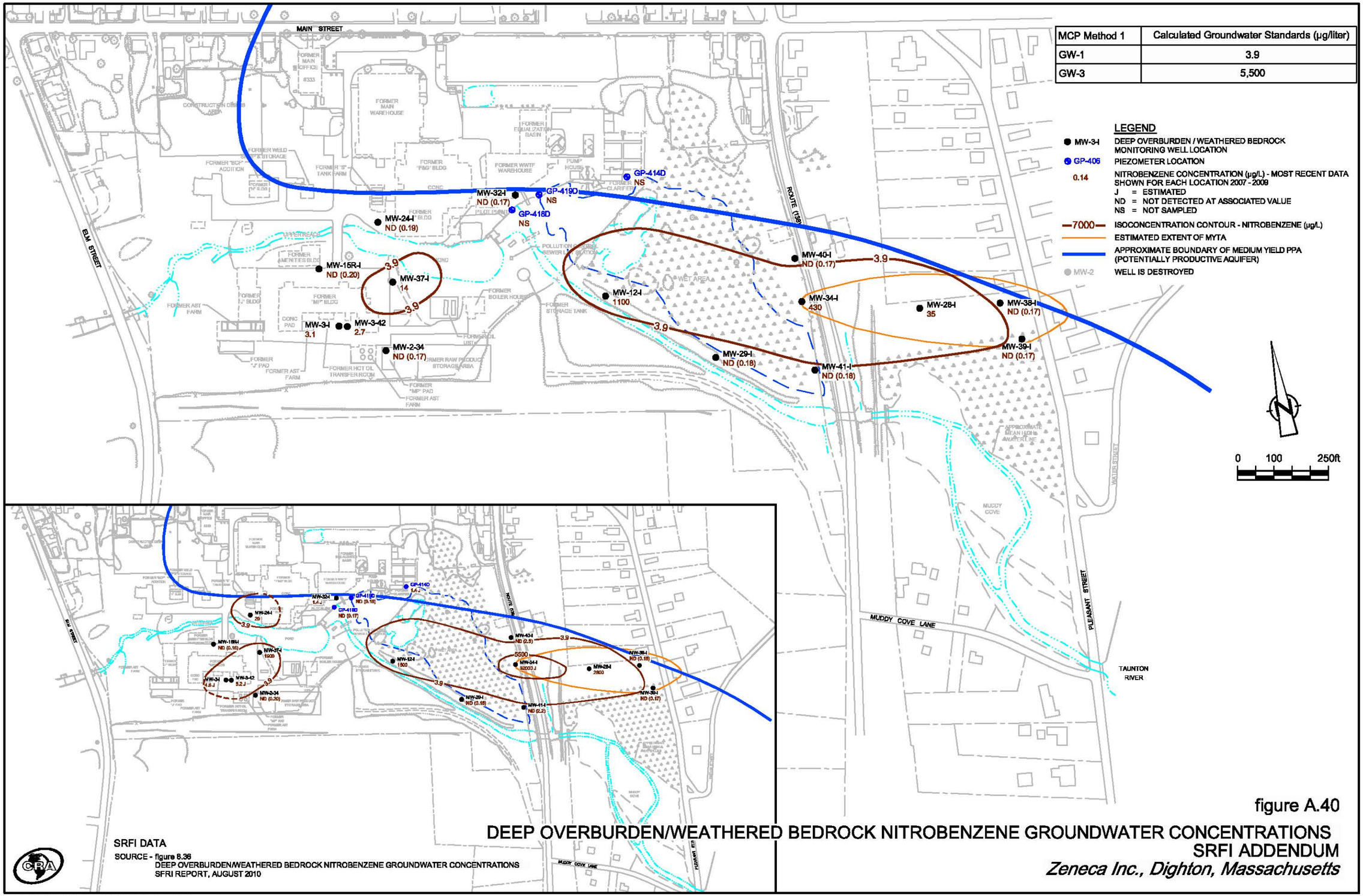
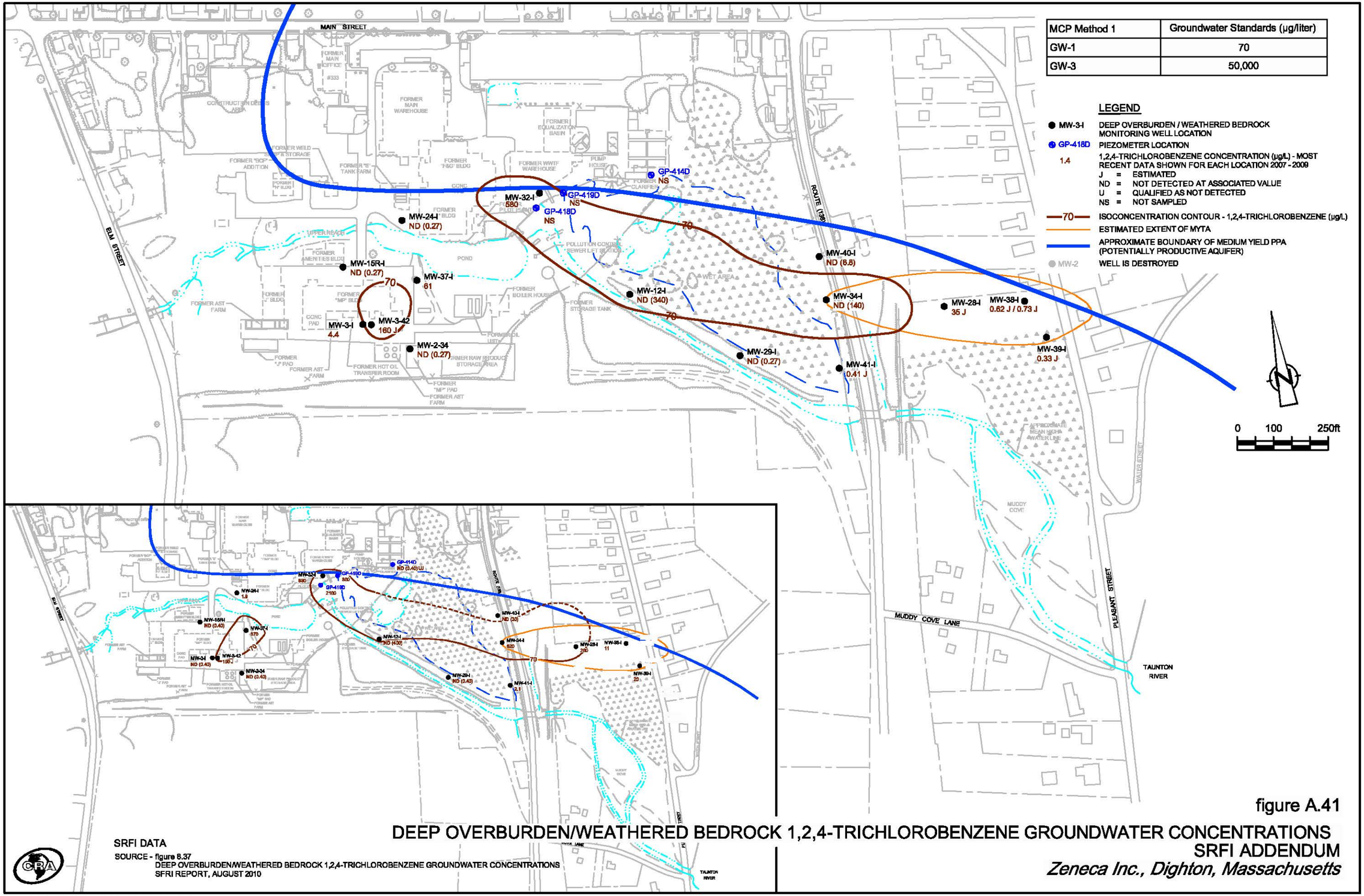


figure A.40

DEEP OVERBURDEN/WEATHERED BEDROCK NITROBENZENE GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA040 DEC 14/2010



MCP Method 1	Groundwater Standards (µg/liter)
GW-1	70
GW-3	50,000

LEGEND

- MW-3-I — DEEP OVERBURDEN / WEATHERED BEDROCK MONITORING WELL LOCATION
- GP-418D — PIEZOMETER LOCATION
- 1.4 — 1,2,4-TRICHLOROBENZENE CONCENTRATION (µg/L) - MOST RECENT DATA SHOWN FOR EACH LOCATION 2007 - 2009
  - J = ESTIMATED
  - ND = NOT DETECTED AT ASSOCIATED VALUE
  - U = QUALIFIED AS NOT DETECTED
  - NS = NOT SAMPLED
- 70 — ISOCONCENTRATION CONTOUR - 1,2,4-TRICHLOROBENZENE (µg/L)
- ESTIMATED EXTENT OF MYTA
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- MW-2 — WELL IS DESTROYED

SRFI DATA

SOURCE - figure 8.37
DEEP OVERBURDEN/WEATHERED BEDROCK 1,2,4-TRICHLOROBENZENE GROUNDWATER CONCENTRATIONS
SFRI REPORT, AUGUST 2010

figure A.41

DEEP OVERBURDEN/WEATHERED BEDROCK 1,2,4-TRICHLOROBENZENE GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA041 DEC 14/2010

MCP Method 1	Groundwater Standards (µg/liter)
GW-1	5
GW-3	5,000

LEGEND

- MW-24-I — MONITORING WELL LOCATION
- GP-414D — PIEZOMETER LOCATION
- 1.4 — TRICHLOROETHENE CONCENTRATION (µg/L) - MOST RECENT DATA SHOWN FOR EACH LOCATION 2007 - 2009
  - J = ESTIMATED
  - ND = NOT DETECTED AT ASSOCIATED VALUE
  - U = QUALIFIED AS NOT DETECTED
  - NS = NOT SAMPLED
- ESTIMATED EXTENT OF MYTA
- APPROXIMATE BOUNDARY OF MEDIUM YIELD PPA (POTENTIALLY PRODUCTIVE AQUIFER)
- MW-2 — WELL IS DESTROYED

0 100 250ft

figure A.42

DEEP OVERBURDEN/WEATHERED BEDROCK TRICHLOROETHENE GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM
Zeneca Inc., Dighton, Massachusetts

SRFI DATA
SOURCE - figure 8.38
DEEP OVERBURDEN/WEATHERED BEDROCK TRICHLOROETHENE GROUNDWATER CONCENTRATIONS
SFRI REPORT, AUGUST 2010

15620-78(020)GN-WA042 DEC 14/2010

MCP Method 1	Groundwater Standards (µg/liter)
GW-1	0.5
GW-3	10

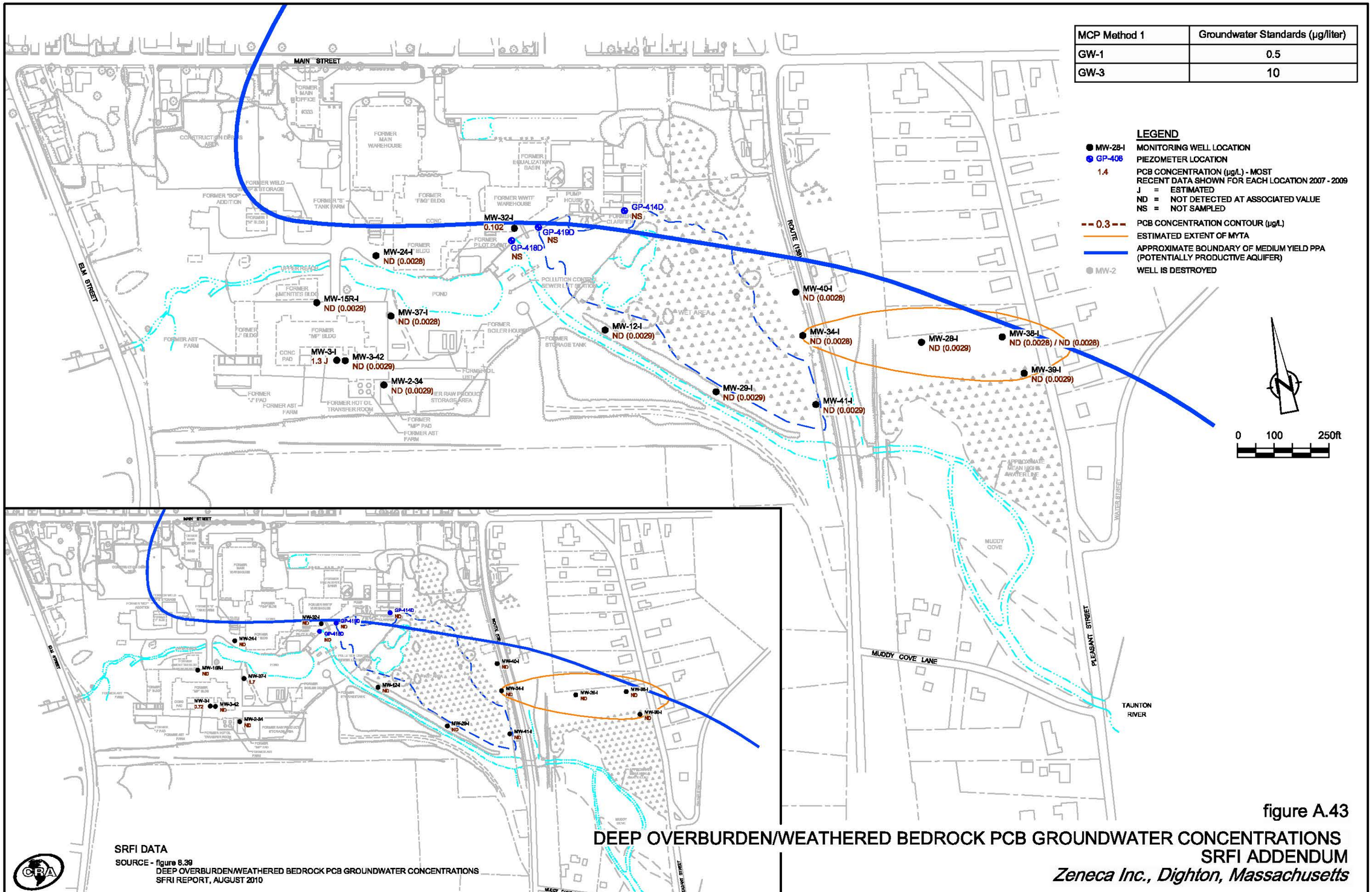


figure A.43

DEEP OVERBURDEN/WEATHERED BEDROCK PCB GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA043 DEC 14/2010

MCP Method 1	Groundwater Standard (µg/liter)
GW-3	900

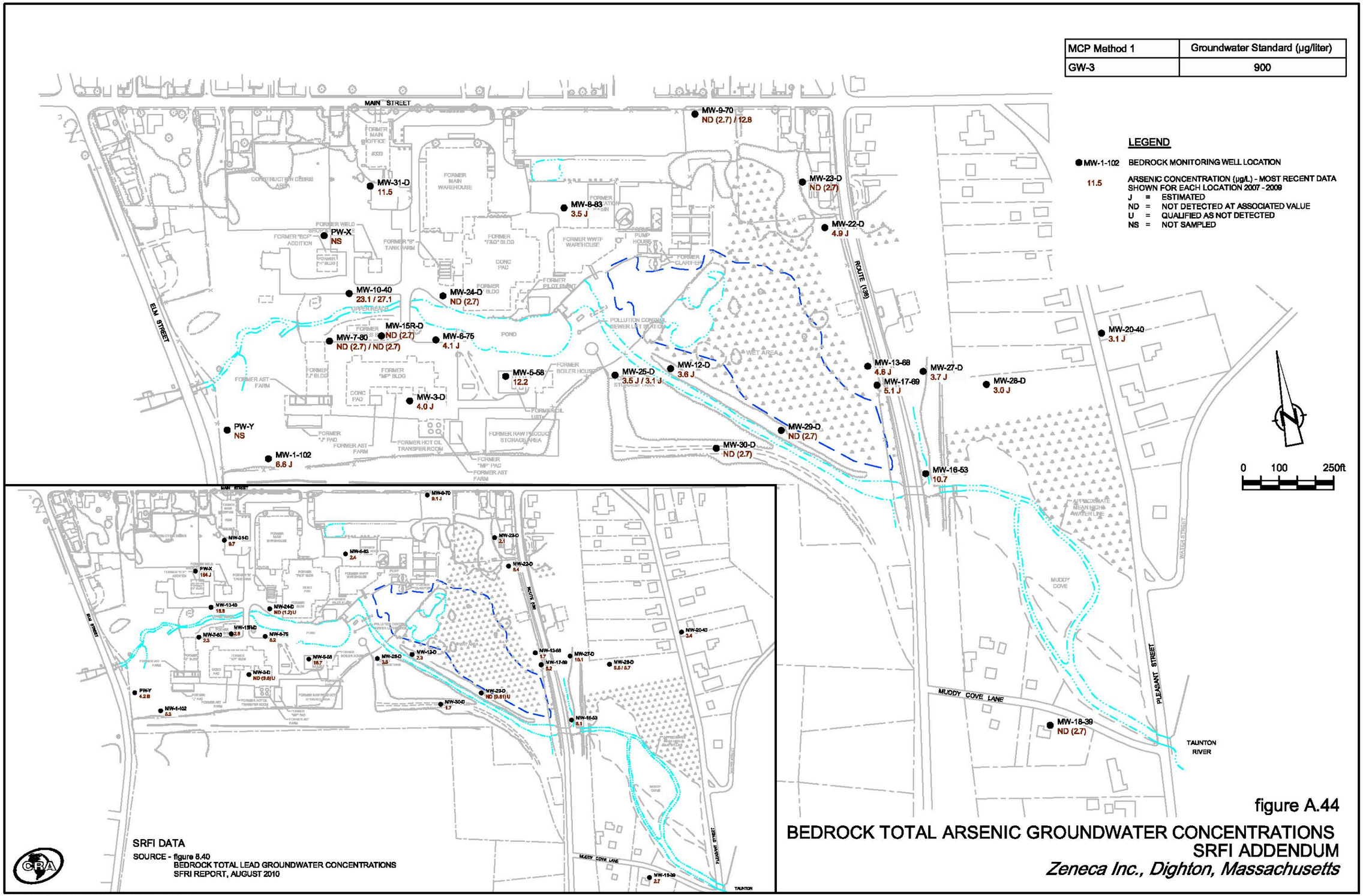


figure A.44

BEDROCK TOTAL ARSENIC GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM

Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA044 DEC 14/2010

MCP Method 1	Groundwater Standard (µg/liter)
GW-3	10

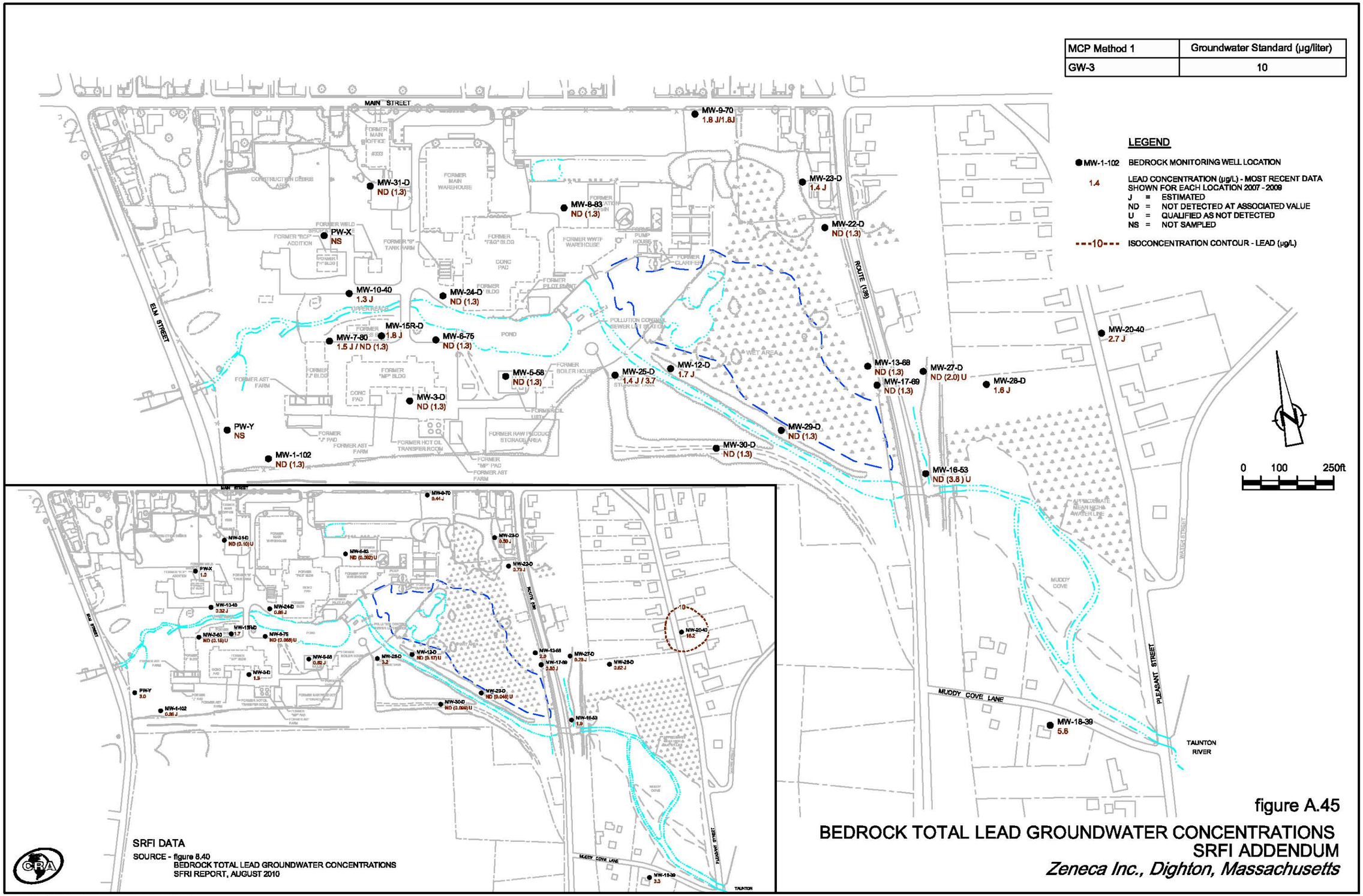


figure A.45

BEDROCK TOTAL LEAD GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM

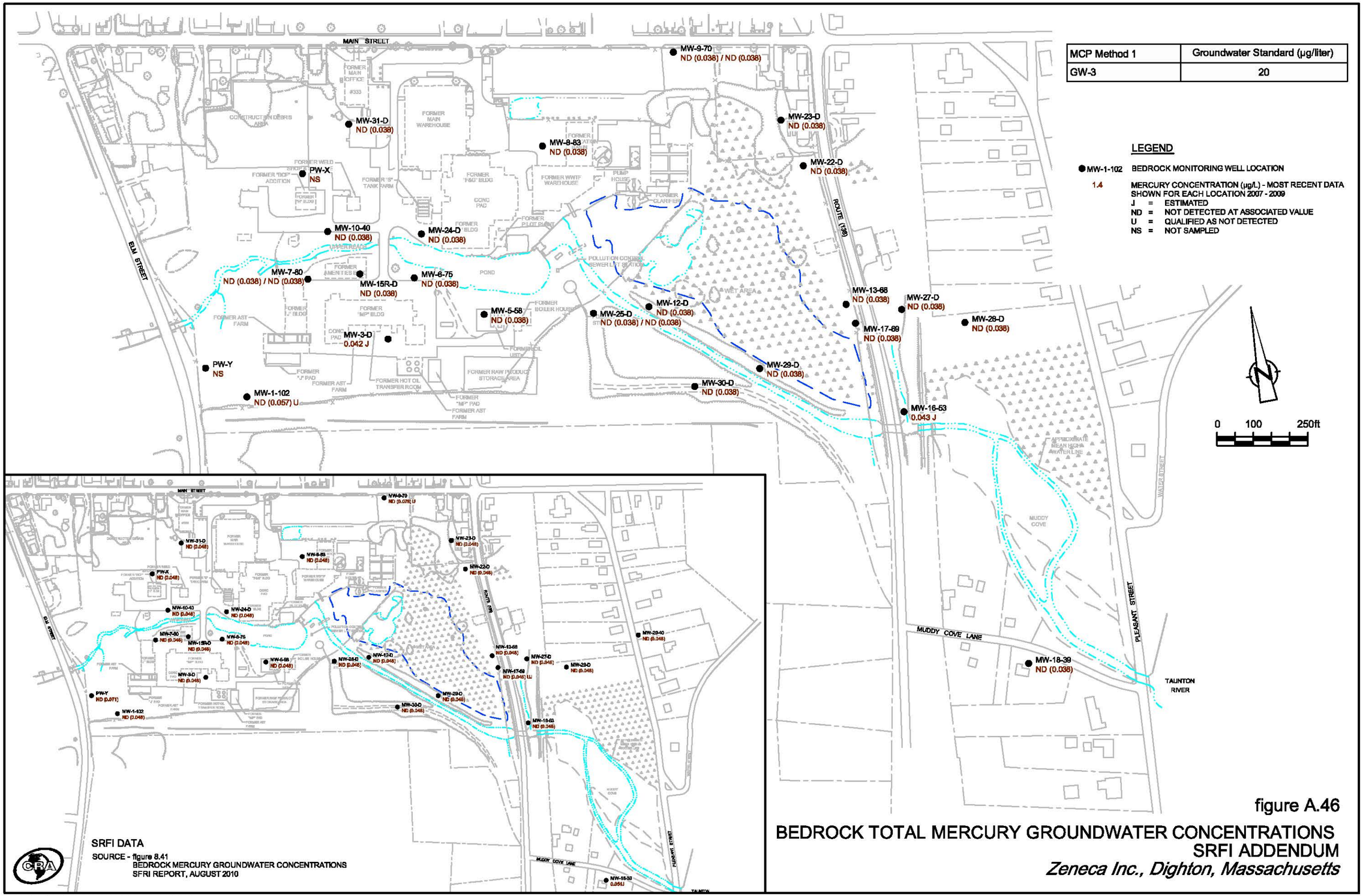
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA045 DEC 14/2010

MCP Method 1	Groundwater Standard (µg/liter)
GW-3	20

LEGEND

- ● MW-1-102 — BEDROCK MONITORING WELL LOCATION
- 1.4 — MERCURY CONCENTRATION (µg/L) - MOST RECENT DATA SHOWN FOR EACH LOCATION 2007 - 2009
  - J = ESTIMATED
  - ND = NOT DETECTED AT ASSOCIATED VALUE
  - U = QUALIFIED AS NOT DETECTED
  - NS = NOT SAMPLED



SRFI DATA

SOURCE - figure 8.41
BEDROCK MERCURY GROUNDWATER CONCENTRATIONS
SFRI REPORT, AUGUST 2010

CRA

figure A.46

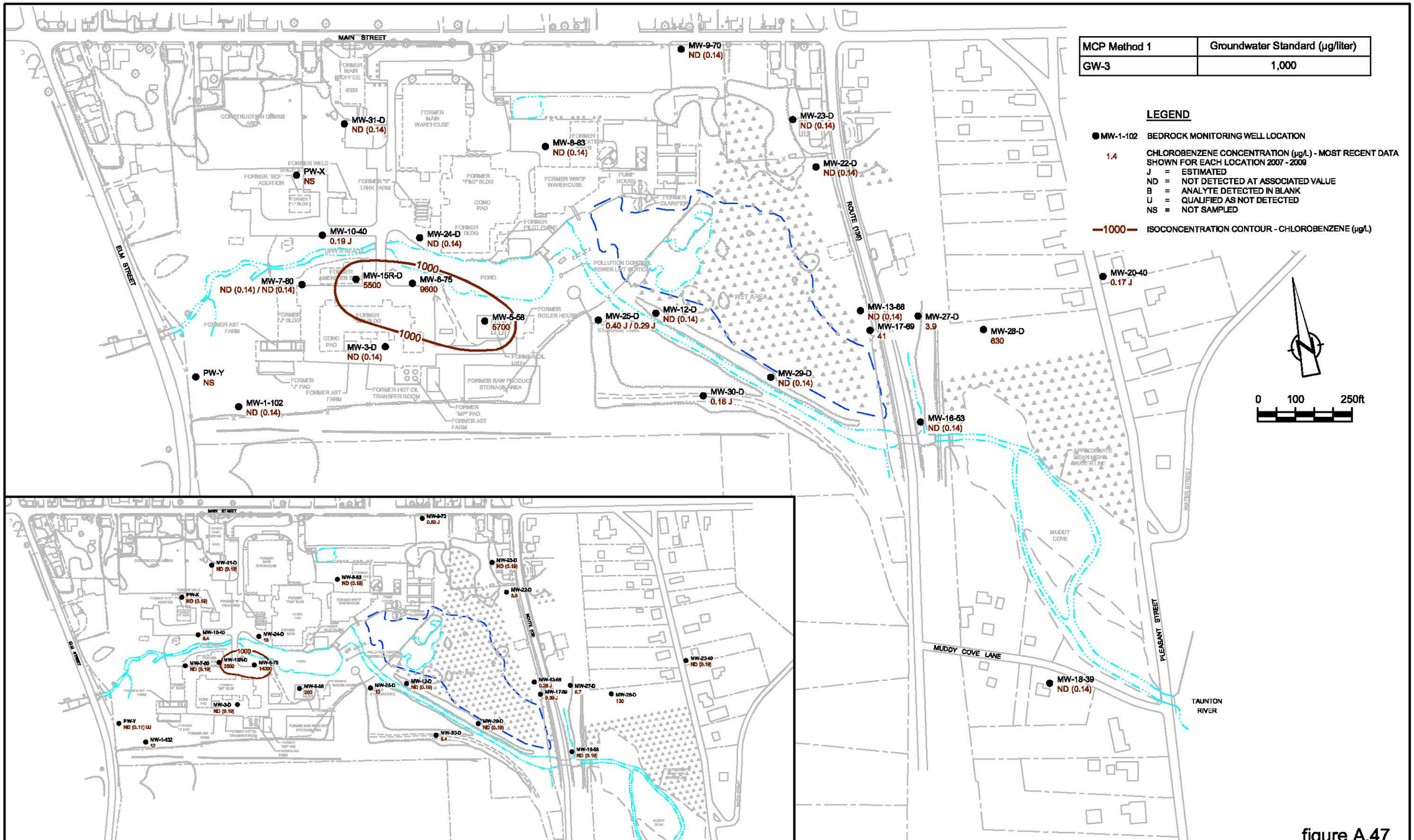
BEDROCK TOTAL MERCURY GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA059 DEC 14/2010

MCP Method 1	Groundwater Standard (µg/liter)
GW-3	1,000

LEGEND

- ● MW-1-102 — BEDROCK MONITORING WELL LOCATION
- 1.4 — CHLOROBENZENE CONCENTRATION (µg/L) - MOST RECENT DATA SHOWN FOR EACH LOCATION 2007 - 2009
  - J = ESTIMATED
  - ND = NOT DETECTED AT ASSOCIATED VALUE
  - B = ANALYTE DETECTED IN BLANK
  - U = QUALIFIED AS NOT DETECTED
  - NS = NOT SAMPLED
- —1000— ISOCONCENTRATION CONTOUR - CHLOROBENZENE (µg/L)



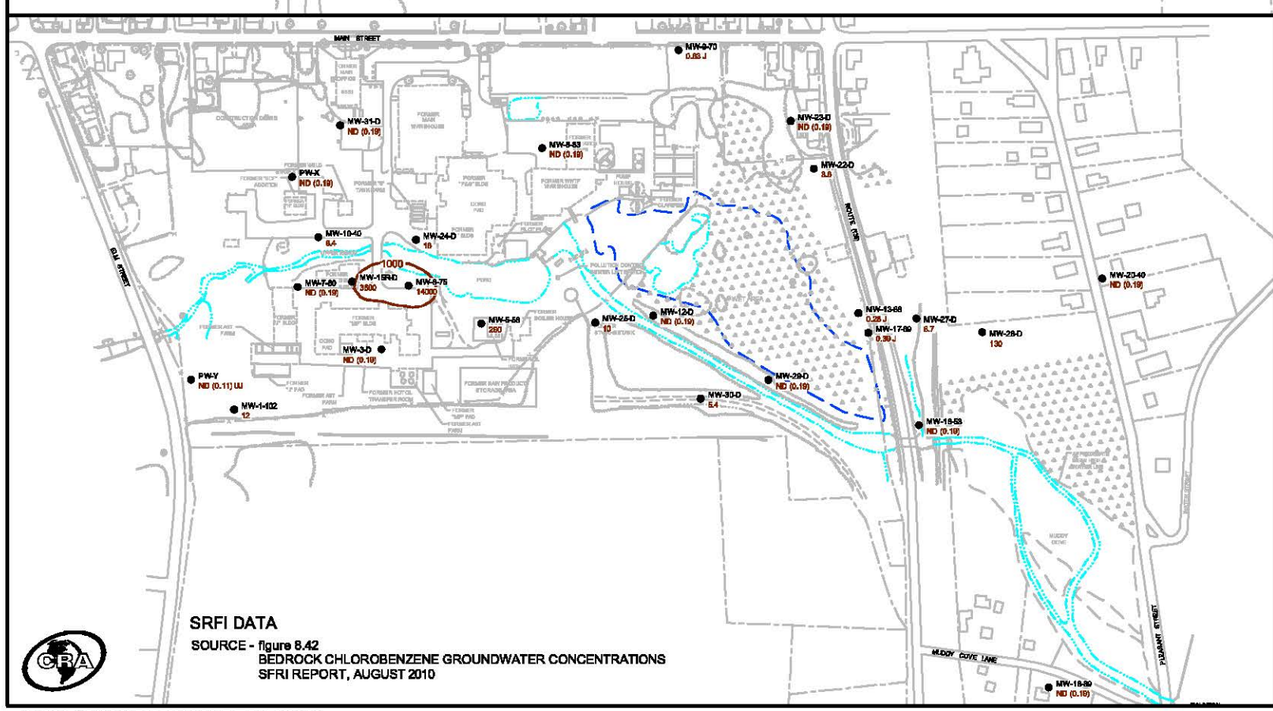


figure A.47

BEDROCK CHLOROBENZENE GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM

Zeneca Inc., Dighton, Massachusetts

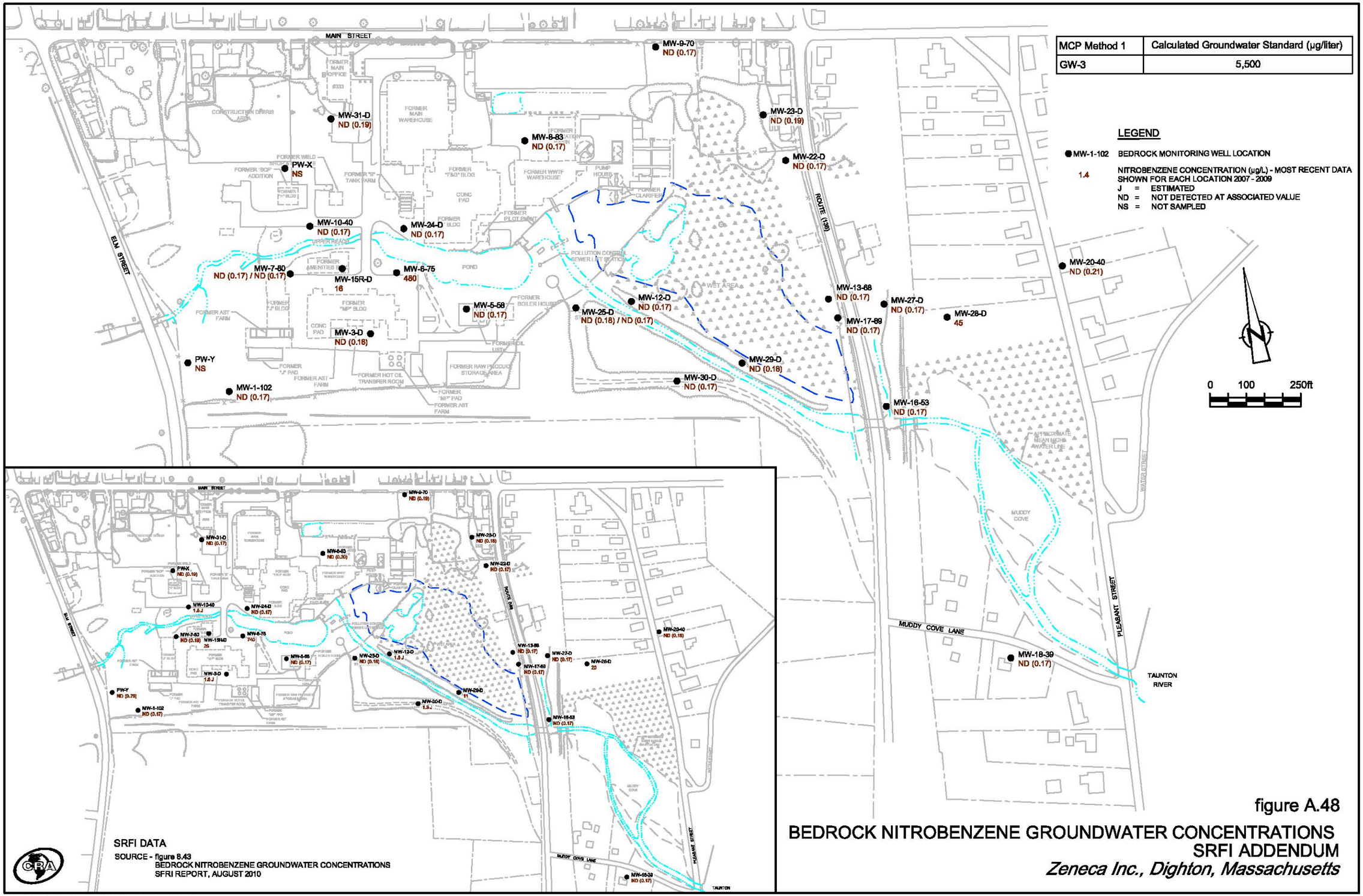
15620-78(020)GN-WA060 DEC 14/2010

MCP Method 1	Calculated Groundwater Standard (µg/liter)
GW-3	5,500

LEGEND

● MW-1-102 BEDROCK MONITORING WELL LOCATION

1.4 NITROBENZENE CONCENTRATION (µg/L) - MOST RECENT DATA SHOWN FOR EACH LOCATION 2007 - 2009
J = ESTIMATED
ND = NOT DETECTED AT ASSOCIATED VALUE
NS = NOT SAMPLED



SRFI DATA
SOURCE - figure 8.43
BEDROCK NITROBENZENE GROUNDWATER CONCENTRATIONS
SFRI REPORT, AUGUST 2010

figure A.48

BEDROCK NITROBENZENE GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA061 DEC 14/2010

MCP Method 1	Groundwater Standard (µg/liter)
GW-3	50,000

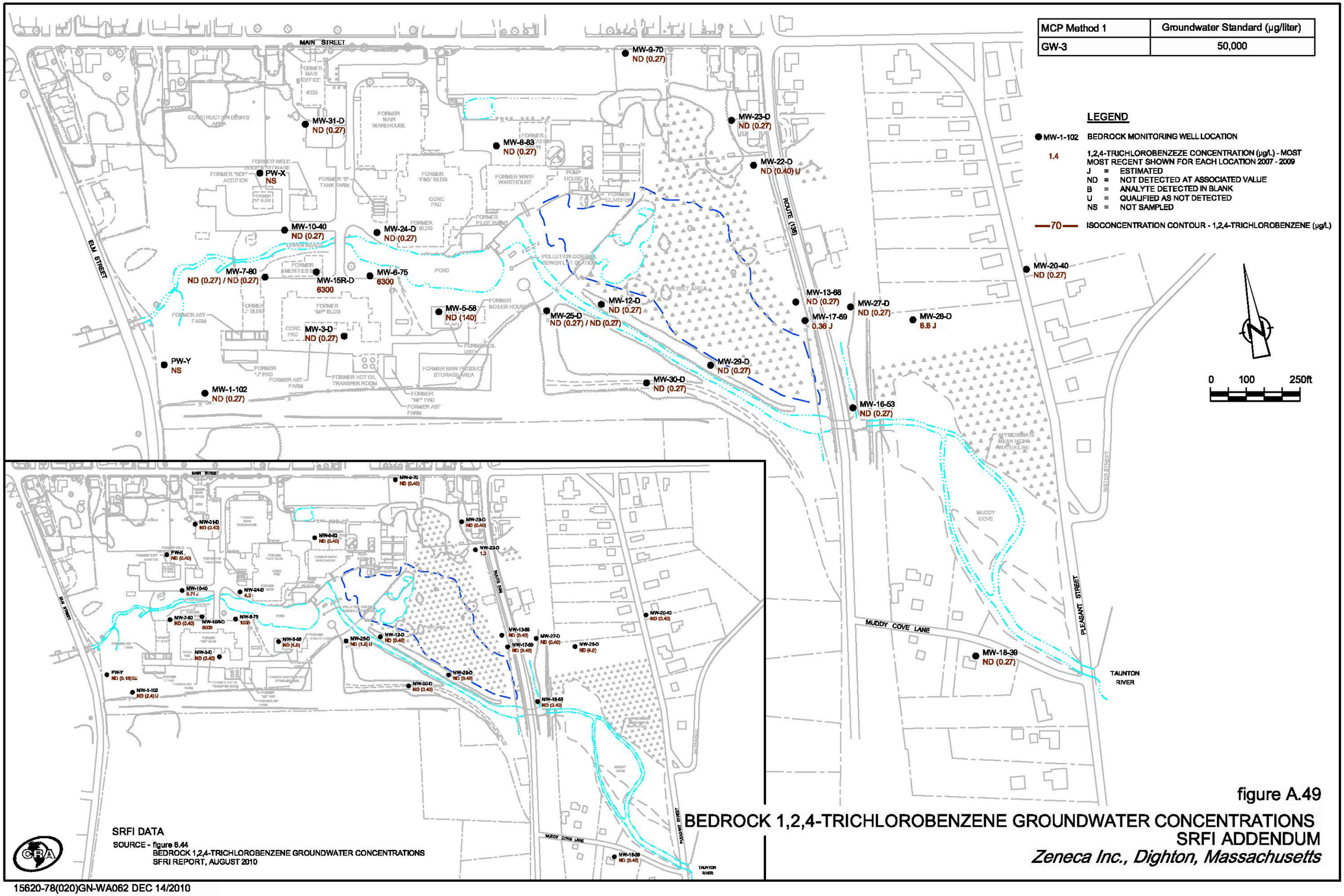


figure A.49

BEDROCK 1,2,4-TRICHLOROBENZENE GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA062 DEC 14/2010

MCP Method 1	Groundwater Standard (µ/liter)
GW-3	5,000

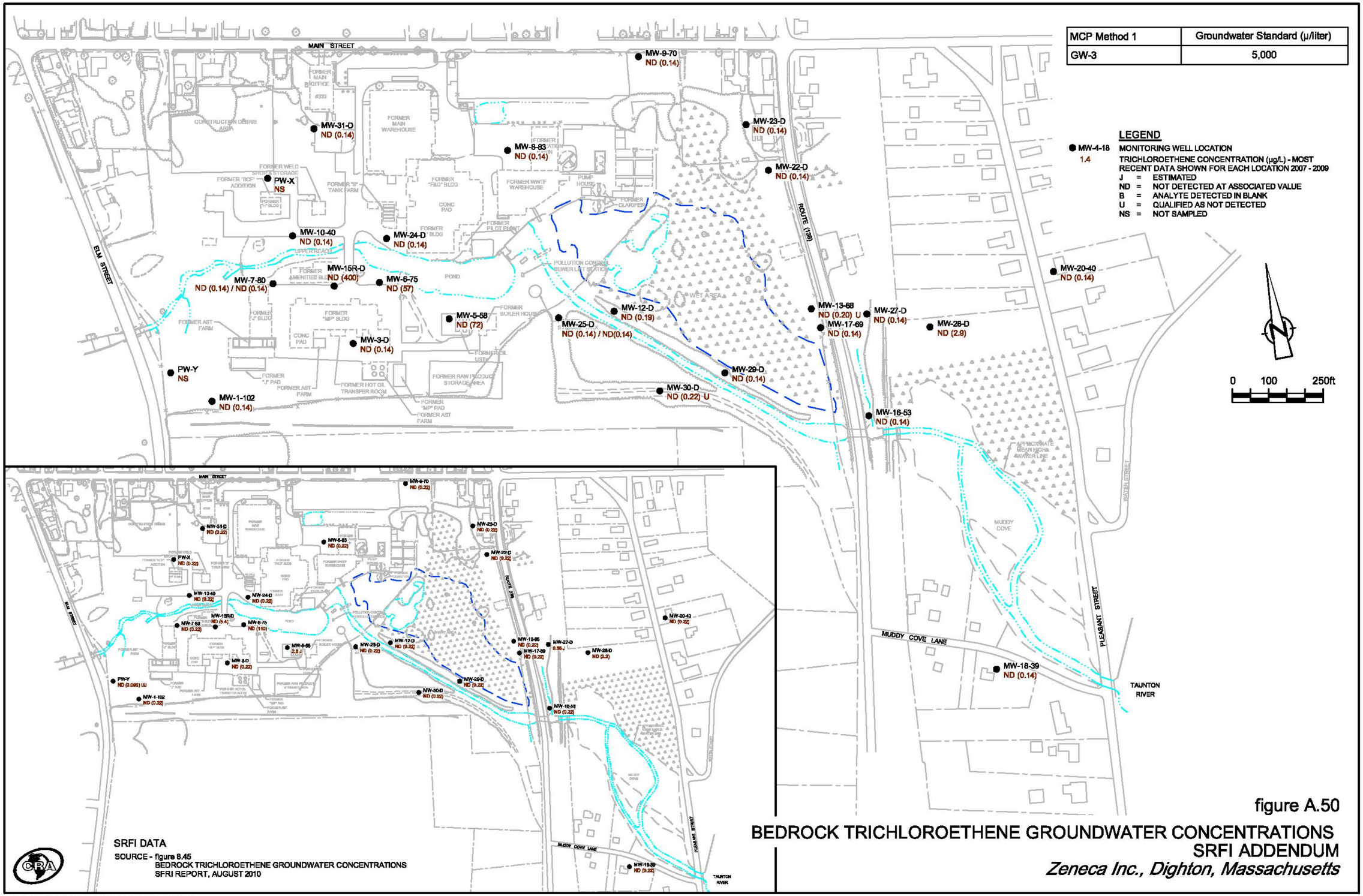


figure A.50

BEDROCK TRICHLOROETHENE GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM
Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA063 DEC 14/2010

MCP Method 1	Groundwater Standards (µg/liter)
GW-3	10

LEGEND

- MW-4-18 — MONITORING WELL LOCATION
- 1.4 — PCB CONCENTRATION (µg/L) - MOST RECENT DATA SHOWN FOR EACH LOCATION 2007 - 2009
- J = ESTIMATED
- ND = NOT DETECTED AT ASSOCIATED VALUE
- B = ANALYTE DETECTED IN BLANK
- NS = NOT SAMPLED

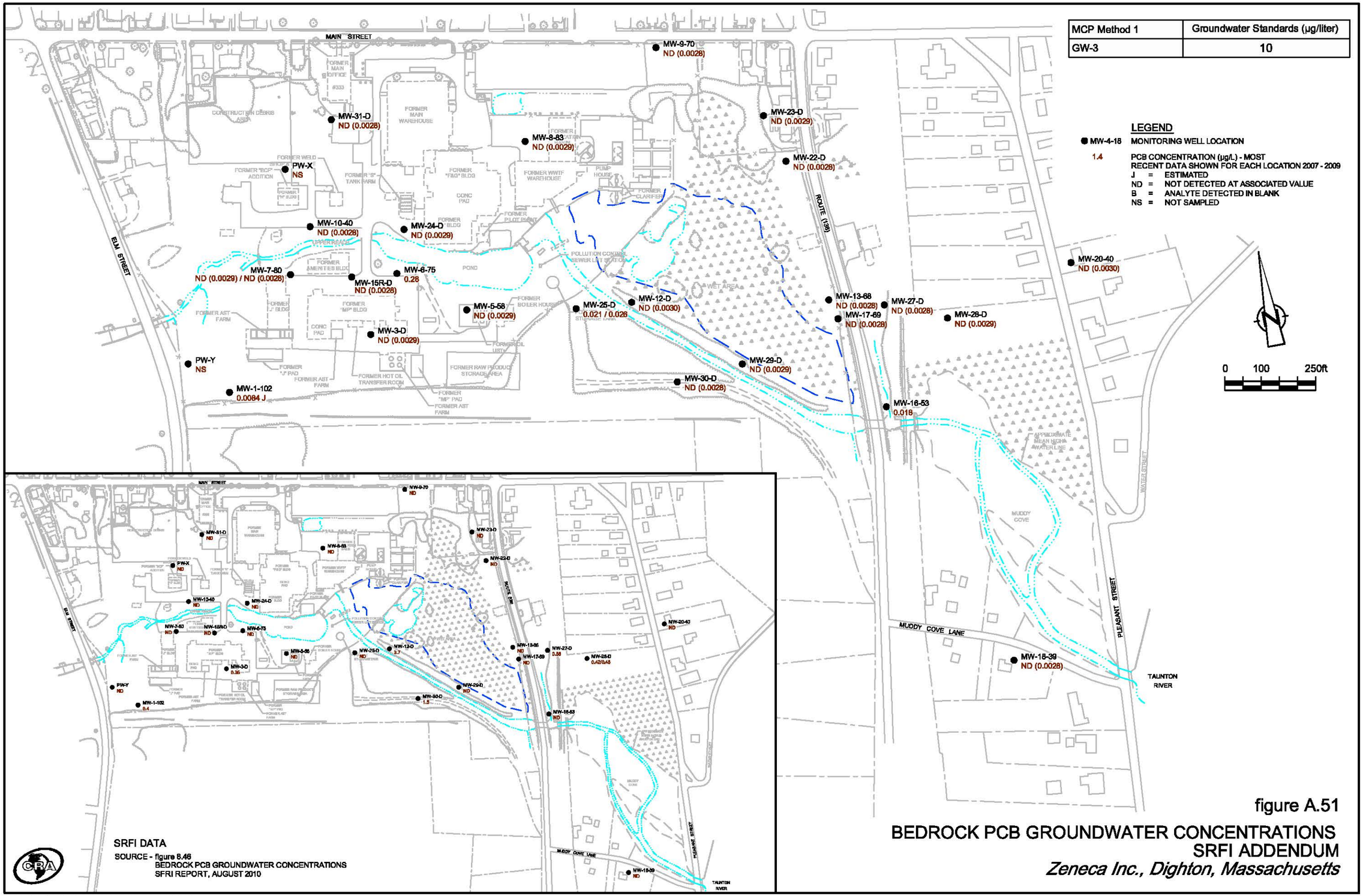


figure A.51

BEDROCK PCB GROUNDWATER CONCENTRATIONS
SRFI ADDENDUM

Zeneca Inc., Dighton, Massachusetts

15620-78(020)GN-WA064 DEC 14/2010

APPENDIX B

CALCULATIONS FOR MCP METHOD 1 CLEANUP LEVELS

TABLE B.1

MCP TABLE 1 - 310 CMR 40.0974 (2) METHOD 1 GROUNDWATER STANDARDS
ZENECA INC.
DIGHTON, MASSACHUSETTS

		Proposed Values [1]		
Oil and/or Hazardous Material	*CAS Number*	*GW-1 Standard µg/L (ppb)*	*GW-2 Standard µg/L (ppb)*	*GW-3 Standard µg/L (ppb)*
Aluminum	7429-90-5	200	--	50000
Copper	7440-50-8	1000	--	900
Manganese	7439-96-5	50	--	50000
Nitrobenzene	98-95-3	3.9	1407	5500
1,2,3-Trichlorobenzene	87-61-6	70	2047	50000
4-Nitrophenol	100-02-7	434	--	2.07
Iron	7439-89-6	300	--	25

Note:

(1) Calculated consistent with methods presented in February 2008 MCP Standards spreadsheet.

TABLE B.2

MCP TABLE 2 - 310 CMR 40.0974 (6)(a) METHOD 1 S-1 SOIL STANDARDS
ZENECA INC.
DIGHTON, MASSACHUSETTS

Oil and/or Hazardous Material	*CAS Number*	*Proposed [1] S-1 Soil & GW-1 µg/g (ppm)*	*Basis*	*Proposed [1] S-1 Soil & GW-2 µg/g (ppm)*	*Basis*	*Proposed [1] S-1 Soil & GW-3 µg/g (ppm)*	*Basis*
Aluminum	7429-90-5	1000	Ceiling (High)	1000	Ceiling (High)	1000	Ceiling (High)
Copper	7440-50-8	1000	Ceiling (High)	1000	Ceiling (High)	1000	Ceiling (High)
Manganese	7439-96-5	1000	Ceiling (High)	1000	Ceiling (High)	1000	Ceiling (High)
Nitrobenzene	98-95-3	22	Noncancer Risk	22	Noncancer Risk	22	Noncancer Risk
1,2,3-Trichlorobenzene	87-61-6	160	Leaching	66	Leaching	489	Noncancer Risk
4-Nitrophenol	100-02-7	89	Noncancer Risk	89	Noncancer Risk	89	Noncancer Risk
Iron	7439-89-6	1000	Ceiling (High)	1000	Ceiling (High)	1000	Ceiling (High)

Note:

(1) Calculated consistent with methods presented in February 2008 MCP Standards spreadsheet.

TABLE B.3

MCP TABLE 3 - 310 CMR 40.0975 (6)(b) METHOD 1 S-2 SOIL STANDARDS
ZENECA INC.
DIGHTON, MASSACHUSETTS

Oil and/or Hazardous Material	*CAS Number*	*Proposed (1) S-2 Soil & GW-1 µg/g (ppm)*	*Basis*	*Proposed (1) S-2 Soil & GW-2 µg/g (ppm)*	*Basis*	*Proposed (1) S-2 Soil & GW-3 µg/g (ppm)*	*Basis*
Aluminum	7429-90-5	3000	Ceiling (High)	3000	Ceiling (High)	3000	Ceiling (High)
Copper	7440-50-8	3000	Ceiling (High)	3000	Ceiling (High)	3000	Ceiling (High)
Manganese	7439-96-5	888	S-3 Standard	888	S-3 Standard	888	S-3 Standard
Nitrobenzene	98-95-3	40	S-3 Standard	40	S-3 Standard	40	S-3 Standard
1,2,3-Trichlorobenzene	87-61-6	160	Leaching	66	Leaching	900	S-3 Standard
4-Nitrophenol	100-02-7	1257	Noncancer Risk	1257	Noncancer Risk	1257	Noncancer Risk
Iron	7439-89-6	3000	Ceiling (High)	3000	Ceiling (High)	3000	Ceiling (High)

Note:

(1) Calculated consistent with methods presented in February 2008 MCP Standards spreadsheet.

TABLE B.4

MCP TABLE 4 - 310 CMR 40.0975 (6)(c) METHOD 1 S-3 SOIL STANDARDS
ZENECA INC.
DIGHTON, MASSACHUSETTS

Oil and/or Hazardous Material	*CAS Number*	*Proposed (1) S-3 Soil & GW-1 µg/g (ppm)*	*Basis*	*Proposed (1) S-3 Soil & GW-2 µg/g (ppm)*	*Basis*	*Proposed (1) S-3 Soil & GW-3 µg/g (ppm)*	*Basis*
Aluminum	7429-90-5	5000	Ceiling (High)	5000	Ceiling (High)	5000	Ceiling (High)
Copper	7440-50-8	5000	Ceiling (High)	5000	Ceiling (High)	5000	Ceiling (High)
Manganese	7439-96-5	888	Noncancer Risk	888	Noncancer Risk	888	Noncancer Risk
Nitrobenzene	98-95-3	40	Noncancer Risk	40	Noncancer Risk	40	Noncancer Risk
1,2,3-Trichlorobenzene	87-61-6	160	Leaching	66	Leaching	900	Noncancer Risk
4-Nitrophenol	100-02-7	162	Noncancer Risk	162	Noncancer Risk	162	Noncancer Risk
Iron	7439-89-6	5000	Ceiling (High)	5000	Ceiling (High)	5000	Ceiling (High)

Note:

(1) Calculated consistent with methods presented in February 2008 MCP Standards spreadsheet.

TABLE B.5

MCP TABLE 5 - 310 CMR 40.0985 (6) METHOD 2 - DIRECT CONTACT SOIL STANDARDS
ZENECA INC.
DIGHTON, MASSACHUSETTS

		S-1 (1)		*S-2 (1)*		*S-3 (1)*	
Oil and/or Hazardous Material	***CAS***	***S-1 (mg/kg)***	***Basis***	***S-2 (mg/kg)***	***Basis***	***S-3 (mg/kg)***	Basis
Aluminum	7429-90-5	1000	Ceiling (High)	3000	Ceiling (High)	5000	Ceiling (High)
Copper	7440-50-8	1000	Ceiling (High)	3000	Ceiling (High)	5000	Ceiling (High)
Manganese	7439-96-5	1000	Ceiling (High)	888	S-3 Standard	888	Noncancer Risk
Nitrobenzene	98-95-3	22	Noncancer Risk	40	S-3 Standard	40	Noncancer Risk
1,2,3-Trichlorobenzene	87-61-6	489	Noncancer Risk	900	S-3 Standard	900	Noncancer Risk
4-Nitrophenol	100-02-7	89	Noncancer Risk	1257	Noncancer Risk	162	Noncancer Risk
Iron	7439-89-6	1000	Ceiling (High)	3000	Ceiling (High)	5000	Ceiling (High)

Note:

(1) Calculated consistent with methods presented in February 2008 MCP Standards spreadsheet.

TABLE B.6

MCP TABLE 6 - 310 CMR 40.0996 (7) UPPER CONCENTRATION LIMITS IN GROUNDWATER AND SOIL
ZENECA INC.
DIGHTON, MASSACHUSETTS

Oil and/or Hazardous Material	*CAS Number*	*Proposed (1) UCLs in Groundwater µg/L (ppb)*	*Proposed (1) UCLs in Soil µg/g (ppm)*
Aluminum	7429-90-5	100000	10000
Copper	7440-50-8	10000	10000
Manganese	7439-96-5	100000	8881
Nitrobenzene	98-95-3	55000	405
1,2,3-Trichlorobenzene	87-61-6	100000	8999
4-Nitrophenol	100-02-7	4338	1621
Iron	7439-89-6	3000	10000

Note:

(1) Calculated consistent with methods presented in February 2008 MCP Standards spreadsheet.

TABLE B.7

REPORTABLE CONCENTRATIONS IN GROUNDWATER AND SOIL
ZENECA INC.
DIGHTON, MASSACHUSETTS

Oil and/or Hazardous Material	*CAS Number*	*RCGW-1 (1) µg/L (ppb)*	*RCGW-2 (1) µg/L (ppb)*	*RCS-1 (1) µg/g (ppm)*	*RCS-2 (1) µg/g (ppm)*
Aluminum	7429-90-5	200	50000	1000	3000
Copper	7440-50-8	900	900	1000	3000
Manganese	7439-96-5	50	50000	1000	888
Nitrobenzene	98-95-3	3.9	1407	22	40
1,2,3-Trichlorobenzene	87-61-6	70	2047	66	66
4-Nitrophenol	100-02-7	2.07	2	89	1257
Iron	7439-89-6	25	25	1000	3000

Note:

(1) Calculated consistent with methods presented in February 2008 MCP Standards spreadsheet.

TABLE B.8

GROUNDWATER PROTECTED FOR DRINKING WATER USE
ZENECA INC.
DIGHTON, MASSACHUSETTS

			RISK-BASED LEVELS														
			Non-Cancer				*Cancer*				*Standard,*			*Lowest*	*Highest*	**GW-1**	
			Hazard Index = 0.2				*ELCR= 1.0E-06*				*or Lowest*		*Lowest*	*Risk or Combined Exposure*		**Calculated Levels**	
	Existing					*Combined*				*Combined*	*Risk-Based,*		*Non-Cancer*	*Ceiling*	*Background*	**(Rounded)**	
	Standard	*Basis*	*Ingestion*	*Dermal*	*Inhalation*	*Exposure*	*Ingestion*	*Dermal*	*Inhalation*	*Exposure*	*Odor Threshold*		*or Cancer*	*Value*	*or PQL*		
Oil and/or Hazardous Materi	*µg/L*		*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*Basis*	*µg/L*	*µg/L*	*µg/L*	*µg/L*	*Basis*
Aluminum	200	SMCL		6.3E+05		6.3E+05	4.9E+00			4.9E+00	2.0E+02	SMCL	4.9E+00	2.0E+02	2.0E+02	2.0E+02	SMCL
Copper	1000	SMCL	3.1E+01	2.5E+04		3.1E+01					1.0E+03	SMCL	3.1E+01	1.0E+03	1.0E+03	1.0E+03	SMCL
Manganese	50	SMCL	1.0E+01	4.4E+04		1.0E+01	2.3E-02			2.3E-02	5.0E+01	SMCL	2.3E-02	5.0E+01	5.0E+01	5.0E+01	SMCL
Nitrobenzene			6.8E+02	2.6E+01	5.E+00	3.9E+00					3.9E+00	Noncancer	3.9E+00	3.9E+00	3.9E+00	3.9E+00	Noncancer
1,2,3-Trichlorobenzene	5000	SMCL	1.0E+03	2.7E+01	7.E+01	1.9E+01					5.0E+03	SMCL	1.9E+01	5.0E+03	5.0E+03	7.0E+01	SMCL
4-Nitrophenol			3.4E+03	5.0E+02		4.3E+02					4.3E+02	Noncancer	4.3E+02	4.3E+02	4.3E+02	7.0E+01	Noncancer
Iron	300	SMCL	1.4E+02	2.4E+04		1.4E+02					3.0E+02	SMCL	1.4E+02	3.0E+02	3.0E+02	7.0E+01	SMCL

TABLE B.9

DEVELOPMENT OF INHALATION COMPONENT OF GW-1, INHALATION EXPOSURES FROM SHOWERING
ZENECA INC.
DIGHTON, MASSACHUSETTS

			INTERIM CALCULATIONS								Drinking Water Concentrations Based on Inhalation Exposures Only	
	Henry's Law Constant	*Molecular Weight*	*Gas-Film Mass Transfer Coefficient*	*Liquid-Film Mass Transfer Coefficient*	*Overall Mass Transfer Coefficient*	*Adjusted Mass Transfer Coefficient*	*Concentration Leaving Water Droplet*	*Indoor Air Generation Rate*	*Exposure Factor Noncancer*	*Exposure Factor Cancer Risk*	Noncancer Risk	Cancer Risk
	HLC	*MW*	*kg*	*kl*	*KL*	*KaL*	*Cwd*	*S*	*EXPinh*	*EXPinh*		
Oil and/or Hazardous Materia	*atm-m³/mol*	*g/mole*	*cm/hr*	*cm/hr*	*cm/hr*	*cm/hr*	*µg/l*	*µg/(m³-min)*	*(µg/m³)/(µg/l)*	*(µg/m³)/(µg/l)*	µg/l	µg/l
Aluminum												
Copper												
Manganese												
Nitrobenzene	2.39E-05	123	1147.64	11.96	1.04	1.41	0.05	0.08	8.63E-02	3.24E-02	5.E+00	
1,2,3-Trichlorobenzene	1.42E-03	181	946.06	9.86	8.38	11.32	0.31	0.52	5.91E-01	2.22E-01	7.E+01	
4-Nitrophenol												
Iron												

TABLE B.10

DEVELOPMENT OF DERMAL COMPONENT OF GW-1, DERMAL DOSE INFORMATION
ZENECA INC.
DIGHTON, MASSACHUSETTS

Oil and/or Hazardous Material	*Ratio of perm. in strateum corneum to viable epidermis* *B*	*Lag Time (tau)* *hours*	*Effective Diffusivity of Chemical Transfer Through Skin* *Dsc*	*Time to Reach Steady State t* hours*	*t* when B>0.6*	*b*	*c*	*Absorbed Dose per event per area skin exposed per µg/L DAevent (mg/cm2-event)/(µg/L)* *Noncancer*	*Cancer*	*Outside Effective Predictive Domain*	*"Fraction Absorbed"* *FA*
Aluminum		0.105	1.58E-06			3.0E-01	3.3E-01	7.62E-10	6.33E-10		1.0
Copper		0.105	1.58E-06			3.0E-01	3.3E-01	7.62E-10	6.33E-10		1.0
Manganese		0.105	1.58E-06			3.0E-01	3.3E-01	7.62E-10	6.33E-10		1.0
Nitrobenzene	2.26E-02	0.514	3.24E-07	1.23		3.2E-01	3.5E-01	9.16E-09	8.35E-09		1.0
1,2,3-Trichlorobenzene	3.69E-01	1.085	1.54E-07	2.60		5.8E-01	6.1E-01	1.79E-07	1.63E-07		1.0
4-Nitrophenol	4.53E-03	0.631	2.64E-07	1.52		3.1E-01	3.4E-01	1.92E-09	1.75E-09		1.0
Iron	1.39E-02	0.216	7.71E-07	0.52		3.1E-01	3.4E-01	5.92E-09	5.30E-09		1.0

TABLE B.10

DEVELOPMENT OF DERMAL COMPONENT OF GW-1, DERMAL DOSE INFORMATION
ZENECA INC.
DIGHTON, MASSACHUSETTS

Oil and/or Hazardous Material	*Absorbed Dose per event per area skin exposed per µg/L DAevent (mg/cm2-event)/(µg/L) Considering FA term* DA_{event} *Noncancer*	*Cancer*	*Equation used to calculate risk for noncancer*	*Equation used to calculate risk for cancer*	*Dermal Multiplier for chemicals outside Effective Predictive Domain DM*	**Dermal Based Drinking Water Levels** Noncancer µg/L	Cancer µg/L
Aluminum	7.62E-10	6.33E-10	Reduced Steady State			6.25E+05	
Copper	7.62E-10	6.33E-10	Reduced Steady State			2.50E+04	
Manganese	7.62E-10	6.33E-10	Reduced Steady State			4.38E+04	
Nitrobenzene	9.16E-09	8.35E-09	Non-Steady State	Non-Steady State		2.60E+01	
1,2,3-Trichlorobenzene	1.79E-07	1.63E-07	Non-Steady State	Non-Steady State		2.66E+01	
4-Nitrophenol	1.92E-09	1.75E-09	Non-Steady State	Non-Steady State		4.97E+02	
Iron	5.92E-09	5.30E-09	Steady State	Steady State		2.41E+04	

TABLE B.11

DEVELOPMENT OF GW-2, GROUNDWATER PROTECTED FOR INDOOR AIR
ZENECA INC.
DIGHTON, MASSACHUSETTS

	Risk-Based Indoor Air Levels					*Target*		*Alpa*	*Henry's law constant at*
	Non-cancer	*Cancer*	*50%*	*Lowest*	*Background*	*Indoor*		*Attenuation*	*ave. groundwater*
	HI =	*ELCR=*	*Odor*	*Risk-Based*	*Indoor*	*Air Level*		*Factor (1)*	*temperature,*
	0.2	*1.E-06*	*Threshold*	*Level*	*Air Level*			*α*	*H'_{TS}*
Oil and/or Hazardous Material	*μg/m³*	*μg/m³*	*μg/m³*	*μg/m³*	*μg/m³*	*μg/m³*	*Basis*	*dimensionless*	*dimensionless*
Aluminum	1.00E+00			1.00E+00		1	Threshold Risk		
Copper									
Manganese	1.00E-02			1.00E-02		0.01	Threshold Risk		
Nitrobenzene	4.00E-01			4.00E-01		0.4	Threshold Risk	9.12E-04	3.12E-04
1,2,3-Trichlorobenzene	4.00E+01		11000	4.00E+01		40	Threshold Risk	7.53E-04	2.60E-02
4-Nitrophenol									
Iron									

Notes:

(1) See Table B.14 for development of Alpha attenuation factor.

TABLE B.11

DEVELOPMENT OF GW-2, GROUNDWATER PROTECTED FOR INDOOR AIR
ZENECA INC.
DIGHTON, MASSACHUSETTS

Oil and/or Hazardous Material	*Units Conversion Factor*	*DEP Dilution, Degradation Factor (d)*	*Target Groundwater Value*	*Lowest Target GW Value, Ceiling Value, Solubility*		*Highest, Column Q, Background, PQL*	GW-2 Calculated Levels (Rounded)	
	L/m³	*dimensionless*	*µg/L*	*µg/L*	*Basis*	*µg/L*	µg/L	Basis
Aluminum	1000	1						NA
Copper	1000	1						NA
Manganese	1000	1						NA
Nitrobenzene	1000	1	1.41E+03	1.41E+03	Threshold Risk	1.41E+03	1.E+03	Threshold Risk
1,2,3-Trichlorobenzene	1000	1	2.05E+03	2.05E+03	Threshold Risk	2.05E+03	2.E+03	Threshold Risk
4-Nitrophenol	1000	1						NA
Iron	1000	1						NA

Note:

(1) See Table B.14 for development of Alpha attenuation factor.

TABLE B.12

DEVELOPMENT OF GW-3, GROUNDWATER PROTECTED FOR ECOLOGICAL
ZENECA INC.
DIGHTON, MASSACHUSETTS

Oil and/or Hazardous Material	*Lowest Ecologically Based Criteria µg/L*	*Basis*	*GW -> SW dilution factor D_{sw}*	*In GW attenuation factor D_{gw}*	*Target GW Value adjusted for dilution/ attenuation µg/L*	*Lowest Adjusted AWQC, Ceiling µg/L*	*Highest GW AF, Background, or PQL µg/L*	**GW-3 Calculated Levels (Rounded)**	
								µg/L	**Basis**
Aluminum			10	2.5		50000	5.000E+04	5.E+04	Ceiling
Copper	36	CMC(SW)/10	10	2.5	900	900	9.000E+02	9.E+02	CMC(SW)/10
Manganese			10	2.5		50000	5.000E+04	5.E+04	Ceiling
Nitrobenzene	220	Chronic	10	2.5	5500	5500	5.500E+03	6.E+03	Chronic
1,2,3-Trichlorobenzene	340	chronic LOEC	10	25	85000	50000	5.000E+04	5.E+04	Ceiling
4-Nitrophenol	0.0828	Chronic	10	2.5	2.07	2.07	2.070E+00	2.E+00	Chronic
Iron	1	Chronic	10	2.5	25	25	2.500E+01	3.E+01	Chronic

TABLE B.13

IDENTIFICATION OF SURFACE WATER BENCHMARKS USED AS GW-3 TARGET VALUES
ZENECA INC.
DIGHTON, MASSACHUSETTS

		Candidate Ecological Benchmarks										
		Ecological NAWQC [1]										
		Freshwater				*Saltwater*				*Lowest*	*Lowest Chronic*	
Chemical	*CASRN*	*CMC(FW) (ug/L)*		*CCC(FW) (ug/L)*		*CMC(SW) (ug/L)*		*CCC(SW) (ug/L)*		*NAWQC (ug/L)*	*Value or Estimated Chronic Value*	*NAWQC basis*
Aluminum	7429-90-5											
Copper	7440-50-8	13		9		4.8		3.1		36	36	CMC(SW)/10
Manganese	7439-96-5											
Nitrobenzene	98-95-3											
1,2,3-Trichlorobenzene [3]	87-61-6											
4-Nitrophenol	100-02-7											
Iron	7439-89-6			1						1	1	CCC(FW)

Notes:

AQUIRE = Aquatic Toxicity Information Retrieval Database http://www.epa.gov/ecotox/
CASRN = Chemical Abstracts Service Registry Number
CCC = Criterion Continuous Concentration
CMC = Criterion Maximum Concentration
FW = Freshwater
NAWQC = National Ambient Water Quality Criterion
ORNL = Oak Ridge National Laboratory
SW = Saltwater
[1] All values from EPA (1999) unless specified otherwise
[2] All values from AQUIRE unless specified otherwise
[5] Values from Talmadge (1998)
[(a)] Criterion is dependent on hardness, calculated for 20 mg/L hardness, as $CaCO_3$
[(b)] Criterion dependent on pH, value of 7.8 used
[(c)] Acute values are divided by 10 to estimate chronic values

Surface water benchmark for derivation of GW-3 Standard is selected according to following sequence:
1. Select lowest NAWQC for environmental effects in saltwater or freshwater (CMC, CCC).
2. If above unavailable, select lowest chronic value from AQUIRE as ecological benchmark.
3. If all above unavailable, select lowest acute value from AQUIRE as ecological benchmark.
4. If all above unavailable, select lowest chronic value from ORNL (Suter and Tsao, 1996) or others as ecological benchmark.
5. If all above unavailable, select lowest chronic Tier II value from ORNL (Suter and Tsao, 1996) or others as ecological benchmark.
6. If only an acute value has been selected after steps 1-5, divide the acute value by 10 to estimate a chronic value as ecological benchmark.
7. Select surface water benchmark as the lower of the selected ecological benchmark or the NAWQC for fish consumption.

TABLE B.13

IDENTIFICATION OF SURFACE WATER BENCHMARKS USED AS GW-3 TARGET VALUES
ZENECA INC.
DIGHTON, MASSACHUSETTS

	Candidate Ecological Benchmarks								
	AQUIRE Referenced Lowest Toxicity Value [4]				*Value from Alternative Source*				
Chemical	*Chronic (ug/L)*	*Acute (ug/L)*	*Acute Value Divided by 10 (ug/L)*	*Final Value From AQUIRE (ug/L)*	*(ug/L) Chronic*	*Acute (ug/L)*	*Adjusted Acute (ug/L)*	*Value from Alternative Reference (ug/L)*	*Alternative Source*
Aluminum									
Copper									
Manganese									
Nitrobenzene					220			220	Region V
1,2,3-Trichlorobenzene	340			340					
4-Nitrophenol					0.0828	0.828		0.0828	Region IV
Iron					1			1	Region IV

Notes:

AQUIRE = Aquatic Toxicity Information Retrieval Database http://www.epa.gov/ecotox/
CASRN = Chemical Abstracts Service Registry Number
CCC = Criterion Continuous Concentration
CMC = Criterion Maximum Concentration
FW = Freshwater
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ORNL = Oak Ridge National Laboratory
SW = Saltwater
[1] All values from EPA (1999) unless specified otherwise
[2] All values from AQUIRE unless specified otherwise
[5] Values from Talmadge (1998)
[(a)] Criterion is dependent on hardness, calculated for 20 mg/L hardness, as $CaCO_3$
[(b)] Criterion dependent on pH, value of 7.8 used
[(c)] Acute values are divided by 10 to estimate chronic values

Surface water benchmark for derivation of GW-3 Standard is selected according to following sequence:
1. Select lowest NAWQC for environmental effects in saltwater or freshwater (CMC, CCC).
2. If above unavailable, select lowest chronic value from AQUIRE as ecological benchmark.
3. If all above unavailable, select lowest acute value from AQUIRE as ecological benchmark.
4. If all above unavailable, select lowest chronic value from ORNL (Suter and Tsao, 1996) or others as ecological benchmark.
5. If all above unavailable, select lowest chronic Tier II value from ORNL (Suter and Tsao, 1996) or others as ecological benchmark.
6. If only an acute value has been selected after steps 1-5, divide the acute value by 10 to estimate a chronic value as ecological benchmark.
7. Select surface water benchmark as the lower of the selected ecological benchmark or the NAWQC for fish consumption.

TABLE B.13

IDENTIFICATION OF SURFACE WATER BENCHMARKS USED AS GW-3 TARGET VALUES
ZENECA INC.
DIGHTON, MASSACHUSETTS

	Benchmarks Selected as Target Values			*Toxicity Test for Selected Benchmark*				
Chemical	*Concentration (ug/L)*	*Endpoint Type*	*Reference for Selected Benchmark*	*Species*	*Common Name*	*Effect*	*Test Duration (hr)*	*Test Conditions*
Aluminum								
Copper	36	CMC(SW)/10	NAWQC					
Manganese								
Nitrobenzene	220	Chronic	Region V					
1,2,3-Trichlorobenzene	340	chronic LOEC	Calmari,et al.	*Daphnia magna*	Water Flea	GRO	336	static-renewal
4-Nitrophenol	0.0828	Chronic	Region IV					
Iron	1	Chronic	Region IV					

Notes:

AQUIRE = Aquatic Toxicity Information Retrieval Database http://www.epa.gov/ecotox/
CASRN = Chemical Abstracts Service Registry Number
CCC = Criterion Continuous Concentration
CMC = Criterion Maximum Concentration
FW = Freshwater
NAWQC = National Ambient Water Quality Criterion
ORNL = Oak Ridge National Laboratory
SW = Saltwater
[1] All values from EPA (1999) unless specified otherwise
[2] All values from AQUIRE unless specified otherwise
[5] Values from Talmadge (1998)
[(a)] Criterion is dependent on hardness, calculated for 20 mg/L hardness, as $CaCO_3$
[(b)] Criterion dependent on pH, value of 7.8 used
[(c)] Acute values are divided by 10 to estimate chronic values

Surface water benchmark for derivation of GW-3 Standard is selected according to following sequence:
1. Select lowest NAWQC for environmental effects in saltwater or freshwater (CMC, CCC).
2. If above unavailable, select lowest chronic value from AQUIRE as ecological benchmark.
3. If all above unavailable, select lowest acute value from AQUIRE as ecological benchmark.
4. If all above unavailable, select lowest chronic value from ORNL (Suter and Tsao, 1996) or others as ecological benchmark.
5. If all above unavailable, select lowest chronic Tier II value from ORNL (Suter and Tsao, 1996) or others as ecological benchmark.
6. If only an acute value has been selected after steps 1-5, divide the acute value by 10 to estimate a chronic value as ecological benchmark.
7. Select surface water benchmark as the lower of the selected ecological benchmark or the NAWQC for fish consumption.

TABLE B.13

IDENTIFICATION OF SURFACE WATER BENCHMARKS USED AS GW-3 TARGET VALUES
ZENECA INC.
DIGHTON, MASSACHUSETTS

	References for Selected Benchmarks (Target Values)		
Chemical	*AQUIRE Citation Number*	*AQUIRE Search Date*	*Selected Endpoint Reference*
Aluminum			
Copper			
Manganese			
Nitrobenzene			
1,2,3-Trichlorobenzene	15526	1/8/2001	Calamari, D., S. Galassi, F. Setti and M. Vighi. 1983. Toxicity of selected chlorobenzenes to aquatic organisms. Chemosphere 12(2):253-262.
4-Nitrophenol			
Iron			

Notes:

AQUIRE = Aquatic Toxicity Information Retrieval Database http://www.epa.gov/ecotox/
CASRN = Chemical Abstracts Service Registry Number
CCC = Criterion Continuous Concentration
CMC = Criterion Maximum Concentration
FW = Freshwater
NAWQC = National Ambient Water Quality Criterion
ORNL = Oak Ridge National Laboratory
SW = Saltwater
[1] All values from EPA (1999) unless specified otherwise
[2] All values from AQUIRE unless specified otherwise
[5] Values from Talmadge (1998)
[(a)] Criterion is dependent on hardness, calculated for 20 mg/L hardness, as $CaCO_3$
[(b)] Criterion dependent on pH, value of 7.8 used
[(c)] Acute values are divided by 10 to estimate chronic values

Surface water benchmark for derivation of GW-3 Standard is selected according to following sequence:
1. Select lowest NAWQC for environmental effects in saltwater or freshwater (CMC, CCC).
2. If above unavailable, select lowest chronic value from AQUIRE as ecological benchmark.
3. If all above unavailable, select lowest acute value from AQUIRE as ecological benchmark.
4. If all above unavailable, select lowest chronic value from ORNL (Suter and Tsao, 1996) or others as ecolog
5. If all above unavailable, select lowest chronic Tier II value from ORNL (Suter and Tsao, 1996) or others as
6. If only an acute value has been selected after steps 1-5, divide the acute value by 10 to estimate a chronic v
7. Select surface water benchmark as the lower of the selected ecological benchmark or the NAWQC for fish

TABLE B.14

CALCULATION OF THE INFINITE SOURCE INDOOR ATTENUATION COEFFICIENT
ZENECA INC.
DIGHTON, MASSACHUSETTS

Oil and/or Hazardous Material	*Enthalpy of vaporization at ave. groundwater temperature, $DH_{v,TS}$ (cal/mol)*	*Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)*	*Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)*	*Stratum A effective diffusion coefficient, D^{eff}_{A} (cm^2/s)*	*Capill. Zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)*	*Total effective diffusion coefficient, D^{eff}_{T} (cm^2/s)*	*Crack effective diffusion coefficient, D^{crack} (cm^2/s)*	*Exponent of equivalent foundation Peclet # $exp(Pe^f)$ (unitless)*	*Infinite source indoor attenuation coefficient, a (unitless)*
Aluminum									
Copper									
Manganese									
Nitrobenzene	13,378	7.24E-06	3.12E-04	1.50E-02	2.82E-03	4.35E-03	1.50E-02	1.62E+74	9.12E-04
1,2,3-Trichlorobenzene	9,572	6.03E-04	2.60E-02	1.54E-02	1.33E-03	2.20E-03	1.54E-02	2.33E+72	7.53E-04
4-Nitrophenol									
Iron									

TABLE B.15

CHEMICAL PROPERTIES
ZENECA INC.
DIGHTON, MASSACHUSETTS

Oil and/or Hazardous Material	*CAS*	*Diffusivity in air, Da (cm^2/s)*	*Diffusivity in water, Dw (cm^2/s)*	*Henry's law constant H' (unitless)*	*Henry's law constant at ref temp H (atm-m3/mol)*	*Henry's law constant reference temperature, TR (°C)*	*Enthalpy of vaporization at the normal boiling point, DHv,b (cal/mol)*	*Normal boiling point, T_B (°K)*	*Critical temperature, T_C (°K)*	*Pure component water solubility, S (mg/L)*
Aluminum	7429-90-5					25				
Copper	7440-50-8					25				
Manganese	7439-96-5					25				
Nitrobenzene	98-95-3	7.60E-02	8.60E-06	9.80E-04	2.39E-05	25	10,566	483.95	719.00	2.093
1,2,3-Trichlorobenzene	87-61-6	7.80E-02	8.80E-06	5.81E-02	1.42E-03	25	8,322	386.15	602.00	300
4-Nitrophenol	100-02-7					25				
Iron	7439-89-6					25				

TABLE B.16

METHOD 2 S-1 DIRECT CONTACT RISK-BASED SOIL LEVELS
ZENECA INC.
DIGHTON, MASSACHUSETTS

	RESIDENTIAL RECEPTOR RISK-BASED LEVELS									**Method 2 S-1 DIRECT CONTACT LEVEL (Rounded)**	
Oil and/or Hazardous Material	*Non-Cancer Direct Contact mg/kg*	*HI = Vegetable Ingestion mg/kg*	*0.2 Combined Exposure mg/kg*	*Cancer Direct Contact mg/kg*	*ELCR = Vegetable Ingestion mg/kg*	*1.E-06 Combined Exposure mg/kg*	*Lowest of Risk-Based or Ceiling Levels mg/kg*	*Basis*	*Highest of Combined Exposure, Background or PQL mg/kg*	**mg/kg**	**Basis**
Aluminum	7.6E+04		7.6E+04				1.0E+03	Ceiling (High)	1.00E+03	1.00E+03	Ceiling (High)
Copper	3.0E+03		3.0E+03				1.0E+03	Ceiling (High)	1.00E+03	1.00E+03	Ceiling (High)
Manganese	5.3E+03		5.3E+03				1.0E+03	Ceiling (High)	1.00E+03	1.00E+03	Ceiling (High)
Nitrobenzene	2.2E+01		2.2E+01				2.2E+01	Noncancer Risk	2.22E+01	2.22E+01	Noncancer Risk
1,2,3-Trichlorobenzene	4.9E+02		4.9E+02				4.9E+02	Noncancer Risk	4.89E+02	4.89E+02	Noncancer Risk
4-Nitrophenol	8.9E+01		8.9E+01				8.9E+01	Noncancer Risk	8.88E+01	8.88E+01	Noncancer Risk
Iron	2.3E+04		2.3E+04				1.0E+03	Ceiling (High)	1.00E+03	1.00E+03	Ceiling (High)

TABLE B.17

METHOD 2 S-2 RISK-BASED SOIL LEVELS
ZENECA INC.
DIGHTON, MASSACHUSETTS

Oil and/or Hazardous Material	*RESIDENTIAL RECEPTOR RISK-BASED LEVELS* *Non-Cancer HI = 0.2 mg/kg*	*Cancer ELCR = 1.E-06 mg/kg*	*Lowest of Risk-Based or Ceiling Levels mg/kg*	*Bais*	*Highest of Column D, Background or PQL mg/kg*	*Lower of the S-3 and S-2 Calculated Values mg/kg*	**Method 2 S-2 RISK-BASED LEVEL (Rounded)** mg/kg	**Basis**
Aluminum	7.3E+05		3.0E+03	Ceiling (High)	3.00E+03	3.00E+03	3.00E+03	Ceiling (High)
Copper	2.9E+04		3.0E+03	Ceiling (High)	3.00E+03	3.00E+03	3.00E+03	Ceiling (High)
Manganese	5.1E+04		3.0E+03	Ceiling (High)	3.00E+03	8.88E+02	8.88E+02	S-3 Standard
Nitrobenzene	3.1E+02		3.1E+02	Noncancer Risk	3.14E+02	4.05E+01	4.05E+01	S-3 Standard
1,2,3-Trichlorobenzene	6.5E+03		3.0E+03	Ceiling (High)	3.00E+03	9.00E+02	9.00E+02	S-3 Standard
4-Nitrophenol	1.3E+03		1.3E+03	Noncancer Risk	1.26E+03	1.62E+02	1.62E+02	S-3 Standard
Iron	2.2E+05		3.0E+03	Ceiling (High)	3.00E+03	3.00E+03	3.00E+03	Ceiling (High)

TABLE B.18
METHOD 2 S-3 RISK-BASED SOIL LEVELS
ZENECA INC.
DIGHTON, MASSACHUSETTS

	CONSTRUCTION/ EXCAVATION RECEPTOR RISK-BASED LEVELS						*Lowest of Risk-Based or Ceiling Levels*		*Highest of Column H, Background or PQL*	**Method 2 S-3 RISK-BASED LEVEL (Rounded)**	
Oil and/or Hazardous Material	*Non-Cancer Ingestion/ Dermal mg/kg*	*HI = Particulate Inhalation mg/kg*	*0.2 Combined Exposure mg/kg*	*Cancer Direct Contact mg/kg*	*ELCR = Particulate Inhalation mg/kg*	*1.E-06 Combined Exposure mg/kg*	*mg/kg*	*Basis*	*mg/kg*	**mg/kg**	**Basis**
Aluminum	1.5E+05	9.7E+04	5.8E+04				5.0E+03	Ceiling (High)	5.00E+03	5.00E+03	Ceiling (High)
Copper	5.9E+03		5.9E+03				5.0E+03	Ceiling (High)	5.00E+03	5.00E+03	Ceiling (High)
Manganese	1.0E+04	9.7E+02	8.9E+02				8.9E+02	Noncancer Risk	8.88E+02	8.88E+02	Noncancer Risk
Nitrobenzene	4.1E+01	3.9E+04	4.0E+01				4.0E+01	Noncancer Risk	4.05E+01	4.05E+01	Noncancer Risk
1,2,3-Trichlorobenzene	9.0E+02	3.9E+06	9.0E+02				9.0E+02	Noncancer Risk	9.00E+02	9.00E+02	Noncancer Risk
4-Nitrophenol	1.6E+02		1.6E+02				1.6E+02	Noncancer Risk	1.62E+02	1.62E+02	Noncancer Risk
Iron	4.4E+04		4.4E+04				5.0E+03	Ceiling (High)	5.00E+03	5.00E+03	Ceiling (High)

TABLE B.19

LEACHING-BASED SOIL LEVELS
ZENECA INC.
DIGHTON, MASSACHUSETTS

	Target Growndwater Standards (Before Rounding)			*DAFs GW1 & GW-2*	*DAFs GW3*	*Conversion Factor*	*Strictly the Leaching-Based Concentrations*			**Maximum of Leaching Potential, Soil PQL or Soil Background**					
Oil and/or Hazardous Material	*GW-1 µg/L*	*GW-2 µg/L*	*GW-3 µg/L*			*mg/µg*	*S- /GW-1 mg/kg*	*S- /GW-2 mg/kg*	*S- /GW-3 mg/kg*	S- /GW-1 mg/kg	S- /GW-1 rounded mg/kg	S- /GW-2 mg/kg	S- /GW-2 rounded mg/kg	S- /GW-3 mg/kg	S- /GW-3 rounded mg/kg
Aluminum	2.0E+02		5.0E+04			0.001									
Copper	1.0E+03		9.0E+02			0.001									
Manganese	5.0E+01		5.0E+04			0.001									
Nitrobenzene	3.9E+00	1.4E+03	5.5E+03	2	40	0.001	7.82E-03	2.81E+00	2.20E+02	7.82E-03	7.8E-03	2.81E+00	2.8E+00	2.20E+02	2.8E+02
1,2,3-Trichlorobenzene	5.0E+03	2.0E+03	5.0E+04	32	306	0.001	1.60E+02	6.55E+01	1.53E+04	1.60E+02	7.8E-03	6.55E+01	2.8E+00	1.53E+04	2.8E+02
4-Nitrophenol	4.3E+02		2.1E+00			0.001									
Iron	3.0E+02		2.5E+01			0.001									

TABLE B.20

DILUTION ATTENUATION FACTORS
ZENECA INC.
DIGHTON, MASSACHUSETTS

Oil and/or Hazardous Material	*CAS #*	*Modeled? Y/N*	*Solubility mg/L*	*REF*	*Diffusion Coeff. cm2/sec*	*REF*	*Henry's Law Constant atm-m3/mol*	*REF*	*Chemical Group (a)*	*Koc ml/g*	*REF*	*Molecular Weight g/mole*	*REF*	*Density gm/ml*	*REF*	*Highest of GW Stds. mg/L*	*Degradation Rate Soil per day*
Aluminum	7429-90-5	N															
Copper	7440-50-8	N															
Manganese	7439-96-5	N															
Nitrobenzene	98-95-3	Y	2093.0		0.076		2.39E-05			64.6		123		1.20		50	
1,2,3-Trichlorobenzene	87-61-6	Y	300.0		0.030		1.42E-03			1780.0		181		1.50		0.5	
4-Nitrophenol	100-02-7	N															
Iron	7439-89-6	N															

Notes:

Chemical group =1(adopted from the EPA's SSL): Semi-volatile non-ionizing organic compounds
Chemical group =2(adopted from the EPA's SSL):VOCs, chlorinated benzenes and certain chlorinated pesticides

TABLE B.20

DILUTION ATTENUATION FACTORS
ZENECA INC.
DIGHTON, MASSACHUSETTS

Oil and/or Hazardous Material	*CAS #*	*DAF 50%*	*DAF 85%*	*DAF 90%*	*DAF 95%*	*DAF,1993*	*DAF by 1993 EQN.*	*85%tile estimate by regression*	*50%tile estimate by regression*
Aluminum	7429-90-5								
Copper	7440-50-8								
Manganese	7439-96-5								
Nitrobenzene	98-95-3	40	2				11	2.276505191	40.20280946
1,2,3-Trichlorobenzene	87-61-6	306	32	19	9	1542	304	83.17692695	891.1364527
4-Nitrophenol	100-02-7								
Iron	7439-89-6								

Notes:

Chemical group =1(adopted from the EPA's SSL): Semi-volatile non-ionizing organic compounds
Chemical group =2(adopted from the EPA's SSL):VOCs, chlorinated benzenes and certain chlorinated pesticides

TABLE B.21

TOXICITY INFORMATION
ZENECA INC.
DIGHTON, MASSACHUSETTS

Oil and/or Hazardous Material	*CAS*	*Last Checked IRIS?*	*Chronic Oral Reference Dose (or Substitute) mg/kg/day*	*REF*	*Subchronic Oral Reference Dose (or Substitute) mg/kg/day*	*REF*	*Chronic Inhalation Reference Concentration (or substitute) mg/m^3*	*REF*	*Subchronic Inhalation Reference Concentration (or substitute) mg/m^3*	*REF*	*Oral Cancer Slope Factor 1/(mg/kg/day)*	*CLASS*	*REF*	*Inhalation Unit Risk 1/(µg/m^3)*	*REF*
Aluminum	7429-90-5	12/1/10	1.0E+00	46	1.0E+00	46	5.0E-03	46	5.0E-03	46		D	1		
Copper	7440-50-8	12/1/10	4.0E-02	45	4.0E-02	45						D	1		
Manganese	7439-96-5	12/1/10	7.0E-02	45	7.0E-02	45	5.0E-05	45	5.0E-05	45		D	1		
Nitrobenzene	98-95-3	12/1/10	5.0E-04	1	5.0E-04	1	2.0E-03	2	2.0E-03	2		D	1		
1,2,3-Trichlorobenzene	87-61-6	12/1/10	1.0E-02	47	1.0E-02	47	2.0E-01	47	2.0E-01	47		D	1		
4-Nitrophenol	100-02-7	12/1/10	2.0E-03	48	2.0E-03	48						D	1		
Iron	7439-89-6	12/1/10	3.0E-01	48	3.0E-01	48						D	1		

References:

(1) IRIS, Integrated Risk Information System Database, December 1, 2010.
(2) HEAST, Health Effects Assessment Summary Table, July 1, 1997.
(6) US EPA Soil Screening Guidance: Technical Background Document, EPA/540/R95/128, May 1996
(6a) Measured Koc from the SSL Guidance.
(11) United States Environmental Protection Agency (USEPA), 1986. "Superfund Public Health Evaluation Manual"; U.S. Environmental Protection Agency Office of Emergency and Remedial Response, EPA/540/1-86/060 (OSWER Directive 9285.4-1); Washington, D.C., Oct
(33) OSHA Documentation of TLV -TWA
(27) USEPA, 1992. "Reference Guide to Odor Thresholds for Hazardous Air Pollutants Listed in the Clean Air Act Amendment of 1990", U.S. Environmental Protection Agency; Office of Research and Development, EPA/600/R-92/047; Washington, D.C., March 1992.
(45) Cited by EPA Region I (EPA-R1) in letter dated September 21, 2004.
(46) Region IX - Preliminary Remediation Goals (R9-PRGs), October 1, 2004. Provisional values supplied by NCEA.
(47) Substituted 1,2,4-trichlorobenzene toxicity data.
(48) Toxicity data taken from CRA HHRA (2007).
(49) Risk Assessment Information System (http://rais.ornl.gov/).

TABLE B.21

TOXICITY INFORMATION
ZENECA INC.
DIGHTON, MASSACHUSETTS

		Relative Absorption Factors (RAFs)											*Oral Absorption Efficiency Tox Study*	*Oral Absorption Efficiency Tox Study*
		Soil						*Water*			*Vegetables*			
Oil and/or Hazardous Material	*CAS*	*Chronic Ingestion*	*Chronic Dermal*	*Subchronic Ingestion*	*Subchronic Dermal*	*Cancer Ingestion*	*Cancer Dermal*	*Subchronic Ingestion*	*Chronic Ingestion*	*Cancer Ingestion*	*Noncancer Ingestion*	*Cancer Ingestion*	*OAEnoncancer*	*OAEcancer*
Aluminum	7429-90-5	1	0.01	1	0.01	NC	NC	1	1		1		1	NC
Copper	7440-50-8	1	0.01	1	0.01	NC	NC	1	1		1		1	NC
Manganese	7439-96-5	1	0.01	1	0.01	NC	NC	1	1		1		1	NC
Nitrobenzene	98-95-3	1	0.1	1	0.1	NC	NC	1	1		1		1	NC
1,2,3-Trichlorobenzene	87-61-6	1	0.08	1	0.08	NC	NC	1	1				1	NC
4-Nitrophenol	100-02-7	1	0.1	1	0.1	NC	NC	1	1		1		1	NC
Iron	7439-89-6	1	0.01	1	0.01	NC	NC	1	1		1		1	NC

References:

(1) IRIS, Integrated Risk Information System Database, December 1, 2010.
(2) HEAST, Health Effects Assessment Summary Table, July 1, 1997.
(6) US EPA Soil Screening Guidance: Technical Background Document, EPA/540/R95/128, May 1996
(6a) Measured Koc from the SSL Guidance.
(11) United States Environmental Protection Agency (USEPA), 1986. "Superfund Public Health Evaluation Manual"; U.S. Environmental Protection Agency Office of Emergency and Remedial Response, EPA/540/1-86/060 (OSWER Directive 9285.4-1); Washington, D.C., Oct
(33) OSHA Documentation of TLV -TWA
(27) USEPA, 1992. "Reference Guide to Odor Thresholds for Hazardous Air Pollutants Listed in the Clean Air Act Amendment of 1990", U.S. Environmental Protection Agency; Office of Research and Development, EPA/600/R-92/047; Washington, D.C., March 1992.
(45) Cited by EPA Region I (EPA-R1) in letter dated September 21, 2004.
(46) Region IX - Preliminary Remediation Goals (R9-PRGs), October 1, 2004. Provisional values supplied by NCEA.
(47) Substituted 1,2,4-trichlorobenzene toxicity data.
(48) Toxicity data taken from CRA HHRA (2007).
(49) Risk Assessment Information System (http://rais.ornl.gov/).

TABLE B.21

TOXICITY INFORMATION
ZENECA INC.
DIGHTON, MASSACHUSETTS

Oil and/or Hazardous Material	*CAS*	*Soil Back-Ground mg/kg*	*GW Back-Ground µg/L*	*Indoor Air Background µg/m³*	*Hide columns interim calculation µg/m3*	*ppbv*	*Odor Threshold in water µg/L*	*REF*	*Odor Threshold in air µg/m³*	*ppm*	*REF*	*Odor Index*	*Soil PQL mg/kg*	*Water PQL µg/L*	*Solubility µg/L*	*REF*
Aluminum	7429-90-5															
Copper	7440-50-8															
Manganese	7439-96-5															
Nitrobenzene	98-95-3														2.09E+03	
1,2,3-Trichlorobenzene	87-61-6				15	0.08			22000	2.971979034	27				3.00E+05	6
4-Nitrophenol	100-02-7				15	0.08									1.16E+04	49
Iron	7439-89-6				15	0.08										

References:

(1) IRIS, Integrated Risk Information System Database, December 1, 2010.
(2) HEAST, Health Effects Assessment Summary Table, July 1, 1997.
(6) US EPA Soil Screening Guidance: Technical Background Document, EPA/540/R95/128, May 1996
(6a) Measured Koc from the SSL Guidance.
(11) United States Environmental Protection Agency (USEPA), 1986. "Superfund Public Health Evaluation Manual"; U.S. Environmental Protection Agency Office of Emergency and Remedial Response, EPA/540/1-86/060 (OSWER Directive 9285.4-1); Washington, D.C., Oct
(33) OSHA Documentation of TLV -TWA
(27) USEPA, 1992. "Reference Guide to Odor Thresholds for Hazardous Air Pollutants Listed in the Clean Air Act Amendment of 1990", U.S. Environmental Protection Agency; Office of Research and Development, EPA/600/R-92/047; Washington, D.C., March 1992.
(45) Cited by EPA Region I (EPA-R1) in letter dated September 21, 2004.
(46) Region IX - Preliminary Remediation Goals (R9-PRGs), October 1, 2004. Provisional values supplied by NCEA.
(47) Substituted 1,2,4-trichlorobenzene toxicity data.
(48) Toxicity data taken from CRA HHRA (2007).
(49) Risk Assessment Information System (http://rais.ornl.gov/).

TABLE B.21

TOXICITY INFORMATION
ZENECA INC.
DIGHTON, MASSACHUSETTS

Oil and/or Hazardous Material	*CAS*	*Henry's Law Constant atm-m^3/mol*	*REF*	*Henry's Law Constant conc/conc*	*Molecular Weight g/mole*	*REF*	*Vapor Pressure Torr 20-30 C*	*log Kow*	*REF*	*Koc ml/g*	*REF*	*Melting Point C*	*REF*	*Soil Saturation Level (Csat) mg/kg*	*Permeability Coefficient Kp cm/hr*	*Plant Uptake Factor Ksp Kg-soil/Kg-plant*
Aluminum	7429-90-5														1.0E-03	
Copper	7440-50-8														1.0E-03	
Manganese	7439-96-5														1.0E-03	
Nitrobenzene	98-95-3	2.39E-05		1E-03	123	45		1.81	45	6.46E+01					5.3E-03	
1,2,3-Trichlorobenzene	87-61-6	1.42E-03	6	6E-02	181	11		3.98	33	1.7E+03	6a	17	6	3.02E+03	7.1E-02	
4-Nitrophenol	100-02-7	4.15E-10	49	2E-08	139	49		1.91	49	2.9E+02	49	1540	49		1.0E-03	
Iron	7439-89-6				55.9	49						114	49		4.8E-03	

References:

(1) IRIS, Integrated Risk Information System Database, December 1, 2010.
(2) HEAST, Health Effects Assessment Summary Table, July 1, 1997.
(6) US EPA Soil Screening Guidance: Technical Background Document, EPA/540/R95/128, May 1996
(6a) Measured Koc from the SSL Guidance.
(11) United States Environmental Protection Agency (USEPA), 1986. "Superfund Public Health Evaluation Manual"; U.S. Environmental Protection Agency Office of Emergency and Remedial Response, EPA/540/1-86/060 (OSWER Directive 9285.4-1); Washington, D.C., Oct
(33) OSHA Documentation of TLV -TWA
(27) USEPA, 1992. "Reference Guide to Odor Thresholds for Hazardous Air Pollutants Listed in the Clean Air Act Amendment of 1990", U.S. Environmental Protection Agency; Office of Research and Development, EPA/600/R-92/047; Washington, D.C., March 1992.
(45) Cited by EPA Region I (EPA-R1) in letter dated September 21, 2004.
(46) Region IX - Preliminary Remediation Goals (R9-PRGs), October 1, 2004. Provisional values supplied by NCEA.
(47) Substituted 1,2,4-trichlorobenzene toxicity data.
(48) Toxicity data taken from CRA HHRA (2007).
(49) Risk Assessment Information System (http://rais.ornl.gov/).

TABLE B.21

TOXICITY INFORMATION
ZENECA INC.
DIGHTON, MASSACHUSETTS

		CEILING LEVELS										
		S-1			S-2			S-3				
Oil and/or Hazardous Material	*CAS*	*Based on Volatility mg/kg*	*Lower of Volatility & Csat mg/kg*	*Ceiling Basis*	*Based on Volatility mg/kg*	*Lower of Volatility & Csat mg/kg*	*Ceiling Basis*	*Based on Volatility mg/kg*	*Lower of Volatility & Csat mg/kg*	*Ceiling Basis*	Groundwater *GW-1, -2 and -3 µg/L*	*Ceiling Basis*
Aluminum	7429-90-5	1.00E+03	1.00E+03	Ceiling (High)	3.00E+03	3.00E+03	Ceiling (High)	5.00E+03	5.00E+03	Ceiling (High)	5.00E+04	0.005%
Copper	7440-50-8	1.00E+03	1.00E+03	Ceiling (High)	3.00E+03	3.00E+03	Ceiling (High)	5.00E+03	5.00E+03	Ceiling (High)	5.00E+04	0.005%
Manganese	7439-96-5	1.00E+03	1.00E+03	Ceiling (High)	3.00E+03	3.00E+03	Ceiling (High)	5.00E+03	5.00E+03	Ceiling (High)	5.00E+04	0.005%
Nitrobenzene	98-95-3	1.00E+03	1.00E+03	Ceiling (High)	3.00E+03	3.00E+03	Ceiling (High)	5.00E+03	5.00E+03	Ceiling (High)	5.00E+04	0.005%
1,2,3-Trichlorobenzene	87-61-6	1.00E+03	1.00E+03	Ceiling (High)	3.00E+03	3.00E+03	Ceiling (High)	5.00E+03	3.02E+03	Soil Saturation	5.00E+04	0.005%
4-Nitrophenol	100-02-7	1.00E+03	1.00E+03	Ceiling (High)	3.00E+03	3.00E+03	Ceiling (High)	5.00E+03	5.00E+03	Ceiling (High)	5.00E+04	0.005%
Iron	7439-89-6	1.00E+03	1.00E+03	Ceiling (High)	3.00E+03	3.00E+03	Ceiling (High)	5.00E+03	5.00E+03	Ceiling (High)	5.00E+04	0.005%

References:

(1) IRIS, Integrated Risk Information System Database, December 1, 2010.
(2) HEAST, Health Effects Assessment Summary Table, July 1, 1997.
(6) US EPA Soil Screening Guidance: Technical Background Document, EPA/540/R95/128, May 1996
(6a) Measured Koc from the SSL Guidance.
(11) United States Environmental Protection Agency (USEPA), 1986. "Superfund Public Health Evaluation Manual"; U.S. Environmental Protection Agency Office of Emergency and Remedial Response, EPA/540/1-86/060 (OSWER Directive 9285.4-1); Washington, D.C., Oct
(33) OSHA Documentation of TLV -TWA
(27) USEPA, 1992. "Reference Guide to Odor Thresholds for Hazardous Air Pollutants Listed in the Clean Air Act Amendment of 1990", U.S. Environmental Protection Agency; Office of Research and Development, EPA/600/R-92/047; Washington, D.C., March 1992.
(45) Cited by EPA Region I (EPA-R1) in letter dated September 21, 2004.
(46) Region IX - Preliminary Remediation Goals (R9-PRGs), October 1, 2004. Provisional values supplied by NCEA.
(47) Substituted 1,2,4-trichlorobenzene toxicity data.
(48) Toxicity data taken from CRA HHRA (2007).
(49) Risk Assessment Information System (http://rais.ornl.gov/).

APPENDIX C

CALCULATIONS FOR SOIL CLEANUP LEVELS PROTECTIVE OF MIGRATION TO INDOOR AIR

TABLE C.1

CALCULATION OF RISK-BASED CONCENTRATIONS (RBCs) FOR SOIL BASED ON PROTECTION OF INDOOR AIR QUALITY - INDUSTRIAL/COMMERCIAL WORKER
ZENECA INC.
DIGHTON, MASSACHUSETTS

	Chemical Properties (1)							Risk-Based Concentrations for Soil, RBC_{soil}			
Contaminant of Concern (COC)	*Henry's Law Constant, H_L (atm m³/mol)*		*Water Diffusion Coefficient, D^{H2O} (cm²/s)*		*Air Diffusion Coefficient, D^{air} (cm²/s)*		*Organic Carbon artitioning Coefficient, K (mL/g)*	*Johnson & Ettinger Attenuation Factor, α (2)*	*Indoor Air Risk-Based Concentration RBC_{ia} (3) (µg/m³)*	*Soil Gas Concentration at Source C_{sg} (4) (µg/m³)*	*Concentration Sorbed to Soil Particles C_{sp} (5) (µg/g)*	*Bulk Soil Concentration C_{soil} (6) (µg/g)*
VOCs												
1,2,3-Trichlorobenzene	6.03E-04	(10°C)	8.80E-06	(25°C)	7.22E-02	(10°C)	1.78E+03	1.16E-03	4.00E+01	3.44E+04	1.18E+01	1.18E+01
1,2,4-Trichlorobenzene	6.02E-04	(10°C)	8.60E-06	(25°C)	8.05E-02	(10°C)	1.78E+03	1.16E-03	4.00E+01	3.44E+04	1.18E+01	1.19E+01
Chlorobenzene	1.29E-03	(10°C)	8.70E-06	(25°C)	6.76E-02	(10°C)	2.24E+02	1.16E-03	4.00E+00	3.44E+03	6.91E-02	7.25E-02
Naphthalene	1.39E-04	(10°C)	7.50E-06	(25°C)	5.46E-02	(10°C)	1.19E+03	1.16E-03	6.00E-01	5.16E+02	1.03E+00	1.03E+00
Nitrobenzene	7.24E-06	(10°C)	8.60E-06	(25°C)	7.03E-02	(10°C)	6.46E+01	1.16E-03	4.00E-01	3.44E+02	3.56E-01	4.01E-01
Trichloroethene	4.58E-03	(10°C)	9.10E-06	(25°C)	7.31E-02	(10°C)	9.43E+01	1.16E-03	1.37E+00	1.18E+03	2.82E-03	3.35E-03
Xylene (total)	2.65E-03	(10°C)	8.44E-06	(25°C)	7.12E-02	(10°C)	2.49E+02	1.16E-03	2.00E+01	1.72E+04	1.88E-01	1.98E-01

TABLE C.1

CALCULATION OF RISK-BASED CONCENTRATIONS (RBCs) FOR SOIL BASED ON PROTECTION OF INDOOR AIR QUALITY - INDUSTRIAL/COMMERCIAL WORKER
ZENECA INC.
DIGHTON, MASSACHUSETTS

Notes:

(1) The applied chemical properties are consistent with values used following MCP methodology.
The Henry's Law constants and air diffusion coefficients were corrected for an average vadose zone temperature of 15°C. The reference temperature for the water diffusion coefficients is 25°C and, considering its low value, a correction to 10°C was considered negligible.

(2) The soil gas attenuation factor α and building indoor air concentration are based on the solution for soil gas migration to building indoor air presented in Johnson and Ettinger [1991; Equation (21)], the vadose zone ai properties listed below, and a 4 Pa pressure difference between the vadose zone and the building (ΔP) as applied by MCP GW spreadsheet for a residential building. The calculation of the soil gas attenuation factor a air concentration were conducted using the Excel spreadsheet "SL-ADV-Feb04.xls" developed by USEPA (2004) and the following Site-specific vadose zone and building properties.

Vadose Zone Soil Properties:		
Vadose Zone Temperature (°C)	10	Default vadose zone soil temperature, as indicated in MCP GW2 spreadsheet
Distance Below Grade to Top of Contamination, L_t (cm)	184	Based on the assumption that impacted soils occur directly beneath the foundation slab.
Soil Strata A and C - MOE Coarse Soil:		
Total Porosity, ε_T (%)	43	Default porosity value for coarse-grained soil type, as indicated in MCP GW2 spreadsheet
Moisture-Filled Porosity, ε_m	0.060	Default moisture-filled porosity value for coarse-grained soil type, as indicated in MCP GW2 spreadsheet
Vapour-Filled Porosity, ε_v	0.370	Default vapour-filled porosity value for coarse-grained soil type, as indicated in MCP GW2 spreadsheet
Dry Bulk Soil Density, ρ_{db} (g/cm³)	1.50	Default dry bulk density value for coarse-grained soil type, as indicated in MCP GW2 spreadsheet
Fraction of Organic Carbon Content, f_{oc}	0.005	Default fraction of organic carbon content value for coarse-grained soil type, as indicated in USEPA, 2004.
Thickness of Soil Stratum A, h_A (cm)	184	Based on the assumption that impacted soils occur directly beneath the foundation slab.
Thickness of Soil Stratum C, h_C (cm)	0.1	Based on the thickness of Soil Stratum C indicated in MOE (2009b).
Soil Stratum B - MOE Gravel Crush:		
Total Porosity, ε_T (%)	40	Default porosity value for Soil Stratum B soil type, as indicated in MOE (2009b).
Moisture-Filled Porosity, ε_m	0.01	Default moisture-filled porosity value for Soil Stratum B soil type, as indicated in MOE (2009b).
Vapour-Filled Porosity, ε_v	0.39	Default vapour-filled porosity value for Soil Stratum B soil type, as indicated in MOE (2009b).
Dry Bulk Soil Density, ρ_{db} (g/cm³)	1.60	Default dry bulk density value for Soil Stratum B soil type, as indicated in MOE (2009b).
Fraction of Organic Carbon Content, f_{oc}	0	Default fraction of organic carbon content value for Soil Stratum B soil type, as indicated in MOE (2009b).
Thickness of Soil Stratum B, h_B (cm)	29.9	Based on the thickness of Soil Stratum B indicated in MOE (2009b).
Building Properties:		
Enclosed Floor Space Length, L_B (m)	9.61	Based on default building dimensions, as indicated in MCP GW2 spreadsheet.
Enclosed Floor Space Width, W_B (m)	9.61	Based on default building dimensions, as indicated in MCP GW2 spreadsheet.
Enclosed Space Height, H_B (m)	4.88	Based on default building dimensions, as indicated in MCP GW2 spreadsheet.
Building Air Exchange Rate, T_{air} (1/hr)	0.45	Based on default commercial/industrial air exchange rate, as indicated in MCP GW2 spreadsheet
Floor-Wall Seam Crack Width, w (cm)	0.1	Default floor-wall seam crack width for default buildings, as indicated in MCP GW2 spreadsheet
Foundation Thickness, L_{crack} (cm)	15	Default thickness of building foundation, as indicated in MCP GW2 spreadsheet
Depth Below Grade to Bottom of Enclosed Space Floor, L_F (cm)	183	Default thickness of building foundation, as indicated in MCP GW2 spreadsheet

(3) The indoor air based concentrations were taken from MCP with the exception of nitrobenzene and 1,2,3-trichlorobenzene. These two indoor air based concentrations were calculated following MCP methodology.

(4) The Site-specific soil gas criteria at the source is calculated from $C_{sg}=RBC_{ia} / \alpha$.

(5) Concentration sorbed to soil particles determined from the soil gas concentration assuming equilibrium conditions between the gas, aqueous, and sorbed phases using $C_{sp}=C_{sg}*K_{oc}*f_{oc}/H/1000/1000$ where the Henry T is the vadose temperature in degrees Kelvin and the universal gas constant R is 8.21E-05 atm m³/mol K.

(6) Bulk soil concentration comprised of the gas, aqueous, and sorbed phases determined from C_{sp} using phase relationships as follows: $C_{soil}=C_{sp}/\rho_{db}*(\varepsilon_m/k_d+H\varepsilon_v/k_d+\rho_{db})$ where ε_m and ε_v are the moisture and vapour filled porosities, respectively, and $k_d=K_{oc}*f_{oc}$.

APPENDIX D

EVALUATION OF RISK TO ECOLOGICAL RECEPTORS IN THE PHRAGMITES MARSH IN MUDDY COVE

EXECUTIVE SUMMARY

Conestoga-Rovers & Associates (CRA), on behalf of Zeneca Inc., conducted an evaluation of risk to ecological receptors exposed to sediment of the Phragmites marsh, located in the northwest portion of Muddy Cove in Dighton, Massachusetts. An Ecological Risk Assessment conducted by Menzie Cura & Associates (MCA) and a follow-up evaluation conducted by CRA in developing Media Cleanup Standards (MCS) for Muddy Cove identified a limited potential for risk to avian and mammalian receptors due to relatively low habitat quality. Consequently, the evaluation of risk for the Phragmites marsh focused on benthic invertebrates. As part of the overall remediation of Muddy Cove, Zeneca has agreed to enhance the Phragmites Marsh by eradicating the dense stand of *Phragmites*, and restoring the area as freshwater marsh with native species. Because the enhancement activities will likely result in the exposure of the deeper sediments, the evaluation of risk considered concentrations of Constituents of Potential Ecological Concern (COPECs) at depth intervals of 0 to 0.5 feet (ft) below ground surface (bgs), 1 to 2 ft bgs, and greater than 2 ft.

The evaluation concluded that concentrations of arsenic, copper, iron, mercury, selenium, and total PCBs in the 0 to 0.5 ft interval potentially pose risk to benthic invertebrates. For the 1 to 2 ft depth interval, concentrations of beryllium, copper, mercury, and selenium potentially pose risk. At depths greater than 2 ft, none of the constituents detected in sediment are likely to pose risk to benthic invertebrates. These results indicate that activities to restore the area of the Phragmites marsh as native marsh will remove sediment with concentrations of COPECs that potentially pose risk. Concentrations of COPECs in the deeper sediments that are not removed but may be exposed will not pose risk to benthic invertebrates or other ecological receptors.

The major uncertainty in the risk evaluation is whether the limited data available for the Phragmites marsh adequately characterizes the horizontal extent of the COPECs.

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LIST OF ACRONYMS

ARCS	Assessment and Remediation of Contaminated Sediments
BCOC	Bioaccumulative Chemical of Concern
BGS	Below Ground Surface
BTAG	Biological Technical Assistance Group
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
CCME	Canadian Council of Ministers of the Environment
CRA	Conestoga-Rovers & Associates
COPEC	Constituent of Potential Ecological Concern
ERA	Ecological Risk Assessment
ER-L	Effects Range-Low
ER-M	Effects Range-Median
ESL	Ecological Screening Level
ESV	Ecological Screening Value
FT	Feet
HMW	High Molecular Weight
LEL	Lowest Effects Level
LMW	Low Molecular Weight
MADEP	Massachusetts Department of Environmental Protection
MCA	Menzie-Cura & Associates
MCS	Media Cleanup Standards
MEK	Methyl Ethyl Ketone
mg/kg	Milligram per Kilogram
MPC	Maximum Permissible Level
NC	Negligible Concentration
NEC	No Effects Concentration
NEL	No Effects Level
NOAA	National Oceanic and Atmospheric Administration
ORNL	Oak Ridge National Laboratory
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCL	Protective Concentration Level
PEC	Probable Effects Concentration
PEL	Probable Effects Level
PG/G	Picogram per gram
RAIS	Risk Assessment Information System
SQ	Screening Quotient
SVOC	Semi-Volatile Organic Compound
TCEQ	Texas Commission on Environmental Quality
TEC	Threshold Effects Concentration
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1.0 INTRODUCTION

Conestoga-Rovers & Associates (CRA), on behalf of Zeneca Inc. (Zeneca), has prepared a document that proposes Media Cleanup Standards (MCS) for the Zeneca site in Dighton, Massachusetts. The area addressed in the MCS proposal includes Muddy Cove, a small body of lentic water adjacent to the Taunton River. Menzie-Cura & Associates (MCA) conducted an ecological risk assessment (ERA) for Muddy Cove and identified mercury as the primary risk driver for ecological receptors, specifically, the benthic invertebrate community of Muddy Cove. Zeneca has agreed to remediate the sediment of Muddy Cove to concentrations of total mercury not to exceed 12.3 milligrams per kilogram (mg/kg). Remediation of sediment for mercury will also remove other chemicals co-occurring with mercury that have the potential to pose risk to benthic invertebrates.

An area of dense vegetation dominated by common reed (*Phrgamites sp.*) is present in the northwestern portion of Muddy Cove. This area is referred to as the Phragmites marsh. The July 2007 HHRA identified a potential human health risk due to exposure to arsenic, PCBs, and benzo(a)pyrene in the sediments in the Phragmites marsh. Risk to ecological receptors has not been evaluated for the Phragmites marsh. This document fills this data gap by evaluating the potential risk posed by chemical constituents detected in sediment collected from the Phragmites marsh.

2.0 APPROACH FOR RISK EVALUATION

Sediment samples were collected at four locations within the Phragmites marsh on November 2, 2005. Samples were collected at depth intervals of 0 to 0.5 feet (ft) below ground surface (bgs), 1 to 2 ft bgs, 2 to 3 ft bgs, and 3.5 to 4.5 ft bgs. The 3.5 to 4.5 ft interval was sampled at one location. Samples from the other depth intervals were collected at all four locations. Samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and polychlorinated biphenyls (PCBs). Data for the Phragmites marsh are provided as Attachment D-1.

Discussions with representatives of the United States Environmental Protection Agency (USEPA) and the National Oceanic and Atmospheric Administration (NOAA), a natural resource trustee, have produced an agreement of understanding to enhance the Phragmites marsh by removing the *Phragmites*, an aggressive invasive species of plant, and restore the area as freshwater marsh with native species. Restoration of the Phragmites marsh will be included in the CMS and will likely incorporate excavation of sediment to remove the root system of the *Phragmites*. Because the restoration of freshwater marsh will likely utilize the post-excavation depths and contours (i.e., substrate will not be brought in to return the bottom elevations to current conditions), the risk evaluation assumes that the shallow depth intervals (0 to 0.5 ft and 1 to 2 ft) will be removed and the two deeper depth intervals (2 to 3 ft and 3.5 to 4.5 ft) will likely remain.

This risk evaluation focuses on risk to benthic invertebrates. The ERA conducted for Muddy Cove concluded that risk to upper trophic level receptors (e.g., avian and mammalian piscivores) is limited to avian piscivores (i.e., belted kingfisher). A follow-up analysis conducted by CRA in developing the MCS for Muddy Cove concluded that risk to avian piscivores is overestimated due to the low quality of habitat for avian piscivores in Muddy Cove.. *Phragmites* likewise provides low quality habitat for avian and mammalian receptors. Moreover, Zeneca has agreed to 1) remediate sediments to a concentration of mercury, the primary driver for ecological risk in Muddy Cove, not to exceed 12.3 mg/kg, and 2) remove the surficial sediment of the Phragmites marsh. These actions will reduce the area-wide average for mercury to a concentration that is protective of both avian and mammalian receptors. Based on these considerations, the assessment endpoint for this risk assessment is the abundance of invertebrate species and diversity of the benthic communities of the Phragmites marsh.

The evaluation of risk to benthic invertebrates was conducted using an iterative approach. For the first iteration, the maximum concentration of each constituent detected, regardless of depth interval, was compared to a conservative Ecological

Screening Value (ESV). Those constituents with maximum concentrations that exceeded their ESVs were identified as Constituents of Potential Ecological Concern (COPECs) and carried forward for further evaluation. The constituents with maximum concentrations below their ESVs were eliminated from further consideration.

For constituents identified as COPECs, samples were then partitioned by depth interval and the maximum concentration for each depth interval was compared to its ESV.

The second iteration of the evaluation process considered concentrations of the COPECs at reference sites and alternative ecological benchmarks. The ERA conducted by MCA included collection and analysis of sediment samples from reference sites comparable to Muddy Cove. Alternative benchmarks were identified using the Ecological Benchmark Tool available through the Risk Assessment Information System (RAIS) maintained the Oak Ridge National Laboratory (ORNL) (http://rais.ornl.gov/tools/eco_search.php). Benchmarks identified by Crommentuijn et al., 1997) were also considered.

The ESVs used as benchmarks for the first iteration are generally lower effects levels. Impacts to benthic invertebrates are unlikely to be observed at concentrations below the ESVs. The alternative benchmarks considered can also be considered screening benchmarks, but represent concentrations at which some level of impact to benthic invertebrates is more likely to be observed. For constituents identified as COPECs, three effects concentrations were defined. Benchmarks below the maximum concentration for the reference sites identified in the ERA conducted by MCA were not considered because they were are applicable to site-specific conditions. For each COPEC, a lower effects concentration was defined as the higher of the ESV and maximum concentration for the reference sites. An upper effects concentration was defined as the highest of the alternative benchmarks. A median effects concentration was defined as the mid-point between the lower effects and upper effects concentrations. The maximum concentration of each COPEC within a depth interval, if detected, was compared to the three effects concentrations.

3.0 ECOLOGICAL SCREENING VALUES

Table D.1 identifies the ESVs used in the first iteration of the risk evaluation. The Massachusetts Department of Environmental Protection (MassDEP) has adopted the "consensus" Threshold Effects Concentrations (TECs) identified by MacDonald et al. (2000) as screening benchmarks. If available for a detected constituent, the TEC was selected as the ESV. Threshold Effects Concentrations are available for most of the PAHs and several metals. Ecological benchmarks for VOCs and SVOCs (other than PAHs) are limited. The USEPA Region 5 has identified Ecological Screening Levels (ESLs) for many of the VOCs and SVOCs detected in the sediment of the Phragmites marsh. Other sources of ESVs included USEPA (1996), NOAA (1999), Crommentuijn et al. (1997), and Persaud et al., (1993).

4.0 COMPARISON OF MAXIMUM CONCENTRATIONS TO ESVS

4.1 POOLED SAMPLES

Table D.2 identifies that constituents detected in the sediment of the Phragmites marsh. Information presented in Table D.2 includes the number of samples, number of samples with detected concentrations, sample location and depth interval of the maximum concentration, and ESV. The Screening Quotient (SQ), which is also identified in Table D.2, is the maximum concentration of a constituent divided by its ESV. A SQ greater than 1.0 (unity), identifies a potential for risk. Constituents with a SQ greater than unity were identified as COPECs and were carried forward for further evaluation. The Texas Commission for Environmental Quality (TCEQ, 2006) identifies Bioaccumulative Chemicals of Concern (BCOCs) for sediment. Table D.2 also identifies BCOCs.

Eight VOCs, exclusive of the four BTEX constituents (benzene, toluene, ethylbenzene, and toluene) were detected in the sediment of the Phragmites marsh. Of the eight VOCs detected, the maximum concentrations of 2-butanone (methyl ethyl ketone) and acetone exceed their ESVs.

Two of the four BTEX constituents, benzene and toluene, were detected. The maximum concentrations of benzene and toluene are below their ESVs.

Five SVOCs, exclusive of PAHs, were detected. The maximum concentrations of 4-methylphenol and phenol exceed their ESVs.

Fifteen PAHs were detected in the sediment of the Phragmites marsh. Ecological Screening Values are available for total PAHs, Low Molecular Weight (LMW) PAHs, and High Molecular Weight (HMW) PAHs. Table D.3 identifies the individual PAHs detected as LMW, HWM, or other PAHs (those not classified as either LMW or HMW). To calculate the concentrations of total, LMW, and HMW PAHs, the concentrations of the PAHs in a sample were summed. For individual PAHs reported as not detected, a value equal to one-half the detection limit was assigned. The maximum concentrations of total PAHs (5.0 mg/kg), LMW PAHs (1.2 mg/kg), and HMW PAHs (2.7 mg/kg) exceed their respective benchmarks. For the individual PAHs, the maximum concentrations of benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene are below their ESVs. For all of the other individual PAHs, the maximum concentrations exceed their ESVs.

Twenty-three metals were detected. The maximum concentrations of barium, cadmium, cobalt, and manganese are below their ESVs. ESVs are not available for calcium, magnesium, potassium, and sodium. These four metals are essential nutrients and are not expected to pose risk to ecological receptors. Consequently, these four essential nutrients are eliminated from further consideration. The remaining 12 metals are identified as COPECs and are carried forward for further consideration.

For PCBs, Aroclor 1248, Aroclor 1254, and tetrachlorobiphenyl were detected. The concentrations of the two aroclors exceed their ESVs. An ESV is not available for tetrachlorobiphenyl. The maximum concentration of total PCBs exceeds its ESV.

4.2 SAMPLES BY DEPTH INTERVAL

Tables 3, 4, and 5 identify the maximum concentrations for the 0 to 0.5 ft, 1 to 2 ft, and greater than 2 ft depth intervals (the 2 to 3 ft and 3.5 to 4.5 ft depth intervals are combined). Tables 3 through 5 also identify the number of samples that exceed the ESVs for each constituent.

For the 0 to 0.5 ft depth interval, the maximum concentrations of all COPECs detected in that depth interval exceed their respective ESVs (Table D.3).

For the 1 to 2 ft depth interval, the majority of COPECs have maximum concentrations that exceed their ESVs (Table D.4). The maximum concentrations of LMW PAHs (as well as naphthalene and phenanthrene), chrysene (a HMW PAH), and nickel are below their ESVs. Aroclor 1254 and tetrachlorobiphenyl were not detected in the 1 to 2 ft depth interval.

For the depth interval greater than 2 ft, relatively few COPECs have maximum concentrations that exceed their ESVs. The maximum concentrations of 2-butanone, acetone, arsenic, beryllium, lead, mercury, methyl mercury, and selenium exceed their ESVs.

At this point of the evaluation, 2-butanone and acetone can be eliminated from further consideration. Both are common laboratory contaminants and, as VOCs, are not expected to be present in natural environments at significant concentrations. The concentrations of both are relative consistent among the three sample depths, which suggests potential laboratory sources.

5.0 CONSIDERATION OF ALTERNATIVE BENCHMARKS

Table 6-1 of the ERA prepared by MCA (2005) identifies concentrations of metals, PAHs, VOCs, and PCBs for reference sites for Muddy Cove. Table D.6 of this document identifies the maximum concentration of the COPECs for the shallow and deep samples for the reference sites. Table D.6 also identifies the ESVs used for the first iteration. For the majority of COPECs, the ESVs are below the site-specific reference concentrations for Muddy Cove. Of the COPECs identified in Table D.6, the ESVs for arsenic, beryllium, and selenium are greater than their ESVs.

Table D.6 identifies alternative ecological benchmarks for the COPECs identified in the first iteration (other than 2-butanone and acetone, which were eliminated as common laboratory contaminants). Only alternative benchmarks that are greater than the maximum concentration from reference sites are identified in Table D.6.

Table D.7 identifies three effects concentrations for the constituents identified as COPECs. The lower effects concentration is the higher of the ESV or maximum concentration detected at the reference sites. Minimal impacts are expected at the lowest effects concentration. The upper effects concentration is the highest concentration of the alternative benchmarks. Some level of impact to benthic communities is expected at the upper effects level. The mid-point of the lower effects and upper effects concentrations defines the median effects concentrations. This value can reasonably be used to determine if a concentration of a COPEC poses a significant potential for risk to the benthic invertebrate communities. This approach is used by some regulatory agencies (e.g., TCEQ, 2006) to define Protective Concentration Levels (PCLs).

The maximum concentrations of the COPECs for each depth interval are identified in Table D.7. For the 0 to 0.5 ft interval, concentrations of arsenic, copper, iron, mercury, selenium, and total PCBs exceed their median effects concentrations. The concentrations of beryllium, copper, iron, mercury, and selenium also exceed their upper effects concentrations, suggesting a potential for risk to benthic invertebrates. However the comprehensive ERA for Muddy Cove identified mercury and PAHs as the primary drivers for risk to ecological receptors.

For the 1 to 2 ft depth interval, concentrations of beryllium, copper, mercury, and selenium exceed their median effects concentration. The median effects concentration for mercury is 14.4 mg/kg, which is slightly above the effects concentration of 12.3 mg/kg identified in the MCS proposal. The maximum concentration of beryllium for this depth interval exceeds the upper effects concentration. These results suggest a potential for risk to benthic invertebrates at the 1 to 2 ft depth interval.

For the depth interval greater than 2 ft, the maximum concentration of beryllium (1.3 mg/kg) slightly exceeds its median effects level (1.15 mg/kg). Concentrations of beryllium in the other four samples from this depth interval are below the media effects level. Beryllium is not expected to be associated with the Zeneca site. Furthermore, ecological benchmarks for beryllium are limited. The two benchmarks are the Negligible Concentration (NC) of 1.1 mg/kg and Maximum Permissible Concentration (MPC) of 1.2 mg/kg identified by Crommentuijn et al. (1997). It can reasonably be concluded that impacts to benthic invertebrates at the maximum concentration of 1.3 mg/kg are expected to be minimal.

6.0 UNCERTAINTIES

The evaluation of risk presented in this document has several areas of uncertainty. The available data are limited to four sample locations. It is uncertain that the horizontal and vertical extent of the COPECs in the Phragmites marsh has been fully characterized. In addition, the data are 5 years old. Given the dynamic nature of aquatic systems, it is uncertain if the current concentrations of the COPECs in the Phragmites marsh are similar to those documented in November 2005.

The evaluation of risk was based on comparison of sediment concentrations to ecological benchmarks. This is generally a conservative approach and, if anything, tends to overestimate the potential for risk. Additional lines of evidence, such as toxicity testing specific to the Phragmites marsh and quantification of the benthic communities were not available.

7.0 CONCLUSIONS

The potential risk to benthic invertebrates was evaluated for the Phragmites marsh in Muddy Cove. The Phragmites marsh and Muddy Cove are associated with the former Zeneca facility in Dighton, Massachusetts. The risk evaluation focused on benthic invertebrates, as a comprehensive ERA conducted for Muddy Cove and follow-up evaluation by CRA concluded that the potential for risk to avian and mammalian receptors did not exceed the threshold for concern due to low habitat quality and small area relative to overall foraging area.

The evaluation of risk was conducted using an iterative approach. The first iteration pooled data from all sample depths. A constituent was identified as a COPEC if the maximum detected concentration exceeded its ESV, a conservative screening benchmark. For those constituents identified as COPECs, maximum concentrations for each of three depth intervals (0 to 0.5 ft, 1 to 2 ft, and greater than 2 ft) were identified and compared to their ESVs.

For the second iteration, concentrations from reference sites for Muddy Cove and alternative ecological benchmarks were considered. Based on these considerations, three effects concentrations were defined: a lower effects concentration, an upper effects concentration, and a median effects concentration. The median effects concentration, which was the mid-point between the lower effects and upper effects concentrations, was used to identify those COPECs with a potential to pose risk to benthic invertebrates.

For the 0 to 0.5 ft depth interval, arsenic, copper, iron, mercury, selenium, and total PCBs were identified as potentially posing risk to benthic invertebrates. For the 1 to 2 ft depth interval, beryllium, copper, mercury, and selenium were identified as potentially posing risk. For the depth interval greater than 2 ft, only beryllium was identified as potentially posing risk However, based on a limited number of ecological benchmarks and one slight exceedence of the median effects concentration, beryllium is unlikely to pose a significant potential for risk to the benthic community. The association of beryllium and selenium with the former Zeneca facility is questionable.

Zeneca has agreed to ecologically enhance the area of the Phragmites marsh by eradicating *Phragmites* and removing the root system through excavation of sediment. These activities will eliminate the 0 to 0.5 ft and 1 to 2 ft depth intervals, which will concurrently eliminate the potential for risk to benthic invertebrates. If the removal activities leave the greater than 2 ft depth interval exposed, the potential for risk to the benthic community that colonizes the exposed substrate will be minimal.

8.0 LITERATURE CITED

Canadian Council of Ministers of the Environment. 2002. http://www.ec.gc.ca/ceqg-rcqe/English/Ceqg/Sediment/default.cfm.

Crommentuijn, T., M.D. Polder, and E.J. van de Plassche. 1997. Maximum Permissible Concentrations and Negligible Concentrations for Metals, Taking Background Concentrations into Account. National Institute of Public Health and the Environment, Bilthoven, The Netherlands. Report No. 601501 001.

MacDonald, D.D. 1994. Approach to the Assessment of Sediment Quality in Florida Coastal Waters. Office of Water Policy, Florida Department of Environmental Protection, Tallahassee, Florida.

MacDonald, D. D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.

National Oceanic and Atmospheric Administration. 1999. National Oceanic and Atmospheric Administration, Sediment Quality Guidelines for the National Status and Trends Program. June 12, 1999.

Persaud, D., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of the Environment and Energy. August 1993. ISBN 0-7729-9248-7. Website available at: http://www.ene.gov.on.ca/envision/gp/B1_3.pdf.

Texas Commission on Environmental Quality. 2006. Update to Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas. RG-263 (Revised). January 2006 Version.

USEPA. Undated. Freshwater Sediment Screening Benchmarks. http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/fwsed/screenbench.htm

USEPA. 1995. Ecological screening values, Ecological Risk Assessment Bulletin No. 2, Waste Management Division. Atlanta, Georgia. (superceded by http://www.epa.gov/region04/waste/ots/ecolbul.html#tbl3).

USEPA. 1996. Calculation and Evaluation of Sediment Effect Concentrations for the Amphipod *Hyalella azteca* and the Midge *Chironomus riparius.* Great Leaks National Program Office, Chicago, Illinois. EPA 905/R96/008.

USEPA. 2003. USEPA, Region 5, RCRA, Ecological Screening Levels, August 22, 2003.

Washington Department of Ecology. 2001. Sediment Quality Chemical Criteria. Sediment Management Unit. Updated August 9, 2001.

TABLE D.1

ECOLOGICAL SCREENING VALUES FOR CONSTITUENTS DETECTED IN SEDIMENT
PHRAGMITES MARSH
DIGHTON, MASSACHUSETTS

Constituent	*Units*	*Ecological Screening Value*	*Source*
VOCs			
1,2,4-Trichlorobenzene	mg/kg	5.062	USEPA 5 ESL
1,2-Dichlorobenzene	mg/kg	0.294	USEPA 5 ESL
1,3-Dichlorobenzene	mg/kg	1.315	USEPA 5 ESL
1,4-Dichlorobenzene	mg/kg	0.318	USEPA 5 ESL
2-Butanone (Methyl ethyl ketone) (MEK)	mg/kg	0.0424	USEPA 5 ESL
Acetone	mg/kg	0.0099	USEPA 5 ESL
Carbon disulfide	mg/kg	0.0239	USEPA 5 ESL
Chlorobenzene	mg/kg	0.291	USEPA 5 ESL
BTEX			
Benzene	mg/kg	0.14157	USEPA 5 ESL
Toluene	mg/kg	1.22	USEPA 5 ESL
SVOCs			
4-Methylphenol	mg/kg	0.0202	USEPA 5 ESL
bis(2-Ethylhexyl)phthalate (DEHP)	mg/kg	0.182	USEPA 5 ESL
Butyl benzylphthalate (BBP)	mg/kg	1.97	USEPA 5 ESL
Dibenzofuran	mg/kg	0.449	USEPA 5 ESL
Phenol	mg/kg	0.0491	USEPA 5 ESL
PAHs			
Total PAHs	mg/kg	1.61	Consensus TEC
Low Molecular Weight (LMW) PAHs	mg/kg	0.552	NOAA ER-L
2-Methylnaphthalene	mg/kg	0.0202	USEPA 5 ESL
Acenaphthylene	mg/kg	0.00587	USEPA 5 ESL
Anthracene	mg/kg	0.0572	Consensus TEC
Naphthalene	mg/kg	0.176	Consensus TEC
Phenanthrene	mg/kg	0.204	Consensus TEC
High Molecular Weight (HMW) PAHs	mg/kg	1.7	NOAA ER-L
Benzo(a)anthracene	mg/kg	0.108	Consensus TEC
Benzo(a)pyrene	mg/kg	0.15	Consensus TEC
Chrysene	mg/kg	0.166	Consensus TEC
Dibenz(a,h)anthracene	mg/kg	0.033	Consensus TEC
Fluoranthene	mg/kg	0.423	Consensus TEC
Pyrene	mg/kg	0.195	Consensus TEC
Other PAHs			
Benzo(b)fluoranthene	mg/kg	10.4	USEPA 5 ESL
Benzo(g,h,i)perylene	mg/kg	0.17	USEPA 5 ESL
Benzo(k)fluoranthene	mg/kg	0.24	USEPA 5 ESL
Indeno(1,2,3-cd)pyrene	mg/kg	0.2	USEPA 5 ESL

TABLE D.1

ECOLOGICAL SCREENING VALUES FOR CONSTITUENTS DETECTED IN SEDIMENT
PHRAGMITES MARSH
DIGHTON, MASSACHUSETTS

Constituent	*Units*	*Ecological Screening Value*	*Source*
Metals			
Aluminum	mg/kg	58000	ARCS PEC
Antimony	mg/kg	2	NOAA ER-L
Arsenic	mg/kg	9.79	Consensus TEC
Barium	mg/kg	157	Dutch NC
Beryllium	mg/kg	1.1	Dutch NC
Cadmium	mg/kg	0.99	Consensus TEC
Calcium	mg/kg	N/A	---
Chromium	mg/kg	43.4	Consensus TEC
Cobalt	mg/kg	50	USEPA 5 ESL
Copper	mg/kg	31.6	Consensus TEC
Iron	mg/kg	20000	Ontario LEL
Lead	mg/kg	35.8	Consensus TEC
Magnesium	mg/kg	N/A	---
Manganese	mg/kg	460	Ontario LEL
Mercury	mg/kg	0.18	Consensus TEC
Methyl mercury	pg/g	10	USEPA 5 ESL
Nickel	mg/kg	22.7	Consensus TEC
Potassium	mg/kg	N/A	---
Selenium	mg/kg	0.72	Dutch NC
Silver	mg/kg	0.5	USEPA 5 ESL
Sodium	mg/kg	N/A	---
Vanadium	mg/kg	42	Dutch NC
Zinc	mg/kg	121	Consensus TEC
PCBs			
Total PCBs	mg/kg	0.0598	Consensus TEC
Aroclor-1248 (PCB-1248)	mg/kg	0.03	Ontario LEL
Aroclor-1254 (PCB-1254)	mg/kg	0.06	Ontario LEL
Tetrachlorobiphenyl	mg/kg	N/A	---
Trichlorobiphenyl	mg/kg	N/A	---

Notes:

ARCS PEC - Probable Effects Concentration (USEPA, 1996)
Consensus TEC - Threshold Effects Concentration (MacDonald et al., 2000)
Dutch NC - Negligible Concentration (Crommentuijn et al., 1997)
NOAA ER-L - Effects Range-Low (NOAA, 1999)
Ontario LEL - Lowest Effects Level (Persaud et al., 1993)
USEPA 5 ESL - USEPA Region 5 Ecological Screening Levels (USEPA, 2003)

TABLE D.2

CONSTITUENTS DETECTED IN SEDIMENT - ALL SAMPLE INTERVALS
PHRAGMITES MARSH
DIGHTON, MASSACHUSETTS

Constituent	*Units*	*No. of Samples*	*No. of Detects*	*Maximum Concentration*		*Location of Maximum*	*Depth of Maximum*	*ESV*	*Screening Quotient*	*BCOC*	*Retain for Further Evaluation*
VOCs											
1,2,4-Trichlorobenzene	mg/kg	13	1	0.0029	J	SB02-SED	2-3 ft	5.062	0.00057	No	No
1,2-Dichlorobenzene	mg/kg	13	1	0.015		SB02-SED	2-3 ft	0.294	0.051	No	No
1,3-Dichlorobenzene	mg/kg	13	1	0.0019	J	SB02-SED	2-3 ft	1.315	0.0014	No	No
1,4-Dichlorobenzene	mg/kg	13	1	0.007	J	SB02-SED	2-3 ft	0.318	0.022	No	No
2-Butanone (Methyl Ethyl Ketone) (MEK)	mg/kg	13	3	0.12		SB04-SED	1-2 ft	0.0424	**2.8**	No	YES
Acetone	mg/kg	13	12	0.17		SB01-SED	2-3 ft	0.0099	**17**	No	YES
Carbon Disulfide	mg/kg	13	6	0.011	J	SB03-SED	1-2 ft	0.0239	0.46	No	No
Chlorobenzene	mg/kg	13	3	0.078		SB02-SED	2-3 ft	0.291	0.27	No	No
BTEX											
Benzene	mg/kg	13	1	0.0018	J	SB02-SED	2-3 ft	0.14157	0.013	No	No
Toluene	mg/kg	13	2	0.014		SB01-SED	1-2 ft	1.22	0.011	No	No
SVOCs											
4-Methylphenol	mg/kg	13	2	0.21	J	SB02-SED	0-0.5 ft	0.0202	**10**	No	YES
bis(2-Ethylhexyl)phthalate (DEHP)	mg/kg	13	1	0.15	J	SB01-SED	0-0.5 ft	0.182	0.82	No	No
Butyl Benzylphthalate (BBP)	mg/kg	13	5	0.14	J	SB01-SED	0-0.5 ft	1.97	0.071	No	No
Dibenzofuran	mg/kg	13	1	0.029	J	SB02-SED	1-2 ft	0.449	0.065	No	No
Phenol	mg/kg	13	1	0.078	J	SB02-SED	1-2 ft	0.0491	**1.6**	No	YES
PAHs											
Total PAHs	mg/kg	13	9	5.0		SB02-SED	0-0.5 ft	1.61	**3.1**	No	YES
Low Molecular Weight (LMW) PAHs	mg/kg	13	8	1.2		SB02-SED	0-0.5 ft	0.552	**2.1**	No	YES
2-Methylnaphthalene	mg/kg	13	2	0.082	J	SB02-SED	0-0.5 ft	0.0202	**4.1**	No	YES
Acenaphthylene	mg/kg	13	2	0.15	J	SB02-SED	0-0.5 ft	0.00587	**26**	No	YES
Anthracene	mg/kg	13	4	0.21	J	SB02-SED	0-0.5 ft	0.0572	**3.7**	No	YES
Naphthalene	mg/kg	13	4	0.39	J	SB03-SED	0-0.5 ft	0.176	**2.2**	No	YES
Phenanthrene	mg/kg	13	6	0.32	J	SB02-SED	0-0.5 ft	0.204	**1.6**	No	YES
High Molecular Weight PAHs	mg/kg	13	10	2.7		SB02-SED	0-0.5 ft	1.7	**1.6**	No	YES
Benzo(a)anthracene	mg/kg	13	9	0.40	J	SB02-SED	0-0.5 ft	0.108	**3.7**	No	YES
Benzo(a)pyrene	mg/kg	13	7	0.45	J	SB03-SED	0-0.5 ft	0.15	**3.0**	No	YES
Chrysene	mg/kg	13	9	0.48	J	SB03-SED	0-0.5 ft	0.166	**2.9**	No	YES
Dibenz(a,h)anthracene	mg/kg	13	2	0.083	J	SB03-SED	1-2 ft	0.033	**2.5**	No	YES
Fluoranthene	mg/kg	13	9	0.68	J	SB02-SED	0-0.5 ft	0.423	**1.6**	No	YES
Pyrene	mg/kg	13	9	0.66	J	SB02-SED	0-0.5 ft	0.195	**3.4**	No	YES
Other PAHs											
Benzo(b)fluoranthene	mg/kg	13	7	0.49	J	SB03-SED	0-0.5 ft	10.4	0.047	No	No
Benzo(g,h,i)perylene	mg/kg	13	5	0.34	J	SB03-SED	0-0.5 ft	0.17	**2.0**	No	YES
Benzo(k)fluoranthene	mg/kg	13	6	0.17	J	SB03-SED	0-0.5 ft	0.24	0.71	No	No
Indeno(1,2,3-cd)pyrene	mg/kg	13	5	0.3	J	SB02-SED	0-0.5 ft	0.20	**1.5**	No	YES

TABLE D.2

CONSTITUENTS DETECTED IN SEDIMENT - ALL SAMPLE INTERVALS
PHRAGMITES MARSH
DIGHTON, MASSACHUSETTS

Constituent	*Units*	*No. of Samples*	*No. of Detects*	*Maximum Concentration*	*Location of Maximum*	*Depth of Maximum*	*ESV*	*Screening Quotient*	*BCOC*	*Retain for Further Evaluation*
Metals										
Aluminum	mg/kg	13	13	11,500	SB02-SED	0-0.5 ft	58,000	0.20	No	No
Antimony	mg/kg	13	4	3.7	SB04-SED	0-0.5 ft	2.0	**1.9**	No	YES
Arsenic	mg/kg	13	13	146	SB02-SED	0-0.5 ft	9.79	**15**	No	YES
Barium	mg/kg	13	13	33.2	SB02-SED	0-0.5 ft	157	0.21	No	No
Beryllium	mg/kg	13	13	2.1	SB03-SED	1-2 ft	1.1	**1.9**	No	YES
Cadmium	mg/kg	13	1	0.44	SB04-SED	2-3 ft	0.99	0.44	Yes	No
Calcium	mg/kg	13	13	3,470	SB01-SED	1-2 ft	N/A	---	No	No [a]
Chromium	mg/kg	13	13	534	SB04-SED	0-0.5 ft	43.4	**12**	No	YES
Cobalt	mg/kg	13	13	20.8	SB02-SED	0-0.5 ft	50	0.42	No	No
Copper	mg/kg	13	11	464	SB01-SED	0-0.5 ft	31.6	**15**	Yes	YES
Iron	mg/kg	13	13	81,200	SB02-SED	0-0.5 ft	20,000	**4.1**	No	YES
Lead	mg/kg	13	13	1,200	SB02-SED	0-0.5 ft	35.8	**34**	No	YES
Magnesium	mg/kg	13	13	4,140	SB01-SED	2-3 ft	N/A	---	No	No [a]
Manganese	mg/kg	13	13	277	SB02-SED	0-0.5 ft	460	0.60	No	No
Mercury	mg/kg	13	13	256	SB03-SED	0-0.5 ft	0.18	**1,422**	Yes	YES
Methyl Mercury	pg/g	13	13	101,000	SB02-SED	0-0.5 ft	10	**10,100**	Yes	YES
Nickel	mg/kg	13	13	39.7	SB02-SED	0-0.5 ft	22.7	**1.7**	Yes	YES
Potassium	mg/kg	13	13	1,580	SB01-SED	2-3 ft	N/A	---	No	No [a]
Selenium	mg/kg	13	12	4.9	SB02-SED	0-0.5 ft	0.72	**6.8**	Yes	YES
Silver	mg/kg	13	7	11.1	SB04-SED	0-0.5 ft	0.5	**22**	No	YES
Sodium	mg/kg	13	13	14,600	SB03-SED	1-2 ft	N/A	---	No	No [a]
Vanadium	mg/kg	13	13	52	SB01-SED	0-0.5 ft	42	**1.2**	No	YES
Zinc	mg/kg	13	13	341	SB02-SED	0-0.5 ft	121	**2.8**	Yes	YES
PCBs										
Total PCBs	mg/kg	13	5	10.4	SB03-SED	0-0.5 ft	0.0598	**174**	YES	YES
Aroclor-1248 (PCB-1248)	mg/kg	13	4	7.7	SB03-SED	0-0.5 ft	0.03	**257**	YES	YES
Aroclor-1254 (PCB-1254)	mg/kg	13	2	2.7	SB03-SED	0-0.5 ft	0.06	**45**	YES	YES
Tetrachlorobiphenyl	mg/kg	3	2	0.41	SB04-SED	0-0.5 ft	N/A	---		

Notes:

Bold Font identifies constituent with Screening Quotient > 1
J - Estimated concentration
N/A - Ecological Screening Value not available
ESV - Ecological Screening Value
BCOC - Bioaccumulative Chemical of Concern

TABLE D.3

CONSTITUENTS DETECTED IN SEDIMENT - 0-0.5 FT INTERVAL
PHRAGMITES MARSH
DIGHTON, MASSACHUSETTS

Constituent	*Units*	*No. of Samples*	*No. of Detects*	*Maximum Concentratio*		*Location of Maximum*	*ESV*	*Screening Quotient*	*No. Samples >*	*BCOC*
VOCs										
Acetone	mg/kg	4	3	0.11	J	SB02-SED	0.0099	**11**	3	No
SVOCs										
4-Methylphenol	mg/kg	4	1	0.21	J	SB02-SED	0.0202	**10**	1	No
PAHs										
Total PAHs	mg/kg	4	4	5.0		SB02-SED	1.61	**3.1**	3	No
Low Molecular Weight (LMW) PAH	mg/kg	4	3	1.2		SB02-SED	0.552	**2.1**	2	
2-Methylnaphthalene	mg/kg	4	1	0.082	J	SB02-SED	0.0202	**4.1**	1	No
Acenaphthylene	mg/kg	4	1	0.15	J	SB02-SED	0.00587	**26**	1	No
Anthracene	mg/kg	4	2	0.21	J	SB02-SED	0.0572	**3.7**	1	No
Naphthalene	mg/kg	4	3	0.39	J	SB03-SED	0.176	**2.2**	2	No
Phenanthrene	mg/kg	4	3	0.32	J	SB02-SED	0.204	**1.6**	1	No
High Molecular Weight (HMW) PAH	mg/kg	4	4	2.7		SB02-SED	1.7	**1.6**	2	No
Benzo(a)anthracene	mg/kg	4	4	0.40	J	SB02-SED	0.108	**3.7**	4	No
Benzo(a)pyrene	mg/kg	4	4	0.45	J	SB03-SED	0.15	**3.0**	3	No
Chrysene	mg/kg	4	4	0.48	J	SB03-SED	0.166	**2.9**	3	No
Dibenz(a,h)anthracene	mg/kg	4	1	0.083	J	SB02-SED	0.033	**2.5**	1	No
Fluoranthene	mg/kg	4	4	0.68	J	SB02-SED	0.423	**1.6**	2	No
Pyrene	mg/kg	4	4	0.66	J	SB02-SED	0.195	**3.4**	4	No
Other PAHs										
Benzo(g,h,i)perylene	mg/kg	4	2	0.34	J	SB03-SED	0.17	**2.0**	2	No

TABLE D.3

CONSTITUENTS DETECTED IN SEDIMENT - 0-0.5 FT INTERVAL
PHRAGMITES MARSH
DIGHTON, MASSACHUSETTS

Constituent	*Units*	*No. of Samples*	*No. of Detects*	*Maximum Concentratio*	*Location of Maximum*	*ESV*	*Screening Quotient*	*No. Samples >*	*BCOC*
Metals									
Antimony	mg/kg	4	3	3.7	SB04-SED	2.0	**1.9**	3	No
Arsenic	mg/kg	4	4	146	SB02-SED	9.79	**15**	4	No
Beryllium	mg/kg	4	4	1.9	SB04-SED	1.1	**1.7**	3	No
Chromium	mg/kg	4	4	534	SB04-SED	43.4	**12**	4	No
Copper	mg/kg	4	4	464	SB01-SED	31.6	**15**	4	Yes
Iron	mg/kg	4	4	81,200	SB02-SED	20,000	**4.1**	1	No
Lead	mg/kg	4	4	1,200	SB02-SED	35.8	**34**	4	No
Mercury	mg/kg	4	4	256	SB03-SED	0.18	**1,422**	4	Yes
Methyl Mercury	pg/g	4	4	101,000	SB02-SED	10	**10,100**	4	Yes
Nickel	mg/kg	4	4	39.7	SB02-SED	22.7	**1.7**	2	Yes
Selenium	mg/kg	4	4	4.9	SB02-SED	0.72	**6.8**	4	Yes
Silver	mg/kg	4	4	11.1	SB04-SED	0.5	**22**	4	No
Vanadium	mg/kg	4	4	52	SB01-SED	42	**1.2**	1	No
Zinc	mg/kg	4	4	341	SB02-SED	121	**2.8**	1	Yes
PCBs									
Total PCBs	mg/kg	4	2	10.4	SB03-SED	0.0598	**174**	2	Yes
Aroclor-1248 (PCB-1248)	mg/kg	4	2	7.7	SB03-SED	0.03	**257**	2	Yes
Aroclor-1254 (PCB-1254)	mg/kg	4	2	2.7	SB03-SED	0.06	**45**	2	Yes
Tetrachlorobiphenyl	mg/kg	2	2	0.41	SB04-SED	N/A	---	---	Yes

Notes:

Bold Font identifies constituent with Screening Quotient > 1
J - Estimated concentration
BGS - Below Ground Surface
ESV - Ecological Screening Value
BCOC - Bioaccumulative Chemical of Concern

TABLE D.4

CONSTITUENTS DETECTED IN SEDIMENT - 1-2 FT INTERVAL
PHRAGMITES MARSH
DIGHTON, MASSACHUSETTS

Constituent	*Units*	*No. of Samples*	*No. of Detects*	*Maximum Concentration*		*Location of*	*ESV*	*Screening Quotient*	*No. Samples >*	*BCOC*
VOCs										
2-Butanone (Methyl Ethyl Ketone) (MEK	mg/kg	4	1	0.12		SB04-SED	0.0424	**2.8**	1	No
Acetone	mg/kg	4	4	0.16		SB01-SED	0.0099	**16**	4	No
SVOCs										
4-Methylphenol	mg/kg	4	1	0.065	J	SB02-SED	0.0202	**3.2**	1	No
Phenol	mg/kg	4	1	0.078	J	SB02-SED	0.0491	**1.6**	1	No
PAHs										
Total PAHs	mg/kg	4	3	2.3		SB02-SED	1.61	**1.4**	2	No
Low Molecular Weight (LMW) PAHs	mg/kg	4	3	0.50		SB02-SED	0.552	0.91	0	No
2-Methylnaphthalene	mg/kg	4	1	0.072	J	SB02-SED	0.0202	**3.6**	1	No
Acenaphthylene	mg/kg	4	1	0.051	J	SB02-SED	0.00587	**8.7**	1	No
Anthracene	mg/kg	4	2	0.081	J	SB02-SED	0.0572	**1.4**	1	No
Naphthalene	mg/kg	4	1	0.12	J	SB02-SED	0.176	0.68	0	No
Phenanthrene	mg/kg	4	3	0.15	J	SB02-SED	0.204	0.74	0	No
High Molecular Weight (HMW) PAHs	mg/kg	4	3	1.2		SB02-SED	1.7	0.68	0	No
Benzo(a)anthracene	mg/kg	4	3	0.18	J	SB02-SED	0.108	**1.7**	3	No
Benzo(a)pyrene	mg/kg	4	3	0.19	J	SB02-SED	0.15	**1.3**	2	No
Chrysene	mg/kg	4	3	0.17	J	SB02-SED	0.166	**1.0**	0	No
Dibenz(a,h)anthracene	mg/kg	4	1	0.048	J	SB03-SED	0.033	**1.5**	1	No
Fluoranthene	mg/kg	4	3	0.31	J	SB02-SED	0.423	**0.7**	0	No
Pyrene	mg/kg	4	3	0.29	J	SB02-SED	0.195	**1.5**	2	No
Other PAHs										
Benzo(g,h,i)perylene	mg/kg	4	3	0.18	J	SB02-SED	0.17	**1.1**	1	No

TABLE D.4

CONSTITUENTS DETECTED IN SEDIMENT - 1-2 FT INTERVAL
PHRAGMITES MARSH
DIGHTON, MASSACHUSETTS

Constituent	*Units*	*No. of Samples*	*No. of Detects*	*Maximum Concentration*	*Location of*	*ESV*	*Screening Quotient*	*No. Samples >*	*BCOC*
Metals									
Antimony	mg/kg	4	1	2.3	SB03-SED	2.0	**1.2**	1	No
Arsenic	mg/kg	4	4	49.5	SB03-SED	9.79	**5.1**	4	No
Beryllium	mg/kg	4	4	2.1	SB03-SED	1.1	**1.9**	3	No
Chromium	mg/kg	4	4	181	SB01-SED	43.4	**4.2**	2	No
Copper	mg/kg	4	3	307	SB01-SED	31.6	**10**	3	Yes
Iron	mg/kg	4	4	23,800	SB02-SED	20,000	**1.2**	1	No
Lead	mg/kg	4	4	244	SB02-SED	35.8	**6.8**	3	No
Mercury	mg/kg	4	4	17.3	SB03-SED	0.18	**96**	4	Yes
Methyl Mercury	pg/g	4	4	25,600	SB03-SED	10	**2,560**	4	Yes
Nickel	mg/kg	4	4	19.2	SB01-SED	22.7	0.85	0	Yes
Selenium	mg/kg	4	4	2.2	SB01-SED SB02-SED	0.72	**3.1**	4	Yes
Silver	mg/kg	4	3	2.2	SB01-SED	0.5	**4.4**	4	No
Vanadium	mg/kg	4	4	51	SB01-SED	42	**1.2**	1	No
Zinc	mg/kg	4	4	132	SB02-SED	121	**1.1**	1	Yes
PCBs									
Total PCBs	mg/kg	4	1	0.77	SB03-SED	0.0598	**13**	1	Yes
Aroclor-1248 (PCB-1248)	mg/kg	4	1	0.77	SB03-SED	0.03	**26**	1	Yes

Notes:

Bold Font identifies constituent with Screening Quotient > 1
J - Estimated concentration
BGS - Below Ground Surface
ESV - Ecological Screening Value
BCOC - Bioaccumulative Chemical of Concern

TABLE D.5

CONSTITUENTS DETECTED IN SEDIMENT - GREATER THAN 2 FT
PHRAGMITES MARSH
DIGHTON, MASSACHUSETTS

Constituent	*Units*	*No. of Samples*	*No. of Detects*	*Maximum Concentration*	*Location of Maximum*	*ESV*	*Screening Quotient*	*No. Samples >*	*BCOC*
VOCs									
2-Butanone (Methyl Ethyl Ketone) (MEK	mg/kg	5	2	0.11	SB04-SED	0.0424	**2.6**	1	No
Acetone	mg/kg	5	5	0.17	SB01-SED	0.0099	**17**	5	No
PAHs									
Total PAHs	mg/kg	5	2	0.43	SB01-SED	1.61	0.3	0	No
High Molecular Weight (HMW) PAHs	mg/kg	5	2	0.21	SB01-SED	1.7	0.13	0	No
Benzo(a)anthracene	mg/kg	5	2	0.04 J	SB02-SED	0.108	0.41	0	No
Benzo(a)pyrene	mg/kg	5	1	0.015 J	SB03-SED	0.15	0.10	0	No
Chrysene	mg/kg	5	2	0.036 J	SB01-SED	0.166	0.22	0	No
Fluoranthene	mg/kg	5	2	0.053 J	SB02-SED	0.423	0.13	0	No
Pyrene	mg/kg	5	2	0.049 J	SB02-SED	0.195	0.25	0	No
Metals									
Arsenic	mg/kg	5	5	56.9	SB02-SED	9.79	**5.8**	2	No
Beryllium	mg/kg	5	5	1.3	SB03-SED	1.1	**1.2**	1	No
Chromium	mg/kg	5	5	39.9	SB04-SED	43.4	0.92	0	No
Copper	mg/kg	5	4	28.2	SB01-SED	31.6	0.89	0	Yes
Iron	mg/kg	5	5	14,600	SB02-SED	20,000	0.73	0	No
Lead	mg/kg	5	5	124	SB02-SED	35.8	**3.5**	2	No
Mercury	mg/kg	5	5	3.6	SB03-SED	0.18	**20**	4	Yes
Methyl Mercury	pg/g	5	5	3,940	SB02-SED	10	**394**	4	Yes
Nickel	mg/kg	5	5	21.5	SB02-SED	22.7	0.95	0	Yes
Selenium	mg/kg	5	4	1.3	SB02-SED	0.72	**1.8**	3	Yes
Vanadium	mg/kg	5	5	26.9	SB01-SED	42	0.64	0	No
Zinc	mg/kg	5	5	88.6	SB02-SED	121	0.73	0	Yes
PCBs									
Total PCBs	mg/kg	5	1	0.029	SB03-SED	0.0598	0.48	0	Yes
Aroclor-1248 (PCB-1248)	mg/kg	5	1	0.029	SB03-SED	0.03	0.97	0	Yes

Notes:

Bold Font identifies constituent with Screening Quotient > 1
J - Estimated concentration
BGS - Below Ground Surface
ESV - Ecological Screening Value
BCOC - Bioaccumulative Chemical of Concern

TABLE D.6

CONCENTRATIONS OF COPECs AT REFERENCE SITES AND ALTERNATIVE ECOLOGICAL BENCHMARKS
PHRAGMITES MARSH
DIGHTON, MASSACHUSETTS

				Consensus	*NOAA*		*USEPA*		*ARCS*			*Florid*	*Wash*	*CCME*	*Ontario*	*Dutch*	
Constituent	*Units*	*Max Reference*	*ESV*	*PEC*	*ER-L*	*ER-M*	*R3*	*R4*	*TEC*	*PEC*	*NEC*	*PEL*	*NEL*	*PEL*	*SEL*	*NC*	*MPC*
SVOCs																	
4-Methylphenol	mg/kg	0.16	**0.0202**				0.67						0.67				
Phenol	mg/kg	0.16	**0.0491**				0.42						0.42				
PAHs																	
Total PAHs	mg/kg		1.61	22.8	4.022	44.792	0.076	1.684	3.55	13.7	84.6	16.77					
Low Molecular Weight (LMW) PAHs	mg/kg		0.552		0.552	3.16	0.19	0.33	0.786	3.37	3.04	1.442	3.7				
High Molecular Weight (HMW) PAHs	mg/kg		1.7		1.7	9.6	1.61	0.655	2.9	4.35	51	6.676	9.6				
Metals																	
Antimony	mg/kg	0.3	2		2	25	2	12								3.2	19
Arsenic	mg/kg	21	**9.79**	33		70				57	92.9	41.6	57		33	31	190
Beryllium	mg/kg	0.99	1.1													1.1	1.2
Chromium	mg/kg	380	**43.4**			370											1,720
Copper	mg/kg	130	**31.6**	149		270							390	197			
Iron	mg/kg	31,000	**20,000**												40,000		
Lead	mg/kg	120	**35.8**	128		218				396			450		250	132	4,800
Mercury	mg/kg	2.8	**0.18**														26
Methyl Mercury	pg/g	12,000	**10**													310,000	1,400,000
Nickel	mg/kg	26	**22.7**	48.6		51.6			39.6	38.5	37.9	42.8			75	35	44
Selenium	mg/kg	0.69	0.72													0.72	2.9
Silver	mg/kg	13	**0.5**														
Vanadium	mg/kg	48	**42**														56
Zinc	mg/kg	210	**121**	459		410				1,530	541	271	410	315	820		620
PCBs																	
Total PCBs	mg/kg	0.39	**0.0598**	0.676											5.3		
Tetrachorobiphenyl	mg/kg	0.15															

TABLE D.6

CONCENTRATIONS OF COPECs AT REFERENCE SITES AND ALTERNATIVE ECOLOGICAL BENCHMARKS
PHRAGMITES MARSH
DIGHTON, MASSACHUSETTS

Notes:

Bold Font identifies constituent with ESV < maximum concentration at reference site
Blank Cell - value not availble
Sources
- ARCS - Assessment and Remediation of Contaminated Sites (USEPA, 1996)
- CCME - Canadian Council of Ministers of the Environment (2002)
- Consensus - MacDonald et al. (2000)
- Dutch - Crommentuijn et al. (1997)
- Florida - Florida Department of Environmental Protection (MacDonald, 1994)
- NOAA - National Oceanic and Atmospheric Administration (NOAA, 1999)
- Ontario (Persaud et al., 1993)
- USEPA R3 BTAG - United States Environmental Protection Agency, Region 3, Biological Technical Assistance Group (undated)
- USEPA R4 - United States Environmental Protection Agency, Region 4 (1995)
- Wash - Washington State Department of Ecology (2001)

Benchmarks
- ER-L - Effects Range-Low
- ER-M - Effects Range-Median
- ESV - Ecological Screening Value
- LEL - Lowest Effects Level
- MPC - Maximum Permissible Concentration
- NC - Negligible Concentration
- NEC - No Effects Concentration
- NEL - No Effects Level
- PEC - Probable Effects Concentration
- PEL - Probable Effects Level
- TEC - Threshold Effects Concentration

TABLE D.7

COMPARISON OF COPEC CONCENTRATIONS TO EFFECT CONCENTRATIONS BY DEPTH INTERVAL
PHRAGMITES MARSH
DIGHTON, MASSACHUSETTS

					Sample Interval		
Constituent	*Units*	*Effects Conc*	*Effects Conc*	*Effects Conc*	*0 - 0.5 ft*	*1-2 ft*	*>2 ft*
SVOCs							
4-Methylphenol	mg/kg	0.16	0.67	0.42	0.21 J	0.065 J	ND
Phenol	mg/kg	0.16	0.42	0.29	ND	0.078 J	ND
PAHs							
Total PAHs	mg/kg	1.61	100	50.8	5.0	2.3	0.43
Low Molecular Weight (LMW) PAHs	mg/kg	0.076	3.7	1.9	1.2	0.50	ND
High Molecular Weight PAHs	mg/kg	0.19	51	25.6	2.7	1.2	0.21
Metals							
Antimony	mg/kg	2	25	13.5	3.7	2.3	ND
Arsenic	mg/kg	21	190	106	**146**	49.5	56.9
Beryllium	mg/kg	1.1	1.2	1.15	**1.9**	**2.1**	**1.3**
Chromium	mg/kg	370	1,720	1,045	534	181	39.9
Copper	mg/kg	130	390	260	**464**	**307**	28.2
Iron	mg/kg	31,000	40,000	35,500	**81,200**	23,800	14,600
Lead	mg/kg	120	4,800	2,460	1,200	244	124
Mercury	mg/kg	2.8	26	14.4	**256**	**17.3**	3.6
Methyl Mercury	pg/g	12,000	1,400,000	706,000	101,000	25,600	3,940
Nickel	mg/kg	26	75	50.5	39.7	19.2	21.5
Selenium	mg/kg	0.72	2.9	1.81	**4.9**	**2.2**	1.3
Silver	mg/kg		13		11.1	2.2	ND
Vanadium	mg/kg	48	56	52	52	51	26.9
Zinc	mg/kg	210	1,530	870	341	132	88.6
PCBs							
Total PCBs	mg/kg	0.39	5.3	2.845	**10.4**	0.77	0.029

Notes:

Bold Font identifies concentration that exceeds the Median Effects Concentration
J - Estimated concentration

ATTACHMENT D-1

SEDIMENT DATA FOR PHRAGMITES MARSH

ATTACHMENT D-1

OFF SITE - SEDIMENT SAMPLING - ANALYTICAL RESULTS

AOC:		*OFF*	*OFF*	*OFF*	*OFF*
Sample Location:		*SB01-SED*	*SB01-SED*	*SB01-SED*	*SB01-SED*
Sample ID:		*SED-15620-110105-RR-001*	*SED-15620-110105-RR-002*	*SED-15620-110105-RR-003*	*S-15620-110205-JM-006*
Unit:		*SED*	*SED*	*SED*	*SED*
Sample Date:		*11/1/2005*	*11/1/2005*	*11/1/2005*	*11/2/2005*
Sample Depth:		*0-0.5 ft BGS*	*1-2 ft BGS*	*2-3 ft BGS*	*3.5-4.5 ft BGS*
Parameter	*Units*				
Volatiles					
1,1,1-Trichloroethane	mg/kg	ND (0.0028)	ND (0.0031)	ND (0.0021)	ND (0.00092)
1,1,2,2-Tetrachloroethane	mg/kg	ND (0.0047)	ND (0.0051)	ND (0.0035)	ND (0.0015) UJ
1,1,2-Trichloroethane	mg/kg	ND (0.0071)	ND (0.0077)	ND (0.0053)	ND (0.0023)
1,1-Dichloroethane	mg/kg	ND (0.003)	ND (0.0033)	ND (0.0022)	ND (0.00097)
1,1-Dichloroethene	mg/kg	ND (0.0062)	ND (0.0067)	ND (0.0046)	ND (0.002)
1,2,4-Trichlorobenzene	mg/kg	ND (0.014)	ND (0.016)	ND (0.011)	ND (0.0047)
1,2-Dibromo-3-chloropropane (DBCP)	mg/kg	ND (0.0049)	ND (0.0053)	ND (0.0036)	ND (0.0016)
1,2-Dibromoethane (Ethylene dibromide)	mg/kg	ND (0.0028)	ND (0.003)	ND (0.0021)	ND (0.00091)
1,2-Dichlorobenzene	mg/kg	ND (0.0097)	ND (0.011)	ND (0.0072)	ND (0.0031)
1,2-Dichloroethane	mg/kg	ND (0.0032)	ND (0.0034)	ND (0.0024)	ND (0.001)
1,2-Dichloropropane	mg/kg	ND (0.0066)	ND (0.0071)	ND (0.0049)	ND (0.0021)
1,3-Dichlorobenzene	mg/kg	ND (0.0095)	ND (0.01)	ND (0.0071)	ND (0.0031)
1,4-Dichlorobenzene	mg/kg	ND (0.0072)	ND (0.0077)	ND (0.0053)	ND (0.0023)
2-Butanone (Methyl ethyl ketone) (MEK)	mg/kg	ND (0.015)	ND (0.016)	0.11	ND (0.0047)
2-Hexanone	mg/kg	ND (0.0085)	ND (0.0092)	ND (0.0063)	ND (0.0028)
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/kg	ND (0.0088)	ND (0.0096)	ND (0.0066)	ND (0.0029)
Acetone	mg/kg	ND (0.052)	0.16 J	0.17	0.031 J
Benzene	mg/kg	ND (0.0057)	ND (0.0062)	ND (0.0043)	ND (0.0019)
Bromodichloromethane	mg/kg	ND (0.0026)	ND (0.0028)	ND (0.0019)	ND (0.00085)
Bromoform	mg/kg	ND (0.0064)	ND (0.0069)	ND (0.0048)	ND (0.0021)
Bromomethane (Methyl bromide)	mg/kg	ND (0.0098)	ND (0.011)	ND (0.0073)	ND (0.0032)
Carbon disulfide	mg/kg	ND (0.0038)	ND (0.0041)	0.0073 J	ND (0.0012)
Carbon tetrachloride	mg/kg	ND (0.0026)	ND (0.0028)	ND (0.0019)	ND (0.00085)
Chlorobenzene	mg/kg	ND (0.0089)	ND (0.0096)	ND (0.0066)	ND (0.0029)
Chloroethane	mg/kg	ND (0.0099)	ND (0.011)	ND (0.0073)	ND (0.0032) UJ
Chloroform (Trichloromethane)	mg/kg	ND (0.0026)	ND (0.0028)	ND (0.0019)	ND (0.00085)
Chloromethane (Methyl chloride)	mg/kg	ND (0.003)	ND (0.0032)	ND (0.0022)	ND (0.00097)
cis-1,2-Dichloroethene	mg/kg	ND (0.0078)	ND (0.0085)	ND (0.0058)	ND (0.0025)
cis-1,3-Dichloropropene	mg/kg	ND (0.003)	ND (0.0033)	ND (0.0022)	ND (0.00097)
Cyclohexane	mg/kg	ND (0.004)	ND (0.0043)	ND (0.0029)	ND (0.0013)
Dibromochloromethane	mg/kg	ND (0.0027)	ND (0.003)	ND (0.002)	ND (0.00088)
Dichlorodifluoromethane (CFC-12)	mg/kg	ND (0.0053)	ND (0.0057)	ND (0.0039)	ND (0.0017)
Ethylbenzene	mg/kg	ND (0.0098)	ND (0.011)	ND (0.0072)	ND (0.0032)
Isopropyl benzene	mg/kg	ND (0.012)	ND (0.013)	ND (0.0087)	ND (0.0038)
Methyl acetate	mg/kg	ND (0.026)	ND (0.028)	ND (0.019)	ND (0.0085)
Methyl cyclohexane	mg/kg	ND (0.0082)	ND (0.0089)	ND (0.0061)	ND (0.0026)
Methyl tert butyl ether (MTBE)	mg/kg	ND (0.0043)	ND (0.0046)	ND (0.0032)	ND (0.0014)
Methylene chloride	mg/kg	ND (0.014)	ND (0.015)	ND (0.01)	ND (0.0045)
Styrene	mg/kg	ND (0.0084)	ND (0.0091)	ND (0.0062)	ND (0.0027)
Tetrachloroethene	mg/kg	ND (0.008)	ND (0.0087)	ND (0.006)	ND (0.0026)
Toluene	mg/kg	ND (0.0062)	0.014 J	ND (0.0046)	ND (0.002)
trans-1,2-Dichloroethene	mg/kg	ND (0.0068)	ND (0.0074)	ND (0.0051)	ND (0.0022)

ATTACHMENT D-1

OFF SITE - SEDIMENT SAMPLING - ANALYTICAL RESULTS

AOC:		*OFF*	*OFF*	*OFF*	*OFF*
Sample Location:		*SB01-SED*	*SB01-SED*	*SB01-SED*	*SB01-SED*
Sample ID:		*SED-15620-110105-RR-001*	*SED-15620-110105-RR-002*	*SED-15620-110105-RR-003*	*S-15620-110205-JM-006*
Unit:		*SED*	*SED*	*SED*	*SED*
Sample Date:		*11/1/2005*	*11/1/2005*	*11/1/2005*	*11/2/2005*
Sample Depth:		*0-0.5 ft BGS*	*1-2 ft BGS*	*2-3 ft BGS*	*3.5-4.5 ft BGS*
Parameter	*Units*				
trans-1,3-Dichloropropene	mg/kg	ND (0.0029)	ND (0.0031)	ND (0.0021)	ND (0.00093)
Trichloroethene	mg/kg	ND (0.009)	ND (0.0098)	ND (0.0067)	ND (0.0029)
Trichlorofluoromethane (CFC-11)	mg/kg	ND (0.013)	ND (0.014)	ND (0.0094)	ND (0.0041)
Trifluorotrichloroethane (Freon 113)	mg/kg	ND (0.0036)	ND (0.0039)	ND (0.0027)	ND (0.0012)
Vinyl chloride	mg/kg	ND (0.0069)	ND (0.0074)	ND (0.0051)	ND (0.0022)
Xylene (total)	mg/kg	ND (0.029)	ND (0.031)	ND (0.021)	ND (0.0093)
Semi-Volatiles					
2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	mg/kg	ND (0.032)	ND (0.034)	ND (0.027)	ND (0.011)
2,4,5-Trichlorophenol	mg/kg	ND (0.13)	ND (0.13)	ND (0.1)	ND (0.042)
2,4,6-Trichlorophenol	mg/kg	ND (0.038)	ND (0.04)	ND (0.032)	ND (0.013)
2,4-Dichlorophenol	mg/kg	ND (0.041)	ND (0.044)	ND (0.035)	ND (0.014)
2,4-Dimethylphenol	mg/kg	ND (0.035)	ND (0.037)	ND (0.03)	ND (0.012)
2,4-Dinitrophenol	mg/kg	ND (5.5)	ND (5.8)	ND (4.6)	ND (1.8)
2,4-Dinitrotoluene	mg/kg	ND (0.023)	ND (0.024)	ND (0.019)	ND (0.0077)
2,6-Dinitrotoluene	mg/kg	ND (0.031)	ND (0.033)	ND (0.026)	ND (0.011)
2-Chloronaphthalene	mg/kg	ND (0.047)	ND (0.049)	ND (0.039)	ND (0.016)
2-Chlorophenol	mg/kg	ND (0.035)	ND (0.037)	ND (0.029)	ND (0.012)
2-Methylnaphthalene	mg/kg	ND (0.054)	ND (0.057)	ND (0.045)	ND (0.018)
2-Methylphenol	mg/kg	ND (0.049)	ND (0.052)	ND (0.041)	ND (0.016)
2-Nitroaniline	mg/kg	ND (0.027)	ND (0.029)	ND (0.023)	ND (0.0092)
2-Nitrophenol	mg/kg	ND (0.039)	ND (0.042)	ND (0.033)	ND (0.013)
3,3'-Dichlorobenzidine	mg/kg	ND (0.054)	ND (0.058)	ND (0.045)	ND (0.018)
3-Nitroaniline	mg/kg	ND (1.1)	ND (1.2)	ND (0.93)	ND (0.37)
4,6-Dinitro-2-methylphenol	mg/kg	ND (5.5)	ND (5.8)	ND (4.6)	ND (1.8)
4-Bromophenyl phenyl ether	mg/kg	ND (0.11)	ND (0.12)	ND (0.092)	ND (0.037)
4-Chloro-3-methylphenol	mg/kg	ND (0.048)	ND (0.051)	ND (0.04)	ND (0.016)
4-Chloroaniline	mg/kg	ND (0.11)	ND (0.12)	ND (0.092)	ND (0.037)
4-Chlorophenyl phenyl ether	mg/kg	ND (0.045)	ND (0.048)	ND (0.038)	ND (0.015)
4-Methylphenol	mg/kg	ND (0.049)	ND (0.052)	ND (0.041)	ND (0.017)
4-Nitroaniline	mg/kg	ND (0.031)	ND (0.033)	ND (0.026)	ND (0.01)
4-Nitrophenol	mg/kg	ND (0.029)	ND (0.031)	ND (0.025)	ND (0.0099)
Acenaphthene	mg/kg	ND (0.048)	ND (0.051)	ND (0.04)	ND (0.016)
Acenaphthylene	mg/kg	ND (0.046)	ND (0.049)	ND (0.038)	ND (0.015)
Acetophenone	mg/kg	ND (0.55)	ND (0.58)	ND (0.46)	ND (0.18)
Anthracene	mg/kg	0.052 J	0.054 J	ND (0.042)	ND (0.017)
Atrazine	mg/kg	ND (0.55)	ND (0.58)	ND (0.46)	ND (0.18)
Benzaldehyde	mg/kg	ND (0.49)	ND (0.52)	ND (0.41)	ND (0.16)
Benzo(a)anthracene	mg/kg	0.12 J	0.14 J	0.044 J	ND (0.016)
Benzo(a)pyrene	mg/kg	0.13 J	0.17 J	ND (0.031)	ND (0.012)
Benzo(b)fluoranthene	mg/kg	0.15 J	0.2 J	ND (0.037)	ND (0.015)
Benzo(g,h,i)perylene	mg/kg	ND (0.042)	0.14 J	ND (0.035)	ND (0.014)
Benzo(k)fluoranthene	mg/kg	0.066 J	0.085 J	ND (0.036)	ND (0.014)

ATTACHMENT D-1

OFF SITE - SEDIMENT SAMPLING - ANALYTICAL RESULTS

	AOC:	*OFF*	*OFF*	*OFF*	*OFF*
	Sample Location:	*SB01-SED*	*SB01-SED*	*SB01-SED*	*SB01-SED*
	Sample ID:	*SED-15620-110105-RR-001*	*SED-15620-110105-RR-002*	*SED-15620-110105-RR-003*	*S-15620-110205-JM-006*
	Unit:	*SED*	*SED*	*SED*	*SED*
	Sample Date:	*11/1/2005*	*11/1/2005*	*11/1/2005*	*11/2/2005*
	Sample Depth:	*0-0.5 ft BGS*	*1-2 ft BGS*	*2-3 ft BGS*	*3.5-4.5 ft BGS*
Parameter	*Units*				
Biphenyl (1,1-Biphenyl)	mg/kg	ND (0.55)	ND (0.58)	ND (0.46)	ND (0.18)
bis(2-Chloroethoxy)methane	mg/kg	ND (0.049)	ND (0.052)	ND (0.041)	ND (0.017)
bis(2-Chloroethyl)ether	mg/kg	ND (0.043)	ND (0.045)	ND (0.036)	ND (0.014)
bis(2-Ethylhexyl)phthalate (DEHP)	mg/kg	0.15 J	ND (0.14)	ND (0.11)	ND (0.046)
Butyl benzylphthalate (BBP)	mg/kg	0.14 J	0.07 J	ND (0.041)	0.022 J
Caprolactam	mg/kg	ND (0.55)	ND (0.58)	ND (0.46)	ND (0.18)
Carbazole	mg/kg	ND (0.05)	ND (0.054)	ND (0.042)	ND (0.017)
Chrysene	mg/kg	0.14 J	0.17 J	0.036 J	ND (0.014)
Dibenz(a,h)anthracene	mg/kg	ND (0.036)	ND (0.038)	ND (0.03)	ND (0.012)
Dibenzofuran	mg/kg	ND (0.049)	ND (0.052)	ND (0.041)	ND (0.017)
Diethyl phthalate	mg/kg	ND (0.044)	ND (0.047)	ND (0.037)	ND (0.015)
Dimethyl phthalate	mg/kg	ND (0.046)	ND (0.049)	ND (0.038)	ND (0.015)
Di-n-butylphthalate (DBP)	mg/kg	ND (0.27)	ND (0.28)	ND (0.22)	ND (0.09)
Di-n-octyl phthalate (DnOP)	mg/kg	ND (0.051)	ND (0.054)	ND (0.042)	ND (0.017)
Fluoranthene	mg/kg	0.21 J	0.25 J	0.053 J	ND (0.016)
Fluorene	mg/kg	ND (0.052)	ND (0.056)	ND (0.044)	ND (0.018)
Hexachlorobenzene	mg/kg	ND (0.044)	ND (0.047)	ND (0.037)	ND (0.015)
Hexachlorobutadiene	mg/kg	ND (0.043)	ND (0.046)	ND (0.036)	ND (0.014)
Hexachlorocyclopentadiene	mg/kg	ND (0.18)	ND (0.19)	ND (0.15)	ND (0.059)
Hexachloroethane	mg/kg	ND (0.042)	ND (0.045)	ND (0.035)	ND (0.014)
Indeno(1,2,3-cd)pyrene	mg/kg	ND (0.044)	0.13 J	ND (0.037)	ND (0.015)
Isophorone	mg/kg	ND (0.042)	ND (0.045)	ND (0.035)	ND (0.014)
Naphthalene	mg/kg	0.13 J	ND (0.056)	ND (0.044)	ND (0.018)
Nitrobenzene	mg/kg	ND (0.071)	ND (0.075)	ND (0.06)	ND (0.024)
N-Nitrosodi-n-propylamine	mg/kg	ND (0.045)	ND (0.047)	ND (0.037)	ND (0.015)
N-Nitrosodiphenylamine	mg/kg	ND (0.46)	ND (0.48)	ND (0.38)	ND (0.15)
Pentachlorophenol	mg/kg	ND (3)	ND (3.2)	ND (2.5)	ND (1)
Phenanthrene	mg/kg	0.11 J	0.13 J	ND (0.044)	ND (0.018)
Phenol	mg/kg	ND (0.045)	ND (0.048)	ND (0.038)	ND (0.015)
Pyrene	mg/kg	0.2 J	0.24 J	0.049 J	ND (0.018)
Metals					
Aluminum	mg/kg	6390	5790	10400	5150
Antimony	mg/kg	3.0	ND (2.2)	ND (1.8)	ND (0.71)
Arsenic	mg/kg	23.1	17.8	56.9	19.8
Barium	mg/kg	17.0	12.3	17.1	9.6
Beryllium	mg/kg	0.94	0.94	0.65	0.95
Cadmium	mg/kg	ND (0.46)	ND (0.49)	0.44	ND (0.15)
Calcium	mg/kg	3470	3340	2260	1140
Chromium	mg/kg	343	181	39.9	13.3
Cobalt	mg/kg	4.0	3.4	9.6	3.0
Copper	mg/kg	464	307	28.2	5.8
Iron	mg/kg	11900	9470	14600	8230

ATTACHMENT D-1

OFF SITE - SEDIMENT SAMPLING - ANALYTICAL RESULTS

	AOC:	*OFF*	*OFF*	*OFF*	*OFF*
	Sample Location:	*SB01-SED*	*SB01-SED*	*SB01-SED*	*SB01-SED*
	Sample ID:	*SED-15620-110105-RR-001*	*SED-15620-110105-RR-002*	*SED-15620-110105-RR-003*	*S-15620-110205-JM-006*
	Unit:	*SED*	*SED*	*SED*	*SED*
	Sample Date:	*11/1/2005*	*11/1/2005*	*11/1/2005*	*11/2/2005*
	Sample Depth:	*0-0.5 ft BGS*	*1-2 ft BGS*	*2-3 ft BGS*	*3.5-4.5 ft BGS*
Parameter	*Units*				
Lead	mg/kg	157[a]	120	49.7	124
Magnesium	mg/kg	4040	3890	4140	2030
Manganese	mg/kg	86.1	96.3	108	65.6
Mercury	mg/kg	23.7	15.2	3.6	1.1
Methyl mercury	pg/g	32700	7150	3940	200
Nickel	mg/kg	22.8[a]	19.2	21.5	6.9
Potassium	mg/kg	1280	1250	1580	730
Selenium	mg/kg	2.0	2.2	ND (1.4)	1.0
Silver	mg/kg	4.1	2.2	ND (0.31) U	ND (0.066)
Sodium	mg/kg	11600	12500	11500	4510
Thallium	mg/kg	ND (3.0)	ND (3.2)	ND (2.5)	ND (1.0)
Vanadium	mg/kg	52.0	51.0	26.9	14.3
Zinc	mg/kg	32.5	38.7	88.6	30.3
PCBs					
(PCB 209) Decachlorobiphenyl	mg/kg	-	-	-	-
Aroclor-1016 (PCB-1016)	mg/kg	ND (0.17)	ND (0.19)	ND (0.15)	ND (0.059)
Aroclor-1221 (PCB-1221)	mg/kg	ND (0.084)	ND (0.089)	ND (0.071)	ND (0.028)
Aroclor-1232 (PCB-1232)	mg/kg	ND (0.1)	ND (0.11)	ND (0.087)	ND (0.035)
Aroclor-1242 (PCB-1242)	mg/kg	ND (0.073)	ND (0.078)	ND (0.061)	ND (0.025)
Aroclor-1248 (PCB-1248)	mg/kg	ND (0.08)	ND (0.085)	ND (0.067)	ND (0.027)
Aroclor-1254 (PCB-1254)	mg/kg	ND (0.029)	ND (0.031)	ND (0.024)	ND (0.0098)
Aroclor-1260 (PCB-1260)	mg/kg	ND (0.024)	ND (0.026)	ND (0.02)	ND (0.0082)
Dichlorobiphenyls C12 H8 Cl2	mg/kg	-	-	-	-
Heptachlorobiphenyls C12 H3 Cl7	mg/kg	-	-	-	-
Hexachlorobiphenyls C12 H4 Cl6	mg/kg	-	-	-	-
Monochlorobiphenyls C12 H9 Cl	mg/kg	-	-	-	-
Nonachlorobiphenyls C12 HCl9	mg/kg	-	-	-	-
Octachlorobiphenyl	mg/kg	-	-	-	-
Pentachlorobiphenyl	mg/kg	-	-	-	-
Tetrachlorobiphenyl	mg/kg	-	-	-	-
Total PCBs	mg/kg	0	0	0	0
Trichlorobiphenyl	mg/kg	-	-	-	-
General Chemistry					
TOC average duplicates	mg/kg	-	-	-	71000
Total solids	%	15.2	14.3	18.1	45.2

ATTACHMENT D-1

OFF SITE - SEDIMENT SAMPLING - ANALYTICAL RESULTS

AOC:		*OFF*	*OFF*	*OFF*	*OFF*	*OFF*
Sample Location:		*SB02-SED*	*SB02-SED*	*SB02-SED*	*SB03-SED*	*SB03-SED*
Sample ID:		*S-15620-110205-JM-001*	*S-15620-110205-JM-002*	*S-15620-110205-JM-003*	*S-15620-110205-JM-009*	*S-15620-110205-JM-010*
Unit:		*SED*	*SED*	*SED*	*SED*	*SED*
Sample Date:		*11/2/2005*	*11/2/2005*	*11/2/2005*	*11/2/2005*	*11/2/2005*
Sample Depth:		*0-0.5 ft BGS*	*1-2 ft BGS*	*2-3 ft BGS*	*0-0.5 ft BGS*	*1-2 ft BGS*
Parameter	*Units*					
Volatiles						
1,1,1-Trichloroethane	mg/kg	ND (0.0027)	ND (0.0014)	ND (0.0004)	ND (0.0018)	ND (0.0029)
1,1,2,2-Tetrachloroethane	mg/kg	ND (0.0045)	ND (0.0024)	ND (0.00067)	ND (0.003) UJ	ND (0.0048)
1,1,2-Trichloroethane	mg/kg	ND (0.0069)	ND (0.0036)	ND (0.001)	ND (0.0044)	ND (0.0072)
1,1-Dichloroethane	mg/kg	ND (0.0029)	ND (0.0015)	ND (0.00043)	ND (0.0019)	ND (0.003)
1,1-Dichloroethene	mg/kg	ND (0.006)	ND (0.0031)	ND (0.00088)	ND (0.0039)	ND (0.0062)
1,2,4-Trichlorobenzene	mg/kg	ND (0.014)	ND (0.0073)	0.0029 J	ND (0.0091)	ND (0.015)
1,2-Dibromo-3-chloropropane (DBCP)	mg/kg	ND (0.0047)	ND (0.0025)	ND (0.00069)	ND (0.0031)	ND (0.0049)
1,2-Dibromoethane (Ethylene dibromide)	mg/kg	ND (0.0027)	ND (0.0014)	ND (0.0004)	ND (0.0018)	ND (0.0028)
1,2-Dichlorobenzene	mg/kg	ND (0.0094)	ND (0.0049)	0.015	ND (0.0061)	ND (0.0098)
1,2-Dichloroethane	mg/kg	ND (0.0031)	ND (0.0016)	ND (0.00045)	ND (0.002)	ND (0.0032)
1,2-Dichloropropane	mg/kg	ND (0.0063)	ND (0.0033)	ND (0.00093)	ND (0.0041)	ND (0.0066)
1,3-Dichlorobenzene	mg/kg	ND (0.0092)	ND (0.0048)	0.0019 J	ND (0.006)	ND (0.0096)
1,4-Dichlorobenzene	mg/kg	ND (0.0069)	ND (0.0036)	0.007 J	ND (0.0045)	ND (0.0072)
2-Butanone (Methyl ethyl ketone) (MEK)	mg/kg	ND (0.014)	ND (0.0074)	ND (0.0021)	ND (0.0092)	ND (0.015)
2-Hexanone	mg/kg	ND (0.0082)	ND (0.0043)	ND (0.0012)	ND (0.0053)	ND (0.0086)
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/kg	ND (0.0085)	ND (0.0045)	ND (0.0013)	ND (0.0055)	ND (0.0089)
Acetone	mg/kg	0.096 J	0.039 J	0.012 J	0.051 J	0.13 J
Benzene	mg/kg	ND (0.0055)	ND (0.0029)	0.0018 J	ND (0.0036)	ND (0.0058)
Bromodichloromethane	mg/kg	ND (0.0025)	ND (0.0013)	ND (0.00037)	ND (0.0016)	ND (0.0026)
Bromoform	mg/kg	ND (0.0062)	ND (0.0032)	ND (0.00091)	ND (0.004)	ND (0.0064)
Bromomethane (Methyl bromide)	mg/kg	ND (0.0094)	ND (0.0049)	ND (0.0014)	ND (0.0061)	ND (0.0098)
Carbon disulfide	mg/kg	ND (0.0036)	0.0034 J	0.0013 J	ND (0.0024)	0.011 J
Carbon tetrachloride	mg/kg	ND (0.0025)	ND (0.0013)	ND (0.00037)	ND (0.0016)	ND (0.0026)
Chlorobenzene	mg/kg	0.05	0.033	0.078	ND (0.0056)	ND (0.009)
Chloroethane	mg/kg	ND (0.0095) UJ	ND (0.005) UJ	ND (0.0014) UJ	ND (0.0062) UJ	ND (0.0099) UJ
Chloroform (Trichloromethane)	mg/kg	ND (0.0025)	ND (0.0013)	ND (0.00037)	ND (0.0016)	ND (0.0026)
Chloromethane (Methyl chloride)	mg/kg	ND (0.0029)	ND (0.0015)	ND (0.00043)	ND (0.0019)	ND (0.003)
cis-1,2-Dichloroethene	mg/kg	ND (0.0075)	ND (0.004)	ND (0.0011)	ND (0.0049)	ND (0.0079)
cis-1,3-Dichloropropene	mg/kg	ND (0.0029)	ND (0.0015)	ND (0.00043)	ND (0.0019)	ND (0.003)
Cyclohexane	mg/kg	ND (0.0038)	ND (0.002)	ND (0.00056)	ND (0.0025)	ND (0.004)
Dibromochloromethane	mg/kg	ND (0.0026)	ND (0.0014)	ND (0.00039)	ND (0.0017)	ND (0.0027)
Dichlorodifluoromethane (CFC-12)	mg/kg	ND (0.0051)	ND (0.0027)	ND (0.00075)	ND (0.0033)	ND (0.0053)
Ethylbenzene	mg/kg	ND (0.0094)	ND (0.0049)	ND (0.0014)	ND (0.0061)	ND (0.0098)
Isopropyl benzene	mg/kg	ND (0.011)	ND (0.006)	ND (0.0017)	ND (0.0074)	ND (0.012)
Methyl acetate	mg/kg	ND (0.025)	ND (0.013)	ND (0.0037)	ND (0.016)	ND (0.026)
Methyl cyclohexane	mg/kg	ND (0.0079)	ND (0.0041)	ND (0.0012)	ND (0.0051)	ND (0.0082)
Methyl tert butyl ether (MTBE)	mg/kg	ND (0.0041)	ND (0.0022)	ND (0.00061)	ND (0.0027)	ND (0.0043)
Methylene chloride	mg/kg	ND (0.013)	ND (0.007)	ND (0.002)	ND (0.0087)	ND (0.014)
Styrene	mg/kg	ND (0.0081)	ND (0.0042)	ND (0.0012)	ND (0.0052)	ND (0.0084)
Tetrachloroethene	mg/kg	ND (0.0077)	ND (0.0041)	ND (0.0011)	ND (0.005)	ND (0.0081)
Toluene	mg/kg	ND (0.006)	ND (0.0031)	ND (0.00088)	0.0043 J	ND (0.0062)
trans-1,2-Dichloroethene	mg/kg	ND (0.0066)	ND (0.0035)	ND (0.00097)	ND (0.0043)	ND (0.0069)

ATTACHMENT D-1

OFF SITE - SEDIMENT SAMPLING - ANALYTICAL RESULTS

AOC:		*OFF*	*OFF*	*OFF*	*OFF*	*OFF*
Sample Location:		*SB02-SED*	*SB02-SED*	*SB02-SED*	*SB03-SED*	*SB03-SED*
Sample ID:		*S-15620-110205-JM-001*	*S-15620-110205-JM-002*	*S-15620-110205-JM-003*	*S-15620-110205-JM-009*	*S-15620-110205-JM-010*
Unit:		*SED*	*SED*	*SED*	*SED*	*SED*
Sample Date:		*11/2/2005*	*11/2/2005*	*11/2/2005*	*11/2/2005*	*11/2/2005*
Sample Depth:		*0-0.5 ft BGS*	*1-2 ft BGS*	*2-3 ft BGS*	*0-0.5 ft BGS*	*1-2 ft BGS*
Parameter	*Units*					
trans-1,3-Dichloropropene	mg/kg	ND (0.0028)	ND (0.0015)	ND (0.00041)	ND (0.0018)	ND (0.0029)
Trichloroethene	mg/kg	ND (0.0087)	ND (0.0046)	ND (0.0013)	ND (0.0056)	ND (0.0091)
Trichlorofluoromethane (CFC-11)	mg/kg	ND (0.012)	ND (0.0064)	ND (0.0018)	ND (0.0079)	ND (0.013)
Trifluorotrichloroethane (Freon 113)	mg/kg	ND (0.0035)	ND (0.0018)	ND (0.00051)	ND (0.0023)	ND (0.0037)
Vinyl chloride	mg/kg	ND (0.0066)	ND (0.0035)	ND (0.00098)	ND (0.0043)	ND (0.0069)
Xylene (total)	mg/kg	ND (0.028)	ND (0.014)	ND (0.0041)	ND (0.018)	ND (0.029)
Semi-Volatiles						
2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	mg/kg	ND (0.044)	ND (0.017)	ND (0.0084)	ND (0.1)	ND (0.029)
2,4,5-Trichlorophenol	mg/kg	ND (0.17)	ND (0.068)	ND (0.033)	ND (0.39)	ND (0.11)
2,4,6-Trichlorophenol	mg/kg	ND (0.052)	ND (0.021)	ND (0.01)	ND (0.12)	ND (0.034)
2,4-Dichlorophenol	mg/kg	ND (0.057)	ND (0.023)	ND (0.011)	ND (0.13)	ND (0.037)
2,4-Dimethylphenol	mg/kg	ND (0.049)	ND (0.019)	ND (0.0094)	ND (0.11)	ND (0.032)
2,4-Dinitrophenol	mg/kg	ND (7.6)	ND (3)	ND (1.5)	ND (17)	ND (5)
2,4-Dinitrotoluene	mg/kg	ND (0.032)	ND (0.013)	ND (0.0061)	ND (0.072)	ND (0.021)
2,6-Dinitrotoluene	mg/kg	ND (0.043)	ND (0.017)	ND (0.0083)	ND (0.098)	ND (0.028)
2-Chloronaphthalene	mg/kg	ND (0.065)	ND (0.025)	ND (0.012)	ND (0.15)	ND (0.042)
2-Chlorophenol	mg/kg	ND (0.048)	ND (0.019)	ND (0.0092)	ND (0.11)	ND (0.031)
2-Methylnaphthalene	mg/kg	0.082 J	0.072 J	ND (0.014)	ND (0.17)	ND (0.049)
2-Methylphenol	mg/kg	ND (0.068)	ND (0.027)	ND (0.013)	ND (0.15)	ND (0.044)
2-Nitroaniline	mg/kg	ND (0.038)	ND (0.015)	ND (0.0072)	ND (0.085)	ND (0.025)
2-Nitrophenol	mg/kg	ND (0.055)	ND (0.022)	ND (0.01)	ND (0.12)	ND (0.036)
3,3'-Dichlorobenzidine	mg/kg	ND (0.075)	ND (0.03)	ND (0.014)	ND (0.17)	ND (0.049)
3-Nitroaniline	mg/kg	ND (1.5)	ND (0.6)	ND (0.29)	ND (3.5)	ND (1)
4,6-Dinitro-2-methylphenol	mg/kg	ND (7.6)	ND (3)	ND (1.5)	ND (17)	ND (5)
4-Bromophenyl phenyl ether	mg/kg	ND (0.15)	ND (0.06)	ND (0.029)	ND (0.34)	ND (0.099)
4-Chloro-3-methylphenol	mg/kg	ND (0.066)	ND (0.026)	ND (0.013)	ND (0.15)	ND (0.043)
4-Chloroaniline	mg/kg	ND (0.15)	ND (0.06)	ND (0.029)	ND (0.34)	ND (0.099)
4-Chlorophenyl phenyl ether	mg/kg	ND (0.062)	ND (0.025)	ND (0.012)	ND (0.14)	ND (0.041)
4-Methylphenol	mg/kg	0.21 J	0.065 J	ND (0.013)	ND (0.15)	ND (0.044)
4-Nitroaniline	mg/kg	ND (0.043)	ND (0.017)	ND (0.0081)	ND (0.096)	ND (0.028)
4-Nitrophenol	mg/kg	ND (0.041)	ND (0.016)	ND (0.0078)	ND (0.092)	ND (0.027)
Acenaphthene	mg/kg	ND (0.066)	ND (0.026)	ND (0.013)	ND (0.15)	ND (0.043)
Acenaphthylene	mg/kg	0.15 J	0.051 J	ND (0.012)	ND (0.14)	ND (0.042)
Acetophenone	mg/kg	ND (0.76)	ND (0.3)	ND (0.15)	ND (1.7)	ND (0.5)
Anthracene	mg/kg	0.21 J	0.081 J	ND (0.013)	ND (0.16)	ND (0.045)
Atrazine	mg/kg	ND (0.76)	ND (0.3)	ND (0.15)	ND (1.7)	ND (0.5)
Benzaldehyde	mg/kg	ND (0.68)	ND (0.27)	ND (0.13)	ND (1.5)	ND (0.44)
Benzo(a)anthracene	mg/kg	0.4 J	0.18 J	0.017 J	0.31 J	0.11 J
Benzo(a)pyrene	mg/kg	0.42 J	0.19 J	ND (0.0098)	0.45 J	0.13 J
Benzo(b)fluoranthene	mg/kg	0.47 J	0.22 J	0.015 J	0.49 J	0.15 J
Benzo(g,h,i)perylene	mg/kg	0.23 J	0.18 J	ND (0.011)	0.34 J	0.12 J
Benzo(k)fluoranthene	mg/kg	0.16 J	0.069 J	ND (0.011)	0.17 J	0.072 J

ATTACHMENT D-1

OFF SITE - SEDIMENT SAMPLING - ANALYTICAL RESULTS

	AOC:	*OFF*	*OFF*	*OFF*	*OFF*	*OFF*
	Sample Location:	*SB02-SED*	*SB02-SED*	*SB02-SED*	*SB03-SED*	*SB03-SED*
	Sample ID:	*S-15620-110205-JM-001*	*S-15620-110205-JM-002*	*S-15620-110205-JM-003*	*S-15620-110205-JM-009*	*S-15620-110205-JM-010*
	Unit:	*SED*	*SED*	*SED*	*SED*	*SED*
	Sample Date:	*11/2/2005*	*11/2/2005*	*11/2/2005*	*11/2/2005*	*11/2/2005*
	Sample Depth:	*0-0.5 ft BGS*	*1-2 ft BGS*	*2-3 ft BGS*	*0-0.5 ft BGS*	*1-2 ft BGS*
Parameter	*Units*					
Biphenyl (1,1-Biphenyl)	mg/kg	ND (0.76)	ND (0.3)	ND (0.15)	ND (1.7)	ND (0.5)
bis(2-Chloroethoxy)methane	mg/kg	ND (0.068)	ND (0.027)	ND (0.013)	ND (0.15)	ND (0.044)
bis(2-Chloroethyl)ether	mg/kg	ND (0.059)	ND (0.023)	ND (0.011)	ND (0.13)	ND (0.039)
bis(2-Ethylhexyl)phthalate (DEHP)	mg/kg	ND (0.19)	ND (0.075)	ND (0.036)	ND (0.43)	ND (0.12)
Butyl benzylphthalate (BBP)	mg/kg	ND (0.067)	0.078 J	ND (0.013)	ND (0.15)	0.11 J
Caprolactam	mg/kg	ND (0.76)	ND (0.3)	ND (0.15)	ND (1.7)	ND (0.5)
Carbazole	mg/kg	ND (0.07)	ND (0.028)	ND (0.013)	ND (0.16)	ND (0.046)
Chrysene	mg/kg	0.44 J	0.17 J	0.012 J	0.48 J	0.14 J
Dibenz(a,h)anthracene	mg/kg	0.083 J	ND (0.02)	ND (0.0095)	ND (0.11)	0.048 J
Dibenzofuran	mg/kg	ND (0.069)	0.029 J	ND (0.013)	ND (0.15)	ND (0.045)
Diethyl phthalate	mg/kg	ND (0.061)	ND (0.024)	ND (0.012)	ND (0.14)	ND (0.04)
Dimethyl phthalate	mg/kg	ND (0.064)	ND (0.025)	ND (0.012)	ND (0.14)	ND (0.042)
Di-n-butylphthalate (DBP)	mg/kg	ND (0.37)	ND (0.15)	ND (0.071)	ND (0.84)	ND (0.24)
Di-n-octyl phthalate (DnOP)	mg/kg	ND (0.07)	ND (0.028)	ND (0.013)	ND (0.16)	ND (0.046)
Fluoranthene	mg/kg	0.68 J	0.31 J	0.023 J	0.45 J	0.2 J
Fluorene	mg/kg	ND (0.073)	ND (0.029)	ND (0.014)	ND (0.16)	ND (0.047)
Hexachlorobenzene	mg/kg	ND (0.061)	ND (0.024)	ND (0.012)	ND (0.14)	ND (0.04)
Hexachlorobutadiene	mg/kg	ND (0.06)	ND (0.024)	ND (0.011)	ND (0.13)	ND (0.039)
Hexachlorocyclopentadiene	mg/kg	ND (0.24)	ND (0.096)	ND (0.047)	ND (0.55)	ND (0.16)
Hexachloroethane	mg/kg	ND (0.058)	ND (0.023)	ND (0.011)	ND (0.13)	ND (0.038)
Indeno(1,2,3-cd)pyrene	mg/kg	0.3 J	0.15 J	ND (0.012)	0.27 J	0.11 J
Isophorone	mg/kg	ND (0.058)	ND (0.023)	ND (0.011)	ND (0.13)	ND (0.038)
Naphthalene	mg/kg	0.33 J	0.12 J	ND (0.014)	0.39 J	ND (0.047)
Nitrobenzene	mg/kg	ND (0.099)	ND (0.039)	ND (0.019)	ND (0.22)	ND (0.064)
N-Nitrosodi-n-propylamine	mg/kg	ND (0.062)	ND (0.024)	ND (0.012)	ND (0.14)	ND (0.04)
N-Nitrosodiphenylamine	mg/kg	ND (0.63)	ND (0.25)	ND (0.12)	ND (1.4)	ND (0.41)
Pentachlorophenol	mg/kg	ND (4.2)	ND (1.6)	ND (0.8)	ND (9.4)	ND (2.7)
Phenanthrene	mg/kg	0.32 J	0.15 J	ND (0.014)	0.18 J	0.094 J
Phenol	mg/kg	ND (0.063)	0.078 J	ND (0.012)	ND (0.14)	ND (0.041)
Pyrene	mg/kg	0.66 J	0.29 J	0.02 J	0.42 J	0.18 J
Metals						
Aluminum	mg/kg	11500	7660	3930	5620	7070
Antimony	mg/kg	2.2	ND (1.2)	ND (0.56)	ND (1.6) U	2.3
Arsenic	mg/kg	146	36.6	3.8	53.6	49.5
Barium	mg/kg	33.2	21.5	7.8	15.6	14.8
Beryllium	mg/kg	1.9	1.6	0.63	1.4	2.1
Cadmium	mg/kg	ND (0.32)	ND (0.25)	ND (0.12)	ND (0.29)	ND (0.42)
Calcium	mg/kg	1830	1520	639	2050	2530
Chromium	mg/kg	241	76.2	7.6	166	75.8
Cobalt	mg/kg	20.8	6.2	5.4	3.5	4.0
Copper	mg/kg	284	94.7	6.9	150	73.5
Iron	mg/kg	81200	23800	7670	8100	10300

ATTACHMENT D-1

OFF SITE - SEDIMENT SAMPLING - ANALYTICAL RESULTS

	AOC:	*OFF*	*OFF*	*OFF*	*OFF*	*OFF*
	Sample Location:	*SB02-SED*	*SB02-SED*	*SB02-SED*	*SB03-SED*	*SB03-SED*
	Sample ID:	*S-15620-110205-JM-001*	*S-15620-110205-JM-002*	*S-15620-110205-JM-003*	*S-15620-110205-JM-009*	*S-15620-110205-JM-010*
	Unit:	*SED*	*SED*	*SED*	*SED*	*SED*
	Sample Date:	*11/2/2005*	*11/2/2005*	*11/2/2005*	*11/2/2005*	*11/2/2005*
	Sample Depth:	*0-0.5 ft BGS*	*1-2 ft BGS*	*2-3 ft BGS*	*0-0.5 ft BGS*	*1-2 ft BGS*
Parameter	*Units*					
Lead	mg/kg	1200	244	9.9	204	162
Magnesium	mg/kg	3220	2980	1390	3160	4050
Manganese	mg/kg	277	199	107	73.6	67.5
Mercury	mg/kg	9.0	2.9	0.077	256	17.3
Methyl mercury	pg/g	101000	1000	478	80400	25600
Nickel	mg/kg	39.7	12.5	6.2	13.5	10.4
Potassium	mg/kg	1270	1040	354	1240	1420
Selenium	mg/kg	4.9	2.2	0.75	1.5	2.1
Silver	mg/kg	4.1	0.99	ND (0.052)	2.2	0.81
Sodium	mg/kg	2610	2600	363	9690	14600
Thallium	mg/kg	ND (2.1)	ND (1.6)	ND (0.80)	ND (1.9)	ND (2.7)
Vanadium	mg/kg	37.7	26.1	8.0	26.1	24.3
Zinc	mg/kg	341	132	21.2	58.0	82.9
PCBs						
(PCB 209) Decachlorobiphenyl	mg/kg	-	-	-	ND (0.053)	ND (0.067)
Aroclor-1016 (PCB-1016)	mg/kg	ND (0.12)	ND (0.095)	ND (0.046)	ND (0.22)	ND (0.16)
Aroclor-1221 (PCB-1221)	mg/kg	ND (0.058)	ND (0.046)	ND (0.022)	ND (0.11)	ND (0.076)
Aroclor-1232 (PCB-1232)	mg/kg	ND (0.072)	ND (0.057)	ND (0.028)	ND (0.13)	ND (0.094)
Aroclor-1242 (PCB-1242)	mg/kg	ND (0.051)	ND (0.04)	ND (0.019)	ND (0.092)	ND (0.066)
Aroclor-1248 (PCB-1248)	mg/kg	ND (0.055)	ND (0.044)	ND (0.021)	7.7	0.77
Aroclor-1254 (PCB-1254)	mg/kg	ND (0.02)	ND (0.016)	ND (0.0077)	2.7	ND (0.026)
Aroclor-1260 (PCB-1260)	mg/kg	ND (0.017)	ND (0.013)	ND (0.0064)	ND (0.03)	ND (0.022)
Dichlorobiphenyls C12 H8 Cl2	mg/kg	-	-	-	ND (0.0076)	ND (0.0096)
Heptachlorobiphenyls C12 H3 Cl7	mg/kg	-	-	-	ND (0.024)	ND (0.03)
Hexachlorobiphenyls C12 H4 Cl6	mg/kg	-	-	-	ND (0.015)	ND (0.019)
Monochlorobiphenyls C12 H9 Cl	mg/kg	-	-	-	ND (0.012)	ND (0.015)
Nonachlorobiphenyls C12 HCl9	mg/kg	-	-	-	ND (0.053)	ND (0.067)
Octachlorobiphenyl	mg/kg	-	-	-	ND (0.023)	ND (0.029)
Pentachlorobiphenyl	mg/kg	-	-	-	ND (0.015)	ND (0.019)
Tetrachlorobiphenyl	mg/kg	-	-	-	0.32	ND (0.011)
Total PCBs	mg/kg	0	0	0	10.4	0.77
Trichlorobiphenyl	mg/kg	-	-	-	ND (0.015)	ND (0.018)
General Chemistry						
TOC average duplicates	mg/kg	150000	170000	37000	130000	200000
Total solids	%	21.9	27.7	57.2	24.3	16.8

ATTACHMENT D-1

OFF SITE - SEDIMENT SAMPLING - ANALYTICAL RESULTS

	AOC:	*OFF*	*OFF*	*OFF*	*OFF*
	Sample Location:	*SB03-SED*	*SB04-SED*	*SB04-SED*	*SB04-SED*
	Sample ID:	*S-15620-110205-JM-011*	*S-15620-110205-JM-014*	*S-15620-110205-JM-015*	*S-15620-110205-JM-016*
	Unit:	*SED*	*SED*	*SED*	*SED*
	Sample Date:	*11/2/2005*	*11/2/2005*	*11/2/2005*	*11/2/2005*
	Sample Depth:	*2-3 ft BGS*	*0-0.5 ft BGS*	*1-2 ft BGS*	*2-3 ft BGS*
Parameter	*Units*				
Volatiles					
1,1,1-Trichloroethane	mg/kg	ND (0.00082)	ND (0.002)	ND (0.0016)	ND (0.00046)
1,1,2,2-Tetrachloroethane	mg/kg	ND (0.0014)	ND (0.0034)	ND (0.0027) UJ	ND (0.00077)
1,1,2-Trichloroethane	mg/kg	ND (0.002)	ND (0.0051)	ND (0.0041)	ND (0.0012)
1,1-Dichloroethane	mg/kg	ND (0.00087)	ND (0.0021)	ND (0.0017)	ND (0.00049)
1,1-Dichloroethene	mg/kg	ND (0.0018)	ND (0.0044)	ND (0.0035)	ND (0.001)
1,2,4-Trichlorobenzene	mg/kg	ND (0.0042)	ND (0.01)	ND (0.0083)	ND (0.0024)
1,2-Dibromo-3-chloropropane (DBCP)	mg/kg	ND (0.0014)	ND (0.0035)	ND (0.0028)	ND (0.00079)
1,2-Dibromoethane (Ethylene dibromide)	mg/kg	ND (0.00081)	ND (0.002)	ND (0.0016)	ND (0.00046)
1,2-Dichlorobenzene	mg/kg	ND (0.0028)	ND (0.0069)	ND (0.0056)	ND (0.0016)
1,2-Dichloroethane	mg/kg	ND (0.00091)	ND (0.0023)	ND (0.0018)	ND (0.00052)
1,2-Dichloropropane	mg/kg	ND (0.0019)	ND (0.0047)	ND (0.0038)	ND (0.0011)
1,3-Dichlorobenzene	mg/kg	ND (0.0027)	ND (0.0068)	ND (0.0055)	ND (0.0016)
1,4-Dichlorobenzene	mg/kg	ND (0.0021)	ND (0.0051)	ND (0.0041)	ND (0.0012)
2-Butanone (Methyl ethyl ketone) (MEK)	mg/kg	ND (0.0042)	ND (0.01)	0.12	0.036
2-Hexanone	mg/kg	ND (0.0025)	ND (0.0061)	ND (0.0049)	ND (0.0014)
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/kg	ND (0.0025)	ND (0.0063)	ND (0.0051)	ND (0.0014)
Acetone	mg/kg	0.03 J	0.11 J	0.062 J	0.014 J
Benzene	mg/kg	ND (0.0016)	ND (0.0041)	ND (0.0033)	ND (0.00093)
Bromodichloromethane	mg/kg	ND (0.00075)	ND (0.0019)	ND (0.0015)	ND (0.00043)
Bromoform	mg/kg	ND (0.0018)	ND (0.0046)	ND (0.0037)	ND (0.001)
Bromomethane (Methyl bromide)	mg/kg	ND (0.0028)	ND (0.0069)	ND (0.0056)	ND (0.0016)
Carbon disulfide	mg/kg	ND (0.0011)	ND (0.0027)	0.0058 J	0.0019 J
Carbon tetrachloride	mg/kg	ND (0.00075)	ND (0.0019)	ND (0.0015)	ND (0.00043)
Chlorobenzene	mg/kg	ND (0.0026)	ND (0.0063)	ND (0.0051)	ND (0.0015)
Chloroethane	mg/kg	ND (0.0028) UJ	ND (0.007) UJ	ND (0.0056) UJ	ND (0.0016) UJ
Chloroform (Trichloromethane)	mg/kg	ND (0.00075)	ND (0.0019)	ND (0.0015)	ND (0.00043)
Chloromethane (Methyl chloride)	mg/kg	ND (0.00086)	ND (0.0021)	ND (0.0017)	ND (0.00049)
cis-1,2-Dichloroethene	mg/kg	ND (0.0022)	ND (0.0056)	ND (0.0045)	ND (0.0013)
cis-1,3-Dichloropropene	mg/kg	ND (0.00086)	ND (0.0021)	ND (0.0017)	ND (0.00049)
Cyclohexane	mg/kg	ND (0.0011)	ND (0.0028)	ND (0.0023)	ND (0.00064)
Dibromochloromethane	mg/kg	ND (0.00079)	ND (0.0019)	ND (0.0016)	ND (0.00045)
Dichlorodifluoromethane (CFC-12)	mg/kg	ND (0.0015)	ND (0.0038)	ND (0.003)	ND (0.00086)
Ethylbenzene	mg/kg	ND (0.0028)	ND (0.0069)	ND (0.0056)	ND (0.0016)
Isopropyl benzene	mg/kg	ND (0.0034)	ND (0.0084)	ND (0.0067)	ND (0.0019)
Methyl acetate	mg/kg	ND (0.0075)	ND (0.019)	ND (0.015)	ND (0.0043)
Methyl cyclohexane	mg/kg	ND (0.0024)	ND (0.0058)	ND (0.0047)	ND (0.0013)
Methyl tert butyl ether (MTBE)	mg/kg	ND (0.0012)	ND (0.0031)	ND (0.0025)	ND (0.0007)
Methylene chloride	mg/kg	ND (0.004)	ND (0.0099)	ND (0.0079)	ND (0.0023)
Styrene	mg/kg	ND (0.0024)	ND (0.006)	ND (0.0048)	ND (0.0014)
Tetrachloroethene	mg/kg	ND (0.0023)	ND (0.0057)	ND (0.0046)	ND (0.0013)
Toluene	mg/kg	ND (0.0018)	ND (0.0044)	ND (0.0035)	ND (0.001)
trans-1,2-Dichloroethene	mg/kg	ND (0.002)	ND (0.0049)	ND (0.0039)	ND (0.0011)

ATTACHMENT D-1

OFF SITE - SEDIMENT SAMPLING - ANALYTICAL RESULTS

	AOC:	*OFF*	*OFF*	*OFF*	*OFF*
	Sample Location:	*SB03-SED*	*SB04-SED*	*SB04-SED*	*SB04-SED*
	Sample ID:	*S-15620-110205-JM-011*	*S-15620-110205-JM-014*	*S-15620-110205-JM-015*	*S-15620-110205-JM-016*
	Unit:	*SED*	*SED*	*SED*	*SED*
	Sample Date:	*11/2/2005*	*11/2/2005*	*11/2/2005*	*11/2/2005*
	Sample Depth:	*2-3 ft BGS*	*0-0.5 ft BGS*	*1-2 ft BGS*	*2-3 ft BGS*
Parameter	*Units*				
trans-1,3-Dichloropropene	mg/kg	ND (0.00083)	ND (0.0021)	ND (0.0017)	ND (0.00047)
Trichloroethene	mg/kg	ND (0.0026)	ND (0.0064)	ND (0.0052)	ND (0.0015)
Trichlorofluoromethane (CFC-11)	mg/kg	ND (0.0036)	ND (0.009)	ND (0.0072)	ND (0.0021)
Trifluorotrichloroethane (Freon 113)	mg/kg	ND (0.001)	ND (0.0026)	ND (0.0021)	ND (0.00059)
Vinyl chloride	mg/kg	ND (0.002)	ND (0.0049)	ND (0.0039)	ND (0.0011)
Xylene (total)	mg/kg	ND (0.0082)	ND (0.02)	ND (0.016)	ND (0.0047)
Semi-Volatiles					
2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	mg/kg	ND (0.013)	ND (0.13)	ND (0.019)	ND (0.0072)
2,4,5-Trichlorophenol	mg/kg	ND (0.052)	ND (0.51)	ND (0.073)	ND (0.028)
2,4,6-Trichlorophenol	mg/kg	ND (0.016)	ND (0.15)	ND (0.022)	ND (0.0085)
2,4-Dichlorophenol	mg/kg	ND (0.017)	ND (0.17)	ND (0.024)	ND (0.0093)
2,4-Dimethylphenol	mg/kg	ND (0.015)	ND (0.14)	ND (0.021)	ND (0.008)
2,4-Dinitrophenol	mg/kg	ND (2.3)	ND (23)	ND (3.2)	ND (1.2)
2,4-Dinitrotoluene	mg/kg	ND (0.0095)	ND (0.094)	ND (0.013)	ND (0.0052)
2,6-Dinitrotoluene	mg/kg	ND (0.013)	ND (0.13)	ND (0.018)	ND (0.007)
2-Chloronaphthalene	mg/kg	ND (0.019)	ND (0.19)	ND (0.027)	ND (0.01)
2-Chlorophenol	mg/kg	ND (0.014)	ND (0.14)	ND (0.02)	ND (0.0078)
2-Methylnaphthalene	mg/kg	ND (0.022)	ND (0.22)	ND (0.031)	ND (0.012)
2-Methylphenol	mg/kg	ND (0.02)	ND (0.2)	ND (0.029)	ND (0.011)
2-Nitroaniline	mg/kg	ND (0.011)	ND (0.11)	ND (0.016)	ND (0.0061)
2-Nitrophenol	mg/kg	ND (0.016)	ND (0.16)	ND (0.023)	ND (0.0089)
3,3'-Dichlorobenzidine	mg/kg	ND (0.023)	ND (0.22)	ND (0.032)	ND (0.012)
3-Nitroaniline	mg/kg	ND (0.46)	ND (4.5)	ND (0.64)	ND (0.25)
4,6-Dinitro-2-methylphenol	mg/kg	ND (2.3)	ND (23)	ND (3.2)	ND (1.2)
4-Bromophenyl phenyl ether	mg/kg	ND (0.046)	ND (0.45)	ND (0.064)	ND (0.025)
4-Chloro-3-methylphenol	mg/kg	ND (0.02)	ND (0.2)	ND (0.028)	ND (0.011)
4-Chloroaniline	mg/kg	ND (0.046)	ND (0.45)	ND (0.064)	ND (0.025)
4-Chlorophenyl phenyl ether	mg/kg	ND (0.019)	ND (0.18)	ND (0.026)	ND (0.01)
4-Methylphenol	mg/kg	ND (0.02)	ND (0.2)	ND (0.029)	ND (0.011)
4-Nitroaniline	mg/kg	ND (0.013)	ND (0.13)	ND (0.018)	ND (0.0069)
4-Nitrophenol	mg/kg	ND (0.012)	ND (0.12)	ND (0.017)	ND (0.0066)
Acenaphthene	mg/kg	ND (0.02)	ND (0.2)	ND (0.028)	ND (0.011)
Acenaphthylene	mg/kg	ND (0.019)	ND (0.19)	ND (0.027)	ND (0.01)
Acetophenone	mg/kg	ND (0.23)	ND (2.3)	ND (0.32)	ND (0.12)
Anthracene	mg/kg	ND (0.021)	ND (0.21)	ND (0.029)	ND (0.011)
Atrazine	mg/kg	ND (0.23)	ND (2.3)	ND (0.32)	ND (0.12)
Benzaldehyde	mg/kg	ND (0.2)	ND (2)	ND (0.28)	ND (0.11)
Benzo(a)anthracene	mg/kg	ND (0.02)	0.22 J	ND (0.028)	ND (0.011)
Benzo(a)pyrene	mg/kg	ND (0.015)	0.22 J	ND (0.021)	ND (0.0083)
Benzo(b)fluoranthene	mg/kg	ND (0.018)	ND (0.18)	ND (0.026)	ND (0.0099)
Benzo(g,h,i)perylene	mg/kg	ND (0.017)	ND (0.17)	ND (0.024)	ND (0.0094)
Benzo(k)fluoranthene	mg/kg	ND (0.018)	ND (0.18)	ND (0.025)	ND (0.0097)

ATTACHMENT D-1

OFF SITE - SEDIMENT SAMPLING - ANALYTICAL RESULTS

	AOC:	*OFF*	*OFF*	*OFF*	*OFF*
	Sample Location:	*SB03-SED*	*SB04-SED*	*SB04-SED*	*SB04-SED*
	Sample ID:	*S-15620-110205-JM-011*	*S-15620-110205-JM-014*	*S-15620-110205-JM-015*	*S-15620-110205-JM-016*
	Unit:	*SED*	*SED*	*SED*	*SED*
	Sample Date:	*11/2/2005*	*11/2/2005*	*11/2/2005*	*11/2/2005*
	Sample Depth:	*2-3 ft BGS*	*0-0.5 ft BGS*	*1-2 ft BGS*	*2-3 ft BGS*
Parameter	*Units*				
Biphenyl (1,1-Biphenyl)	mg/kg	ND (0.23)	ND (2.3)	ND (0.32)	ND (0.12)
bis(2-Chloroethoxy)methane	mg/kg	ND (0.02)	ND (0.2)	ND (0.029)	ND (0.011)
bis(2-Chloroethyl)ether	mg/kg	ND (0.018)	ND (0.17)	ND (0.025)	ND (0.0096)
bis(2-Ethylhexyl)phthalate (DEHP)	mg/kg	ND (0.057)	ND (0.56)	ND (0.08)	ND (0.031)
Butyl benzylphthalate (BBP)	mg/kg	ND (0.02)	ND (0.2)	ND (0.028)	ND (0.011)
Caprolactam	mg/kg	ND (0.23)	ND (2.3)	ND (0.32)	ND (0.12)
Carbazole	mg/kg	ND (0.021)	ND (0.21)	ND (0.029)	ND (0.011)
Chrysene	mg/kg	ND (0.018)	0.27 J	ND (0.025)	ND (0.0097)
Dibenz(a,h)anthracene	mg/kg	ND (0.015)	ND (0.15)	ND (0.021)	ND (0.0081)
Dibenzofuran	mg/kg	ND (0.021)	ND (0.2)	ND (0.029)	ND (0.011)
Diethyl phthalate	mg/kg	ND (0.018)	ND (0.18)	ND (0.026)	ND (0.01)
Dimethyl phthalate	mg/kg	ND (0.019)	ND (0.19)	ND (0.027)	ND (0.01)
Di-n-butylphthalate (DBP)	mg/kg	ND (0.11)	ND (1.1)	ND (0.16)	ND (0.06)
Di-n-octyl phthalate (DnOP)	mg/kg	ND (0.021)	ND (0.21)	ND (0.03)	ND (0.011)
Fluoranthene	mg/kg	ND (0.019)	0.32 J	ND (0.027)	ND (0.01)
Fluorene	mg/kg	ND (0.022)	ND (0.21)	ND (0.031)	ND (0.012)
Hexachlorobenzene	mg/kg	ND (0.018)	ND (0.18)	ND (0.026)	ND (0.0099)
Hexachlorobutadiene	mg/kg	ND (0.018)	ND (0.18)	ND (0.025)	ND (0.0097)
Hexachlorocyclopentadiene	mg/kg	ND (0.073)	ND (0.72)	ND (0.1)	ND (0.04)
Hexachloroethane	mg/kg	ND (0.018)	ND (0.17)	ND (0.025)	ND (0.0095)
Indeno(1,2,3-cd)pyrene	mg/kg	ND (0.018)	ND (0.18)	ND (0.026)	ND (0.0099)
Isophorone	mg/kg	ND (0.017)	ND (0.17)	ND (0.024)	ND (0.0095)
Naphthalene	mg/kg	ND (0.022)	ND (0.21)	ND (0.031)	ND (0.012)
Nitrobenzene	mg/kg	ND (0.03)	ND (0.29)	ND (0.041)	ND (0.016)
N-Nitrosodi-n-propylamine	mg/kg	ND (0.019)	ND (0.18)	ND (0.026)	ND (0.01)
N-Nitrosodiphenylamine	mg/kg	ND (0.19)	ND (1.9)	ND (0.27)	ND (0.1)
Pentachlorophenol	mg/kg	ND (1.3)	ND (12)	ND (1.8)	ND (0.68)
Phenanthrene	mg/kg	ND (0.022)	ND (0.22)	ND (0.031)	ND (0.012)
Phenol	mg/kg	ND (0.019)	ND (0.19)	ND (0.026)	ND (0.01)
Pyrene	mg/kg	ND (0.022)	0.31 J	ND (0.031)	ND (0.012)
Metals					
Aluminum	mg/kg	9120	4630	7530	3570
Antimony	mg/kg	ND (0.87)	3.7	ND (1.2)	ND (0.47)
Arsenic	mg/kg	6.0	28.4	10.6	4.3
Barium	mg/kg	9.3	17.6	10.0	4.4
Beryllium	mg/kg	1.3	1.9	1.7	0.64
Cadmium	mg/kg	ND (0.19)	ND (0.38)	ND (0.27)	ND (0.10)
Calcium	mg/kg	1800	2920	2150	783
Chromium	mg/kg	13.0	534	13.5	6.9
Cobalt	mg/kg	4.1	3.0	4.1	2.5
Copper	mg/kg	6.2	400	ND (3.2) U	ND (4.9) U
Iron	mg/kg	13800	6180	10200	5770

ATTACHMENT D-1

OFF SITE - SEDIMENT SAMPLING - ANALYTICAL RESULTS

	AOC:	*OFF*	*OFF*	*OFF*	*OFF*
	Sample Location:	*SB03-SED*	*SB04-SED*	*SB04-SED*	*SB04-SED*
	Sample ID:	*S-15620-110205-JM-011*	*S-15620-110205-JM-014*	*S-15620-110205-JM-015*	*S-15620-110205-JM-016*
	Unit:	*SED*	*SED*	*SED*	*SED*
	Sample Date:	*11/2/2005*	*11/2/2005*	*11/2/2005*	*11/2/2005*
	Sample Depth:	*2-3 ft BGS*	*0-0.5 ft BGS*	*1-2 ft BGS*	*2-3 ft BGS*
Parameter	*Units*				
Lead	mg/kg	6.8	84.9	9.1	5.2
Magnesium	mg/kg	3340	3360	3620	2260
Manganese	mg/kg	122	102	72.5	63.2
Mercury	mg/kg	1.1	58.9	1.4	0.25
Methyl mercury	pg/g	321	10100	2630	748
Nickel	mg/kg	7.7	12.9	11.5	5.8
Potassium	mg/kg	948	1140	1250	395
Selenium	mg/kg	1.3	3.0	1.4	0.64
Silver	mg/kg	ND (0.082)	11.1	ND (0.11)	ND (0.044)
Sodium	mg/kg	6570	8130	8550	1830
Thallium	mg/kg	ND (1.2)	ND (2.5)	ND (1.8)	ND (0.68)
Vanadium	mg/kg	19.7	35.4	20.9	8.8
Zinc	mg/kg	19.4	30.0	55.7	10.8
PCBs					
(PCB 209) Decachlorobiphenyl	mg/kg	-	ND (0.077)	-	-
Aroclor-1016 (PCB-1016)	mg/kg	ND (0.072)	ND (0.14)	ND (0.1)	ND (0.039)
Aroclor-1221 (PCB-1221)	mg/kg	ND (0.035)	ND (0.069)	ND (0.049)	ND (0.019)
Aroclor-1232 (PCB-1232)	mg/kg	ND (0.043)	ND (0.085)	ND (0.061)	ND (0.023)
Aroclor-1242 (PCB-1242)	mg/kg	ND (0.03)	ND (0.06)	ND (0.043)	ND (0.016)
Aroclor-1248 (PCB-1248)	mg/kg	ND (0.033)	2.2	ND (0.046)	0.029 J
Aroclor-1254 (PCB-1254)	mg/kg	ND (0.012)	1	ND (0.017)	ND (0.0066)
Aroclor-1260 (PCB-1260)	mg/kg	ND (0.01)	ND (0.02)	ND (0.014)	ND (0.0055)
Dichlorobiphenyls C12 H8 Cl2	mg/kg	-	ND (0.011)	-	-
Heptachlorobiphenyls C12 H3 Cl7	mg/kg	-	ND (0.034)	-	-
Hexachlorobiphenyls C12 H4 Cl6	mg/kg	-	ND (0.022)	-	-
Monochlorobiphenyls C12 H9 Cl	mg/kg	-	ND (0.017)	-	-
Nonachlorobiphenyls C12 HCl9	mg/kg	-	ND (0.077)	-	-
Octachlorobiphenyl	mg/kg	-	ND (0.034)	-	-
Pentachlorobiphenyl	mg/kg	-	ND (0.022)	-	-
Tetrachlorobiphenyl	mg/kg	-	0.41	-	-
Total PCBs	mg/kg	0	3.2	0	0.029
Trichlorobiphenyl	mg/kg	-	ND (0.021)	-	-
General Chemistry					
TOC average duplicates	mg/kg	68000	230000	130000	45000
Total solids	%	36.5	18.5	26.0	67.4