2012 ANNUAL REPORT
LONG-TERM ENVIRONMENTAL MONITORING PROGRAM
AUBURN ROAD LANDFILL SUPERFUND SITE
LONDONDERRY, NEW HAMPSHIRE

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LIST OF ACRONYMS

ABS	Aquatec Biological Sciences
Accutest	Accutest Laboratories of New England
AFCEE	U.S. Air Force Center for Environmental Excellence
AGQS	Ambient Groundwater Quality Standards
ARPPG	Auburn Road Performing Party Group
bgs	below ground surface
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
ft	feet/foot
GMZ	groundwater management zone
IEMP	Interim Environmental Monitoring Program
LCS	laboratory control sample
LTEMP	Long-Term Environmental Monitoring Program
MAROS	Monitoring and Remediation Optimization System
µg/L	micrograms per liter
mg	milligrams
mg/kg	milligrams per kilogram
mm	millimeters
mV	millivolts
NARPOP	*Natural Attenuation Remedy Project Operations Plan*
NHDES	New Hampshire Department of Environmental Services
ORP	oxidation-reduction potential
PCE	tetrachloroethene
%	percent
PRP(s)	potentially responsible parties
RCRA	Resource Conservation and Recovery Act
ROD	*Record of Decision*
SAP	*Sampling and Analysis Plan*
Site	Auburn Road Landfill
SME	Sevee & Maher Engineers, Inc.
SSD	statistically significant difference
SWQC	Surface Water Quality Criteria
TCE	trichloroethene
Town	Town of Londonderry
U.S.	United States
USGS	United States Geological Survey

LIST OF ACRONYMS
(Concluded)

VOC(s)	volatile organic compound
WESTON®	Weston Solutions, Inc.

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Auburn Road Landfill (Site) is an approximately 200-acre parcel located on Auburn Road in the Town of Londonderry, New Hampshire. Located within the property boundaries are three separate disposal areas that occupy a total of approximately 13 acres. These areas received a mix of domestic wastes and various hazardous wastes until the landfill was closed in 1980. Each disposal area consists of a modified Resource Conservation and Recovery Act Type C cap, roughly 4 feet (ft) thick and consisting of a geotextile impermeable membrane, clay liner, and a vegetated (grass) cover. The three disposal areas, the "Old Town Dump", the "Tire Pile" area, and the "Solid Waste Landfill" have varying refuse thicknesses that range from 8 to 20 ft.

The Site has been the subject of environmental investigation and characterization since the 1980s. Groundwater, surface water, soil, and sediment have been sampled and analyzed as part of remedial investigation, pre-design investigation, remedial design, and remedial construction activities. Since January 1993, routine monitoring of groundwater, surface water, and sediment has been conducted in accordance with the United States Environmental Protection Agency-approved Interim Environmental Monitoring Program. Following an evaluation of the environmental monitoring data through December 1995, a Long-Term Environmental Monitoring Program (LTEMP) was developed. The long-term groundwater monitoring program was developed and implemented to further assess geochemical changes in the local aquifer and to monitor arsenic and volatile organic compound (VOC) concentrations over time (Sevee & Maher Engineers, Inc., 2000).

The 2012 LTEMP conducted by Weston Solutions, Inc. consisted of environmental sampling events in July and October 2012. The normal spring monitoring event, typically conducted during the month of April, was delayed until July while access to monitoring and sampling locations on the Whispering Pines Mobile Home Park property was coordinated. The events included water level monitoring; and groundwater, surface water, and sediment sampling and analysis. The laboratory analytical results indicate the presence of arsenic and VOCs in groundwater at concentrations exceeding their respective New Hampshire Department of Environmental Services Ambient Groundwater Quality Standards (AGQS). Of the 38 monitoring locations sampled in 2012, arsenic was detected in 11 overburden wells, 4 bedrock wells, and

1 piezometer at concentrations that exceed AGQS. Concentrations of arsenic in a piezometer recently installed to the north of Auburn Road resulted in the expansion of the Groundwater Management Zone (GMZ).

Arsenic was detected in surface water (location SW-6) at a concentration below the applicable fresh water acute and chronic criteria. Since 2000, arsenic concentrations in sediment have been routinely below 50 milligrams per kilogram (mg/kg) with the exception of SD-9, which has ranged between 8.3 mg/kg (fall 2009) and 1,230 mg/kg (fall 2008) over the last 5 years. Sediment samples collected from SD-9 in 2012 identified concentrations of arsenic within its historical range.

Sediment toxicity assays conducted on sediment samples collected in fall 2012 indicated survival rates ranging from 63.8 percent (%) to 100% for Hyalella azteca and 37.5% to 51% for Chironomus tentans, which is lower than results from previous LTEMP sediment testing results. A statistically significant reduction in both mean proportion surviving and emerging (Chironomus tentans) was only noted in the sample collected from SD-2.

An update to the MAROS evaluation using the 2012 LTEMP data confirms a stable trend in the dissolved mass of arsenic in groundwater since the commencement of LTEMP activities. In addition, although the spatial redundancy analysis indicated that some wells may be removed from the routine monitoring program due to estimated redundancy; based on the location of the redundant wells with regards to the groundwater plume and the requirements of the current GMZ permit, no changes to the monitoring program are recommended at this time. The MAROS analysis also recommends annual sampling of the majority of LTEMP monitoring wells; however, based on concentration fluctuations seen in site groundwater, maintaining the current sampling frequency is recommended.

SECTION 1

GENERAL

1. GENERAL

1.1 SITE DESCRIPTION AND HISTORY

The following description and history of the Auburn Road Landfill (Site) was referenced from the *Amended Record of Decision for the Auburn Road Landfill, Londonderry, New Hampshire* (*ROD*), issued by the United States (U.S.) Environmental Protection Agency (EPA) on 19 December 1996 (EPA, 1996).

The Site is located in the northeast corner of the Town of Londonderry (Town), New Hampshire (Figure 1). According to the *1996 Amended ROD*, the entire Site consists of approximately 180 acres and includes three separate 4-acre disposal areas that received a mix of domestic wastes and various hazardous wastes beginning in 1965 until the landfills at the Site were closed in 1980. An investigation conducted by the State of New Hampshire in August of 1979 substantiated suspicions that industrial wastes were being accepted for disposal at the Site. Following a Preliminary Site Assessment and hydrogeologic investigation, EPA proposed the Site for listing on the National Priority List in December of 1982.

Following subsequent investigations at the Site by EPA and its contractors, a *ROD* was completed on 17 September 1986 (EPA, 1986). The *ROD* directed the installation of a 9,000-foot (ft) municipal waterline to supply drinking water to nearby residents, fencing the property to restrict access, and the removal of over 2,000 hazardous waste drums from the Site. Following the completion of these activities in 1987, EPA directed the re-evaluation of site conditions. The following documents were prepared at the conclusion of the evaluation:

- *Supplemental Remedial Investigation Report for the Auburn Road Landfill Site*, prepared by Weston Solutions, Inc. (WESTON®) in October 1988 (formerly known as Roy F. Weston, Inc.).
- *Feasibility Study Report for the Auburn Road Landfill Site* prepared by WESTON in March 1989 (formerly known as Roy F. Weston, Inc.).

Based on this evaluation, a *ROD* issued by EPA on 29 September 1989, directed the construction of a groundwater treatment plant to remove metals and volatile organic compounds (VOCs) from groundwater at and in the vicinity of the Site. In addition, a cap was to be installed over the

disposal areas to prevent infiltration through landfilled wastes. On 31 August 1990, EPA issued an Administrative Order to two groups of potentially responsible parties (PRPs) to implement the remedies outlined above (EPA, 1989). The Administrative Order directed the Town to conduct a Source Control component of the remedy, which was to cap the landfills and perform drainage improvements to minimize the contact of groundwater with waste materials in the landfills. Each disposal area was capped with modified Resource Conservation and Recovery Act (RCRA) Type C caps in 1994.

The second half of the Administrative Order directed a group of PRPs, known as the Auburn Road Performing Party Group (ARPPG), to design and build the groundwater treatment plant. In 1991, the PRPs began the pre-design investigation to support the future construction of the groundwater pump and treat facility; however, subsequent groundwater data led to the suspension of these activities. The revised response action selected by EPA and presented in the 1996 *Amended ROD* was a monitored natural attenuation remedy that included:

- An environmental monitoring program.
- Development of a groundwater management zone (GMZ).
- Establishment of institutional controls to notify and prevent residents from using contaminated groundwater in the overburden and bedrock aquifers.
- Continued maintenance of the landfill caps.
- Drainage systems.
- A review of site conditions every 5 years.

The *1996 Amended ROD* describes the area surrounding the Site as zoned for light residential and business use, and is approximately bounded by Auburn Road to the west, Old Derry Road to the south, State Highway 28 Bypass to the east, and the Londonderry-Auburn town line to the north. The Site is approximately 180 acres in size and slopes gently downward from the south to the north, falling roughly 30 feet (ft) in elevation over an approximate distance of 2,000 ft. As this area was also formerly a gravel mining operation, some locally steep banks and disturbed areas are present. Gravel removal occurred in several locations at the Site; however, the largest portion of the operation was in the north, in close proximity to the landfilling operations. Much of the mined disturbed areas contain no vegetation because only sand remains in these locations.

The three disposal areas occupy approximately 12 acres of the Site with each disposal area approximately 4 acres in size (Figure 2). Each disposal area consists of landfilled material covered with a modified RCRA Type C cap, roughly 4 ft thick and consisting of a geotextile impermeable membrane, clay liner, and a vegetated (grass) cover. There are no base liners present at any of the disposal areas. The northernmost of the three disposal areas is the "Old Town Dump", which is the oldest of the disposal areas and has a refuse thickness of between 8 to 15 ft. The "Tire Pile" area is slightly larger than the "Old Town Dump", and has an approximate thickness of 10 to 20 ft. The "Solid Waste Landfill" located in the southern portion of the Site ranges from 8 to 10 ft thick. A septage disposal area was historically located to the north of the Solid Waste Landfill; however, this area was excavated by the Town and disposed of in the Solid Waste Landfill during a remedial effort conducted in 1993.

Surface waters at the Site flow between the landfilled areas and generally across the Site to the east and north. Whispering Pines Pond, located along the northern property boundary of the Town-owned parcel, potentially receives some surface water flow from the Site. The stream located along the eastern property boundary flows north and discharges into Whispering Pines Pond. This stream is periodically impacted by beaver activities, which results in the surrounding area being subjected to water encroachment or flooding. Approximately 7 acres of replicated wetlands and drainage structures were created by the Town in the areas to the west and northwest of the Tire Pile in order to replace affected wetlands and lower the water table in the vicinity of the landfills. The replicated wetland areas and drainage structures flow northward to Whispering Pines Pond. None of the disposal areas lie within the 100-year floodplain of Whispering Pines Pond.

Groundwater at the Site is divided into two units: the overburden and bedrock aquifers. The overburden aquifer includes the glacial outwash deposits that are divided into thick outwash sands and a thin, discontinuous till unit. The outwash sands are well-graded and are between approximately 40 and 70 ft thick, while the thickness of the till unit varies (up to 20 ft) and consists of sand, gravel, silt, and clay. The direction of groundwater flow in the overburden aquifer is to the north-northwest. Whispering Pines Pond receives some groundwater from localized recharge; however, the majority of groundwater from the Site discharges to Cohas Brook located further to the northwest. Hydraulic conductivities within wells in both the

outwash deposits and the till vary from approximately 0.1 to 140 ft per day [Sevee & Maher Engineers, Inc. (SME), 1994; WESTON, 2007]. Historical (post-2000) average spring and fall horizontal hydraulic gradients in the overburden aquifer are 0.0082 and 0.0076, respectively. The average overburden horizontal hydraulic gradient for all available data collected between June 2000 and October 2012 is 0.0079.

The bedrock underlying the Site consists of foliated chlorite/biotite schists and phyllites. The tendency of these rocks in this terrain is to develop orthagonal faults and joints with a distinctive orientation that may be conducive to groundwater flow. Fractures in bedrock at the Site have a definite northeast-southwest and northwest-southeast trend. A steep zone of faulting parallels Auburn Road and is oriented in a north-northeast to south-southwest direction. Fractures east of this fault, which underlie the Site, primarily exhibit a northeast trending strike and are moderate to steeply dipping (50º and 70º) to the southeast. A small set of fractures run perpendicular to the northeast striking set, although the dip appears to be indeterminate. Groundwater flow within the bedrock aquifer is consistently towards the north and northwest (WESTON, 2007). Based on historical data (post-2000), the average spring and fall horizontal hydraulic gradients in the bedrock aquifer are 0.0093 and 0.0086 ft/ft, respectively. The average bedrock horizontal hydraulic gradient for all available data collected between June 2000 and October 2012 is 0.0090 ft/ft.

1.2 PROJECT SCOPE AND OBJECTIVES

The Site has been the subject of environmental investigation and characterization since the 1980s. Groundwater, surface water, soil, and sediment have been sampled and analyzed as part of the remedial investigation, pre-design investigation, remedial design, and remedial construction activities. Since January 1993, routine monitoring of groundwater, surface water, and sediment has been conducted in accordance with the EPA-approved Interim Environmental Monitoring Program (IEMP). One of the purposes of the IEMP was to establish trends and relationships in environmental data such that long-term monitoring objectives and goals could be established (SME, 2000).

Following an evaluation of the environmental monitoring data through December 1995, a Long-Term Environmental Monitoring Program (LTEMP) was developed. Based on that evaluation, the following LTEMP objectives were established:

- Monitor geochemical changes in the aquifer to evaluate effectiveness of capping of the landfills, and installation of surface water drainage controls completed as part of source control remedial actions.
- Monitor arsenic and selected VOC concentrations over time.
- Measure water levels in the groundwater monitoring wells during each sampling event to help assess horizontal/vertical groundwater flow at the time of sampling.

The geochemical monitoring program was outlined in detail in the *Natural Attenuation Remedy Project Operations Plan* (*NARPOP*) document prepared by WESTON and submitted to EPA on 24 March 2000. Included in the *NARPOP* was the *Sampling and Analysis Plan* (*SAP*), which established the methodology and procedures to be used for sampling and data-gathering during the implementation of the LTEMP (WESTON, 2000).

A summary of the field activities and analytical results of the 2000 LTEMP is presented in the *2000 Annual Report, Long-Term Environmental Monitoring Program at the Auburn Road Landfill Site, Londonderry, New Hampshire*, prepared by WESTON on 23 May 2001 (WESTON, 2001). Similar annual LTEMP reports for 2001 through 2011 were submitted on 28 February 2002 (WESTON, 2002), 22 April 2003 (WESTON, 2003), 17 February 2004 (WESTON, 2004), 17 February 2005 (WESTON, 2005), 17 February 2006 (WESTON, 2006a), 2 March 2007 (WESTON, 2007), 31 March 2008 (WESTON, 2008a), 30 May 2008 (WESTON, 2008b), 10 March 2009 (WESTON, 2009), 19 July 2010 (WESTON, 2010), 5 July 2011 (WESTON, 2011), and 19 March 2012 (WESTON, 2012a), respectively.

1.2.1 Fourth Five-Year Review

The fourth Five-Year Review of the Site was completed by EPA in September 2007 (EPA, 2007). The Five-Year Review conducted in 2007 identified several action items that, when addressed, would help establish whether the current groundwater remedy is protective of human health in the long-term (EPA, 2007). The following subsections address several of the action items.

1.2.1.1 Updated Groundwater Flow and Transport Modeling (Draft)

As recommended by the September 2007 *Five-Year Review* of the Site, an updated groundwater fate and transport model (draft) was completed in December 2008 by HydroQual, Inc. to provide an updated prediction of the arsenic cleanup time frame.

Prior modeling by SME in 1992-1993 suggested that this "cleanup" time would be on the order of 5 to 20 years after the capping of the various waste disposal sites, which was completed in 1993. Water quality monitoring over the past 19 years (1993 to the present) has indicated that this estimated time frame was inaccurate. Although the plume has become narrower and arsenic concentrations are currently at one-half of their pre-cap levels, maximum concentrations within the central portion of the plume remain over 100 micrograms per liter (µg/L) near the downgradient property boundary.

Some of the findings from the updated 2008 model included:

- The majority of the dissolved arsenic detected in groundwater downgradient of the landfill is derived from the reductive dissolution of naturally occurring arsenic that is present in site soils.
- A comparison of the pre-cap plume (1993) and the 2008 plume reveal that it is currently narrower and that arsenic concentrations are approximately one-half of their pre-cap levels.
- The draft model simulations predicted a range of 25 to 50-plus years to meet the 10 µg/L cleanup goals at the property boundary; however, the most likely scenario is estimated to be in excess of 50 years (WESTON, 2009).

1.2.1.2 Groundwater Management Zone Permit

Groundwater Management Zone permits are issued by the New Hampshire Department of Environmental Services (NHDES) for sites at which groundwater has been impacted by contaminants at concentrations in excess of NHDES Ambient Groundwater Quality Standards (AGQS). The permits establish the boundaries of the GMZ and include mechanisms to prevent the use of groundwater for any purpose. The implementation of these actions is intended to lead to the eventual restoration of the impacted aquifer(s) and compliance with AGQS.

ARPPG submitted a GMZ permit application to NHDES on 15 May 2007. The proposed GMZ boundary was based on the description of the GMZ in the 1999 EPA *Remedial Design/Remedial Action Statement of Work, Appendix B.* The northern GMZ boundary was modified to extend along Auburn Road as analytical data from monitoring wells (MW-207A/207B and MW-210A/210B) on the downgradient sand and gravel property (west of Cohas Brook) (Figure 1) indicated arsenic concentrations below laboratory reporting limits. The metes and bounds of the proposed GMZ boundary were revised based on the updated survey of the Site conducted in January 2007 and includes the landfill property (owned by the Town) and a portion of Whispering Pines Mobile Home Park (owned by the Simard Family Trust). NHDES issued a GMZ permit (NHDES Permit Number GWP-198803001-L-001) to ARPPG on 30 October 2007 and a revised GMZ permit on 26 November 2007, to correct the name of the permit applicant.

1.2.1.3 Monitoring and Remediation Optimization System Software Evaluation

As a requirement of the September 2007 *Five-Year Review*, the Monitoring and Remediation Optimization System (MAROS) software was utilized to assess the site data. The MAROS application is a Microsoft Access® database developed by the U.S. Air Force Center for Environmental Excellence (AFCEE) to assist users with groundwater data trend analysis and long-term monitoring optimization at contaminated groundwater sites (AFCEE, 2003). The MAROS software tool is designed to analyze data from a mature site investigation, specifically a groundwater plume that has been delineated and monitored for more than four sample events. Along with the guidance found in the *Long-Term Monitoring Optimization Guide* (AFCEE, 1997), MAROS can be used to assist in addressing important compliance monitoring data questions, including:

- Is the temporal trend in the groundwater site analytical data significant?
- What is the spatial distribution of the temporal trends for each identified contaminant of concern?
- Where is the approximate center of mass and is it moving over time?
- Are there redundant wells in the current monitoring network?

- What is the suggested future sampling frequency?
- Do new wells need to be added to the monitoring network to adequately characterize the plume?

A summary of the initial MAROS results and recommendations was presented in the *2007 Annual Report, Long Term Environmental Monitoring Program at the Auburn Road Landfill Site, Londonderry, New Hampshire* (WESTON, 2008a). Based on the 2007 results, EPA requested the continued use of the MAROS software to evaluate groundwater data. The MAROS results, updated with 2012 LTEMP data, are discussed in Subsection 3.5.

1.2.1.4 Volatile Organic Compound Vapor Intrusion Pathway Screening Evaluation

Based on recommendations in the September 2007 *Five-Year Review* (EPA, 2007), an evaluation of the soil vapor intrusion pathway was conducted for the Site. Based on the results of screening evaluation of VOCs in groundwater and a review of the source control landfill gas monitoring conducted by the Town since 1995, the soil vapor pathway at the Site is incomplete and poses no threat to human health (WESTON, 2008c). The soil vapor intrusion pathway evaluation was submitted to EPA in a letter report on 31 December 2008 (WESTON, 2008c).

1.2.2 Fifth Five Year Review

The fifth Five-Year Review of the Site was completed by EPA in September 2012 (EPA, 2012). The Five-Year Review conducted in 2012 identified several issues and associated action items that, when addressed, would help establish whether the current groundwater remedy is protective of human health in the long-term (EPA, 2012) Issues and their associated action items included the following;

Issue 1: Timeframe to reach Site-wide Interim Cleanup Levels is expected to be considerably longer that originally projected and additional investigation is required for the interaction between groundwater and nearby surface waters/sediments.

Action Item 1: Conduct a meeting between EPA, NHDES, United States Geologic Society (USGS), Town of Londonderry, and ARPPG personnel to discuss the required follow-up actions necessary to expedite the time to reach groundwater cleanup levels, the results/findings of the USGS investigation

and further investigate groundwater interactions with surface water and sediment. To date the meeting has not occurred; however it is anticipated to be scheduled within the next 2 months.

Issue 2: Arsenic concentrations in shallow overburden groundwater piezometer CB-1, exceeds 10 parts per billion (NHDES AGQS) beyond the current GMZ boundary.

Action Item 2: On 12 October 2012, ARPPG submitted an application for the renewal of the existing GMZ Permit GWP-198803001-L-001. The GMZ boundary was modified to include an additional property owned by the Town (Tax Map 18 Lot 34) located directly to the north of Auburn Road. On 13 December 2012, NHDES issued GMZ Permit GWP-198803007-L-002 to ARPPG to continue monitoring the past discharge of arsenic and VOCs at the Site.

Issue 3: New toxicity values for several VOC contaminants of concern at the Site have been published. As there is limited VOC groundwater data at the Site, the completeness of the vapor intrusion pathway should be re-evaluated.

Action Item 3: Conduct a comprehensive groundwater sampling event to re-evaluate VOCs in groundwater and the potential for vapor intrusion to be a viable migratory pathway.

SECTION 2

ENVIRONMENTAL MONITORING PROGRAM 2012

2. ENVIRONMENTAL MONITORING PROGRAM 2012

2.1 INTRODUCTION

The 2012 LTEMP consisted of environmental sampling events in the spring (July) and fall (October). The normal spring monitoring event, typically conducted during the month of April, was delayed until July while access to monitoring and sampling locations on the Whispering Pines Mobile Home Park property was coordinated. The collection of groundwater and surface water samples was conducted during both events, while sediment sampling was conducted only during the fall 2012 event.

Field investigation activities were performed in accordance with the procedures and methodologies outlined in the *SAP* and *Quality Assurance Project Plan* submitted by WESTON in 2012. Discussion of the analytical methods and results of the groundwater, surface water, and sediment sampling are provided in Section 3 of this report.

2.2 GROUNDWATER SAMPLING AND ANALYSIS

A summary of the wells sampled and the analytical program for which the groundwater samples were collected are presented in Table 1 and located on Figure 2. Of the monitoring points identified in Table 1, only MW-101B was not sampled during the 2012 sampling program due to dry conditions. In addition to the monitoring points included in the LTEMP and GMZ Permit, four (4) additional piezometers (CB-1, WPP-1, WPP-2, and WPP-3) were included as part of both the spring and fall sampling program. These four piezometers were installed by USGS as part of an ongoing investigation to further characterize the hydrogeologic framework at the Site and to assess the potential for arsenic mobility from natural and anthropogenic sources (USGS, 2012). All groundwater analytical data are discussed further in detail in Section 3.

To the extent possible, all groundwater samples were collected in accordance with low-flow (minimal drawdown) techniques and procedures outlined in the *SAP* (WESTON, 2012b). The objective of low-flow sampling is to minimize the drawdown and disturbance in the well in order to obtain a sample that is representative of the in situ water chemistry. The exception to this sampling technique was at monitoring well MW-212A. A three volume purge sampling

procedure was utilized for sampling at this location due to the well screened interval being greater than 10 ft in length.

The sampling equipment used for sample collection from the wells consisted of dedicated tubing and a peristaltic or Grundfos pump capable of low-flow rates. A general outline of the groundwater sampling procedures is as follows:

1. Equipment used to measure field parameters is calibrated on a daily basis prior to parameter monitoring.

2. Dedicated sampling tubing is placed in the well with the inlet positioned at the approximate middle of the saturated screened interval. Every effort is made to minimize disturbance of the water column in the well.

3. During purging, the following parameters are monitored using an in-line flow through cell and appropriate field parameter probes: specific conductance, pH, temperature, oxidation-reduction potential (ORP), dissolved oxygen (DO), and turbidity. Water levels are monitored with an electronic water level meter.

4. Low-flow rates of approximately 100 to 500 milliliters per minute are used to purge and obtain samples from each well. During the purging process, the water level in the well is monitored to assess the amount of drawdown that is occurring. Flow rates are such that the drawdown is kept to a minimum, and sampling details are recorded on the sampling field sheet.

   During purging of the well, in-line field parameters and water levels are monitored and recorded at approximately 5-minute intervals. Stabilization is achieved when three successive measurements meet the following conditions:

   - pH $\pm$ 0.1 unit
   - Specific conductance $\pm$ 5 percent (%)
   - ORP $\pm$ 10 millivolts (mV)
   - DO, turbidity, and temperature $\pm$ 10%
   - Minimal water level drawdown

5. Sample collection occurs once drawdown and field parameter stabilization has been achieved. Of particular importance is stabilization of DO and turbidity. At the point of stabilization, the flow through-cell is bypassed and samples are collected in the appropriate pre-preserved containers. Samples for total metals analysis are not filtered. Field kits, such as HACH kits, are used to measure alkalinity following field parameter stabilization.

At the completion of the purging process, all groundwater samples were collected directly from the pump discharge line into appropriate sample containers, packed in ice, and submitted under standard chain-of-custody procedures for laboratory analysis.

2.2.1 Long-Term Environmental Monitoring Program

Total arsenic (unfiltered) samples were collected from monitoring wells as outlined in Table 1. Samples were submitted to Accutest Laboratories of New England (Accutest) of Marlborough, Massachusetts for arsenic analysis by EPA Method 6010B.

In accordance with LTEMP/GMZ permit requirements, samples were also collected for VOC analysis from monitoring wells MW-102A and MW-303A (July and October 2012) and GZ-1-3R, NUS-1-2, and NUS-2-2 (October 2012). Samples were also collected for VOC analysis from piezometers CB-1, WPP-1, WPP-2, and WPP-3 during both sampling events. The samples were submitted to Accutest for laboratory analysis of VOCs by EPA Method 8260B.

2.2.2 Groundwater Water Quality Parameters

The water quality parameters measured during each 2012 LTEMP sampling event have been summarized in Table 2. A detailed summary of historical water quality parameters measured during WESTON LTEMP sampling events (2000 to 2012) has been included in Appendix A.

2.3 GROUNDWATER LEVEL MONITORING

Groundwater level measurements were also obtained during the spring and fall 2012 sampling events. In addition to monitoring wells included in the LTEMP, a comprehensive round of water level measurements was conducted at the Site during each event. Water level measurements recorded for each well during the 2012 groundwater sampling events were used to construct potentiometric surface maps for the area in and around the Site. The potentiometric surface maps, a summary of the depth to water measurements, and calculated water table elevations for both the spring and fall monitoring rounds are presented in Subsection 3.1.

2.4 SURFACE WATER/SEDIMENT SAMPLING AND ANALYSIS

During the preparation of the *1996 Amended ROD*, analytical results indicated that contaminant concentrations in sediments were not toxic to organisms and impacts to surface water did not violate New Hampshire Surface Water Quality Standards. Subsequent assessments conducted prior to the *ROD* finalization determined that concentrations of arsenic in both sediment and surface water were a function of the environmental variables present in the stream and the input of arsenic from groundwater discharging to Cohas Brook and, to a lesser extent, Whispering Pines Pond. Based on this, contingencies for anomalous events were included in the *1996 Amended ROD* and the 1997 Consent Decree and a specialized monitoring program was instituted.

The current LTEMP surface water sampling consists of background locations (SW-03 in the unnamed stream and SW-04 upstream of the discharge point in Cohas Brook), an inferred groundwater discharge point (SW-09 in Cohas Brook), and locations downstream of the Site (SW-06 in Whispering Pines Pond and SW-05 in Cohas Brook). The background locations were selected from locations positioned hydraulically upgradient of inferred groundwater discharge areas. Surface water samples were collected from locations SW-03, SW-04, SW-05, SW-06, and SW-09 during the 2012 monitoring program, as identified in Table 3 and illustrated on Figure 2. No sample was collected from SW-09 during the July 2012 sampling event due to dry conditions. In situ measurements of pH, ORP, specific conductance, turbidity, temperature, and DO were recorded at the time of sample collection and are summarized in Table 4. The surface water samples were collected as distinct grab samples by partially submerging the appropriate sample bottles into the water taking care not to overfill and dilute the sample preservative.

Following collection, the surface water samples were packed in ice and submitted under standard chain-of-custody procedures to Accutest for laboratory analysis of total arsenic by EPA Method 6010B. During the October monitoring event, one additional surface water sample was collected from sampling location SW-9, field filtered with a 0.45-micron filter to minimize suspended sediment in the sample, and submitted for dissolved arsenic by EPA Method 6010B for comparison purposes. Surface water analytical data have been summarized in Subsection 3.3.

Sediment samples were collected at locations SD-2, SD-4, SD-5, and SD-9 during the fall 2012 monitoring event, as outlined in Table 5 and illustrated on Figure 2. Following collection, the sediment samples were packed in ice and submitted under standard chain-of-custody procedures to Accutest for laboratory analysis of total arsenic by EPA Method 6010B and to Aquatec Biological Sciences, Inc. (ABS) of Williston, Vermont for sediment toxicity. The sediment toxicity tests consisted of a 10-day static renewal toxicity test using the freshwater amphipod *Hyalella azteca*, and a 28-day static renewal test using the midge larvae *Chironomous tentans*. A statistical analysis of the data was completed to assess the potential significant differences between the test sediments, the site reference sample (SD-4), and the laboratory control sample (LCS).

SECTION 3

RESULTS

3. RESULTS

3.1 GROUNDWATER LEVEL MONITORING

The direction of groundwater flow in the overburden and bedrock water-bearing zones at the Site is to the north/northwest from the landfills towards Cohas Brook. A summary of depth to water values and well construction details is presented in Table 6 (overburden), Table 7 (bedrock), and Table 8 (additional wells).

These tables also include the groundwater potentiometric surface calculated from the depth to water values measured in July and October 2012. These elevations are depicted graphically on the potentiometric surface maps for the overburden and bedrock water-bearing zones (Figures 3 through 6).

The potentiometric surface calculated from data collected in 2012 generally correlate with historical potentiometric surface (2000 to 2011). Horizontal groundwater flow during both the spring and fall events remained to the north/northwest across the Site from the landfills towards Cohas Brook. This observation is consistent with previous interpretations of groundwater flow following quarterly monitoring events by SME prior to 2000 and by WESTON during the LTEMP (post-2000).

These interpretations indicate that the inactive residential wells located along Auburn Road are situated either hydraulically upgradient or cross gradient of the former landfill areas. Based on the locations of these wells related to the three disposal areas and the direction of groundwater flow in both the overburden and bedrock, historic hydraulic impacts to flow in the two aquifers was likely minimal. Groundwater elevations in the vicinity of the landfills were generally higher during the spring event than those noted during the fall event, which is consistent with historical measurements.

3.2 GROUNDWATER SAMPLING AND ANALYSIS

3.2.1 Total Arsenic Results

A summary of the total arsenic laboratory analytical results for each well sampled during the 2012 LTEMP is presented in Table 9 and illustrated on Figures 7 and 8. Of the 29 and 38 monitoring wells and piezometers sampled during July and October, respectively, arsenic was detected in 15 locations during the spring and 20 locations during the fall sampling events. Arsenic concentrations exceeded NHDES AGQS (10 µg/L) in 16 of the wells it was detected in during at least one of the 2012 sampling events. Concentrations ranged from 4.9 µg/L in bedrock monitoring well MW-210A (fall 2012) to 618 µg/L in MW-211B (spring 2012). A detailed comparison of the 2012 analytical results to historical data has been compiled in Table 9. A summary of the historical laboratory analytical results generated prior to the implementation of the LTEMP monitoring (1993 to 1999) and a summary of analytical data through 2012 is presented in Appendix B. A summary of all (LTEMP and GMZ) arsenic concentrations in overburden and bedrock wells sampled in 2012 is depicted on Figures 7 and 8. Isopleth maps illustrating the inferred extent of arsenic in overburden and bedrock groundwater are provided as Figures 9 and 10 (spring) and 11 and 12 (fall).

A hydrogeologic cross-section location map is provided as Figure 13 and hydrogeologic cross-sections A-A' and B-B' are provided as Figures 14A and B and 15A and B, respectively. Cross-section A-A' is oriented along the center of the plume and direction of groundwater flow. Cross-section B-B' is oriented across the plume and perpendicular to the estimated groundwater flow direction. The figures include water level elevation and arsenic concentration data for both spring and fall 2012 LTEMP sampling rounds.

Table 10 provides a summary of the statistical analysis for the LTEMP monitoring wells updated from the September 2007 *Five-Year Review* (EPA, 2007). A brief discussion of the results for each well location is summarized below.

3.2.1.1 Overburden Wells PZ-218 and MW-211B

Piezometer PZ-218 has a screened interval of 4.5 to 6 ft below ground surface (bgs) and is located between the former Tire Dump and the Solid Waste Pile disposal areas. Because of its

shallow depth, this well has been dry several times during past sampling rounds, most recently, fall 2007. A graphical depiction of all available data since 1993 indicates an overall decrease in arsenic concentration in PZ-218 (Table 10 and Appendix C: Graph C-1). Arsenic concentration data exhibit poor correlation, but have decreased slightly at this location during both the LTEMP (2000 to 2012) and historical range (1993 to 2000) for this well.

Replacement monitoring well MW-211B was installed adjacent to PZ-218 in the fall of 2008. Since the completion of installation activities, nine groundwater samples have been collected from this well. A graphical depiction of all available data since fall 2008 indicates an overall increase in arsenic concentration in MW-211B (Table 10 and Appendix C: Graph C-12). Arsenic concentrations exhibited during the spring and fall of 2012 were the highest since installation activities were completed in 2008.

3.2.1.2 Overburden Well MW-212B/Bedrock Wells C-1 and MW-212A

Bedrock monitoring well C-1 is a located immediately downgradient of the Tire Pile and Solid Waste Landfill. Based on a graphical representation of the complete data set (Table 10 and Appendix C: Graph C-2), arsenic concentrations are decreasing in C-1. Although an overall downward trend in the data has been identified, a review of the recent graphed data (2000 to 2012) indicates an increase in arsenic levels; however, these concentrations are consistently below the historical maximum concentrations detected between 1993 and 2000.

Since the completion of installation activities of MW-212A and MW-212B, ten rounds of groundwater samples have been collected from each well. Arsenic was detected at concentrations exceeding AGQS in 19 of the 20 samples with the highest concentration of 376 µg/L in overburden well MW-212B during the spring 2008 sampling event. A graphical depiction of all available data since fall 2008 indicates an overall increase in arsenic concentration in both MW-212A and MW-212B (Table 10 and Appendix C: Graphs C-13 and C-14).

3.2.1.3 Overburden Well GZ-1-2R/Bedrock Well GZ-1-3R

Monitoring wells GZ-1-2R (shallow overburden/screened interval 7.5 to 17.5 ft bgs) and GZ-1-3R (bedrock/screened interval 25 to 30 ft bgs) are located approximately 100 ft north (downgradient) of bedrock well C-1. Based on graphically depicted analytical data, a downward

trend in arsenic concentrations in well GZ-1-2R was identified from 1993 to 2012 (Table 10 and Appendix C: Graph C-3). However, analytical data collected from GZ-1-2R during the LTEMP (2000 to 2012) depicts an increasing trend (dashed line). Arsenic concentrations have been consistently detected in monitoring well GZ-1-3R at concentrations slightly above AGQS. The fall 2011 round saw arsenic concentrations decrease below its AGQS, but concentrations observed during the spring and fall of 2012 were 11.5 µg/L and 10.9 µg/L, respectively.

3.2.1.4 Overburden Wells GZ-6-2R and GZ-6-3R

Overburden well couplet GZ-6-2R/GZ-6-3R is located approximately 800 ft downgradient of wells GZ-1-2R and GZ-1-3R. As illustrated in Table 10 and Appendix C on Graphs C-4 and C-5, well GZ-6-2R shows declining arsenic concentrations, while arsenic concentrations in GZ-6-3R are slightly increasing. An evaluation of the GZ-6-3R graphical trend indicates that the statistical upward trend is likely driven by one or two points. Current arsenic concentrations are within historical ranges and appear stable; however, arsenic concentrations in GZ-6-3R continue to exceed AGQS.

3.2.1.5 Overburden Well MW-302BR/ Bedrock Well MW-302A

The well couplet MW-302A (bedrock) and MW-302BR (overburden) is located approximately 300 ft downgradient of the GZ-6-2R and GZ-6-3R well couplet. The screened intervals for MW-302A and MW-302BR are 54.5 to 59.3 ft bgs and 36.5 to 41.5 ft bgs, respectively. A review of the overburden and bedrock plume maps (Figures 9 through 12), indicate that this monitoring well couplet is inferred to be located along the centerline of the plume. This well couplet also evaluates groundwater quality at the boundary between the property owned by the Town and the downgradient property occupied by the Whispering Pines Mobile Home Park. Based on the complete data set (1993 to 2012), MW-302A shows a graphical decline in arsenic concentrations (Table 10 and Appendix C: Graph C-7). However, concentrations of arsenic in MW-302A have been relatively stable, with no apparent trend, during the current LTEMP period (2000-2012) Arsenic concentrations in monitoring well MW-302BR trended upward until spring 2001; however, an overall decreasing trend is apparent for the complete data set (Table 10 and Appendix C: Graph C-6). With the exception of fall 2006 (132 µg/L), fall 2008 (153 µg/L), fall 2009 (176 µg/L), and fall 2010 (152 µg/L) arsenic has not been detected above 35 µg/L in

MW-302BR since spring 2000 and was non-detect during both 2012 sampling events. The substantial increases in arsenic concentrations may be attributed to a change in groundwater chemistry to reducing conditions at this location.

The ORP for these fall samples at MW-302BR changed to more reducing conditions from the previous spring round as outlined below:

- 101.6 mV in spring 2006 to 7.9 mV in fall 2006
- 32.6 mV in spring 2008 to -124.0 mV in fall 2008
- 71.3 mV in spring 2009 to -103.9 mV in fall 2009
- -36.8 mV in spring 2010 to -114.2 mV in fall 2010

At this time, the cause of the transformation to a subsurface reducing environmental condition is unclear. Previous analysis of precipitation and groundwater elevation data versus arsenic concentrations did not identify a correlation across the Site; however, localized areas may be influenced by seasonal moisture changes.

3.2.1.6 Overburden Wells NUS-1-2 and NUS-2-2

Monitoring wells NUS-1-2 and NUS-2-2 are located along the northern edge of Whispering Pines Pond and are separated by approximately 200 ft. A review of the spring and fall 2012 overburden plume maps (Figures 9 and 11) infers that NUS-2-2 and NUS-1-2 are located roughly along the plume centerline. Based on the complete data set (1993 to 2012), NUS-1 shows a graphical decline in arsenic concentrations since landfill capping (1993-2012) and during the current LTEMP period (2000-2012) (Table 10 and Appendix C: Graph C-8). Monitoring well NUS-2-2 also shows a graphical decline in arsenic concentrations during both periods; however, the rate of decline is slightly less than at NUS-1-2 and data set does not have strong correlation (Table 10, and Appendix C: Graph C-9).

3.2.1.7 Overburden Well MW-109B/Bedrock Well MW-109A

Monitoring wells MW-109B (overburden) and MW-109A (bedrock) are located off-site along Auburn Road on the Whispering Pines Mobile Home Park property. These monitoring wells evaluate the down gradient extent of the plume to the north at the Site near Cohas Brook. Based on a graphical analysis of the complete data set through 2012 (Table 10 and Appendix C: Graph C-10), arsenic concentrations have decreased in MW-109B from levels above 200 µg/L in

2003 to non-detect (≤10 µg/L). Arsenic has been detected only once in the MW-109B and MW-109A well couplet during the last twelve LTEMP sampling rounds.

3.2.1.8 Overburden Well MW-303B

Overburden well MW-303B has a screened interval of 8.5 to 13.8 ft bgs and is located immediately north and downgradient of the Town Dump (between the Town Dump and Whispering Pines Pond). Based on a graphical representation (Table 10 and Appendix C: Graph C-11), of the complete data set (1993 to 2012), the arsenic concentrations show a slightly increasing trend. A second trend identified in data from 2000 to the present (dashed trend line) shows a slightly declining trend. However, both the entire data set and the data set from 2000 to present exhibit poor correlation coefficients (<0.1). The highest concentration of arsenic detected in this well was 52.8 µg/L in 2001, but concentrations have ranged between 20 and 47.3 µg/L for the past 12 years.

3.2.1.9 Piezometers WPP-1, WPP-2, WPP-3 and CB-1

Piezometers WPP-1, WPP-2, WPP-3, and CB-1 were installed in 2012 by USGS as part of an investigation to characterize the hydrogeologic framework of the Site and an assessment of the potential for arsenic mobility from natural and anthropogenic sources. Piezometers WPP-1 and WPP-2 are each located directly downgradient of the Town Dump at the edge of the surface water body. Piezometer WPP-1 exhibited concentrations of arsenic at 6.5 µg/L and 7.2 µg/L during the spring and fall 2012 sampling events, respectively. Arsenic was not identified above the laboratory detection limits in WPP-2 during either the spring or fall 2012 sampling events. Piezometer WPP-3 is located further downgradient from the Town Dump in the center of the adjacent surface water body. Arsenic was not identified above the laboratory detection limits in the samples collected from WPP-3 during either the spring or fall 2012 sampling events. Piezometer CB-1 is located in the downgradient portion of the plume adjacent to Cohas Brook. This piezometer was installed to monitor for concentrations of arsenic in groundwater that may potentially be discharging to the surface water body. Piezometer CB-1 exhibited concentrations of arsenic at 88.9 µg/L and 100 µg/L during the spring and fall 2012 sampling events, respectively. These concentrations exceed the AGQS and resulted in the expansion of the existing GMZ to include the property to the north owned by the Town. All four of these

piezometers will continue to be monitored under the recently renewed GMZ Permit #1988-3007-L-002 issued to the ARPPG on 13 December 2012.

3.2.2 Volatile Organic Compounds

Since 2000, VOC samples have been collected as part of the LTEMP from monitoring well locations GZ-1-3R (annually), MW-102A (semi-annually), NUS-1-2 (annually), NUS-2-2 (annually), and MW-303A (semi-annually) (see Table 1). Samples were also collected for VOC analysis from piezometers WPP-1, WPP-2, WPP-3, and CB-1 during the spring and fall sampling events. Historical LTEMP VOC analytical data have been summarized in Tables 11 through 17. The VOCs listed in the tables are the seven contaminants of concern identified in the *1996 Amended ROD* (vinyl chloride, trans 1-2 dichloroethene, 2-butanone, trichloroethene (TCE), tetrachloroethene (PCE), toluene, and benzene).

Of the seven VOC contaminants of concern, benzene, TCE, PCE, and vinyl chloride were detected in site groundwater during 2012. Benzene was detected in GZ-1-3R, NUS-1-2, and NUS-2-2 during the fall 2012 sampling event, but at concentrations below its respective AGQS. Tetrachloroethene and TCE were detected in monitoring well MW-102A during both 2012 sampling events at concentrations exceeding their respective AGQS. Vinyl chloride was detected in piezometer WPP-1 at concentrations slightly below its respective AGQS during the spring 2012 sampling event and exceeding its respective AGQS during the fall 2012 sampling event.

Concentrations of PCE in MW-102A have been trending downward since the first sampling event in 1993. Although TCE concentrations in MW-102A appear to be stable or trending slightly upward, the most recent results (2007 through 2012) are well within the historical range of concentrations (Tables 14 and 16). Historical summary tables (1993 to 1999) and graphical representations (1993 to 2012) of the seven VOC contaminants of concern are presented in Appendix D.

Eight additional VOCs were detected in area groundwater during the 2012 LTEMP; however, only 1,1-dichloroethene was detected in WPP-2 at a concentration exceeding its AGQS. A detailed summary of VOCs detected in area groundwater during the spring and fall sampling event is presented in Table 18.

3.3 SURFACE WATER SAMPLING AND ANALYSIS

Arsenic was detected in surface water samples collected from SW-5 and SW-6 during the spring 2012 sampling event and in surface water collected from SW-6 during the fall 2012 sampling event. No sample was collected from location SW-9 during the spring 2012 sampling event due to dry conditions. A detailed summary of surface water data collected during the WESTON LTEMP (2000 to 2012) is presented in Table 19. Surface water analytical data collected prior to 1999 has been tabulated and included in Appendix E. Also included in Appendix E are graphical depictions of arsenic concentrations at surface water sample locations from 1993 to 2012 and from 2000 to 2012.

Arsenic concentrations in surface water at the Site have been consistently below New Hampshire Surface Water Quality Criteria (SWQC). The highest arsenic concentration in surface water was detected in a sample collected from SW-9 in 2001 at a concentration of 1,300 µg/L. It was determined that this result was not representative of site conditions and likely due to sedimentation in the sample. Arsenic has not been detected in surface water at a concentration exceeding NHDES SWQC since 2002.

3.4 SEDIMENT SAMPLING AND ANALYSIS

3.4.1 Arsenic

The laboratory analytical results of the sediment samples collected during the fall 2012 round contained arsenic at concentrations ranging from non-detect (<0.63 milligrams per kilogram [mg/kg]) [SD-4] to 373 mg/kg [SD-9].

Arsenic concentrations in sediment samples collected from SD-2, SD-4, and SD-5 have been consistently below 50 mg/kg since fall of 2000, except for the sample collected from monitoring location SD-2 (82 mg/kg) in fall 2009. Samples collected from location SD-9 have fluctuated over the last 5 years, ranging between 8.3 mg/kg (fall 2009) and 1,230 mg/kg (fall 2008). A historical summary of the sediment sampling data for arsenic between 1993 and 1999 is provided in Appendix F. A summary of the laboratory analytical data for sediment samples collected by WESTON from 2000 to 2012 is presented in Table 20. Also included in Appendix F are

graphical depictions of arsenic concentrations at sediment sample locations from 1993 to 2012 and from 2000 to 2012.

3.4.2 Sediment Toxicity Tests

3.4.2.1 Hyalella azteca 10-Day Survival and Growth Assay

The survival rates for *Hyalella azteca* were reported between 63.8% and 100% in sediment collected from the four sample locations, while the survival rate for the organisms in the LCS was reported to be 100%. Survival rates of the test samples show that there was a statistically significant difference in survival in the samples collected from SD-5 and SD-9, indicating that the sediment samples had adverse impact on the test organisms.

Mean weights for the amphipods ranged from 0.056 milligrams (mg) in sample SD-9 to 0.109 mg in sample SD-5. Mean lengths of the amphipods ranged from 2.89 millimeters (mm) in sample SD-9 to 3.94 mm in sample SD-5. Mean weight and length for the Site Reference Sample (SD-4) was 0.065 mg and 3.27 mm, respectively. A statistically significant difference in weight from the laboratory control sediment was observed in samples SD-2, SD-4, and SD-9, and a statistically significant difference in weight from the reference control sample was observed in sample SD-9. A statistically significant difference in length from the LCS was observed in sample SD-2, SD-4, and SD-9, and a statistically significant difference in length from the reference control sample was observed in sample SD-2. The statistically significant differences noted in SD-4 are not related to sediment toxicity as sample SD-4 is the reference sample location.

A summary of the *Hyalella azteca* sediment toxicity testing results from 1998 to 2011 are presented in Table 21. A copy of the ABS sediment toxicity test report is included in Appendix G.

3.4.2.2 Chironomus tentans 28-Day Survival and Emergence Assay

The *Chironomus tentans* in site sediments showed a mean survival rate ranging from 37.5% (SD-2) to 51.3% (SD-5), and a mean emergence ranging from 31.3% (SD-2) to 51.3% (SD-5). A statistically significant difference in mean proportion surviving and mean proportion emerging was identified in the sample collected from SD-2 in comparison to the LCS and a

statistically significant difference in the mean proportion emerging was identified in the sample collected from SD-2 in comparison to the reference control sample. The cause of the statistically significant reduction in both mean proportions surviving and emerging at SD-2 may be related to sediment toxicity; however, they do not appear to be the result of arsenic, as the highest concentrations of arsenic were observed in the sample collected from SD-9. A summary of the *Chironomus tentans* sediment toxicity testing results from 1998 to 2012 are presented in Table 21. A copy of the ABS sediment toxicity test report is included in Appendix G.

3.4.2.3 Historical Data Analysis

Fifteen rounds of toxicity testing have been conducted on sediment collected at the Site, with no consistent indication that arsenic in sediment is impacting the survival and growth of *Hyalella azteca* and the survival and emergence of *Chironomus tentans*. Of the 15 rounds of sediment toxicity testing (5 assay tests per round), 9 contained samples during at least one assay test with a statistically significant difference (SSD) in comparison to the LCS, the background reference sample, or both in one or more assays conducted during each testing round. Table 22 illustrates this comparison and outlines the relationship between the SSD of the LCS and Reference Sample.

Of the 74 assay tests conducted as part of the 15 sediment toxicity rounds, 35 assay tests (47%) contained at least one sample of which the results were qualified as SSD in comparison to the LCS, background sample, or both. Thirty one of the 35 assay tests (89%) with sample results qualified as SSD were the result of differences between one or more samples with the LCS. Of these 31 assay tests with LCS SSD, 21 samples identified as having LCS SSD were samples that were collected from the background reference location. As a result of this comparison, 68% of the assay tests that indicated a LCS SSD, the background reference sample was identified as one of the samples that was qualified as LCS SSD.

3.5 SUMMARY OF UPDATED MAROS RESULTS AND RECOMMENDATIONS

As a requirement of the September 2007 *Five-Year Review*, WESTON had formatted the available groundwater total arsenic data (since 1993) for input into the MAROS software for the following LTEMP monitoring well locations:

- Overburden monitoring wells: MW-1B, PZ-218 (shallow piezometer), MW-101B, MW-104B, MW-106B, MW-108B, MW-109B, MW-207B, MW-210B, MW-211B, MW-212B, MW-213, MW-302R, MW-303B, GZ-1-2R, GZ-6-2R, GZ-6-3R (well cluster with GZ-6-2R), GZ-9-4R, NUS-1-2, NUS-2-2, and NUS-9-1.
- Bedrock monitoring wells: C-1, GZ-1-3R, MW-101A, MW-102A, MW-106A, MW-108A, MW-109A, MW-1A, MW-204, MW-207A, MW-210A, MW-212A, MW-302A, and MW-303A.

As part of this effort, the input data for MAROS was updated to include the 2012 LTEMP sampling results. As of 2012, MW-108B, MW-213, NUS-9-1, and MW-204 have sufficient data to be included in the MAROS model for individual concentration trend analysis.

The updated evaluation of the 1993 to 2012 groundwater data continued to include both quantitative and qualitative analyses with a focus on the LTEMP data. The quantitative statistical evaluation of the Site was conducted using tools in the MAROS software. The MAROS analysis results, in combination with hydrogeological conditions, well construction details, and well locations, were qualitatively reviewed to generate recommendations to support site monitoring objectives. The following general conclusions have been drawn based on the results of these analyses:

- The estimated total mass of arsenic in the overburden plume was stable during the LTEMP period 2006 – 2012. These results suggest that a reduction in mass of the overall plume due to natural attenuation is similar in magnitude to the release of additional mass from the source zone.
- There is a stable trend in the distance of the center of mass from the source, indicating the arsenic mass is not receding back to the source zone, nor migrating further downgradient towards the property boundary. This is consistent with the stable trend in many of the wells in the plume.
- The second moment analysis results indicated that the plume is stable and experienced no significant change in distribution within the overburden zone.

- The combination of results obtained from the zeroth, first, and second moment analyses exhibit a stable plume within the overburden zone over the last 7 years. Results for the bedrock plume also identified a stable trend with a smaller size that is adequately defined by delineation wells.

- The MAROS spatial redundancy analysis indicated that four wells may be removed from the routine monitoring program due to estimated redundancy of information generated from monitoring these locations, including GZ-9-4R, MW-104B, MW-303B, and NUS-2-2. However, each of these wells is considered important to evaluating the distribution of the plume and/or as compliance monitoring points, and therefore should not be removed from the LTEMP. No area of high spatial uncertainty was identified in the overburden aquifer and addition of new wells (out of the 13 wells in the analysis) is not necessary to better characterize the plume.

- The MAROS sampling frequency analysis indicated that the current semi-annual LTEMP monitoring frequency exceeds the minimum needs for most overburden well locations. Although annual LTEMP sampling for both overburden and bedrock wells could be considered, based on the history of significant fluctuations of arsenic in groundwater, the current sampling frequency should be maintained. Well locations that have attained the cleanup goal of a statistically significant manner may be considered for even lower monitoring frequency, e.g., biennial, when regulatory requirements are sufficiently met.

- Seven of the 19 monitoring locations in the overburden aquifer and 7 of the 14 monitoring locations in the bedrock aquifer evaluated in this MAROS analysis were statistically below the cleanup goal for arsenic. These locations are located upgradient or downgradient of the plume and are considered as appropriate locations for delineating the plume. All the other monitoring locations have not ‘attained’ the clean-up goal. Monitoring locations that statistically exhibit concentrations of arsenic in groundwater below the AGQS can be considered for reduced monitoring effort in the future.

- Continue the LTEMP to evaluate trends of arsenic concentrations in groundwater at the Site, and continue monitoring groundwater conditions within the source area to understand the varying nature of the source and reduce the uncertainty of the mass release into the tail area of the plume.

The complete updated 2012 MAROS evaluation and results for the Auburn Road data set, including details of MAROS methodology, are contained in Appendix H.

SECTION 4

CONCLUSIONS

4. CONCLUSIONS

WESTON has prepared this 2012 Draft LTEMP Annual Report for the Auburn Road Landfill Superfund Site in Londonderry, New Hampshire. Activities conducted over the past year have been implemented in accordance with requirements outlined in the *1996 Amended ROD*, LTEMP, GMZ Permit, and September 2007 *Five-Year Review*. The following is a summary of the 2012 LTEMP data and a comparison of those results to historical data and applicable NHDES regulatory criteria.

Groundwater Elevations

- Consistent with historical groundwater elevation data, groundwater flow in the overburden and bedrock water-bearing zones is generally to the north/northwest, from the former landfill areas and towards Cohas Brook.

Groundwater Results

- Of the 38 monitoring wells sampled as part of the 2012 LTEMP, arsenic was detected in 16 wells at concentrations exceeding the NHDES AGQS (10 µg/L).
- Arsenic was detected in newly installed piezometer CB-1 during both the spring and fall sampling events at concentrations exceeding the NHDES AGQS. These results expanded the previously existing GMZ boundary to include the property owned by the Town located to the north.
- Consistent with the 2000-2011 LTEMP sampling program, concentrations of TCE and PCE in well MW-102A continue to exceed their respective AGQS.

Surface Water and Sediment Results

- Arsenic in surface water does not appear to represent a significant risk because of the non-detect and low level concentrations observed in surface water. Sediment toxicity sampling has indicated that although adverse impacts have been observed in sediment samples collected from the Site, they do not appear to be result of arsenic contamination as sediment concentrations during 2012 were below historical concentrations. Furthermore, consistent adverse impacts have not been observed at specific sample locations throughout the Site.

MAROS Evaluation

- Evaluation of the historical groundwater arsenic data for the Site supports the statistical analysis of trends presented in the September 2007 *Five-Year Review Report*.

- A stable trend in dissolved mass of arsenic in both the overburden and bedrock aquifer has been observed in data over the last 7 years.

- The spatial redundancy and sampling frequency analyses indicated that four wells may be removed from the routine monitoring program due to estimated redundancy and that the current semi-annual LTEMP could be reduced to annual sampling with similar data evaluation results. However, based on the location of the estimated redundant wells, historic fluctuations of arsenic concentrations in groundwater, and the requirements of the current GMZ permit, no changes to the monitoring program are recommended at this time.

Based on the results of this 2012 LTEMP, continued monitoring of groundwater and surface water, as outlined in the *SAP* (WESTON, 2012) and the GMZ permit, is recommended for the Site. In regards to sediment sampling, WESTON recommends the continuation of sediment sampling for arsenic; however, the discontinuation of the sediment toxicity analysis. As the background/reference sample has been a significant contributor to the noted SSD within the assay data and the inconsistent/fluctuating toxicity results, there is little to no impact related to sediment toxicity related to arsenic in sediment at, and down gradient of, the Site.

The analytical results indicate that the selected remedy of monitoring natural attenuation continues to be protective of both human health and the environment. Based on this a contingent remedy(ies) is(are) not recommended at this time.

SECTION 5

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5. REFERENCES

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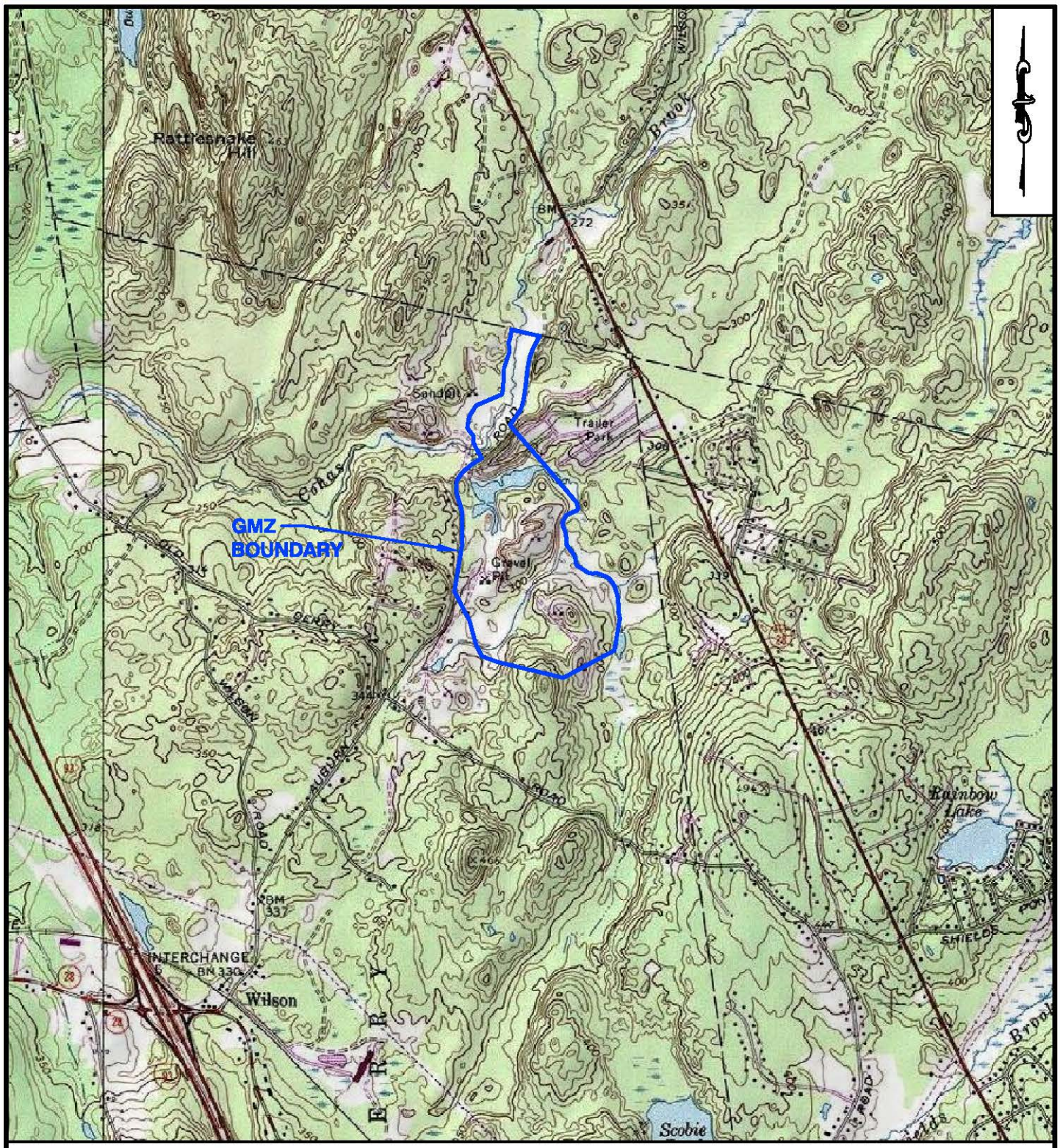
FIGURES



SOURCE:
TOPO! © 2011 NATIONAL GEOGRAPHIC

GRAPHIC SCALE
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APPROXIMATE SCALE IN FEET

SITE LOCATION MAP

WESTON SOLUTIONS
CONCORD NEW HAMPSHIRE

2012 LTEMP ANNUAL REPORT
AUBURN ROAD LANDFILL
LONDONDERRY, NEW HAMPSHIRE

DRAWN	DATE	DES. ENG.	DATE	W.O. NO.
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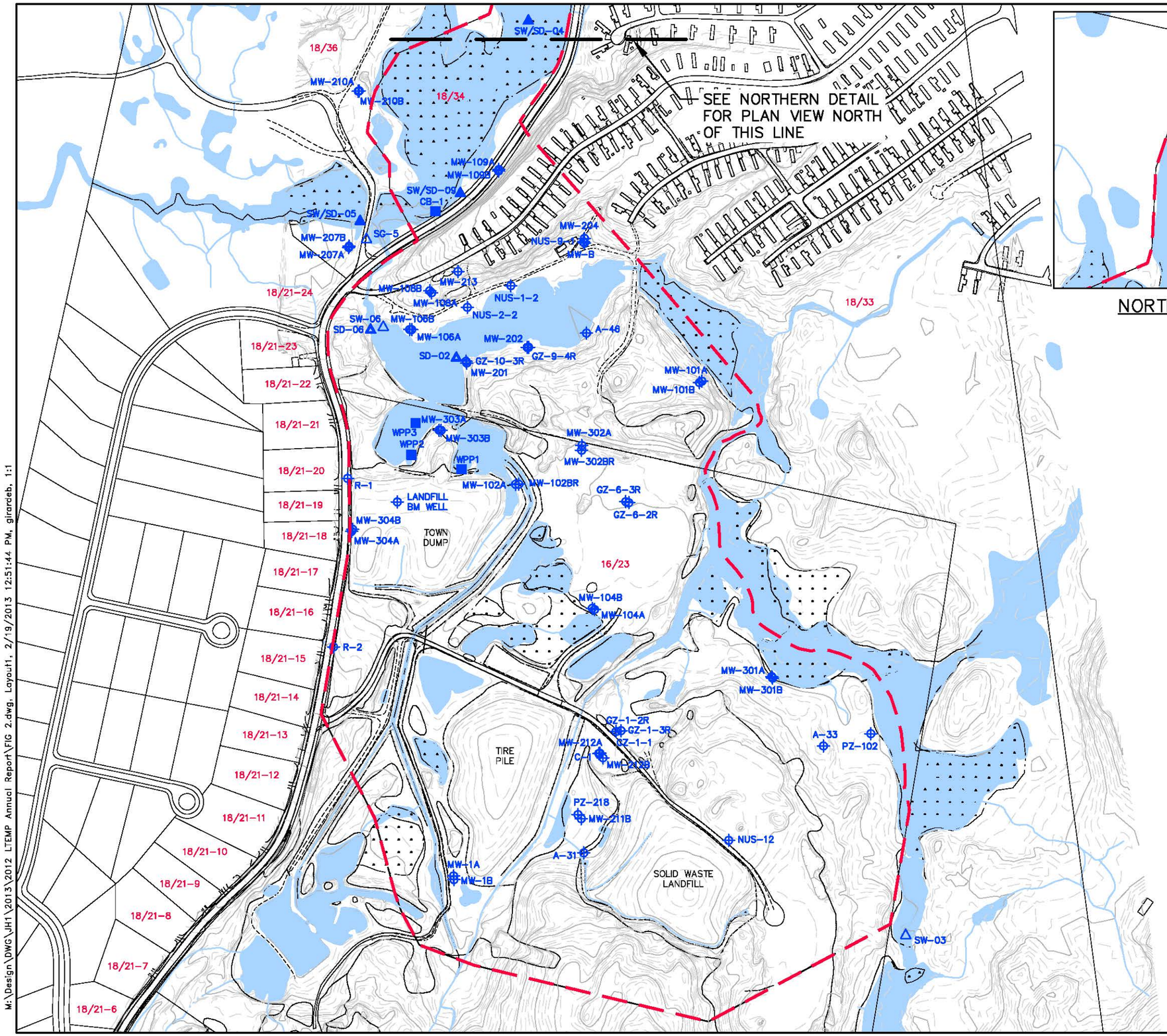

NORTHERN DETAIL

LEGEND

18/33	MAP/LOT NUMBER
MW-303B	MONITORING WELL LOCATION
SD-02	SEDIMENT (ONLY) SAMPLING LOCATION
SW-06	SURFACE WATER (ONLY) SAMPLING LOCATION
SW/SD-05	SURFACE WATER/SEDIMENT SAMPLING LOCATION
WPP1	USGS PIEZOMETER LOCATION
	GMZ BOUNDARY

GRAPHIC SCALE

400 200 0 200 400

APPROXIMATE SCALE IN FEET

NOTES:

1. THE PLANAMETRICS AND TOPOGRAPHY SHOWN ON THIS PLAN ARE BASED ON AERIAL PHOTOGRAPHY DATED DECEMBER 21, 1997, AND COMPILED BY EAST COAST MAPPING, INC. IN FEBRUARY 1998 AND FEBRUARY 2007.
2. THE LOCATIONS AND ELEVATIONS OF THE MONITORING WELLS ARE BASED ON AN ACTUAL FIELD SURVEY PERFORMED IN FEBRUARY OF 2007 BY HOLDEN ENGINEERING AND SURVEYING, INC.
3. THE HORIZONTAL AND VERTICAL DATUM FOR THE AERIAL MAPPING AND GROUND SURVEY ARE BASED ON NAD83 AND NGVD 29. ALL BEARINGS ARE BASED ON NH STATE PLANE COORDINATES GRID NORTH.

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CONCORD NEW HAMPSHIRE

AUBURN ROAD LANDFILL

LONDONDERRY, NEW HAMPSHIRE

SITE PLAN

DRAWN	DATE	FIGURE NO.
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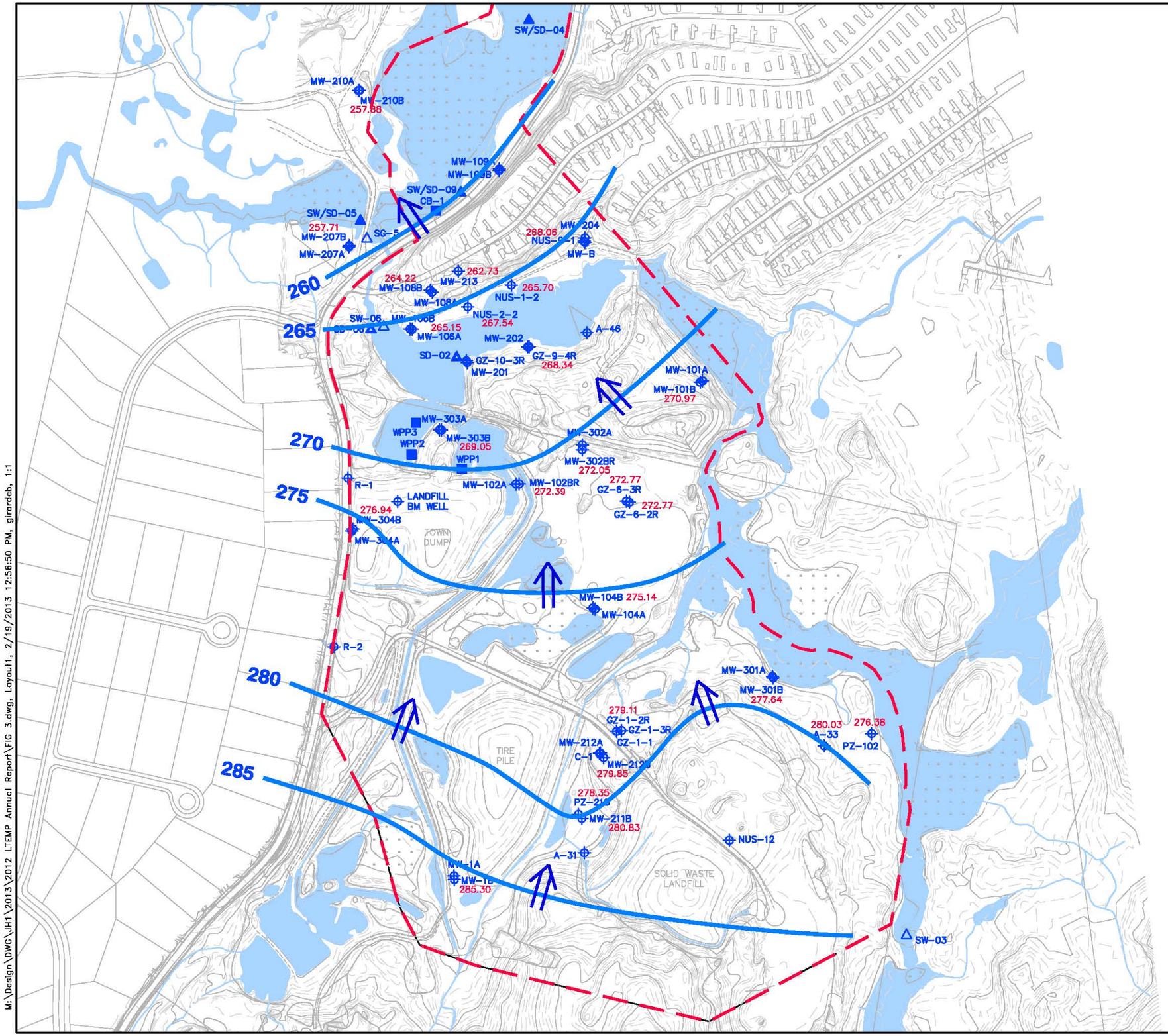
M:\Design\DWG\JH1\2013\2012 LTEMP Annual Report\FIG 2.dwg, Layout1, 2/19/2013 12:51:44 PM, girardeb, 1:1



LEGEND

MW-303B	MONITORING WELL LOCATION
SD-02	SEDIMENT (ONLY) SAMPLING LOCATION
SW-06	SURFACE WATER (ONLY) SAMPLING LOCATION
SW/SD-04	SURFACE WATER/SEDIMENT SAMPLING LOCATION
WPP3	USGS PIEZOMETER LOCATION
	GMZ BOUNDARY
272.77	GROUNDWATER ELEVATION
275	GROUNDWATER CONTOUR LINE WITH ELEVATION
	ESTIMATED DIRECTION OF GROUNDWATER FLOW

GRAPHIC SCALE

400 200 0 200 400

APPROXIMATE SCALE IN FEET

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WESTON SOLUTIONS

CONCORD NEW HAMPSHIRE

AUBURN ROAD LANDFILL
LONDONDERRY, NEW HAMPSHIRE

OVERBURDEN GROUNDWATER POTENTIOMETRIC SURFACE MAP SPRING 2012

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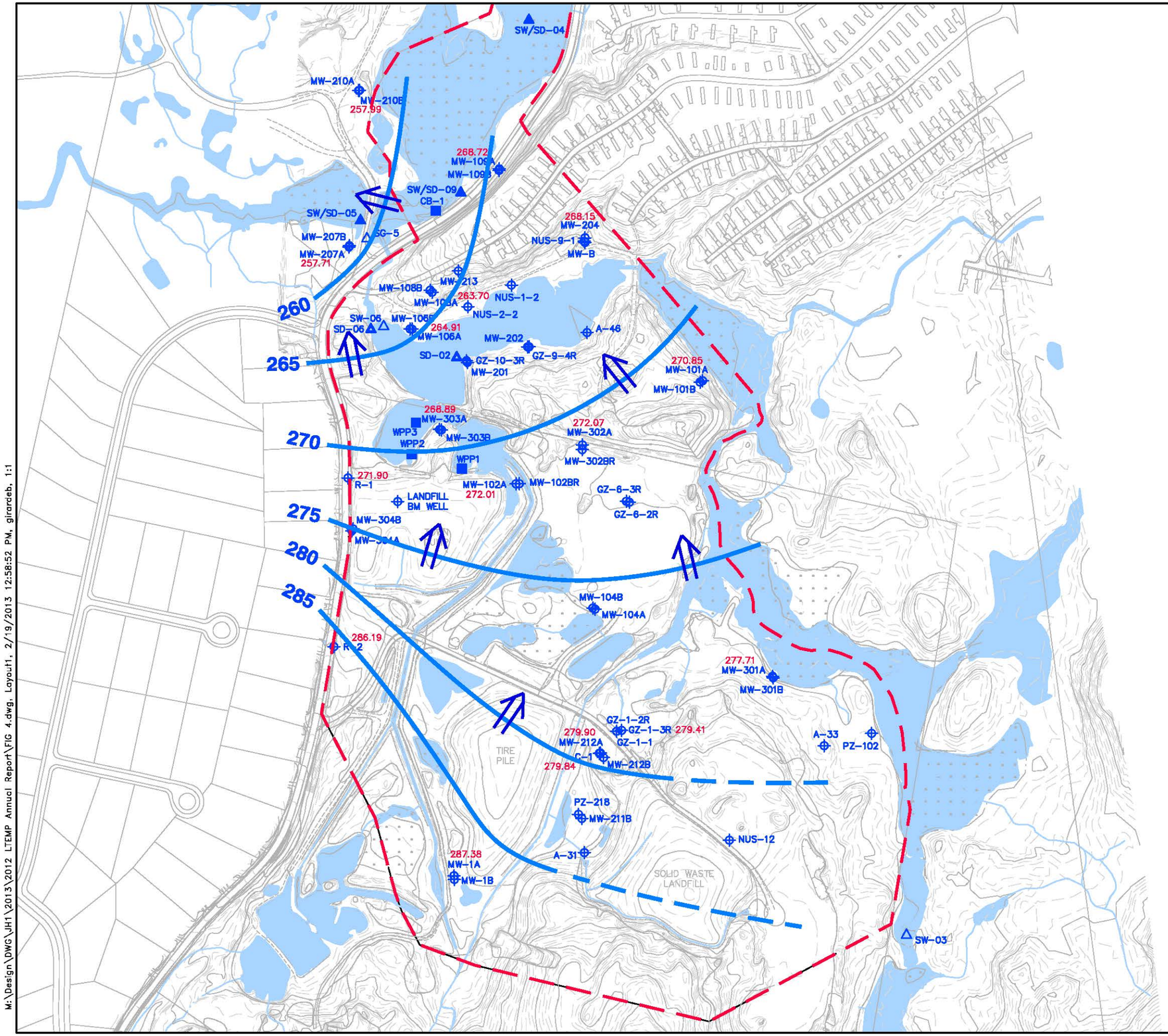

LEGEND

MW-303B	MONITORING WELL LOCATION
SD-02	SEDIMENT (ONLY) SAMPLING LOCATION
SW-06	SURFACE WATER (ONLY) SAMPLING LOCATION
SW/SD-04	SURFACE WATER/SEDIMENT SAMPLING LOCATION
WPP3	USGS PIEZOMETER LOCATION
	GMZ BOUNDARY
272.07	GROUNDWATER ELEVATION
275	GROUNDWATER CONTOUR LINE WITH ELEVATION
	ESTIMATED DIRECTION OF GROUNDWATER FLOW

GRAPHIC SCALE

400 200 0 200 400

APPROXIMATE SCALE IN FEET

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WESTON SOLUTIONS

CONCORD NEW HAMPSHIRE

AUBURN ROAD LANDFILL
LONDONDERRY, NEW HAMPSHIRE

BEDROCK GROUNDWATER POTENTIOMETRIC SURFACE MAP SPRING 2012

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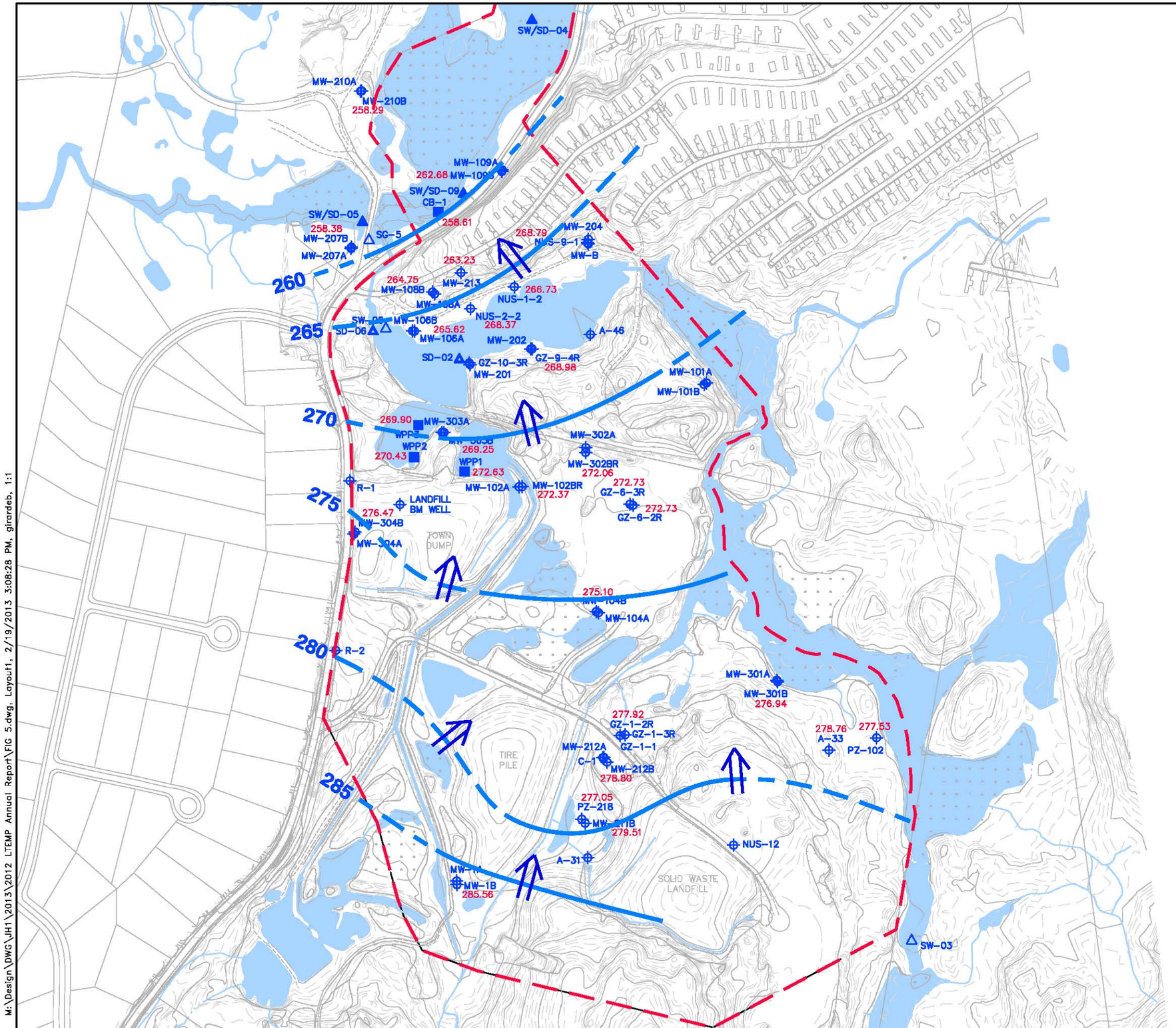
M:\Design\DWG\JH1\2013\2012 LTEMP Annual Report\FIG 4.dwg, Layout1, 2/19/2013 12:58:52 PM, girardeb, 1:1



LEGEND

MW-303B	MONITORING WELL LOCATION
SD-02	SEDIMENT (ONLY) SAMPLING LOCATION
SW-06	SURFACE WATER (ONLY) SAMPLING LOCATION
SW/SD-04	SURFACE WATER/SEDIMENT SAMPLING LOCATION
WPP3	USGS PIEZOMETER LOCATION
	GMZ BOUNDARY
272.77	GROUNDWATER ELEVATION
275	GROUNDWATER CONTOUR LINE WITH ELEVATION (DASHED WHERE INFERRED)
	ESTIMATED DIRECTION OF GROUNDWATER FLOW

GRAPHIC SCALE

400 200 0 200 400

APPROXIMATE SCALE IN FEET

NOTES:

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WESTON SOLUTIONS

CONCORD NEW HAMPSHIRE

AUBURN ROAD LANDFILL
LONDONDERRY, NEW HAMPSHIRE

OVERBURDEN GROUNDWATER POTENTIOMETRIC SURFACE MAP FALL 2012

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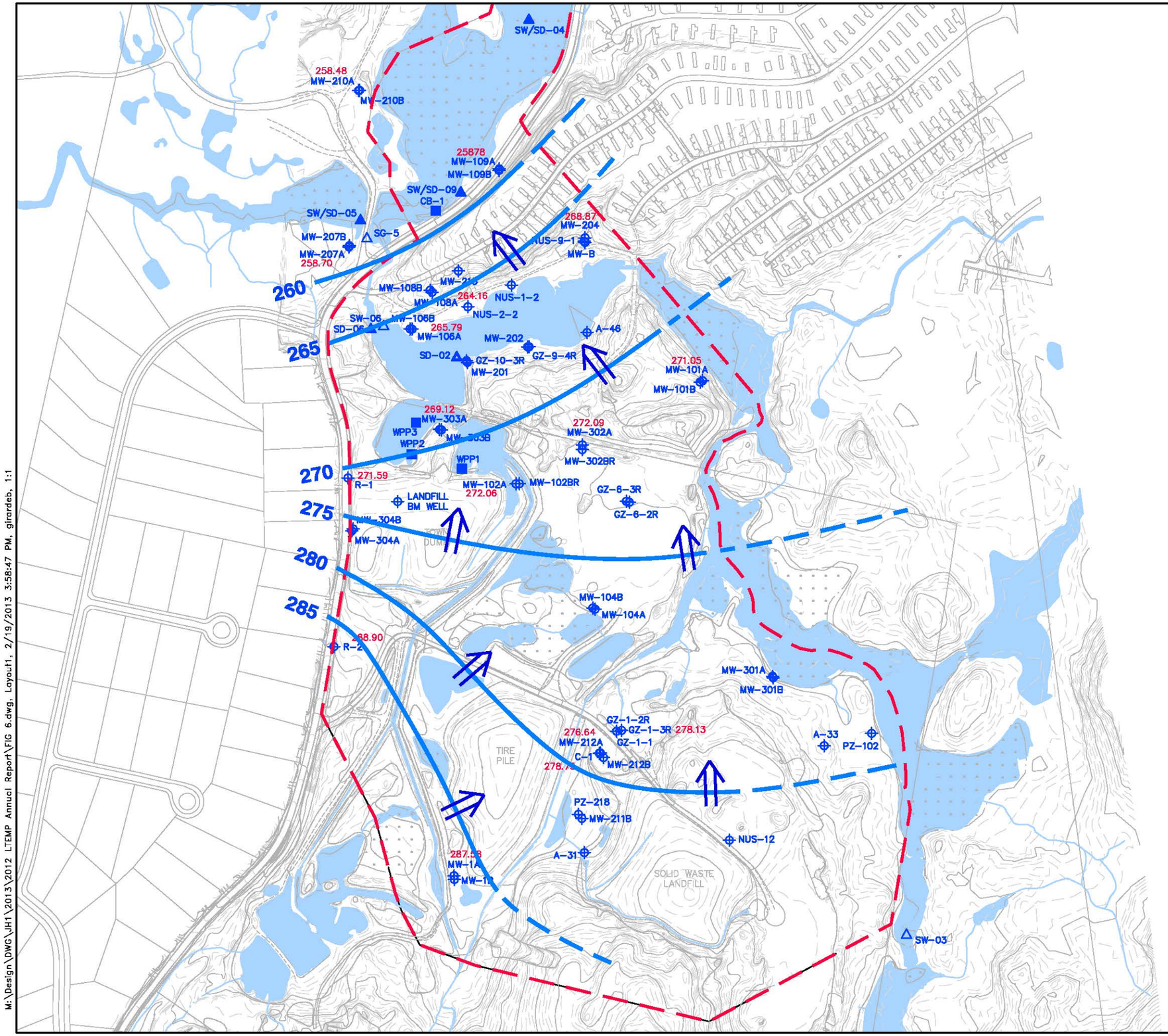

LEGEND

MW-303B	MONITORING WELL LOCATION
SD-02	SEDIMENT (ONLY) SAMPLING LOCATION
SW-06	SURFACE WATER (ONLY) SAMPLING LOCATION
SW/SD-04	SURFACE WATER/SEDIMENT SAMPLING LOCATION
WPP3	USGS PIEZOMETER LOCATION
	GMZ BOUNDARY
272.77	GROUNDWATER ELEVATION
275	GROUNDWATER CONTOUR LINE WITH ELEVATION (DASHED WHERE INFERRED)
	ESTIMATED DIRECTION OF GROUNDWATER FLOW

GRAPHIC SCALE

400 200 0 200 400

APPROXIMATE SCALE IN FEET

NOTES:

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WESTON SOLUTIONS

CONCORD NEW HAMPSHIRE

AUBURN ROAD LANDFILL

LONDONDERRY, NEW HAMPSHIRE

BEDROCK GROUNDWATER POTENTIOMETRIC SURFACE MAP FALL 2012

DRAWN	DATE	FIGURE NO.
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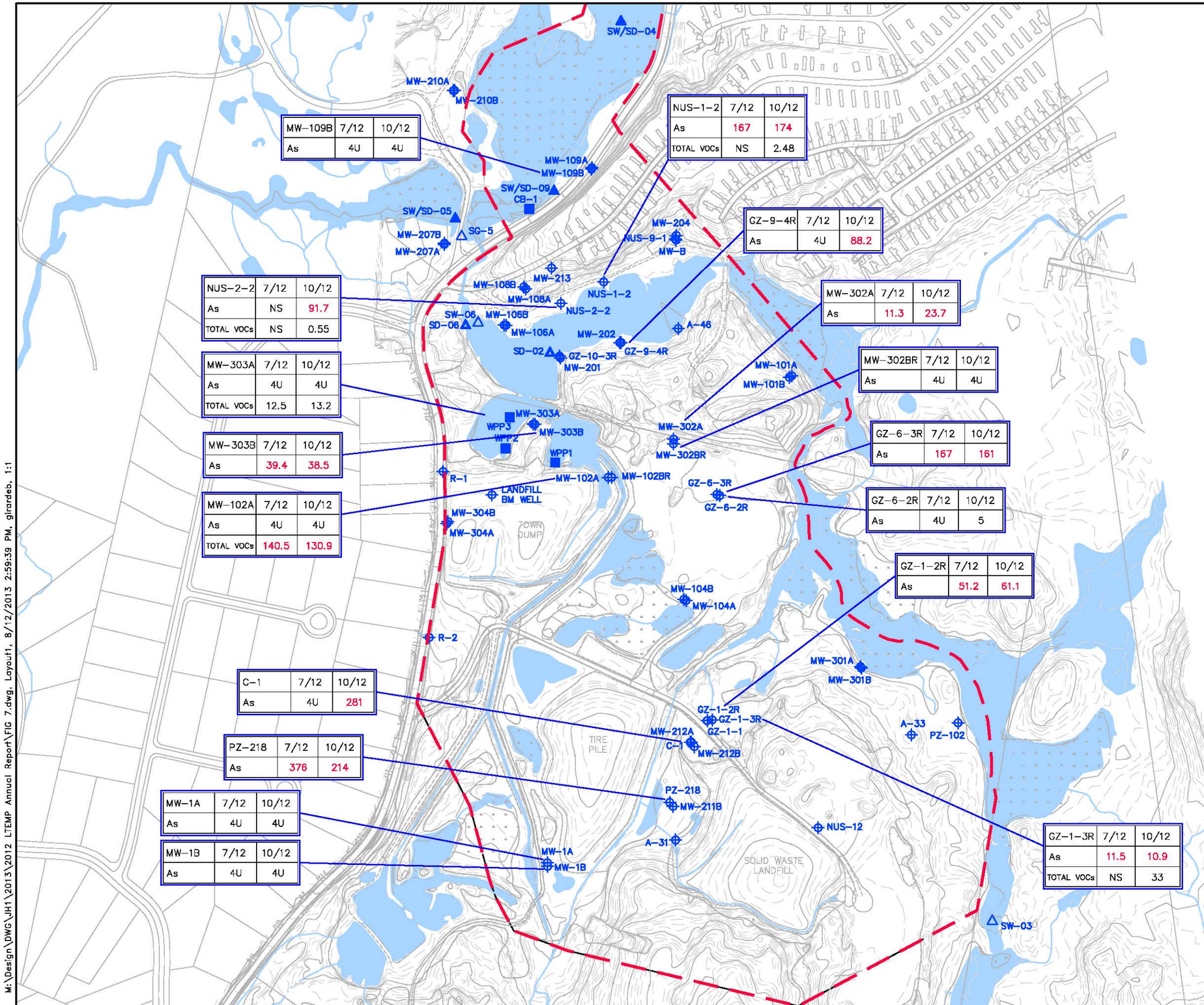
M:\Design\DWG\JH1\2013\2012 LTEMP Annual Report\FIG 6.dwg, Layout1, 2/19/2013 3:58:47 PM, girardeb, 1:1



MW-109B	7/12	10/12
As	4U	4U

NUS-1-2	7/12	10/12
As	167	174
TOTAL VOCs	NS	2.48

GZ-9-4R	7/12	10/12
As	4U	88.2

NUS-2-2	7/12	10/12
As	NS	91.7
TOTAL VOCs	NS	0.55

MW-302A	7/12	10/12
As	11.3	23.7

MW-303A	7/12	10/12
As	4U	4U
TOTAL VOCs	12.5	13.2

MW-302BR	7/12	10/12
As	4U	4U

MW-303B	7/12	10/12
As	39.4	38.5

GZ-6-3R	7/12	10/12
As	167	161

MW-102A	7/12	10/12
As	4U	4U
TOTAL VOCs	140.5	130.9

GZ-6-2R	7/12	10/12
As	4U	5

GZ-1-2R	7/12	10/12
As	51.2	61.1

C-1	7/12	10/12
As	4U	281

PZ-218	7/12	10/12
As	376	214

MW-1A	7/12	10/12
As	4U	4U

MW-1B	7/12	10/12
As	4U	4U

GZ-1-3R	7/12	10/12
As	11.5	10.9
TOTAL VOCs	NS	33

LEGEND

MW-303B — MONITORING WELL LOCATION

SD-02 — SEDIMENT (ONLY) SAMPLING LOCATION

SW-06 — SURFACE WATER (ONLY) SAMPLING LOCATION

SW/SD-05 — SURFACE WATER/SEDIMENT SAMPLING LOCATION

WPP1 — USGS PIEZOMETER LOCATION

GMZ BOUNDARY

ANALYTICAL RESULTS NOTES:

1) ARSENIC AND TOTAL VOC CONCENTRATIONS IN UNITS OF ug/L
2) NS = NOT SAMPLED
3) U = NOT DETECTED AT ASSOCIATED LABORATORY REPORTING LIMIT
4) VALUES IN RED EXCEED NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES AMBIENT GROUNDWATER QUALITY STANDARDS

GRAPHIC SCALE

400 200 0 200 400

APPROXIMATE SCALE IN FEET

NOTES:

1. THE PLANAMETRICS AND TOPOGRAPHY SHOWN ON THIS PLAN ARE BASED ON AERIAL PHOTOGRAPHY DATED DECEMBER 21, 1997, AND COMPILED BY EAST COAST MAPPING, INC. IN FEBRUARY 1998 AND FEBRUARY 2007.
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WESTON SOLUTIONS

CONCORD NEW HAMPSHIRE

AUBURN ROAD LANDFILL
LONDONDERRY, NEW HAMPSHIRE

ARSENIC AND VOC CONCENTRATIONS IN GROUNDWATER ORIGINAL LTEMP – 2012

DRAWN	DATE	FIGURE NO.
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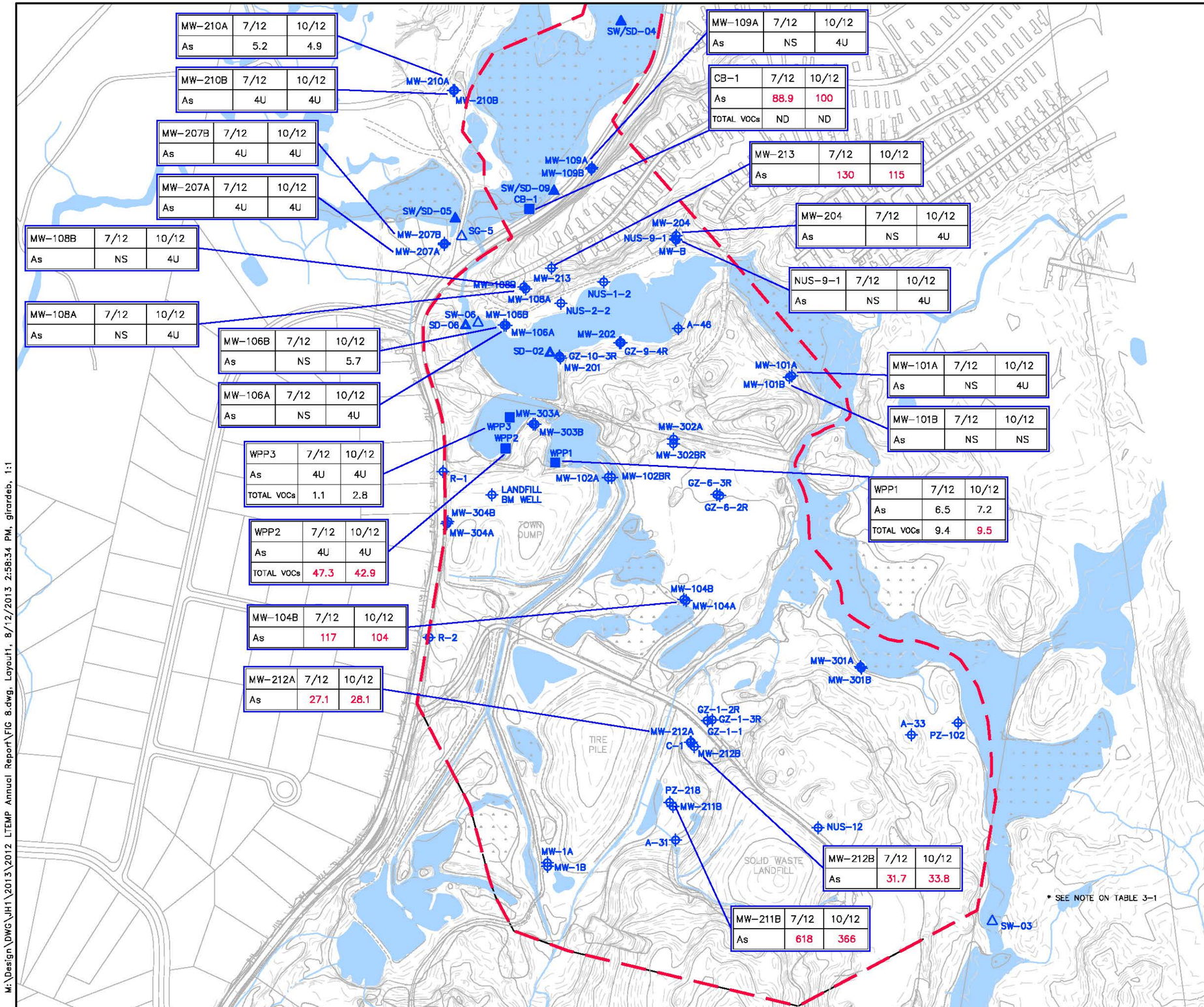
M:\Design\DWG\JH1\2013\2012 LTEMP Annual Report\FIG 7.dwg, Layout1, 8/12/2013 2:59:39 PM, girardeb, 1:1



MW-210A	7/12	10/12
As	5.2	4.9

MW-210B	7/12	10/12
As	4U	4U

MW-207B	7/12	10/12
As	4U	4U

MW-207A	7/12	10/12
As	4U	4U

MW-108B	7/12	10/12
As	NS	4U

MW-108A	7/12	10/12
As	NS	4U

MW-106B	7/12	10/12
As	NS	5.7

MW-106A	7/12	10/12
As	NS	4U

WPP3	7/12	10/12
As	4U	4U
TOTAL VOCs	1.1	2.8

WPP2	7/12	10/12
As	4U	4U
TOTAL VOCs	47.3	42.9

MW-104B	7/12	10/12
As	117	104

MW-212A	7/12	10/12
As	27.1	28.1

MW-109A	7/12	10/12
As	NS	4U

CB-1	7/12	10/12
As	88.9	100
TOTAL VOCs	ND	ND

MW-213	7/12	10/12
As	130	115

MW-204	7/12	10/12
As	NS	4U

NUS-9-1	7/12	10/12
As	NS	4U

MW-101A	7/12	10/12
As	NS	4U

MW-101B	7/12	10/12
As	NS	NS

WPP1	7/12	10/12
As	6.5	7.2
TOTAL VOCs	9.4	9.5

MW-212B	7/12	10/12
As	31.7	33.8

MW-211B	7/12	10/12
As	618	366

LEGEND

- MW-303B — MONITORING WELL LOCATION
- SD-02 — SEDIMENT (ONLY) SAMPLING LOCATION
- SW-06 — SURFACE WATER (ONLY) SAMPLING LOCATION
- SW/SD-05 — SURFACE WATER/SEDIMENT SAMPLING LOCATION
- WPP1 — USGS PIEZOMETER LOCATION
- GMZ BOUNDARY

ANALYTICAL RESULTS NOTES:

1) ARSENIC AND TOTAL VOC CONCENTRATIONS IN UNITS OF ug/L
2) NS = NOT SAMPLED
3) U = NOT DETECTED AT ASSOCIATED LABORATORY REPORTING LIMIT
4) VALUES IN RED EXCEED NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES AMBIENT GROUNDWATER QUALITY STANDARDS

GRAPHIC SCALE

400 200 0 200 400

APPROXIMATE SCALE IN FEET

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WESTON SOLUTIONS

CONCORD NEW HAMPSHIRE

AUBURN ROAD LANDFILL
LONDONDERRY, NEW HAMPSHIRE

ADDITIONAL ARSENIC SAMPLE CONCENTRATIONS IN GROUNDWATER NEW LTEMP/GMZ – 2012

DRAWN	DATE	FIGURE NO.
BEG	FEB 2013	8
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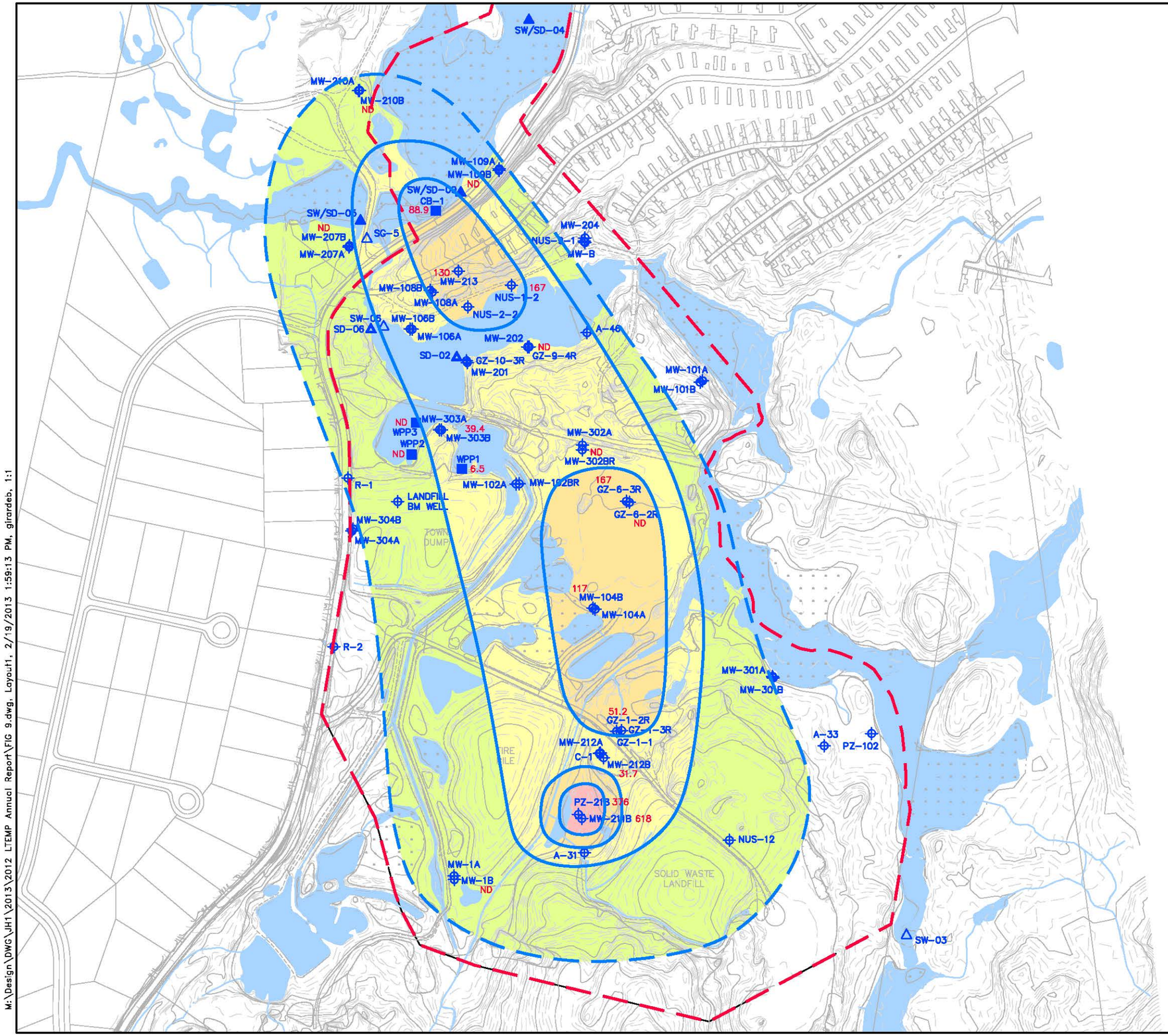
M:\Design\DWG\JH1\2013\2012 LTEMP Annual Report\FIG 8.dwg, Layout1, 8/12/2013 2:58:34 PM, girardeb, 1:1



LEGEND

MW-303B	MONITORING WELL LOCATION
SD-02	SEDIMENT (ONLY) SAMPLING LOCATION
SW-06	SURFACE WATER (ONLY) SAMPLING LOCATION
SW/SD-04	SURFACE WATER/SEDIMENT SAMPLING LOCATION
WPP3	USGS PIEZOMETER LOCATION
171	ARSENIC CONCENTRATION
	GMZ BOUNDARY
	ARSENIC CONCENTRATION CONTOUR (DASHED WHERE INFERRED)
	NON-DETECT (<10 ug/L)
	10-50 ug/L
	50-200 ug/L
	> 200 ug/L
	NO DATA AVAILABLE

GRAPHIC SCALE

400 200 0 200 400

APPROXIMATE SCALE IN FEET

NOTES:

1. THE PLANAMETRICS AND TOPOGRAPHY SHOWN ON THIS PLAN ARE BASED ON AERIAL PHOTOGRAPHY DATED DECEMBER 21, 1997, AND COMPILED BY EAST COAST MAPPING, INC. IN FEBRUARY 1998 AND FEBRUARY 2007.
2. THE LOCATIONS AND ELEVATIONS OF THE MONITORING WELLS ARE BASED ON AN ACTUAL FIELD SURVEY PERFORMED IN FEBRUARY OF 2007 BY HOLDEN ENGINEERING AND SURVEYING, INC.
3. THE HORIZONTAL AND VERTICAL DATUM FOR THE AERIAL MAPPING AND GROUND SURVEY ARE BASED ON NAD83 AND NGVD 29. ALL BEARINGS ARE BASED ON NH STATE PLANE COORDINATES GRID NORTH.

WESTON SOLUTIONS

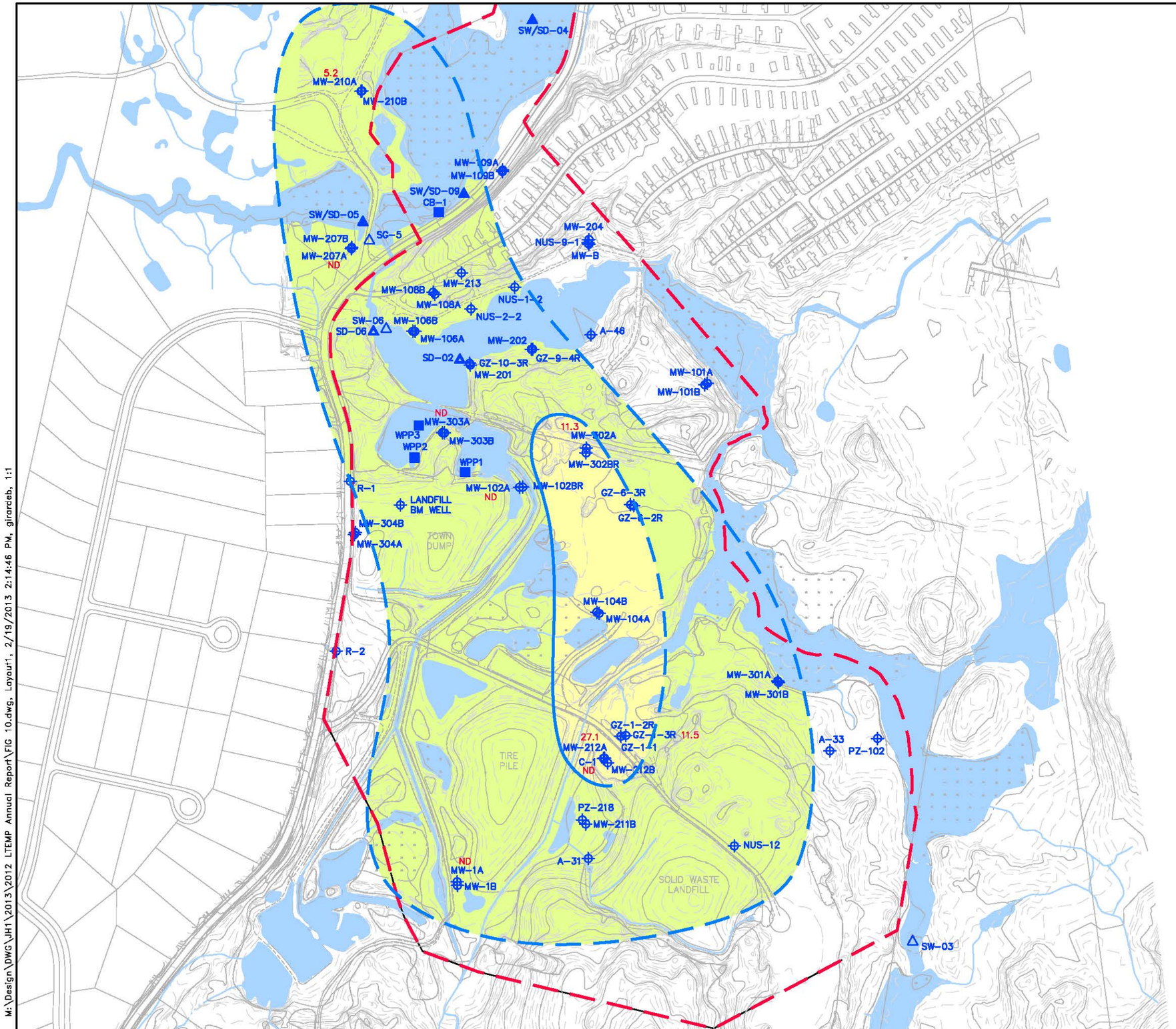
CONCORD NEW HAMPSHIRE

AUBURN ROAD LANDFILL
LONDONDERRY, NEW HAMPSHIRE

ARSENIC CONCENTRATIONS IN OVERBURDEN GROUNDWATER SPRING 2012

DRAWN	DATE	FIGURE NO.
BEG	FEB 2013	9
CHECKED	W.O. No. 12438.001.024	

M:\Design\DWG\JH1\2013\2012 LTEMP Annual Report\FIG 9.dwg, Layout1, 2/19/2013 1:59:13 PM, girardeb, 1:1



LEGEND

MW-303B	MONITORING WELL LOCATION
SD-02	SEDIMENT (ONLY) SAMPLING LOCATION
SW-06	SURFACE WATER (ONLY) SAMPLING LOCATION
SW/SD-04	SURFACE WATER/SEDIMENT SAMPLING LOCATION
WPP3	USGS PIEZOMETER LOCATION
27.1	ARSENIC CONCENTRATION
	GMZ BOUNDARY
	ARSENIC CONCENTRATION CONTOUR (DASHED WHERE INFERRED)
	NON-DETECT (<10 ug/L)
	10-50 ug/L
	50-200 ug/L
	> 200 ug/L
	NO DATA AVAILABLE

GRAPHIC SCALE

400 200 0 200 400

APPROXIMATE SCALE IN FEET

NOTES:

1. THE PLANAMETRICS AND TOPOGRAPHY SHOWN ON THIS PLAN ARE BASED ON AERIAL PHOTOGRAPHY DATED DECEMBER 21, 1997, AND COMPILED BY EAST COAST MAPPING, INC. IN FEBRUARY 1998 AND FEBRUARY 2007.
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3. THE HORIZONTAL AND VERTICAL DATUM FOR THE AERIAL MAPPING AND GROUND SURVEY ARE BASED ON NAD83 AND NGVD 29. ALL BEARINGS ARE BASED ON NH STATE PLANE COORDINATES GRID NORTH.

WESTON SOLUTIONS

CONCORD NEW HAMPSHIRE

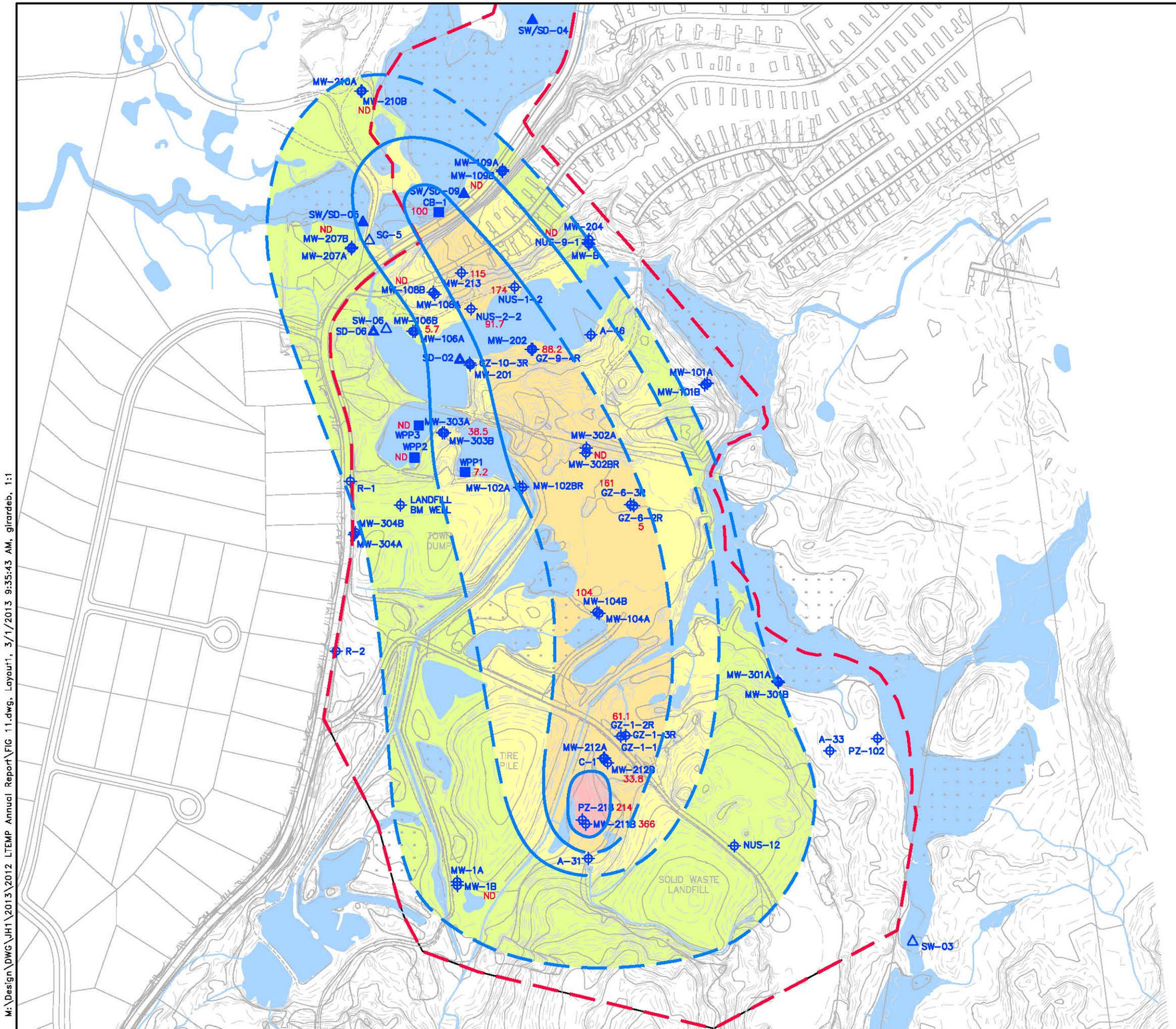
AUBURN ROAD LANDFILL

LONDONDERRY, NEW HAMPSHIRE

ARSENIC CONCENTRATIONS IN BEDROCK GROUNDWATER SPRING 2012

DRAWN	DATE	FIGURE NO.
BEG	FEB 2013	10
CHECKED	W.O. No. 12438.001.024	

M:\Design\DWG\JH1\2013\2012 LTEMP Annual Report\FIG 10.dwg, Layout1, 2/19/2013 2:14:46 PM, girardeb, 1:1



LEGEND

MW-303B	MONITORING WELL LOCATION
SD-02	SEDIMENT (ONLY) SAMPLING LOCATION
SW-06	SURFACE WATER (ONLY) SAMPLING LOCATION
SW/SD-04	SURFACE WATER/SEDIMENT SAMPLING LOCATION
WPP3	USGS PIEZOMETER LOCATION
171	ARSENIC CONCENTRATION
	GMZ BOUNDARY
	ARSENIC CONCENTRATION CONTOUR (DASHED WHERE INFERRED)
	NON-DETECT (<10 ug/L)
	10-50 ug/L
	50-200 ug/L
	> 200 ug/L
	NO DATA AVAILABLE

GRAPHIC SCALE

400 200 0 200 400

APPROXIMATE SCALE IN FEET

NOTES:

1. THE PLANAMETRICS AND TOPOGRAPHY SHOWN ON THIS PLAN ARE BASED ON AERIAL PHOTOGRAPHY DATED DECEMBER 21, 1997, AND COMPILED BY EAST COAST MAPPING, INC. IN FEBRUARY 1998 AND FEBRUARY 2007.
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WESTON SOLUTIONS

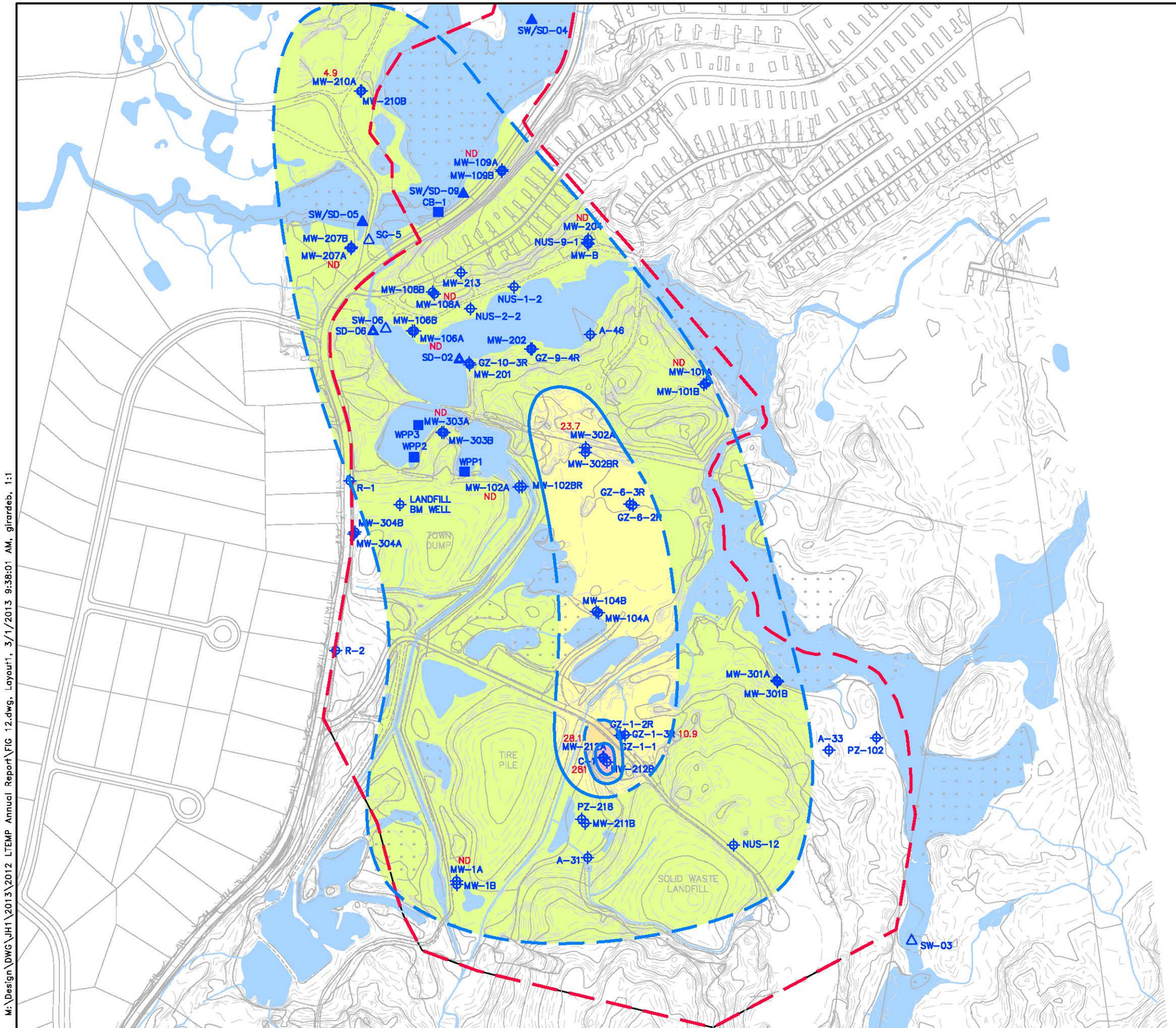
CONCORD NEW HAMPSHIRE

AUBURN ROAD LANDFILL
LONDONDERRY, NEW HAMPSHIRE

ARSENIC CONCENTRATIONS IN OVERBURDEN GROUNDWATER FALL 2012

DRAWN	DATE	FIGURE NO.
BEG	FEB 2013	11
CHECKED	W.O. No. 12438.001.024	

M:\Design\DWG\JH1\2013\2012 LTEMP Annual Report\FIG 11.dwg, Layout1, 3/1/2013 9:35:43 AM, girardeb, 1:1



LEGEND

MW-303B	MONITORING WELL LOCATION
SD-02	SEDIMENT (ONLY) SAMPLING LOCATION
SW-06	SURFACE WATER (ONLY) SAMPLING LOCATION
SW/SD-04	SURFACE WATER/SEDIMENT SAMPLING LOCATION
WPP3	USGS PIEZOMETER LOCATION
27.1	ARSENIC CONCENTRATION
	GMZ BOUNDARY
	ARSENIC CONCENTRATION CONTOUR (DASHED WHERE INFERRED)
	NON-DETECT (<10 ug/L)
	10-50 ug/L
	50-200 ug/L
	> 200 ug/L
	NO DATA AVAILABLE

GRAPHIC SCALE

400 200 0 200 400

APPROXIMATE SCALE IN FEET

NOTES:

1. THE PLANAMETRICS AND TOPOGRAPHY SHOWN ON THIS PLAN ARE BASED ON AERIAL PHOTOGRAPHY DATED DECEMBER 21, 1997, AND COMPILED BY EAST COAST MAPPING, INC. IN FEBRUARY 1998 AND FEBRUARY 2007.
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WESTON SOLUTIONS

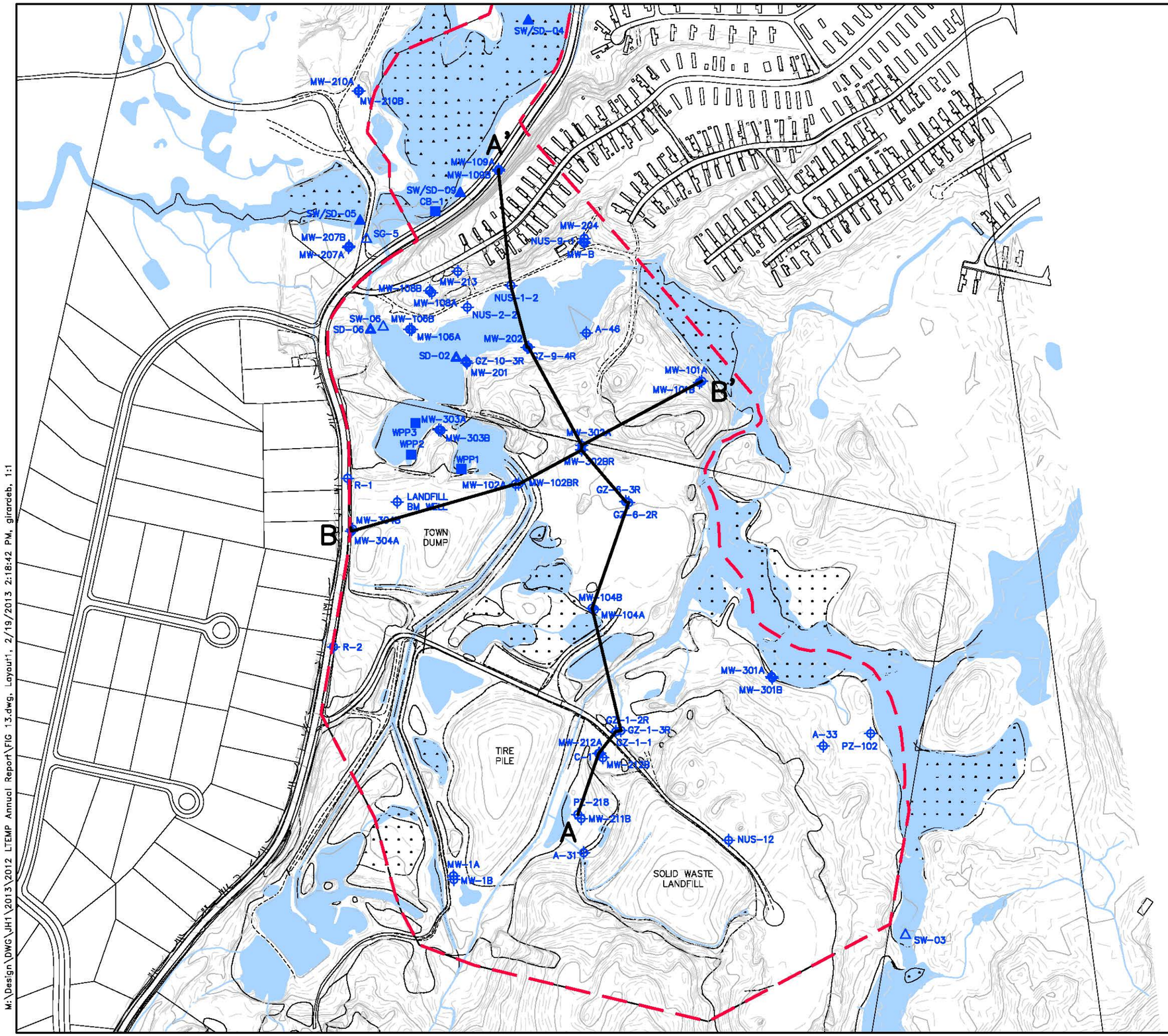
CONCORD NEW HAMPSHIRE

AUBURN ROAD LANDFILL
LONDONDERRY, NEW HAMPSHIRE

ARSENIC CONCENTRATIONS IN BEDROCK GROUNDWATER FALL 2012

DRAWN	DATE	FIGURE NO.
BEG	FEB 2013	12
CHECKED	W.O. No. 12438.001.024	

M:\Design\DWG\JH1\2013\2012 LTEMP Annual Report\FIG 12.dwg, Layout1, 3/1/2013 9:38:01 AM, girardeb, 1:1



LEGEND

MW-303B	MONITORING WELL LOCATION
SD-02	SEDIMENT (ONLY) SAMPLING LOCATION
SW-06	SURFACE WATER (ONLY) SAMPLING LOCATION
SW/SD-04	SURFACE WATER/SEDIMENT SAMPLING LOCATION
WPP3	USGS PIEZOMETER LOCATION
	GMZ BOUNDARY

GRAPHIC SCALE

400 200 0 200 400

APPROXIMATE SCALE IN FEET

NOTES:

1. THE PLANAMETRICS AND TOPOGRAPHY SHOWN ON THIS PLAN ARE BASED ON AERIAL PHOTOGRAPHY DATED DECEMBER 21, 1997, AND COMPILED BY EAST COAST MAPPING, INC. IN FEBRUARY 1998 AND FEBRUARY 2007.
2. THE LOCATIONS AND ELEVATIONS OF THE MONITORING WELLS ARE BASED ON AN ACTUAL FIELD SURVEY PERFORMED IN FEBRUARY OF 2007 BY HOLDEN ENGINEERING AND SURVEYING, INC.
3. THE HORIZONTAL AND VERTICAL DATUM FOR THE AERIAL MAPPING AND GROUND SURVEY ARE BASED ON NAD83 AND NGVD 29. ALL BEARINGS ARE BASED ON NH STATE PLANE COORDINATES GRID NORTH.

WESTON SOLUTIONS

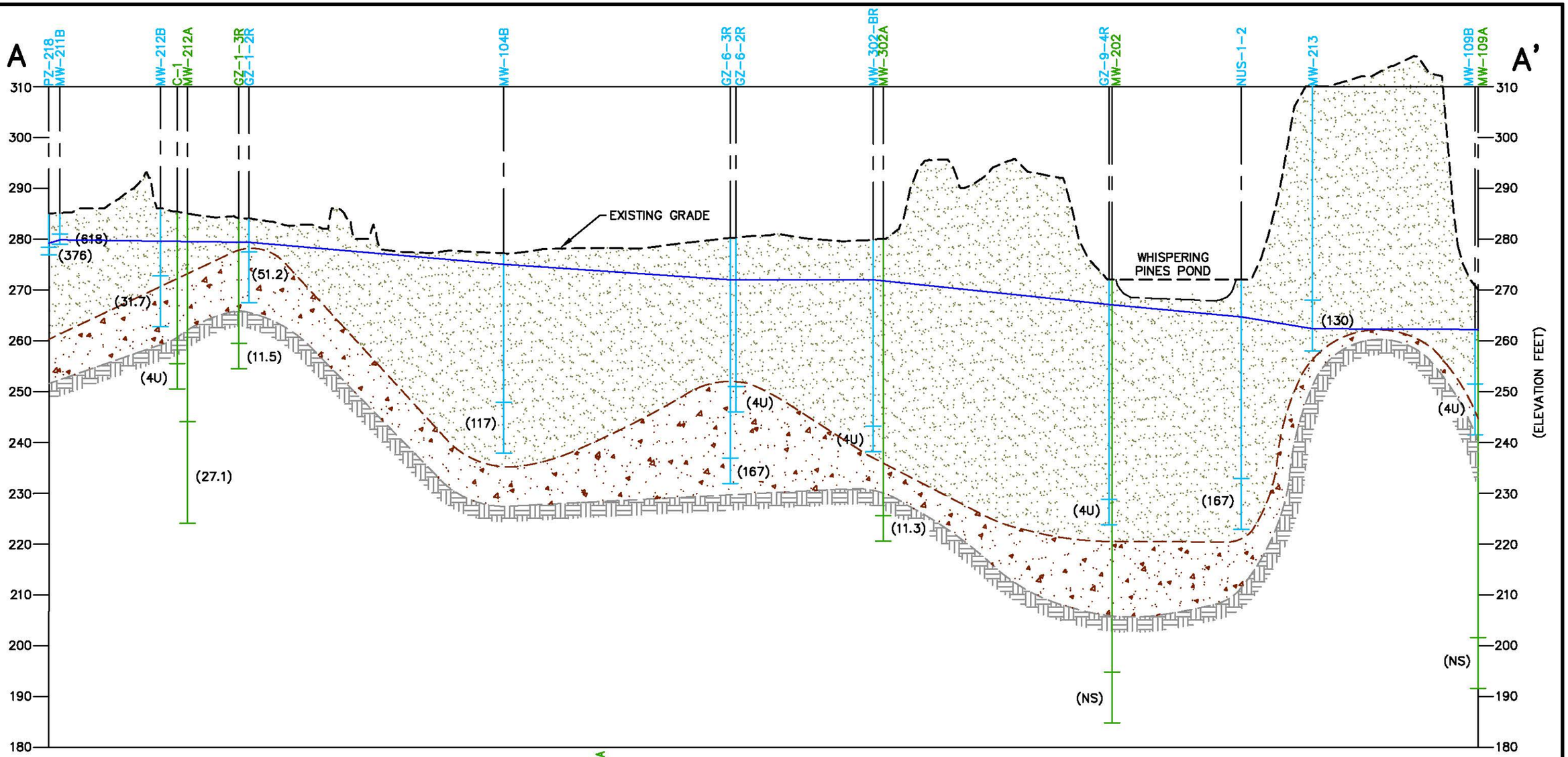
CONCORD NEW HAMPSHIRE

AUBURN ROAD LANDFILL
LONDONDERRY, NEW HAMPSHIRE

CROSS SECTION PLAN VIEW

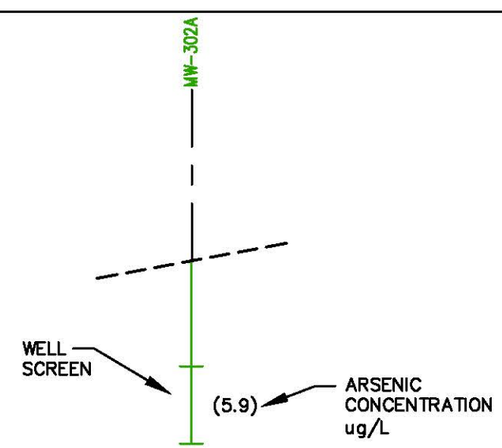
DRAWN	DATE	FIGURE NO.
BEG	FEB 2013	13
CHECKED	W.O. No. 12438.001.024	

M:\Design\DWG\JH1\2013\2012 LTEMP Annual Report\FIG 13.dwg, Layout1, 2/19/2013 2:18:42 PM, girardeb, 1:1



LEGEND

MW-302B	OVERBURDEN MONITORING WELL
MW-302A	BEDROCK MONITORING WELL
	SAND
	TILL
	BEDROCK
	OVERBURDEN GROUNDWATER ELEVATION
(ND)	NOT DETECTED (<10 ug/L)
(NS)	NOT SAMPLED



GRAPHIC SCALE

200 100 0 100 200

APPROXIMATE HORIZONTAL SCALE IN FEET

VERTICAL EXAGGERATION 10X

NOTES:
SCREEN LENGTH AT MONITORING WELL LOCATION NUS-1-2 IS UNKNOWN. SHOWN AT AN ASSUMED LENGTH OF 10 FEET.

WESTON SOLUTIONS

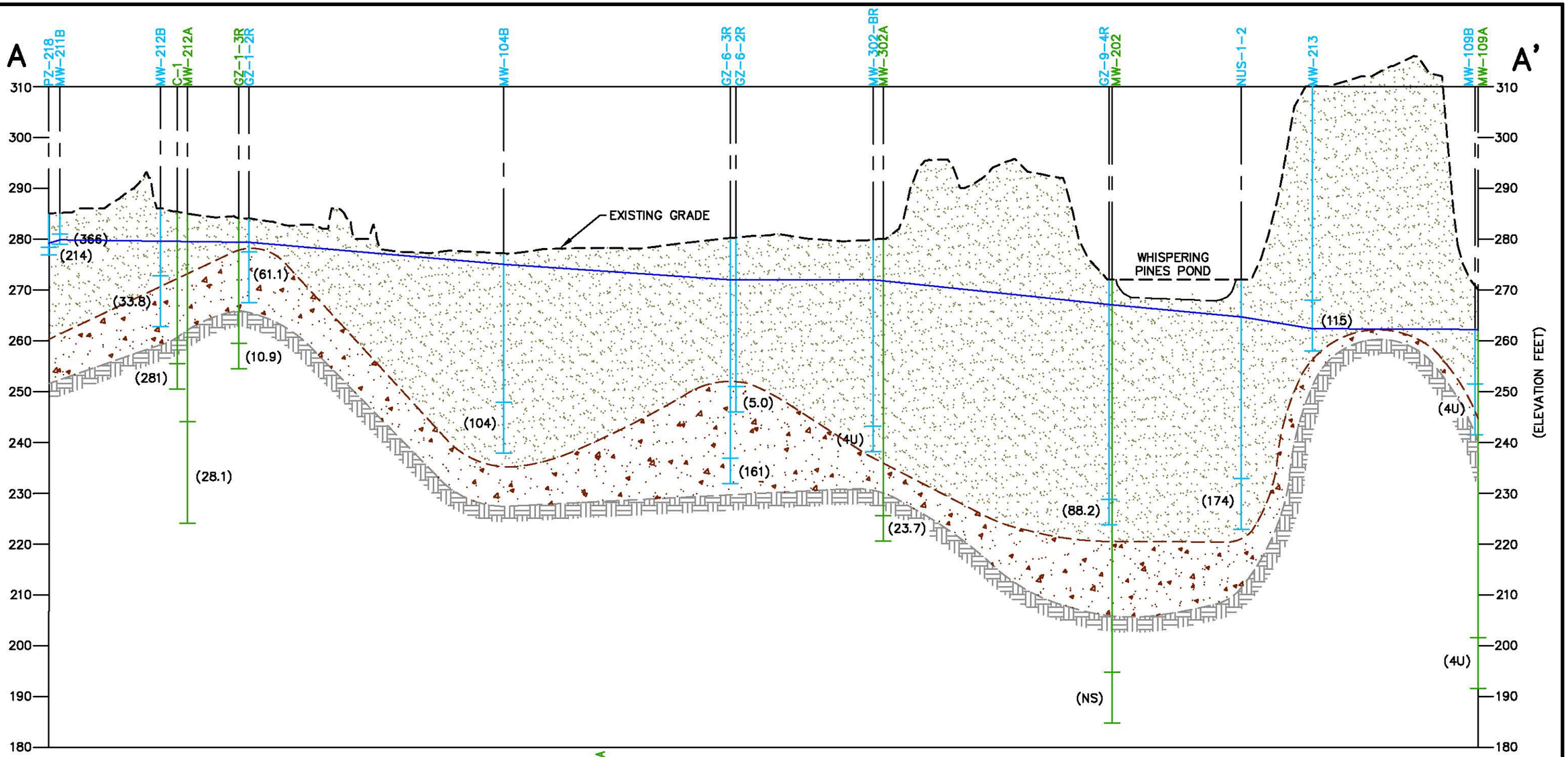
CONCORD NEW HAMPSHIRE

AUBURN ROAD LANDFILL
LONDONDERRY, NEW HAMPSHIRE

HYDROGEOLOGIC CROSS SECTION A-A'
SPRING 2012

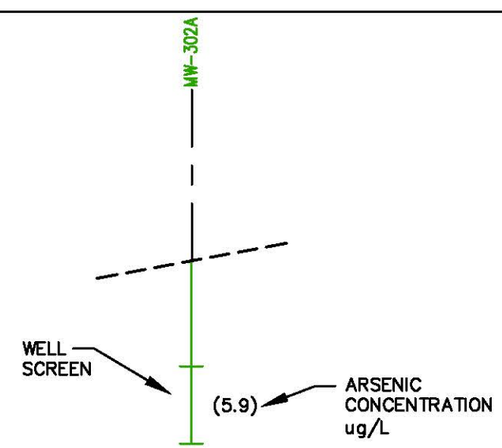
DRAWN	DATE	FIGURE NO.
BEG	FEB 2013	14A
CHECKED	W.O. No. 12438.001.024	

M:\Design\DWG\JH1\2013\2012 LTEMP Annual Report\FIG 14A.dwg, A-A' Spring, 2/19/2013 2:25:39 PM, girardeb, 1:1



LEGEND

MW-302B	OVERBURDEN MONITORING WELL
MW-302A	BEDROCK MONITORING WELL
	SAND
	TILL
	BEDROCK
	OVERBURDEN GROUNDWATER ELEVATION
(ND)	NOT DETECTED (<10 ug/L)
(NS)	NOT SAMPLED



GRAPHIC SCALE

200 100 0 100 200

APPROXIMATE HORIZONTAL SCALE IN FEET

VERTICAL EXAGGERATION 10X

NOTES:
SCREEN LENGTH AT MONITORING WELL LOCATION NUS-1-2 IS UNKNOWN. SHOWN AT AN ASSUMED LENGTH OF 10 FEET.

WESTON SOLUTIONS

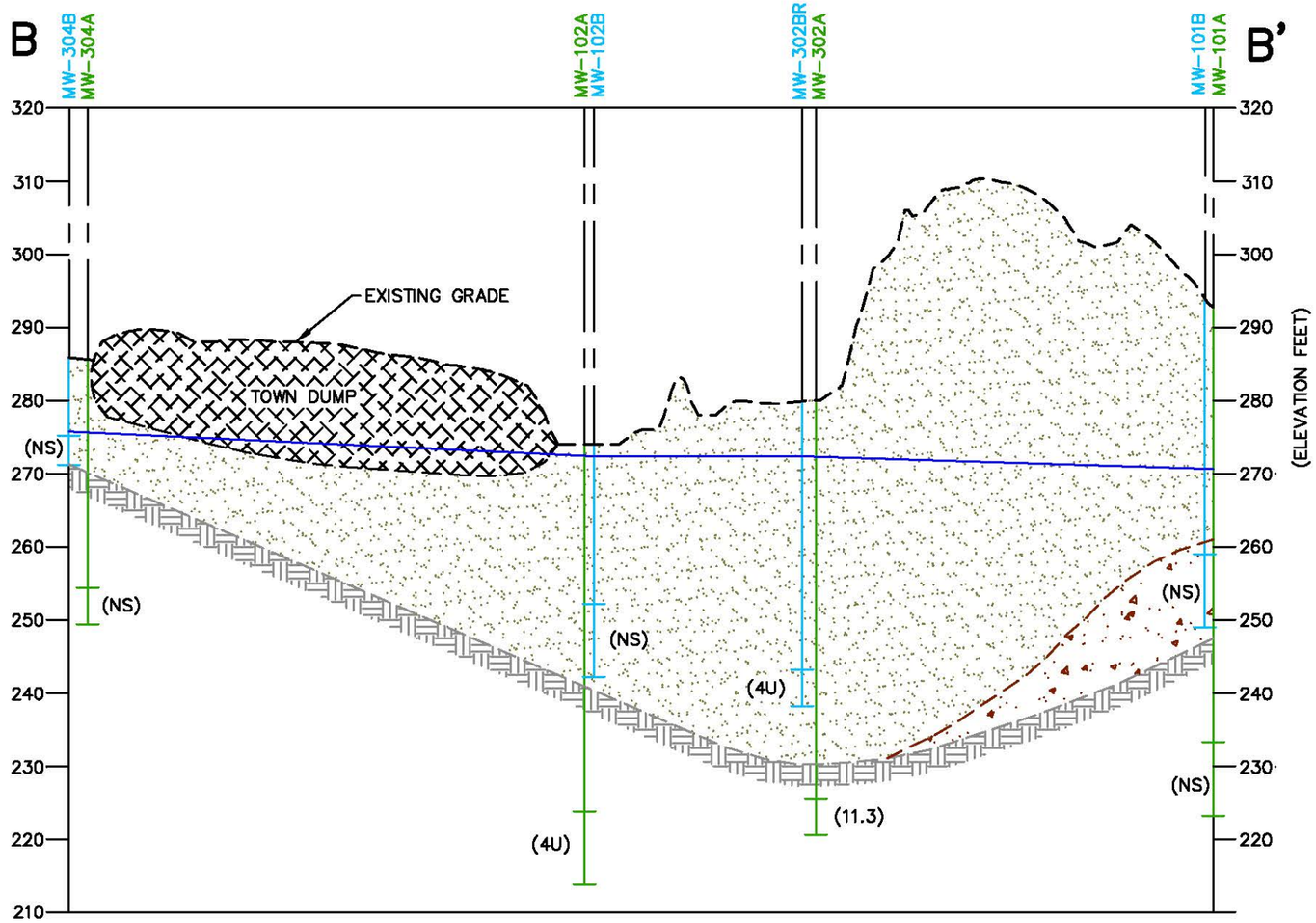
CONCORD NEW HAMPSHIRE

AUBURN ROAD LANDFILL
LONDONDERRY, NEW HAMPSHIRE

HYDROGEOLOGIC
CROSS SECTION A-A'
FALL 2012

DRAWN	DATE	FIGURE NO.
BEG	FEB 2013	14B
CHECKED	W.O. No. 12438.001.024	

M:\Design\DWG\JH1\2013\2012 LTEMP Annual Report\FIG 14B.dwg, A-A' Spring, 2/19/2013 2:28:28 PM, girardab, 1:1

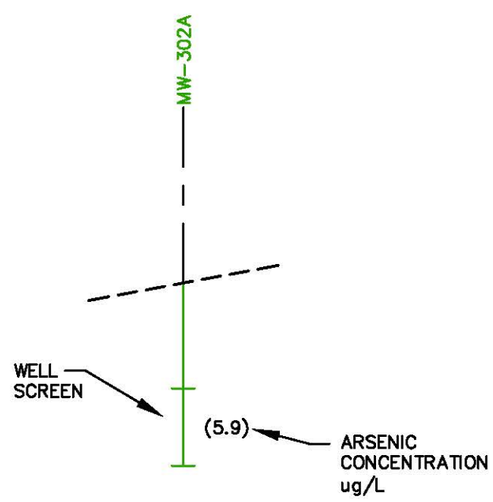


GRAPHIC SCALE

200 100 0 100 200

APPROXIMATE HORIZONTAL SCALE IN FEET

VERTICAL EXAGGERATION 10X



LEGEND

MW-304B	OVERBURDEN MONITORING WELL
MW-304A	BEDROCK MONITORING WELL
	SAND
	TILL
	BEDROCK
	OVERBURDEN GROUNDWATER ELEVATION (DASHED WHERE INFERRED)
(ND)	NOT DETECTED (<10 ug/L)
(NS)	NOT SAMPLED

NOTES:
DEPTH OF BOTTOM OF TOWN DUMP BASED ON FORMER PIEZOMETER INFORMATION.

WESTON SOLUTIONS

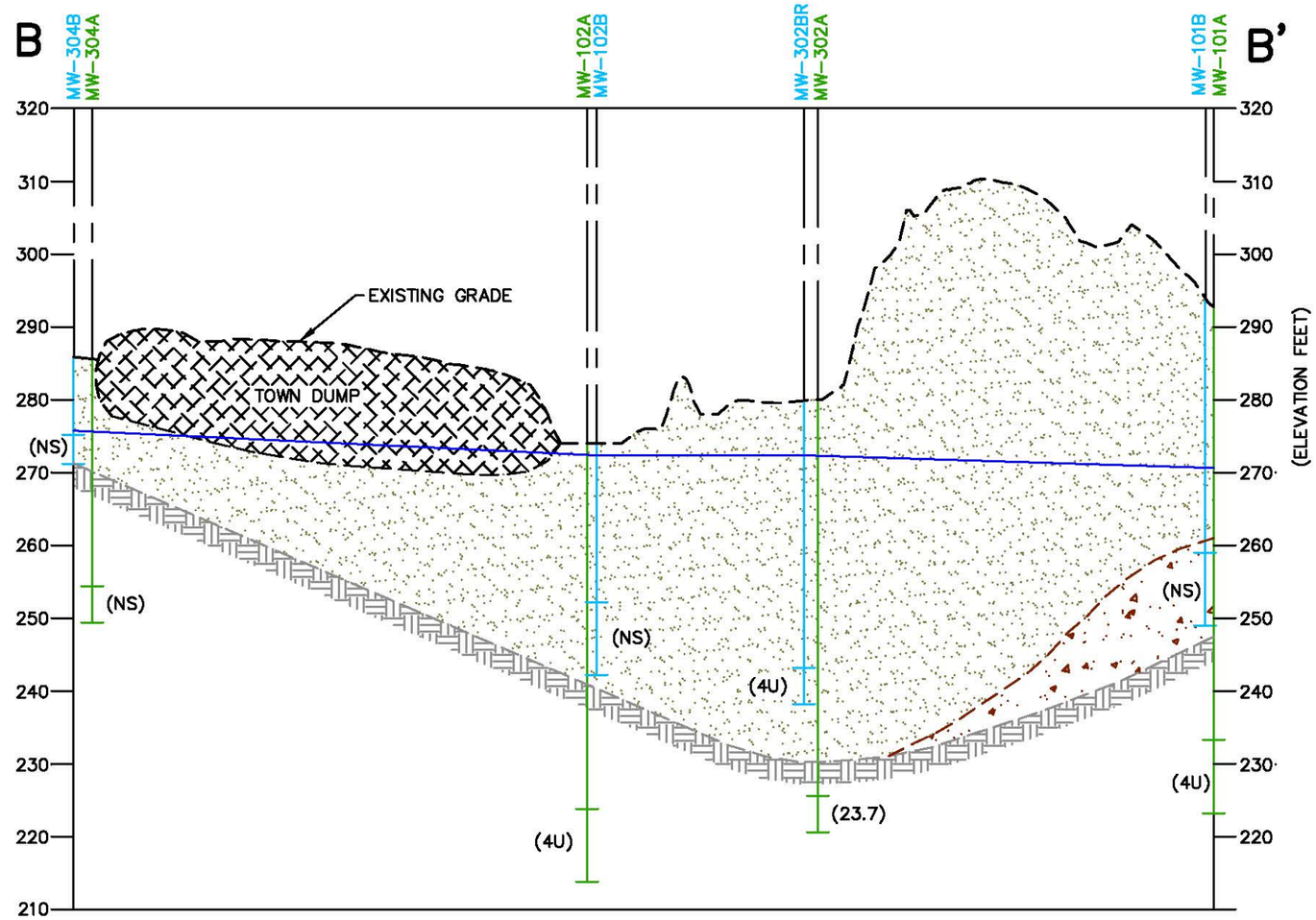
CONCORD NEW HAMPSHIRE

AUBURN ROAD LANDFILL
LONDONDERRY, NEW HAMPSHIRE

HYDROGEOLOGIC CROSS SECTION B–B'
SPRING 2012

DRAWN	DATE	FIGURE NO.
BEG	FEB 2013	15A
CHECKED	W.O. No. 12438.001.024	

M:\Design\DWG\JH1\2013\2012 LTEMP Annual Report\FIG 15A.dwg, B-B' Spring, 2/19/2013 2:30:50 PM, girardeb, 1:1



GRAPHIC SCALE

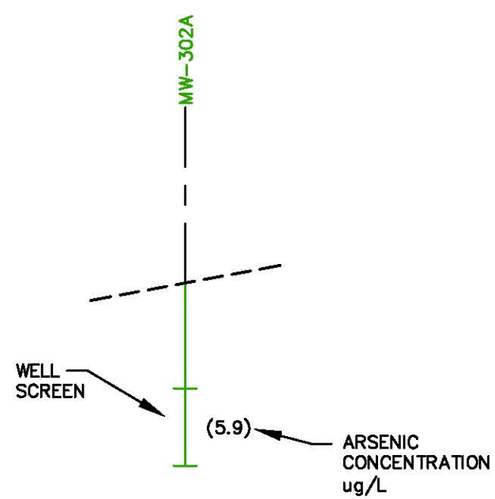
200 100 0 100 200

APPROXIMATE HORIZONTAL SCALE IN FEET

VERTICAL EXAGGERATION 10X

LEGEND

MW-304B	OVERBURDEN MONITORING WELL
MW-304A	BEDROCK MONITORING WELL
	SAND
	TILL
	BEDROCK
	OVERBURDEN GROUNDWATER ELEVATION (DASHED WHERE INFERRED)
(ND)	NOT DETECTED (<10 ug/L)
(NS)	NOT SAMPLED



NOTES:
DEPTH OF BOTTOM OF TOWN DUMP BASED ON FORMER PIEZOMETER INFORMATION.

WESTON SOLUTIONS

CONCORD NEW HAMPSHIRE

AUBURN ROAD LANDFILL
LONDONDERRY, NEW HAMPSHIRE

HYDROGEOLOGIC
CROSS SECTION B-B'
FALL 2012

DRAWN	DATE	FIGURE NO.
BEG	FEB 2013	15B
CHECKED	W.O. No. 12438.001.024	

M:\Design\DWG\JH1\2013\2012 LTEMP Annual Report\FIG 15B.dwg, B-B' Spring, 2/19/2013 2:32:27 PM, girardeb, 1:1

TABLES

Table 1

Groundwater Sampling Locations
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Monitoring Well ID	Sampling Rationale	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Spring			Fall		
					Arsenic	VOCs	Water Level	Arsenic	VOCs	Water Level
LTEMP Overburden Monitoring Wells										
GZ-1-2R	Plume monitoring	17.5	Unknown	7.5 - 17.5	X	-	X	X	-	X
GZ-6-2R	Plume monitoring	35.5	40.8	30.5 - 35.5	X	-	X	X	-	X
GZ-6-3R	Plume monitoring	50	50.6	45 - 50	X	-	X	X	-	X
GZ-9-4R	Plume monitoring	47	Unknown	42 - 47	X	-	X	X	-	X
MW-1B	Background/Upgradient	14.6	Unknown	9.6 - 14.6	X	-	X	X	-	X
MW-104B[1]	Plume monitoring	40	45	29 - 40	X	-	X	X	-	X
MW-109B	Downgradient location	29	Unknown	19 - 29	X	-	X	X	-	X
MW-302B	Plume monitoring	41.5	49.5	36.5 - 41.5	X	-	X	X	-	X
MW-303B	Plume monitoring	13.8	18	8.5 - 13.8	X	-	X	X	-	X
NUS-1-2	Plume monitoring	47.5	47.5	Unknown - 47.5	X	-	X	X	X	X
NUS-2-2	Plume monitoring	25	Unknown	15 - 25	-	-	X	X	X	X
PZ-218	Plume monitoring	6	Unknown	4.5 - 6	X	-	X	X	-	X
MW-211B[2]	Plume monitoring	6.5	6.5	4.5-6.5	X	-	X	X	-	X
MW-207B	Plume delineation/ Downgradient location	35	35.2	25 - 35	X	-	X	X	-	X
MW-210B	Plume delineation/ Downgradient location	16	16.1	6 - 16	X	-	X	X	-	X
MW-212B[2]	Plume delineation (overburden couplet with MW-212A)	22.2	22.2	12.2 – 22.2	X	-	X	X	-	X
MW-213[3]	Plume delineation	52	54	42-52	X	-	X	X	-	X
Additional GMZ Permit Overburden Monitoring Wells										
MW-101B	Plume delineation	45	45.8	35 to 45	-	-	X	X	-	X
MW-106B	Plume delineation	27	27.7	17 to 27	-	-	X	X	-	X
MW-108B	Plume delineation	51	49.5	48 to 51	-	-	X	X	-	X
NUS-9-1	Plume delineation	38	Unknown	13 to 38	-	-	X	X	-	X

Table 1

Groundwater Sampling Locations
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Monitoring Well ID	Sampling Rationale	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Spring			Fall		
					Arsenic	VOCs	Water Level	Arsenic	VOCs	Water Level
Additional Overburden Monitoring Wells										
A-33	Plume delineation	9.2	Unknown	1 - 9.20	-	-	X	-	-	X
MW-301B	Cross gradient	21.2	29.5	16.2 - 21.2	-	-	X	-	-	X
MW-102B	Cross gradient	34.5	Unknown	24 - 34	-	-	X	-	-	X
MW-304B	Cross gradient	14.6	17	10.6 - 14.6	-	-	X	-	-	X
PZ-102	Cross gradient	13	12.5	10 - 13	-	-	X	-	-	X
LTEMP Bedrock Monitoring Wells										
C-1	Plume monitoring	34.5	24.5	29.5 - 34.5	X	-	X	X	-	X
MW-212A[2]	Plume monitoring	60	26	40 - 60	X	-	X	X	-	X
GZ-1-3R	Plume monitoring	30	18.5	25 - 30	X	-	X	X	X	X
MW-1A	Background/Upgradient	30.4	14.0	25.4 - 30.4	X	-	X	X	-	X
MW-102A	Plume monitoring	61.5	34	51.5 - 61.5	X	X	X	X	X	X
MW-207A	Plume delineation	87	35.2	77 to 87	X	-	X	X	-	X
MW-210A	Plume delineation	62	16.1	52 to 62	X	-	X	X	-	X
MW-302A	Plume monitoring	59.3	49.5	54.5 - 59.3	X	-	X	X	-	X
MW-303A	Plume monitoring	37	18	32 - 37	X	X	X	X	X	X
Additional GMZ Permit Bedrock Monitoring Wells										
MW-101A	Plume delineation	70.1	45.8	60 to 70.1	-	-	X	X	-	X
MW-106A	Plume delineation	58.7	27.7	48.7 to 58.7	-	-	X	X	-	X
MW-108A	Plume delineation	72.9	49.5	62.9 to 72.9	-	-	X	X	-	X
MW-109A	Down gradient	78	29	68.1 - 78	-	-	X	X	-	X
MW-204	Plume delineation	98.9	67.9	88.9 to 98.9	-	-	X	X	-	X

Table 1

Groundwater Sampling Locations
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Monitoring Well ID	Sampling Rationale	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Spring			Fall		
					Arsenic	VOCs	Water Level	Arsenic	VOCs	Water Level
Additional Bedrock Monitoring Wells										
R-1	Water level only	400	Unknown	open bore hole	-	-	X	-	-	X
R-2	Water level only	400	Unknown	open bore hole	-	-	X	-	-	X

Notes:

[1] = Added to Long-Term Environmental Monitoring Program (LTEMP) monitoring in 2006 to cover data gap in midpoint of plume.

[2] = Monitoring wells MW-211B (PZ-218) and couplet MW-212A/MW-212B (C-1) were installed in 2008 to assist in plume delineation.

[3] = Monitoring Well MW-213 was installed to assist in identification of Groundwater Management Zone (GMZ).

Monitoring well MW-205 was destroyed and replacement wells MW-207A and MW-207B were installed in 2007.

"'-" = Not Sampled

"X" = Requirements for analysis or depth to water measurement per sampling event.

VOC = volatile organic compounds

ft bgs = feet below ground surface

Table 2

Water Quality Parameters
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Well ID	Temperature (°C)		pH (std. units)		Conductivity (µS/cm)		ORP (mV)		DO (mg/L)		Turbidity (NTU)		Alkalinity (mg/L)	
	Spring 2012	Fall 2012	Spring 2012	Fall 2012	Spring 2012	Fall 2012	Spring 2012	Fall 2012	Spring 2012	Fall 2012	Spring 2012	Fall 2012	Spring 2012	Fall 2012
LTEMP Overburden Monitoring Wells														
GZ-1-2R	12.02	12.88	6.02	5.95	392	375	-50.7	-32.1	0.16	0.39	< 1.0	0.49	240	105
GZ-6-2R	14.73	15.5	6.57	6.74	296	287	-15.6	-4.9	0.17	0.34	1.0	0.51	200	140
GZ-6-3R	15.15	15.15	6.22	6.3	509	495	-28.4	-48	0.50	1.59	2.0	0.61	340	155
GZ-9-4R	12.76	12.04	6.78	6.59	409	458	2.00	-57.4	5.33	0.63	< 1.0	0.79	200	115
MW-1B	14.53	14.89	6.68	6.52	244	244	-141	-129.6	0.35	0.47	0.48	< 1.0	110	60
MW-104B	13.08	12.38	6.03	6.12	430	373	-18.3	-33.1	0.86	0.39	< 1.0	10.3	260	155
MW-109B	12.60	11.65	5.63	5.93	247	257	511.1	124.1	3.60	4.33	0.77	0.99	160	15
MW-302BR	15.65	15.99	6.45	6.48	304	288	-21.9	103.3	0.21	0.39	< 1.0	1.59	160	100
MW-303B	14.89	12.71	6.53	6.72	369	391	-79.7	-78.0	0.60	0.50	10.1	< 1.0	180	140
NUS-1-2	12.48	13.81	6.15	6.64	505	502	-84.8	-73.6	0.10	0.29	1.92	< 1.0	205	260
NUS-2-2	NS	12.5	NS	6.78	NS	315	NS	-77.5	NS	0.13	NS	< 1.0	NS	120
PZ-218	13.79	11.98	5.86	6.02	272	176	-28.8	37.7	0.14	1.62	2.53	10.7	120	50
MW-211B	15.90	12.21	5.86	6.17	158	144	48.7	49.7	3.09	6.16	77.3	56.9	70	65
MW-207B	14.02	13.76	6.34	6.44	295	306	225.2	69.5	0.31	0.14	0.79	< 1.0	75	100
MW-210B	14.85	12.07	6.21	6.30	115	131	488.5	157.2	5.82	7.43	2.09	< 1.0	100	NM
MW-212B	19.49	11.7	5.66	6.01	496	401	-37.1	-17.9	0.48	0.78	4.77	2.66	215	175
MW-213	13.89	13.31	5.07	6.56	393	390	-70.6	-89.5	0.96	0.77	0.98	4.03	130	135
Additional GMZ Permit Overburden Monitoring Wells (Fall Sampling Only)														
MW-101B	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW-106B	NS	14.69	NS	6.28	NS	302	NS	-13.1	NS	0.4	NS	6.14	NS	60
MW-108B	NS	11.17	NS	6.41	NS	219	NS	117.1	NS	1.04	NS	0.79	NS	40
NUS-9-1	NS	11.97	NS	5.91	NS	290	NS	163.1	NS	7.02	NS	< 1.0	NS	40

Table 2

Water Quality Parameters
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Well ID	Temperature (°C)		pH (std. units)		Conductivity (µS/cm)		ORP (mV)		DO (mg/L)		Turbidity (NTU)		Alkalinity (mg/L)	
	Spring 2012	Fall 2012	Spring 2012	Fall 2012	Spring 2012	Fall 2012	Spring 2012	Fall 2012	Spring 2012	Fall 2012	Spring 2012	Fall 2012	Spring 2012	Fall 2012
LTEMP Bedrock Monitoring Wells														
C-1	15.29	10.01	5.87	6.26	272	400	131.1	-55.5	0.10	0.56	4.96	4.27	110	170
GZ-1-3R	12.91	13.16	7.04	7.31	372	314	-107.5	-141.6	0.09	0.21	< 1.0	0.98	200	125
MW-1A	15.15	13.87	6.98	7.59	324	330	-177.3	-172.8	0.21	0.26	0.75	< 1.0	120	100
MW-102A	16.38	15.37	6.83	7.57	357	375	434.9	78.3	2.55	3.31	0.69	< 1.0	110	120
MW-207A	14.55	13.73	9.02	10.04	395	431	320.0	-13.1	1.23	0.1	0.78	< 1.0	100	60
MW-210A	13.02	11.67	7.72	8.02	317	327	430.9	117.1	6.50	3.64	0.87	< 1.0	180	120
MW-212A	11.98	11.60	6.24	6.26	428	350	-30.0	-27.5	0.69	0.71	9.39	4.46	NM	160
MW-302A	15.57	15.31	7.06	7.28	596	577	-96.2	-153.2	0.23	0.39	< 1.0	0.66	340	205
MW-303A	14.32	12.23	7.31	7.44	244	245	-94.2	-145.7	0.15	0.81	0.76	< 1.0	120	140
Additional GMZ Permit Bedrock Monitoring Wells (Fall Sampling Only)														
MW-101A	NS	11.21	NS	7.04	NS	133	NS	101.2	NS	3.12	NS	2.69	NS	60
MW-106A	NS	14.45	NS	7.55	NS	381	NS	67.1	NS	1.58	NS	< 1.0	NS	NM
MW-108A	NS	11.62	NS	7.51	NS	382	NS	100.4	NS	2.52	NS	0.69	NS	110
MW-109A	NS	10.22	NS	7.72	NS	309	NS	-147.1	NS	0.34	NS	0.59	NS	105
MW-204	NS	12.35	NS	7.37	NS	327	NS	16.4	NS	1.34	NS	2.41	NS	105
Piezometers														
CB-1	17.81	14.29	6.04	6.82	326	370	-60.8	-94.5	0.34	6.39	0.77	99.3	110	NM
WPP-1	14.71	12.07	5.99	6.61	378	388	-113.4	-60.2	0.89	3.98	0.53	< 1.0	180	140
WPP-2	13.20	11.81	6.23	6.34	390	387	-40.1	57.0	0.27	0.32	< 1.0	< 1.0	180	140
WPP-3	16.83	12.12	5.55	6.41	348	296	104.2	-221.1	2.33	0.28	2.0	16.1	100	75

Notes:

DO = dissolved oxygen
mg/L = milligrams per liter
mV = millivolt
ºC = degrees Celsius
ORP = oxidation-reduction potential
NM = Not Measured
GMZ = groundwater management zone
NTU = nephelometric turbidity unit
LTEMP = Long-Term Environmental Monitoring Program
µS/cm = micro siemens per centimeter
NS= not sampled

Table 3

Surface Water Sampling Locations
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Location	Spring 2012		Fall 2012	
	Arsenic	VOC	Arsenic	VOC
SW-3	X	-	X	-
SW-4	X	-	X	-
SW-5	X	-	X	-
SW-6	X	-	X	-
SW-9	X	-	X	-
SW-9 (filtered and not filtered)	X	-	X	-

Notes:

VOC = volatile organic compounds

Table 4

Surface Water Quality Parameters
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Surface Water Location	Date	Temperature (C)	Conductivity (µS/cm)	pH (std units)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Alkalinity (mg/L)
SW-3	Spring	19.58	67.0	6.32	98.8	9.76	3.72	80
	Fall	10.95	187	6.94	103.8	10.42	1.15	NM
SW-4	Spring	29.43	275	7.11	-134.5	6.00	3.56	60
	Fall	12.44	241	6.88	178.8	10.15	2.15	NM
SW-5	Spring	29.87	237	6.61	34.4	8.77	10.4	60
	Fall	8.13	299	7.24	35.1	7.5	2.15	NM
SW-6	Spring	31.39	233	7.29	-140.6	6.10	7.77	80
	Fall	9.4	200	7.32	108.5	8.74	4.43	NM
SW-9	Spring	Dry	Dry	Dry	Dry	Dry	Dry	Dry
	Fall	9.33	313	6.6	-6.8	5.55	15.5	NM

Notes:

µS/cm = micro siemens per centimeter
ORP = oxidation-reduction potential
DO = dissolved oxygen
NTU = nephelometric turbidity unit
NM= not measured.
mV = millivolts
mg/L = milligrams per liter

Table 5

Sediment Sampling Locations
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Location	Spring 2012			Fall 2012		
	Arsenic	VOC	Toxicity	Arsenic	VOC	Toxicity
SD-2	-	-	-	X	-	X
SD-4	-	-	-	X	-	X
SD-5	-	-	-	X	-	X
SD-9	-	-	-	X	-	X

Notes:

VOC = volatile organic compounds

Table 6

Depth to Water and Potentiometric Surface Elevations: Overburden Wells (2000-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Monitoring Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
GZ-1-2R	17.5	Unknown	7.5 - 17.5	285.0	277.5	267.5	286.40	6/6/2000	5.87	280.53
								11/8/2000	7.48	278.92
								4/26/2001	5.48	280.92
								10/9/2001	9.35	277.05
								4/23/2002	6.12	280.28
								10/23/2002	9.21	277.19
								4/9/2003	4.05	282.35
								10/6/2003	7.18	279.22
								4/22/2004	4.46	281.94
								10/6/2004	6.90	279.50
								5/5/2005	4.83	281.57
								11/92005	4.53	281.87
								5/30/2006	4.35	282.05
								10/25/2006	6.45	279.95
								4/23/2007	3.52	282.88
								10/31/2007	8.88	277.52
								4/29/2008	4.15	282.25
								10/22/2008	6.37	280.03
								4/27/2009	4.97	281.43
								10/21/2009	7.45	278.95
								4/20/2010	4.11	282.29
								10/25/2010	8.32	278.08
								4/25/2011	5.36	281.04
								10/25/2011	4.51	281.89
								7/12/2012	7.29	279.11
								10/24/2012	8.48	277.92
MW-109B	29	Unknown	19 - 29	296.6	250.6	240.6	273.08	6/7/2000	7.44	265.64
								11/8/2000	7.81	265.27
								4/26/2001	8.40	264.68
								10/9/2001	8.92	264.16
								4/23/2002	8.28	264.80
								10/23/2002	8.74	264.34
								4/9/2003	8.92	264.16
								10/6/2003	8.43	264.65
								4/22/2004	9.14	263.94
								10/6/2004	10.14	262.94
								5/5/2005	9.30	263.78
								11/9/2005	9.27	263.81
								5/30/2006	9.48	263.60
								10/24/2006	9.40	263.68
								4/23/2007	8.89	264.19
								10/30/2007	9.71	263.37
								4/28/2008	9.83	263.25
								10/24/2008	9.58	263.50
								4/27/2009	9.63	263.45
								10/20/2009	9.88	263.20
								4/20/2010	9.13	263.95
								11/12/2010	10.51	262.57
								4/20/2010	9.13	263.95
								7/12/2012	10.66	262.42
								10/24/2012	10.40	262.68

Table 6

Depth to Water and Potentiometric Surface Elevations: Overburden Wells (2000-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Monitoring Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
MW-302BR	41.5	49.5	36.5 - 41.5	279.7	242.6	238.2	282.14	6/7/2000	8.63	273.51
								11/8/2000	9.46	272.68
								4/26/2001	8.05	274.09
								10/9/2001	9.94	272.20
								4/23/2002	8.64	273.50
								10/23/2002	10.50	271.64
								4/9/2003	8.13	274.01
								10/6/2003	9.98	272.16
								4/22/2004	9.28	272.86
								10/6/2004	9.92	272.22
								5/5/2005	9.00	273.14
								11/9/2005	9.14	273.00
								5/30/2006	8.78	273.36
								10/25/2006	9.55	272.59
								4/23/2007	7.71	274.43
								10/29/2007	10.52	271.62
								4/29/2008	8.30	273.84
								10/22/2008	9.03	273.11
								4/28/2009	8.83	273.31
								10/19/2009	9.87	272.27
								4/20/2010	8.60	273.54
								10/25/2010	10.24	271.90
								4/25/2011	8.70	273.44
								10/24/2011	8.55	273.59
								7/12/2012	10.09	272.05
								10/24/2012	10.08	272.06
MW-303B	13.8	18	8.5 - 13.8	272.2	263.7	258.4	273.70	6/7/2000	1.65	272.05
								11/8/2000	2.60	271.10
								4/26/2001	1.40	272.30
								10/9/2001	2.76	270.94
								4/23/2002	1.30	272.40
								10/23/2002	4.30	269.40
								4/9/2003	2.50	271.20
								10/6/2003	2.81	270.89
								4/22/2004	4.30	269.40
								10/6/2004	4.94	268.76
								5/5/2005	4.00	269.70
								11/10/2005	4.50	269.20
								5/30/2006	4.38	269.32
								10/25/2006	4.85	268.85
								4/23/2007	3.35	270.35
								10/37/07	4.82	268.88
								5/1/2008	2.48	271.22
								10/23/2008	3.15	270.55
								4/27/2009	3.23	270.47
								10/19/2009	4.30	269.40
								4/21/2010	3.78	269.92
								10/25/2010	4.55	269.15
								4/25/2011	3.25	270.45
								10/25/2011	3.53	270.17
								7/12/2012	4.65	269.05
								10/24/2012	4.45	269.25

Table 6

Depth to Water and Potentiometric Surface Elevations: Overburden Wells (2000-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Monitoring Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
NUS-1-2	47.5	47.5	30-40	270.4	240.4	230.4	270.12	6/7/2000	0.35	269.77
								11/8/2000	1.24	268.88
								4/26/2001	0.00	270.12
								10/9/2001	0.62	269.50
								4/23/2002	0.00	270.12
								10/23/2002	3.96	266.16
								4/9/2003	2.25	267.87
								10/6/2003	2.79	267.33
								4/22/2004	2.02	268.10
								10/6/2004	3.34	266.78
								5/5/2005	2.25	267.87
								11/9/2005	2.56	267.56
								5/30/2006	3.13	266.99
								10/24/2006	2.62	267.50
								4/23/2007	1.89	268.23
								10/30/2007	3.25	266.87
								4/28/2008	2.29	267.83
								10/24/2008	4.58	265.54
								4/27/2009	3.13	266.99
								10/20/2009	4.66	265.46
								4/20/2010	3.62	266.50
								11/12/2010	Dry @ 6.36	NA
								4/20/2010	3.62	266.50
								7/12/2012	4.42	265.70
								10/24/2012	3.39	266.73
NUS-2-2	25	Unknown	15 - 25	272.6	257.6	247.6	274.34	6/2000	NM	NA
								11/8/2000	4.22	270.12
								4/26/2001	3.60	270.74
								10/9/2001	4.46	269.88
								4/23/2002	3.00	271.34
								10/23/2002	6.71	267.63
								4/9/2003	5.72	268.62
								10/6/2003	6.30	268.04
								4/22/2004	5.30	269.04
								10/6/2004	6.21	268.13
								5/5/2005	5.78	268.56
								11/9/2005	6.06	268.28
								5/30/2006	5.91	268.43
								10/24/2006	6.17	268.17
								4/23/2007	5.36	268.98
								10/30/2007	6.75	267.59
								4/28/2008	5.95	268.39
								10/24/2008	6.34	268.00
								4/27/2009	6.55	267.79
								10/20/2009	3.76	270.58
								4/20/2010	6.50	267.84
								11/12/2010	3.20	271.14
								4/20/2010	6.50	267.84
								7/12/2012	6.80	267.54
								10/24/2012	5.97	268.37

Table 6

Depth to Water and Potentiometric Surface Elevations: Overburden Wells (2000-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Monitoring Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
GZ-9-4R	47	Unknown	42 - 47	270.6	228.6	223.6	273.05	6/7/2000	2.05	271.00
								11/8/2000	2.45	270.60
								4/26/2001	1.28	271.77
								10/9/2001	2.67	270.38
								4/23/2002	1.24	271.81
								10/23/2002	4.63	268.42
								4/9/2003	3.05	270.00
								10/6/2003	4.25	268.80
								4/22/2004	3.82	269.23
								10/6/2004	4.75	268.30
								5/5/2005	3.82	269.23
								11/9/2005	4.26	268.79
								5/30/2006	3.95	269.10
								10/25/2006	4.43	268.62
								4/23/2007	3.23	269.82
								10/30/2007	4.95	268.10
								4/28/2008	3.31	269.74
								10/23/2008	3.95	269.10
								4/27/2009	4.04	269.01
								10/20/2009	4.79	268.26
								4/20/2010	4.14	268.91
								11/12/2010	4.65	268.40
								4/20/2010	4.14	268.91
								7/12/2012	4.71	268.34
								10/24/2012	4.07	268.98
GZ-6-2R	35.5	40.8	30.5 - 35.5	281.7	251.2	246.2	283.95	6/6/2000	9.74	274.21
								11/8/2000	10.36	273.59
								4/26/2001	9.02	274.93
								10/9/2001	11.11	272.84
								4/23/2002	9.69	274.26
								10/23/2002	19.71	264.24
								4/9/2003	8.75	275.20
								10/6/2003	10.70	273.25
								4/22/2004	9.74	274.21
								10/6/2004	10.69	273.26
								5/5/2005	9.78	274.17
								11/9/2005	9.98	273.97
								5/30/2006	9.54	274.41
								10/24/2006	10.51	273.44
								4/23/2007	8.81	275.14
								10/31/2007	11.71	272.24
								4/29/2008	9.27	274.68
								10/22/2008	10.22	273.73
								4/27/2009	9.77	274.18
								10/20/2009	10.87	273.08
								4/20/2010	9.36	274.59
								10/25/2010	11.31	272.64
								4/25/2011	9.59	274.36
								10/24/2011	9.58	274.37
								7/12/2012	11.18	272.77
								10/24/2012	11.22	272.73

Table 6

Depth to Water and Potentiometric Surface Elevations: Overburden Wells (2000-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Monitoring Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
GZ-6-3R	50	50.6	45 - 50	281.6	236.6	231.6	283.91	6/6/2000	9.69	274.22
								11/8/2000	10.31	273.60
								4/26/2001	8.97	274.94
								10/9/2001	11.14	272.77
								4/23/2002	9.69	274.22
								10/23/2002	11.35	272.56
								4/9/2003	8.74	275.17
								10/6/2003	10.67	273.24
								4/22/2004	9.72	274.19
								10/6/2004	10.65	273.26
								5/5/2005	9.73	274.18
								11/9/2005	9.95	273.96
								5/30/2006	9.50	274.41
								10/24/2006	10.48	273.43
								4/23/2007	8.79	275.12
								10/31/2007	11.63	272.28
								4/29/2008	9.24	274.67
								10/22/2008	10.16	273.75
								4/27/2009	9.72	274.19
								10/19/2009	10.83	273.08
								4/20/2010	9.36	274.55
								10/25/2010	11.24	272.67
								4/25/2011	9.55	274.36
								10/25/2011	9.53	274.38
								7/12/2012	11.14	272.77
								10/24/2012	11.18	272.73
PZ-218	6	Unknown	4.5 - 6	282.9	278.4	276.9	285.35	6/6/2000	Dry	NA
								11/8/2000	Dry	NA
								4/26/2001	3.15	282.20
								10/9/2001	Dry	NA
								4/23/2002	4.98	280.37
								10/23/2002	Dry	NA
								4/9/2003[2]	2.90	282.45
								10/6/2003	6.92	278.43
								4/22/2004	3.08	282.27
								10/6/2004	5.10	280.25
								5/5/2005	3.91	281.44
								11/10/2005	3.42	281.93
								5/30/2006	3.10	282.25
								10/25/2006	5.91	279.44
								4/23/2007	2.09	283.26
								10/31/2007	Dry	NA
								4/30/2008	3.56	281.79
								10/22/2008	5.27	280.08
								4/27/2009	4.02	281.33
								10/19/2009	7.27	278.08
								4/21/2010	3.30	282.05
								10/25/2010	8.10	277.25
								4/25/2011	3.29	282.06
								10/25/2011	5.93	279.42
								7/12/2012	7.00	278.35
								10/24/2012	8.30	277.05

Table 6

Depth to Water and Potentiometric Surface Elevations: Overburden Wells (2000-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Monitoring Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
MW-104B	40	45	29 - 40	277.4	248.4	237.4	280.60	6/8/2000	3.48	277.12
								11/8/2000	4.70	275.90
								4/26/2001	3.46	277.14
								10/9/2001	6.21	274.39
								4/23/2002	4.07	276.53
								10/23/2002	6.60	274.00
								4/9/2003	3.16	277.44
								10/6/2003	5.82	274.78
								4/22/2004	3.54	277.06
								10/6/2004	4.35	276.25
								5/5/2005	4.99	275.61
								11/9/2005	3.40	277.20
								5/30/2006	3.60	277.00
								10/24/2006	NM	NA
								4/23/2007	3.10	277.50
								10/31/2007	5.96	274.64
								4/29/2008	3.08	277.52
								10/23/2008	4.49	276.11
								4/27/2009	3.74	276.86
								10/21/2009	4.78	275.82
								4/21/2010	3.19	277.41
								10/25/2010	5.59	275.01
								4/25/2011	3.51	277.09
								10/24/2011	3.38	277.22
								7/12/2012	5.46	275.14
								10/24/2012	5.50	275.10
MW-304B	14.6	17	10.6 - 14.6	285.4	274.8	270.8	288.96	6/8/2000	10.63	278.33
								11/8/2000	12.02	276.94
								4/26/2001	9.20	279.76
								10/9/2001	13.60	275.36
								4/23/2002	9.15	279.81
								10/23/2002	Dry	NA
								4/9/2003	8.00	280.96
								10/6/2003	12.42	276.54
								4/22/2004	8.93	280.03
								10/6/2004	9.12	279.84
								5/5/2005	9.59	279.37
								11/9/2005	9.62	279.34
								5/30/2006	8.50	280.46
								10/26/2006	11.18	277.78
								4/23/2007	7.57	281.39
								10/29/2007	13.52	275.44
								4/29/2008	9.07	279.89
								10/22/2008	11.19	277.77
								4/27/2009	9.65	279.31
								10/21/2009	12.89	276.07
								4/20/2010	8.55	280.41
								10/25/2010	12.58	276.38
								4/25/2011	8.76	280.20
								10/25/2011	9.71	279.25
								7/12/2012	12.02	276.94
								10/24/2012	12.49	276.47

Table 6

Depth to Water and Potentiometric Surface Elevations: Overburden Wells (2000-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Monitoring Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
A-33	9.2	Unknown	1 - 9.2	284.39	283.39	275.19	285.89	6/8/2000	2.67	283.22
								11/8/2000	5.65	280.24
								4/26/2001	2.68	283.21
								10/9/2001	7.29	278.60
								4/23/2002	4.84	281.05
								10/23/2002	6.41	279.48
								4/9/2003	3.49	282.40
								10/6/2003	5.45	280.44
								4/22/2004	3.86	282.03
								10/6/2004	5.82	280.07
								5/5/2005	4.95	280.94
								11/9/2005	4.62	281.27
								5/30/2006	5.10	280.79
								10/26/2006	4.70	281.19
								4/23/2007	2.56	283.33
								10/30/2007	6.74	279.15
								4/30/2008	2.62	283.27
								10/24/2008	4.19	281.70
								4/27/2009	3.54	282.35
								10/21/2009	5.03	280.86
								4/20/2010	2.57	283.32
								10/25/2010	7.07	278.82
								4/25/2011	2.98	282.91
								10/25/2011	3.63	282.26
								7/12/2012	5.86	280.03
								10/24/2012	7.13	278.76
PZ-102	13	12.5	10 - 12	281.7	271.7	269.7	284.19	6/7/2000	4.56	279.63
								11/8/2000	5.70	278.49
								4/26/2001	5.18	279.01
								10/9/2001	7.15	277.04
								4/23/2002	5.04	279.15
								10/23/2002	5.07	279.12
								4/9/2003	4.60	279.59
								10/6/2003	5.42	278.77
								4/22/2004	4.96	279.23
								10/6/2004	5.70	278.49
								5/5/2005	5.10	279.09
								11/9/2005	4.81	279.38
								5/30/2006	3.95	280.24
								10/24/2006	5.60	278.59
								4/23/2007	5.31	278.88
								10/31/2007	6.60	277.59
								4/27/2009	5.38	278.81
								10/21/2009	5.64	278.55
								4/20/2010	NM	NM
								10/25/2010	6.89	277.30
								4/25/2011	5.41	278.78
								10/25/2011	5.69	278.50
								7/12/2012	7.81	276.38
								10/24/2012	6.66	277.53

Table 6

Depth to Water and Potentiometric Surface Elevations: Overburden Wells (2000-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Monitoring Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
MW-301B	21.2	29.5	36.5 - 41.5	279.7	243.2	238.2	282.12	6/8/2000	0.78	281.34
								11/8/2000	3.00	279.12
								4/26/2001	0.00	282.12
								10/9/2001	4.57	277.55
								4/23/2002	2.08	280.04
								10/23/2002	3.65	278.47
								4/9/2003[1]	0.00	282.12
								10/6/2003	2.45	279.67
								4/22/2004	0.65	281.47
								10/6/2004	2.55	279.57
								5/5/2005	0.38	281.74
								11/9/2005	0.04	282.08
								5/30/2006[1]	0.00	282.12
								10/26/2006	2.74	279.38
								4/23/2007[1]	0.00	282.12
								10/29/2007	4.87	277.25
								4/30/2008	0.39	281.73
								10/22/2008	2.46	279.66
								4/27/2009	1.06	281.06
								10/21/2009	3.13	278.99
								4/20/2010[1]	0.00	282.12
								10/25/2010	4.88	277.24
								4/25/2011	0.75	281.37
								10/25/2011	1.20	280.92
								7/12/2012	4.48	277.64
								10/24/2012	5.18	276.94
MW-1B	14.6	Unknown	9.6 - 14.6	290.1	280.5	275.5	292.66	6/7/2000	6.40	286.26
								11/8/2000	7.05	285.61
								4/26/2001	6.73	285.93
								10/9/2001	8.12	284.54
								4/23/2002	6.87	285.79
								10/23/2002	Dry	NA
								4/9/2003	6.46	286.20
								10/6/2003	6.42	286.24
								4/22/2004	6.40	286.26
								10/6/2004	6.40	286.26
								5/5/2005	6.42	286.24
								11/10/2005	6.24	286.42
								5/30/2006	5.16	287.50
								10/25/2006	6.85	285.81
								4/23/2007	6.50	286.16
								10/29/2007	6.07	286.59
								5/1/2008	6.38	286.28
								10/22/2008	6.75	285.91
								4/27/2009	6.68	285.98
								10/19/2009	6.53	286.13
								4/20/2010	6.31	286.35
								10/25/2010	7.16	285.50
								4/25/2011	6.33	286.33
								10/25/2011	6.28	286.38
								7/12/2012	7.36	285.30
								10/24/2012	7.10	285.56

Table 6

Depth to Water and Potentiometric Surface Elevations: Overburden Wells (2000-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Monitoring Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
MW-102BR	34.5	Unknown	19.8 - 29.8	276.2	256.4	246.4	278.42	6/7/2000	4.52	273.90
								11/8/2000	5.60	272.82
								4/26/2001	4.20	274.22
								10/9/2001	5.82	272.60
								4/23/2002	4.74	273.68
								10/23/2002	6.20	272.22
								4/9/2003	4.11	274.31
								10/6/2003	5.90	272.52
								4/22/2004	4.77	273.65
								10/6/2004	5.87	272.55
								5/5/2005	5.48	272.94
								11/9/2005	5.50	272.92
								5/30/2006	5.46	272.96
								10/25/2006	5.75	272.67
								4/23/2007	5.23	273.19
								10/30/2007	6.30	272.12
								5/1/2008	4.53	273.89
								10/23/2008	5.08	273.34
								4/27/2009	5.27	273.15
								10/21/2009	5.83	272.59
								4/20/2010	5.36	273.06
								10/25/2010	6.13	272.29
								4/25/2011	5.30	273.12
								10/25/2011	5.38	273.04
								7/12/2012	6.03	272.39
								10/24/2012	6.05	272.37
MW-207B	35	35.2	25 - 35	262.1	237.1	227.1	264.21	1/9/2007	3.69	260.52
								4/24/2007	4.27	259.94
								10/29/2007	5.25	258.96
								5/1/2008	4.37	259.84
								10/22/2008	5.12	259.09
								4/27/2009	5.03	259.18
								10/19/2009	5.53	258.68
								4/21/2010	4.86	259.35
								10/26/2010	5.85	258.36
								4/25/2011	4.98	259.23
								10/25/2011	5.26	258.95
								7/12/2012	6.50	257.71
								10/24/2012	5.83	258.38
MW-210B	16	16.1	6 - 16	265.5	259.5	249.5	268.20	1/9/2007	6.34	261.86
								4/24/2007	7.73	260.47
								10/29/2007	7.71	260.49
								5/1/2008	8.02	260.18
								10/22/2008	8.20	260.00
								4/27/2009	8.56	259.64
								10/21/2009	8.56	259.64
								4/21/2010	8.06	260.14
								10/26/2010	10.07	258.13
								4/25/2011	9.06	259.14
								10/25/2011	9.10	259.10
								7/12/2012	10.32	257.88
								10/24/2012	9.91	258.29

Table 6

Depth to Water and Potentiometric Surface Elevations: Overburden Wells (2000-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Monitoring Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
MW-211B	6.5	6.5	4.5 - 6.5	285.45	280.95	278.95	288.18	7/24/2008	7.30	280.88
								10/22/2008	6.77	281.41
								4/27/2009	4.21	283.97
								10/19/2009	7.59	280.59
								4/21/2010	3.69	284.49
								10/25/2010	8.46	279.72
								4/25/2011	3.51	284.67
								10/25/2011	5.95	282.23
								7/12/2012	7.35	280.83
								10/24/2012	8.67	279.51
MW-212B	22.2	22.2	12.2 - 22.2	284.93	272.73	262.73	287.78	7/24/2008	7.68	280.10
								10/22/2008	5.56	282.22
								4/27/2009	5.48	282.30
								10/19/2009	8.11	279.67
								4/20/2010	4.47	283.31
								10/25/2010	8.94	278.84
								4/25/2011[3]	14.03	273.75
								10/25/2011	4.80	282.98
								7/12/2012	7.93	279.85
								10/24/2012	8.98	278.80
MW-213	54	54	42-52	296.8	254.8	244.8	296.53	4/27/2009	32.95	263.58
								10/20/2009	33.43	263.10
								4/20/2010	32.63	263.90
								11/12/2010	33.42	263.11
								7/12/2012	33.80	262.73
								10/24/2012	33.25	263.28

Notes:

Measuring point elevations were surveyed by Holden Engineering and Surveying, Inc. of Concord, New Hampshire in February 2007.

These data were used to determine groundwater elevations beginning in fall 2006.

amsl = above mean sea level

bgs = below ground surface

ft = feet

NA = Not Applicable as elevation has never been measured. Will tie well into existing well network once access to the property is granted.

NM = Not Measured

[1] MW-301B Artesian well flowing.

[2] PZ-218 Frozen at surface 2.9 ft below top of inner casing.

[3] The depth to water measurement collected during this round compared to historical data and data for nearby wells indicates that this measurement is suspect.

Table 7

Depth to Water and Potentiometric Surface Elevations: Bedrock Wells (2000-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
GZ-1-3R	30	18.5	25 - 30	284.5	259.5	254.5	285.97	6/2000	NM	NA
								11/8/2000	6.90	279.07
								4/26/2001	3.35	282.62
								10/9/2001	8.78	277.19
								4/23/2002	5.34	280.63
								10/23/2002	8.43	277.54
								4/9/2003	2.89	283.08
								10/6/2003	6.50	279.47
								4/22/2004	3.38	282.59
								10/6/2004	5.30	280.67
								5/5/2005	3.93	282.04
								11/10/2005	3.68	282.29
								5/30/2006	4.21	281.76
								10/25/2006	5.78	280.19
								4/23/2007	2.30	283.67
								10/30/2007	9.75	276.22
								4/29/2008	4.36	281.61
								10/22/2008	5.55	280.42
								4/27/2009	4.05	281.92
								10/21/2009	6.75	279.22
								4/20/2010	3.02	282.95
								10/25/2010	7.72	278.25
								4/25/2011	3.61	282.36
								10/25/2011	3.60	282.37
								7/12/2012	6.56	279.41
								10/24/2012	7.84	278.13
MW-102A	61.5	34	51.5 - 61.5	275.2	223.7	213.7	276.87	6/7/2000	4.06	272.81
								11/8/2000	4.15	272.72
								4/26/2001	2.75	274.12
								10/9/2001	4.52	272.35
								4/23/2002	3.22	273.65
								10/23/2002	4.82	272.05
								4/9/2003	2.71	274.16
								10/6/2003	4.62	272.25
								4/22/2004	4.28	272.59
								10/6/2004	4.81	272.06
								5/5/2005	4.25	272.62
								11/10/2005	4.38	272.49
								5/30/2006	4.20	272.67
								10/25/2006	4.69	272.18
								4/23/2007	3.60	273.27
								10/31/2007	5.16	271.71
								5/1/2008	3.06	273.81
								10/23/2008	3.76	273.11
								4/28/2009	3.69	273.18
								10/19/2009	4.82	272.05
								4/21/2010	3.77	273.10
								10/25/2010	4.82	272.05
								4/25/2011	3.51	273.36
								10/25/2011	4.00	272.87
								7/12/2012	4.86	272.01
								10/24/2012	4.81	272.06

Table 7

Depth to Water and Potentiometric Surface Elevations: Bedrock Wells (2000-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
MW-109A	78	29.0	68.1 - 78	270.5	202.4	192.5	272.01	6/8/2000	9.70	262.31
								11/8/2000	10.19	261.82
								4/26/2001	11.10	260.91
								10/9/2001	11.45	260.56
								4/23/2002	11.10	260.91
								10/23/2002	10.75	261.26
								4/9/2003	11.17	260.84
								10/6/2003	10.35	261.66
								4/22/2004	11.30	260.71
								10/6/2004	12.39	259.62
								5/5/2005	11.66	260.35
								11/10/2005	11.47	260.54
								5/30/2006	11.98	260.03
								10/24/2006	11.30	260.71
								4/23/2007	11.03	260.98
								10/30/2007	10.99	261.02
								4/28/2008	12.40	259.61
								10/24/2008	12.94	259.07
								4/27/2009	12.15	259.86
								10/20/2009	12.14	259.87
								4/20/2010	11.36	260.65
								11/12/2010	12.87	259.14
								7/12/2012	3.29	268.72
								10/24/2012	13.03	258.98
MW-302A	59.3	49.5	54.5 - 59.3	279.9	225.4	220.4	282.14	6/8/2000	9.10	273.04
								11/8/2000	9.48	272.66
								4/26/2001	8.05	274.09
								10/9/2001	9.96	272.18
								4/23/2002	8.63	273.51
								10/23/2002	10.49	271.65
								4/9/2003	8.11	274.03
								10/6/2003	9.95	272.19
								4/22/2004	9.30	272.84
								10/6/2004	9.88	272.26
								5/5/2005	8.88	273.26
								11/9/2005	9.05	273.09
								5/30/2006	8.74	273.40
								10/25/2006	9.54	272.60
								4/23/2007	8.08	274.06
								10/29/2007	10.47	271.67
								4/29/2008	8.28	273.86
								10/22/2008	9.01	273.13
								4/29/2009	8.86	273.28
								10/19/2009	9.80	272.34
								4/21/2010	8.56	273.58
								10/25/2010	10.20	271.94
								4/25/2011	8.66	273.48
								10/24/2011	8.74	273.40
								7/12/2012	10.07	272.07
								10/24/2012	10.05	272.09

Table 7

Depth to Water and Potentiometric Surface Elevations: Bedrock Wells (2000-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
MW-303A	37	18	32 - 37	271.9	239.9	234.9	273.64	6/7/2000	1.81	271.83
								11/8/2000	2.45	271.19
								4/26/2001	1.30	272.34
								10/9/2001	2.58	271.06
								4/23/2002	1.10	272.54
								10/23/2002	4.28	269.36
								4/9/2003	2.32	271.32
								10/6/2003	2.56	271.08
								4/22/2004	4.13	269.51
								10/6/2004	4.46	269.18
								5/5/2005	3.62	270.02
								11/10/2005	4.30	269.34
								5/30/2006	5.19	268.45
								10/25/2006	4.38	269.26
								4/23/2007	3.23	270.41
								10/31/2007	4.91	268.73
								5/1/2008	2.70	270.94
								4/27/2009	3.32	270.32
								10/19/2009	4.33	269.31
								4/20/2010	3.74	269.90
								10/25/2010	4.55	269.09
								4/25/2011	3.35	270.29
								10/25/2011	3.66	269.98
								7/12/2012	4.75	268.89
								10/24/2012	4.52	269.12
R-1	400	Unknown	open bore hole	282.4	NA	-117.6	283.99	6/8/2000	10.15	273.84
								11/8/2000	11.60	272.39
								4/26/2001	8.88	275.11
								10/9/2001	12.72	271.27
								4/23/2002	10.05	273.94
								10/23/2002	13.10	270.89
								4/9/2003	11.48	272.51
								10/6/2003	12.85	271.14
								4/22/2004	9.10	274.89
								10/6/2004	12.06	271.93
								5/5/2005	9.32	274.67
								11/10/2005	9.66	274.33
								5/30/2006	8.42	275.57
								10/26/2006	11.32	272.67
								4/23/2007	7.83	276.16
								10/31/2007	13.03	270.96
								5/1/2008	NM	NM
								10/22/2008	10.95	273.04
								4/27/2009	9.36	274.63
								10/21/2009	12.88	271.11
								4/20/2010	6.78	277.21
								10/25/2010	12.42	271.57
								4/25/2011	9.20	274.79
								10/26/2011	9.65	274.34
								7/12/2012	12.09	271.90
								10/24/2012	12.40	271.59

Table 7

Depth to Water and Potentiometric Surface Elevations: Bedrock Wells (2000-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
R-2	400	Unknown	open bore hole	299.1	NA	-100.9	300.69	6/8/2000	14.20	286.49
								11/8/2000	15.42	285.27
								4/26/2001	13.65	287.04
								10/9/2001	16.51	284.18
								4/23/2002	14.58	286.11
								10/23/2002	16.80	283.89
								4/9/2003	15.14	285.55
								10/6/2003	16.36	284.33
								4/22/2004	13.60	287.09
								10/6/2004	15.22	285.47
								5/5/2005	13.80	286.89
								11/9-10/2005	13.60	287.09
								5/30/2006	12.84	287.85
								10/26/2006	14.22	286.47
								4/23/2007	12.55	288.14
								10/31/2007	14.83	285.86
								5/1/2008	NM	NM
								10/22/2008	14.17	286.52
								4/27/2009	13.67	287.02
								10/21/2009	14.47	286.22
								4/20/2010	13.12	287.57
								10/25/2010	14.65	286.04
								4/25/2011	13.52	287.17
								10/26/2011	13.72	286.97
								7/12/2012	14.5	286.19
								10/24/2012	11.79	288.9
MW-1A	30.4	14.0	25.4 - 30.4	289.4	264.0	259.0	293.39	6/7/2000	5.50	287.89
								11/8/2000	5.80	287.59
								4/26/2001	5.44	287.95
								10/9/2001	6.81	286.58
								4/23/2002	5.55	287.84
								10/23/2002	14.40	278.99
								4/9/2003	5.19	288.20
								10/6/2003	5.13	288.26
								4/22/2004	5.10	288.29
								10/6/2004	5.10	288.29
								5/5/2005	5.45	287.94
								11/10/2005	4.95	288.44
								5/30/2006	4.50	288.89
								10/25/2007	5.60	287.79
								4/23/2007	5.25	288.14
								10/29/2007	5.62	287.77
								5/1/2008	5.10	288.29
								10/22/2008	5.50	287.89
								4/27/2009	5.48	287.91
								10/19/2009	5.19	288.20
								4/20/2010	4.91	288.48
								10/25/2010	5.92	287.47
								4/25/2011	5.00	288.39
								10/25/2011	4.91	288.48
								7/12/2012	6.01	287.38
								10/24/2012	5.81	287.58

Table 7

Depth to Water and Potentiometric Surface Elevations: Bedrock Wells (2000-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
C-1	34.5	24.5	29.5 - 34.5	284.1	254.6	249.6	286.45	6/6/2000	5.53	280.92
								11/8/2000	6.90	279.55
								4/26/2001	3.50	282.95
								10/9/2001	8.82	277.63
								4/23/2002	5.26	281.19
								10/23/2002	8.45	278.00
								4/9/2003	2.96	283.49
								10/6/2003	6.48	279.97
								4/22/2004	3.48	282.97
								10/6/2004	5.30	281.15
								5/5/2005	4.10	282.35
								11/9-10/2005	3.75	282.70
								5/30/2006	3.35	283.10
								10/25/2006	5.82	280.63
								4/23/2007	2.42	284.03
								10/30/2007	8.22	278.23
								4/29/2008	3.85	282.60
								10/22/2008	5.56	280.89
								4/27/2009	4.21	282.24
								10/19/2009	6.79	279.66
								4/21/2010	3.28	283.17
								10/25/2010	7.62	278.83
								4/25/2011	3.65	282.80
								10/24/2011	3.62	282.83
								7/12/2012	6.61	279.84
								10/24/2012	7.70	278.75
MW-205	85	35	75 - 85	261.74	186.74	176.74	NA	6/7/2000	3.77	261.35
								11/8/2000	4.28	260.84
								4/26/2001	4.36	260.76
								10/9/2001	destroyed	NA
MW-207A	87	35.2	77 - 87	261.9	184.9	174.9	264.34	1/9/2007	3.78	260.56
								4/24/2007	3.83	260.51
								10/29/2007	5.31	259.03
								5/1/2008	4.22	260.12
								10/22/2008	5.16	259.18
								4/27/2009	4.91	259.43
								10/19/2009	5.53	258.81
								4/21/2010	4.42	259.92
								10/26/2010	5.69	258.65
								4/25/2011	4.60	259.74
								10/25/2011	4.90	259.44
								7/12/2012	6.43	257.91
								10/24/2012	5.64	258.70

Table 7

Depth to Water and Potentiometric Surface Elevations: Bedrock Wells (2000-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
MW-210A	62	16.1	52 - 62	265.4	213.4	203.4	268.20	1/9/2007	6.32	261.88
								4/24/2007	7.27	260.93
								10/29/2007	7.85	260.35
								5/1/2008	7.60	260.60
								10/22/2008	8.22	259.98
								4/27/2009	8.20	260.00
								10/21/2009	8.56	259.64
								4/21/2010	7.74	260.46
								10/26/2010	9.89	258.31
								4/25/2011	8.45	259.75
								10/25/2011	8.62	259.58
								7/12/2012	10.21	257.99
								10/24/2012	9.72	258.48
MW-212A	60	26	40 - 60	284.04	244.04	224.04	286.85	7/24/2008	6.74	280.11
								10/23/2008	5.51	281.34
								4/28/2009	4.64	282.21
								10/19/2009	7.10	279.75
								4/20/2010	3.66	283.19
								10/25/2010	8.54	278.31
								4/25/2011	4.05	282.80
								10/24/2011	3.90	282.95
								7/12/2012	6.95	279.90
								10/24/2012	10.21	276.64

Notes:

Measuring point elevations were surveyed by Holden Engineering and Surveying, Inc. of Concord, New Hampshire in February 2007.

These data were used to determine groundwater elevations beginning in fall 2006.

amsl = above mean sea level

bgs = below ground surface

ft = feet

NM = Not Measured

NA = Not Applicable

Table 8

Depth to Water and Potentiometric Surface Elevations
Additional Monitoring Wells (2006-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Monitoring Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
Overburden Wells										
A-31	8.1	unknown	3.1 to 8.1	289.67	286.57	281.57	NS	10/25/2006	5.16	NA
								5/1/2008	3.25	NA
								10/24/2008	6.23	NA
								4/27/2009	4.44	NA
								4/20/2010	3.65	NA
A-46	16.4	unknown	1.4 to 16.4	270.2	268.8	253.8	271.98	10/25/2006	2.19	269.79
								4/29/2008	0.69	271.29
								4/27/2009	1.51	270.47
GZ-10-3R	29.6	33.8	24.6 to 29.6	271.1	246.5	241.5	272.95	10/24/2006	5.00	267.95
								10/31/2007	5.41	267.54
								4/28/2008	3.96	268.99
								10/24/2008	4.48	268.47
								4/27/2009	4.74	268.21
MW-101B	45	45.8	35 to 45	294.0	259.0	249.0	296.96	10/25/2006	26.50	270.46
								10/31/2007	27.11	269.85
								4/28/2008	24.07	272.89
								10/23/2008	25.95	271.01
								4/27/2009	25.48	271.48
								10/20/2009	26.65	270.31
								4/20/2010	24.97	271.99
								11/12/2010	26.81	270.15
								7/12/2012	25.99	270.97
								10/24/2012	Dry	Dry
MW-106B	27	27.7	17 to 27	270.42	253.42	243.42	272.52	10/24/2006	6.00	266.52
								10/30/2007	6.78	265.74
								4/28/2008	5.58	266.94
								10/24/2008	6.42	266.10
								4/27/2009	6.54	265.98
								10/20/2009	7.08	265.44
								4/20/2010	6.35	266.17
								11/12/2010	6.80	265.72
								7/12/2012	7.37	265.15
								10/24/2012	6.90	265.62
MW-108B	51	49.5	48 to 51	289.0	241.0	238.0	291.25	10/24/2006	25.41	265.84
								10/31/2007	26.40	264.85
								4/28/2008	25.54	265.71
								10/24/2008	26.05	265.20
								4/27/2009	26.13	265.12
								10/20/2009	26.68	264.57
								4/20/2010	25.87	265.38
								11/12/2010	26.61	264.64
								7/12/2012	27.03	264.22
								10/24/2012	26.50	264.75
NUS-9-1	38	unknown	13 to 38	276.1	263.1	238.1	277.76	10/24/2006	9.27	268.49
								10/31/2007	10.05	267.71
								4/28/2008	8.68	269.08
								10/24/2008	9.53	268.23
								4/27/2009	9.47	268.29
								10/20/2009	obstructed	obstructed
								11/12/2010	9.90	267.86
								7/12/2012	9.70	268.06
								10/24/2012	8.97	268.79
Piezometers										
WPP1	< 8	unknown	6.5 to 7.5	NA	unk	unk	275.37	7/12/2012	NM	NM
								10/24/2012	2.74	272.63
WPP2	< 8	unknown	6.5 to 7.5	NA	unk	unk	272.94	7/12/2012	NM	NM
								10/24/2012	2.51	270.43
WPP3	< 28	unknown	26.5 to 27.5	NA	unk	unk	273.18	7/12/2012	NM	NM
								10/24/2012	3.28	269.9
CB1	< 8	unknown	6.5 to 7.5	NA	unk	unk	262.03	7/12/2012	NM	NM
								10/24/2012	3.42	258.61
Bedrock Wells										
MW-101A	70.1	45.8	60 to 70.1	293.3	233.3	223.2	296.45	10/25/2006	25.90	270.55
								10/31/2007	26.66	269.79
								10/23/2008	26.15	270.30
								4/27/2009	25.50	270.95
								10/20/2009	26.27	270.18
								4/20/2010	25.15	271.30
								11/12/2010	26.35	270.10
								7/12/2012	25.60	270.85
								10/24/2012	25.40	271.05

Table 8

Depth to Water and Potentiometric Surface Elevations
Additional Monitoring Wells (2006-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Monitoring Well ID	Total Depth (ft bgs)	Depth to Bedrock (ft bgs)	Screened Interval (ft bgs)	Ground Elevation (ft amsl)	Screen Top Elevation (ft amsl)	Screen Bottom Elevation (ft amsl)	Measuring Pt. Elevation (ft amsl)	Date	Depth to Water (ft)	Groundwater Elevation (ft amsl)
MW-106A	58.7	27.7	48.7 to 58.7	270.5	221.8	211.8	272.98	10/24/2006	6.82	266.16
								10/30/2007	7.52	265.46
								4/28/2008	6.36	266.62
								10/24/2008	7.17	265.81
								4/27/2009	7.29	265.69
								10/20/2009	7.85	265.13
								4/20/2010	7.04	265.94
								11/12/2010	7.58	265.40
								7/12/2012	8.07	264.91
								10/24/2012	7.19	265.79
MW-108A	72.9	49.5	62.9 to 72.9	288.5	225.6	215.6	290.62	10/24/2006	25.53	265.09
								10/31/2007	25.97	264.65
								4/28/2008	25.40	265.22
								10/24/2008	26.95	263.67
								4/27/2009	25.96	264.66
								10/20/2009	26.57	264.05
								4/20/2010	25.68	264.94
								11/12/2010	26.36	264.26
								7/12/2012	26.92	263.70
								10/24/2012	26.46	264.16
MW-201	75	19.3	65 to 75	272.4	207.4	197.4	275.30	10/24/2006	6.22	269.08
								10/31/2007	7.19	268.11
								4/29/2008	5.53	269.77
								10/23/2008	6.32	268.98
								4/27/2009	6.72	268.58
MW-202	86	10.5	76 to 86	270.8	194.8	184.8	273.54	10/25/2006	6.07	267.47
								10/30/2007	5.53	268.01
								4/29/2008	3.10	270.44
								10/23/2008	4.07	269.47
								4/27/2009	4.24	269.30
MW-204	98.9	67.9	88.9 to 98.9	277.4	188.5	178.5	281.07	10/24/2006	12.42	268.65
								10/31/2007	15.75	265.32
								4/28/2008	11.85	269.22
								10/24/2008	12.45	268.62
								4/27/2009	12.71	268.36
								10/20/2009	7.28	273.79
								4/20/2010	12.24	268.83
								11/12/2010	13.15	267.92
								7/12/2012	12.92	268.15
								10/24/2012	12.20	268.87
MW-301A	41.5	29.5	36.5 to 41.5	279.9	243.4	238.4	282.09	10/26/2006	2.70	279.39
								10/29/2007	4.82	277.27
								5/1/2008	2.96	279.13
								10/22/2008	2.45	279.64
								4/27/2009	1.12	280.97
								10/21/2009	3.11	278.98
								7/12/2012	4.38	277.71
MW-304A	37.4	17	32.4 to 37.4	286.8	254.4	249.4	288.96	10/26/2006	11.83	277.13
								10/29/2007	13.90	275.06
								4/29/2008	10.50	278.46
								10/22/2008	11.79	277.17
								4/27/2009	10.00	278.96
								10/21/2009	13.53	275.43

Notes:
Measuring point elevation data was surveyed by Holden Engineering and Surveying, Inc. of Concord, New Hampshire in February 2007.
amsl = above mean sea level
bgs = below ground surface
ft = feet
NS = Not Surveyed
NA = Not Available
NM = Not Measured

Table 9

Summary of Arsenic in Groundwater Monitoring Wells (2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Well ID	NHDES AGQS	Historical Range 1993-2012 (µg/L)	Arsenic Concentration (µg/L)	
			Spring 2012	Fall 2012
LTEMP Monitoring Wells				
Overburden				
GZ-1-2R	10	33 - 122	**51.2**	**61.1/59.5**
GZ-6-2R	10	< 4.0 - 436	4.0 U	5.0
GZ-6-3R	10	131 - 366	**167**	**161**
GZ-9-4R	10	< 4.0 - 130	4.0 U	**88.2**
MW-1B	10	< 4.0 - <10	4.0 U	4.0 U
MW-104B	10	20.7 - 119	**117/112**	**104/103**
MW-109B	10	2.6 - 268	4.0 U	4.0 U
MW-302BR	10	< 4.0 - 248	4.0 U	4.0 U
MW-303B	10	9.0 - 52.8	**39.4**	**38.5**
NUS-1-2	10	55.3 - 392	**167**	**174**
NUS-2-2	10	< 10 - 173	NS	**91.7**
PZ-218	10	< 4.0 - 976	**376**	**214**
MW-211B (replacement for PZ-218)	10	13.6 - 618	**618**	**366**
MW-212B (overburden couplet with MW-212A)	10	29.8 - 376	**31.7**	**33.8/33.1**
MW-213	10	87.1 - 130	**130/124**	**115**
MW-207B	10	< 4.0 - <10	4.0 U	4.0 U
MW-210B	10	< 4.0 - <10	4.0 U	4.0 U
Bedrock				
C-1	10	33.3 - 494	4.0 U	**281**
MW-212A (replacment for C-1)	10	<10 - 51.1	**27.1**	**28.1**
GZ-1-3R	10	9.2 - 28.7	**11.5**	**10.9**
MW-1A	10	< 4.0 - <10	4.0 U	4.0 U
MW-102A	10	3.1 J - < 4.0	4.0/4.0 U/U	4.0/4.0 U/U
MW-205	10	6.1 - 12.7	destroyed	destroyed
MW-302A	10	5.9 - 67.2	**11.3**	**23.7**
MW-303A	10	< 4.0 - <10	4.0 U	4.0 U
MW-207A	10	< 4.0 - <10	4.0 U	4.0 U
MW-210A	10	< 4.0 - <10	5.2	4.9
Additional GMZ Permit Monitoring Wells 2012				
Overburden				
MW-101B	10	<10 - <10	NS	NS
MW-106B	10	5.7 - <10	NS	5.7
MW-108B	10	<10 - <14	NS	4.0 U
NUS-9-1	10	<10 - <10	NS	4.0 U

Table 9

Summary of Arsenic in Groundwater Monitoring Wells (2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Additional GMZ Permit Monitoring Wells 2012					
Bedrock					
MW-101A	10	7.4 - <10	NS	4.0	U
MW-106A	10	<4.0 - <10	NS	4.0	U
MW-108A	10	<4.0 - <10	NS	4.0	U
MW-109A	10	<4.0 - <10	NS	4.0	U
MW-204	10	<4.0 - 12.5	NS	4.0	U

Non LTEMP/non GMZ Permit wells 2012						
Piezometer						
WPP1	10	6.5 - 7.2	6.5		7.2	
WPP2	10	< 4.0 - < 4.0	4.0	U	4.0	U
WPP3	10	< 4.0 - < 4.0	4.0	U	4.0	U
CB1	10	88.9 - 100	**88.9**		**100**	

Notes:

Data collected prior to 2000 sampling event is as reported in the Draft 1999 Annual Report by Sevee & Maher Engineers, Inc., dated 16 February 2000.

NHDES AGQS = New Hampshire Department of Environmental Services Ambient Groundwater Quality Standard

U = Not detected at the associated laboratory reporting limit.

J = Estimated value.

NS = not sampled

µg/L = micrograms per liter

GMZ = groundwater management zone

LTEMP = Long-Term Environmental Monitoring Program

result/result = Original sample result/duplicate sample result

Table 10

Monitoring Wells Arsenic Statistical Summary
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Well ID	Available Data Set (1993-fall 2012)						Recent Data (2000-fall 2012)	
	Arsenic Concentrations (µg/L)						Arsenic Trends	
					Linear Graphs		Linear Graphs	
	Minimum	Maximum	Arithmetic Mean	Median	Trend	R^2	Trend	R^2
Overburden Wells:								
GZ-1-2R	33	122	62	57.3	D	0.4063	I	0.123
GZ-6-2R	2	436	207	196	D	0.7198	D	0.404
GZ-6-3R	131	366	168	162	I	0.0095	D	0.045
MW-109B	1.55	268	93	55.75	D	0.635	D	0.237
MW-302BR	1.35	248	116	153	D	0.5438	D	0.012
MW-303B	9.0	52.8	31	29.9	I	0.094	D	0.042
NUS-1-2	55.3	392	280	285	D	0.079	D	0.529
NUS-2-2	5.0	204	123	122.5	D	0.1398	D	0.022
PZ-218	2.0	976	500	467.5	D	0.211	D	0.006
MW-211B[1]	13.6	618	182.7	156	I	0.299	I	0.299
MW-212B[1]	29.8	376	69.7	36.35	D	0.295	D	0.295
Bedrock Wells								
C-1	2	494	284	281	D	0.44	I	0.081
MW-302A	5.0	67.2	37	37.7	D	0.5641	NT	0
MW-212A[1]	5.0	51.1	26	26.0	I	0.146	I	0.146

Notes:

µg/L = micrograms per liter

D = Decreasing over time

I = Increasing over time

In calculating arithmetic mean, one-half of the detection limit was utilized for results below reporting limits.

R^2 = Is an indication on how well the trend line represents the data points, the closer to 1.0, the more representative the trend line is of the actual data points.

-- = Data set for well during given time frame is not available.

[1] = Data for monitoring wells MW-211B, MW-212A, and MW-212B begin in 2008.

NT = no trend

Table 11

Summary of Vinyl Chloride Concentrations in Groundwater Monitoring Wells (2000 - 2012) 2012 Long-Term Environmental Monitoring Program Auburn Road Landfill

Well ID	NHDES AGQS	2000		2001		2002		2003		2004		2005	
		Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
GZ-1-3R	2	--	1 U	--	0.40 J	--	1 U	--	1 U	--	0.40 J	--	0.60 J
MW-102A	2	2.9 U	2.6 U	2.3 U	1.7 U	2.2 U	1.6 U	1.0 U	1.0 U	1.0 U	3.5 U	1.0 U	1.0 U
MW-205	2	--	1 U	--	**Destroyed**	--	--	--	--	--	--	--	--
NUS-1-2^	2	--	1 U	--	0.55 J	--	1.0 U	--	0.51 J[1]	--	0.31 J	--	0.32 J
NUS-2-2	2	--	1 U	--	1 U	--	1.0 U	--	1.0 U	--	1.0 UJ[1]	--	1.0 U
MW-303A*	2	1 U	1 U	1 U	1 U	1 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CB-1	2	--	--	--	--	--	--	--	--	--	--	--	--
WPP-1	2	--	--	--	--	--	--	--	--	--	--	--	--
WPP-2	2	--	--	--	--	--	--	--	--	--	--	--	--
WPP-3	2	--	--	--	--	--	--	--	--	--	--	--	--

Table 11

Summary of Vinyl Chloride Concentrations in Groundwater Monitoring Wells (2000 - 2012) 2012 Long-Term Environmental Monitoring Program Auburn Road Landfill

Well ID	NHDES AGQS	2006		2007		2008		2009		2010		2011		2012	
		Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
GZ-1-3R	2	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U
MW-102A	2	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MW-205	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-1-2^	2	--	1.0 U (37) / 1.0 U (42)	--	1.0 U	--	1.0 U	--	1.0 U	--	--	--	--	--	1.0 U
NUS-2-2	2	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	--	--	1.0 U
MW-303A*	2	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CB-1	2	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.0 U
WPP-1	2	--	--	--	--	--	--	--	--	--	--	--	--	1.8	**3.5**
WPP-2	2	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.0 U
WPP-3	2	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.0 U

Notes:

-- = Not sampled or data not available. Data collected prior to the 2000 sampling event is as reported in the Draft 1999 Annual Report by Sevee & Maher Engineers, Inc., 16 February 2000.

Groundwater samples collected in November 2005 were re-collected in December 2005 (for volatile organic compound analysis only) due to laboratory issues.

U = The compound was not detected at the associated numerical sample quantitation limit.

J = The associated numerical value is an estimated quantity.

UJ[1]/J[1] = Estimate results due to surrogate recovery below quality control limits.

AGQS = Ambient Groundwater Quality Standards

NHDES = New Hampshire Department of Environmental Services

All values shown in units of micrograms per liter (parts per billion).

*Well MW-303A is not part of the Long-Term Environmental Monitoring Plan; however, is being sampled at the request of the United States Environmental Protection Agency.

^Monitoring well NUS-1-2 was sampled at more than one depth during the Fall 2006 sampling round.

The data is reported as the concentration followed by the sample depth [i.e., 1.0 U (37) / 1.0 U (42)].

Bold values indicate concentration is above NHDES AGQS

Table 12

Summary of Trans-1-2-Dichloroethene Concentrations in Groundwater Monitoring Wells (2000 - 2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Well	NHDES	2000		2001		2002		2003		2004		2005	
ID	AGQS	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
GZ-1-3R	100	--	1 U	--	1 U	--	1 U	--	1 U	--	1.0 U	--	1.0 U
MW-102A	100	2.9 U	2.6 U	2.3 U	1.7 U	2.2 U	1.6 U	1.0 U	1.0 U	1.0 U	3.5 U	0.21 J	1.0 U
MW-205	100	--	1 U	--	**Destroyed**	--	--	--	--	--	--	--	--
NUS-1-2^	100	--	1 U	--	1 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U
NUS-2-2	100	--	1 U	--	1 U	--	1.0 U	--	1.0 U	--	1.0 UJ[1]	--	1.0 U
MW-303A*	100	1 U	1 U	1 U	1 U	1 U	1 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U
CB-1	100	--	--	--	--	--	--	--	--	--	--	--	--
WPP-1	100	--	--	--	--	--	--	--	--	--	--	--	--
WPP-2	100	--	--	--	--	--	--	--	--	--	--	--	--
WPP-3	100	--	--	--	--	--	--	--	--	--	--	--	--

Table 12

Summary of Trans-1-2-Dichloroethene Concentrations in Groundwater Monitoring Wells (2000 - 2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Well ID	NHDES AGQS	2006		2007		2008		2009		2010		2011		2012	
		Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
GZ-1-3R	100	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U
MW-102A	100	1.0 U	1.0 U	1.0 U	1.8	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MW-205	100	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-1-2^	100	--	1.0 U (37) / 1.0 U (42)	--	1.0 U	--	1.0 U	--	1.0 U	--	--	--	--	--	1.0 U
NUS-2-2	100	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	--	--	1.0 U
MW-303A*	100	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CB-1	100	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.0 U
WPP-1	100	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.0 U
WPP-2	100	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.0 U
WPP-3	100	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.0 U

Notes:

-- = Not sampled or data not available. Data collected prior to the 2000 sampling event is as reported in the Draft 1999 Annual Report by Sevee & Maher Engineers, Inc., 16 February 2000.

U = The compound was not detected at the associated numerical sample quantitation limit.

J = The associated numerical value is an estimated quantity.

UJ[1] = Estimate results due to surrogate recovery below quality control limits.

AGQS = Ambient Groundwater Quality Standards

NHDES = New Hampshire Department of Environmental Services

Groundwater samples collected in November 2005 were re-collected in December 2005 (for volatile organic compound analysis only) due to laboratory issues.

All values shown in units of micrograms per liter (parts per billion).

*Well MW-303A is not part of the Long-Term Environmental Monitoring Plan; however, is being sampled at the request of the United States Environmental Protection Agency.

^Monitoring well NUS-1-2 was sampled at more than one depth during the Fall 2006 sampling round.

The data is reported as the concentration followed by the sample depth [i.e., 1.0 U (37) / 1.0 U (42)].

Table 13

Summary of 2-Butanone Concentrations in Groundwater Monitoring Wells (2000 - 2012) 2012 Long-Term Environmental Monitoring Program Auburn Road Landfill

Well	NHDES	2000		2001		2002		2003		2004		2005	
ID	AGQS	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
GZ-1-3R	170	--	5 U	--	5 U	--	5 U	--	5 U	--	5.0 U	--	5.0 U
MW-102A	170	14 U	13 U	12 U	8.5 U	11 U	8 U	5.0 U	5.0 U	5.0 U	18 U	5.0 U	5.0 U
MW-205	170	--	5 U	--	**Destroyed**	--	--	--	--	--	--	--	--
NUS-1-2^	170	--	5 U	--	5 U	--	5.0 U	--	5.0 U	--	5.0 U	--	5.0 U
NUS-2-2	170	--	5 U	--	5 U	--	5.0 U	--	5.0 U	--	5.0 UJ[1]	--	5.0 U
MW-303A*	170	5 U	5 U	5 U	5 U	5 U	5 U	5.0 U	5 U	5.0 U	5.0 U	5.0 U	5.0 U
CB-1	170	--	--	--	--	--	--	--	--	--	--	--	--
WPP-1	170	--	--	--	--	--	--	--	--	--	--	--	--
WPP-2	170	--	--	--	--	--	--	--	--	--	--	--	--
WPP-3	170	--	--	--	--	--	--	--	--	--	--	--	--

Table 13

Summary of 2-Butanone Concentrations in Groundwater Monitoring Wells (2000 - 2012) 2012 Long-Term Environmental Monitoring Program Auburn Road Landfill

Well	NHDES	2006		2007		2008		2009		2010		2011		2012	
ID	AGQS	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
GZ-1-3R	170	--	5.0 U	--	5.0 U	--	5.0 U	--	5.0 U	--	5.0 U	--	5.0 U	--	5.0 U
MW-102A	170	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
MW-205	170	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-1-2^	170	--	5.0 U (37) / 5.0 U (42)	--	5.0 U	--	5.0 U	--	5.0 U	--	--	--	--	--	5.0 U
NUS-2-2	170	--	5.0 U	--	5.0 U	--	5.0 U	--	5.0 U	--	5.0 U	--	--	--	5.0 U
MW-303A*	170	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
CB-1	170	--	--	--	--	--	--	--	--	--	--	--	--	5.0 U	5.0 U
WPP-1	170	--	--	--	--	--	--	--	--	--	--	--	--	5.0 U	5.0 U
WPP-2	170	--	--	--	--	--	--	--	--	--	--	--	--	5.0 U	5.0 U
WPP-3	170	--	--	--	--	--	--	--	--	--	--	--	--	5.0 U	5.0 U

Notes:

-- = Not sampled or data not available. Data collected prior to the 2000 sampling event is as reported in the Draft 1999 Annual Report by Sevee & Maher Engineers, Inc., 16 February 2000.

U = The compound was not detected at the associated numerical sample quantitation limit.

UJ[1] = Estimate results due to surrogate recovery below quality control limits.

AGQS = Ambient Groundwater Quality Standards

NHDES = New Hampshire Department of Environmental Services

Groundwater samples collected in November 2005 were re-collected in December 2005 (for volatile organic compound analysis only) due to laboratory issues.

All values shown in units of micrograms per liter (parts per billion).

*Well MW-303A is not part of the Long-Term Environmental Monitoring Plan; however, is being sampled at the request of the United States Environmental Protection Agency.

^Monitoring well NUS-1-2 was sampled at more than one depth during the Fall 2006 sampling round.

The data is reported as the concentration followed by the sample depth [i.e., 1.0 U (37) / 1.0 U (42)].

Table 14

Summary of Trichloroethene Concentrations in Groundwater Monitoring Wells (2000 - 2012) 2012 Long-Term Environmental Monitoring Program Auburn Road Landfill

Well	NHDES	2000		2001		2002		2003		2004		2005	
ID	AGQS	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
GZ-1-3R	5	--	2	--	2.2	--	2.6 J	--	2.0 J[1]	--	0.75 J	--	0.96 J
MW-102A	5	**40**	**43**	**42**	**52**	**45**	**47 J**	**34 J**	**39 J[1]**	**38**	3.1 J	**45**	**38**
MW-205	5	--	1 U	--	**Destroyed**	--	**Destroyed**	--	**Destroyed**	--		--	**Destroyed**
NUS-1-2^	5	--	1 U	--	1 U	--	1.0 U	--	1.0 U	--	1.0 U	--	0.25 J
NUS-2-2	5	--	1 U	--	1 U	--	1.0 U	--	1.0 U	--	1.0 UJ[1]	--	1.0 U
MW-303A*	5	1 U	1 U	1 U	1 U	1 U	1 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U
CB-1	5	--	--	--	--	--	--	--	--	--	--	--	--
WPP-1	5	--	--	--	--	--	--	--	--	--	--	--	--
WPP-2	5	--	--	--	--	--	--	--	--	--	--	--	--
WPP-3	5	--	--	--	--	--	--	--	--	--	--	--	--

Table 14

Summary of Trichloroethene Concentrations in Groundwater Monitoring Wells (2000 - 2012) 2012 Long-Term Environmental Monitoring Program Auburn Road Landfill

Well	NHDES	2006		2007		2008		2009		2010		2011		2012	
ID	AGQS	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
GZ-1-3R	5	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U
MW-102A	5	**79.8**	**70.6**	**67.5**	**38.5**	**48.3**	**59.1**	**42.5**	**50.2**	**57.9**	**46.8**	**63.3**	**36.6**	**52.2**	**46.5**
MW-205	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-1-2^	5	--	1.0 U (37) / 1.0 U (42)	--	1.0 U	--	1.0 U	--	1.0 U	--	--	--	--	--	1.0 U
NUS-2-2	5	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	--	--	1.0 U
MW-303A*	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CB-1	5	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.0 U
WPP-1	5	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.0 U
WPP-2	5	--	--	--	--	--	--	--	--	--	--	--	--	1.7	1.0 U
WPP-3	5	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.3

Notes:

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J = The associated numerical value is an estimated quantity.

UJ^1/J^1 = Estimate results due to surrogate recovery below quality control limits.

AGQS = Ambient Groundwater Quality Standards

NHDES = New Hampshire Department of Environmental Services

Groundwater samples collected in November 2005 were re-collected in December 2005 (for volatile organic compound analysis only) due to laboratory issues.

All values shown in units of micrograms per liter (parts per billion).

*Well MW-303A is not part of the Long-Term Environmental Monitoring Plan; however, is being sampled at the request of the United States Environmental Protection Agency.

Values shown in **Bold** indicate that the compound was detected in excess of NHDES AGQS.

^Monitoring well NUS-1-2 was sampled at more than one depth during the Fall 2006 sampling round.

The data is reported as the concentration followed by the sample depth [i.e., 1.0 U (37) / 1.0 U (42)].

Table 15

Summary of Benzene Concentrations in Groundwater Monitoring Wells (2000 - 2012) 2012 Long-Term Environmental Monitoring Program Auburn Road Landfill

Well	NHDES	2000		2001		2002		2003		2004		2005	
ID	AGQS	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
GZ-1-3R	5	--	1.1	--	1.4	--	1.2	--	1.1	--	0.81 J	--	1.7
MW-102A	5	2.9 U	2.6 U	2.3	1.7 U	2.2 U	1.6 U	1.0 U	1.0 U	1.0 U	3.5 U	1.0 U	1.0 U
MW-205	5	--	1 U	--	**Destroyed**	--	--	--	--	--	--	--	--
NUS-1-2^	5	--	1.6	--	1.4	--	1.3	--	1.5	--	0.89 J	--	0.77 J
NUS-2-2	5	--	1 U	--	1 U	--	0.29 J	--	1.0 U	--	0.70 J	--	0.48 J
MW-303A*	5	1 U	1 U	1 U	1 U	1 U	1 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U
CB-1	5	--	--	--	--	--	--	--	--	--	--	--	--
WPP-1	5	--	--	--	--	--	--	--	--	--	--	--	--
WPP-2	5	--	--	--	--	--	--	--	--	--	--	--	--
WPP-3	5	--	--	--	--	--	--	--	--	--	--	--	--

Table 15

Summary of Benzene Concentrations in Groundwater Monitoring Wells (2000 - 2012) 2012 Long-Term Environmental Monitoring Program Auburn Road Landfill

Well	NHDES	2006		2007		2008		2009		2010		2011		2012	
ID	AGQS	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
GZ-1-3R	5	--	1.2	--	1.5	--	1.8	--	0.5 U	--	1.7	--	0.94	--	0.55
MW-102A	5	0.5 U	0.50 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW-205	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-1-2^	5	--	0.57 (37) / 0.54 (42)	--	1.1	--	1.1	--	0.5 U	--	--	--	--	--	0.98
NUS-2-2	5	--	0.63	--	0.5 U	--	0.5 U	--	0.5 U	--	1.2	--	--	--	0.55
MW-303A*	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
CB-1	5	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	0.5 U
WPP-1	5	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	0.5 U
WPP-2	5	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	0.5 U
WPP-3	5	--	--	--	--	--	--	--	--	--	--	--	--	0.5 U	0.5 U

Notes:

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J = The associated numerical value is an estimated quantity.

AGQS = Ambient Groundwater Quality Standards

NHDES = New Hampshire Department of Environmental Services

Groundwater samples collected in November 2005 were re-collected in December 2005 (for volatile organic compound analysis only) due to laboratory issues.

All values shown in units of micrograms per liter (parts per billion).

*Well MW-303A is not part of the Long-Term Environmental Monitoring Plan; however, is being sampled at the request of the United States Environmental Protection Agency.

^Monitoring well NUS-1-2 was sampled at more than one depth during the Fall 2006 sampling round.

The data is reported as the concentration followed by the sample depth [i.e., 1.0 U (37) / 1.0 U (42)].

Table 16

Summary of Tetrachloroethene Concentrations in Groundwater Monitoring Wells (2000 - 2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Well	NHDES	2000		2001		2002		2003		2004		2005	
ID	AGQS	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
GZ-1-3R	5	--	1 U	--	1 UJ[1]	--	1 U	--	1 U	--	1.0 U	--	1.0 U
MW-102A	5	**68**	**65**	**51 J**	**63 J[1]**	**64**	**52**	**22**	**27.0 J[2]**	**36**	4.5	**37**	**45**
MW-205	5	--	1 U	--	**Destroyed**	--	--	--	--	--	--	--	--
NUS-1-2^	5	--	1 U	--	1 UJ[1]	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U
NUS-2-2	5	--	1 U	--	1 UJ[1]	--	1.0 U	--	1.0 U	--	1.0 UJ[1]	--	1.0 U
MW-303A*	5	1 U	1 U	1 UJ	1 UJ[1]	1 U	1 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U
CB-1	5	--	--	--	--	--	--	--	--	--	--	--	--
WPP-1	5	--	--	--	--	--	--	--	--	--	--	--	--
WPP-2	5	--	--	--	--	--	--	--	--	--	--	--	--
WPP-3	5	--	--	--	--	--	--	--	--	--	--	--	--

Table 16

Summary of Tetrachloroethene Concentrations in Groundwater Monitoring Wells (2000 - 2012) 2012 Long-Term Environmental Monitoring Program Auburn Road Landfill

Well	NHDES	2006		2007		2008		2009		2010		2011		2012	
ID	AGQS	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
GZ-1-3R	5	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U
MW-102A	5	**96.9**	**88.2**	**82.0**	**67.1**	**75.8**	**84.3**	**60.3**	**57.1**	**85.4**	**58.7**	**87.4**	**56.9**	**71.1**	**57.3**
MW-205	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-1-2^	5	--	1.0 U (37) / 1.0 U (42)	--	1.0 U	--	1.0 U	--	1.0 U	--	--	--	--	--	
NUS-2-2	5	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	--	--	
MW-303A*	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CB-1	5	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.0 U
WPP-1	5	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.0 U
WPP-2	5	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.0 U
WPP-3	5	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.0 U

Notes:

-- = Not sampled or data not available. Data collected prior to the 2000 sampling event is as reported in the Draft 1999 Annual Report by Sevee & Maher Engineers, Inc., 16 February 2000.

U = The compound was not detected at the associated numerical sample quantitation limit.

J = The associated numerical value is an estimated quantity.

UJ^1/J^1 = Estimate results due to surrogate recovery below quality control limits.

J^2 = Value is estimated since continuing calibration criteria was not met.

AGQS = Ambient Groundwater Quality Standards

NHDES = New Hampshire Department of Environmental Services

Groundwater samples collected in November 2005 were re-collected in December 2005 (for volatile organic compound analysis only) due to laboratory issues.

All values shown in units of micrograms per liter (parts per billion).

*Well MW-303A is not part of the Long-Term Environmental Monitoring Plan; however, is being sampled at the request of the United States Environmental Protection Agency.

Values shown in **Bold** indicate that the compound was detected in excess of NHDES AGQS.

^Monitoring well NUS-1-2 was sampled at more than one depth during the Fall 2006 sampling round.

The data is reported as the concentration followed by the sample depth [i.e., 1.0 U (37) / 1.0 U (42)].

Table 17

Summary of Toluene Concentrations in Groundwater Monitoring Wells (2000 - 2012) 2012 Long-Term Environmental Monitoring Program Auburn Road Landfill

Well	NHDES	2000		2001		2002		2003		2004		2005	
ID	AGQS	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
GZ-1-3R	1,000	--	1 U	--	0.34 J	--	1 U	--	1 U	--	0.21 J	--	2.1
MW-102A	1,000	2.9 U	2.6 U	2.3	1.7 U	2.2 U	1.6 U	1.0 U	1.0 U	1.0 U	3.5 U	1.0 U	1.0 U
MW-205	1,000	--	1 U	--	**Destroyed**	--	--	--	--	--	--	--	--
NUS-1-2^	1,000	--	1 U	--	1 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U
NUS-2-2	1,000	--	1 U	--	1 U	--	1.0 U	--	1.0 U	--	1.0 UJ[1]	--	1.0 U
MW-303A*	1,000	1 U	1 U	1 U	1 U	1 U	1 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U
CB-1	1,000	--	--	--	--	--	--	--	--	--	--	--	--
WPP-1	1,000	--	--	--	--	--	--	--	--	--	--	--	--
WPP-2	1,000	--	--	--	--	--	--	--	--	--	--	--	--
WPP-3	1,000	--	--	--	--	--	--	--	--	--	--	--	--

Table 17

Summary of Toluene Concentrations in Groundwater Monitoring Wells (2000 - 2012) 2012 Long-Term Environmental Monitoring Program Auburn Road Landfill

Well ID	NHDES AGQS	2006		2007		2008		2009		2010		2011		2012	
		Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
GZ-1-3R	1,000	--	1.0 U	--	1.0 U	--	1.0 U	--	215	--	1.0 U	--	1.9	--	1.0 U
MW-102A	1,000	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MW-205	1,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-1-2^	1,000	--	1.0 U (37) / 1.0 U (42)	--	1.0 U	--	1.0 U	--	1.0 U	--	--	--	--	--	1.0 U
NUS-2-2	1,000	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	1.0 U	--	--	--	1.0 U
MW-303A*	1,000	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
CB-1	1,000	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.0 U
WPP-1	1,000	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.0 U
WPP-2	1,000	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.0 U
WPP-3	1,000	--	--	--	--	--	--	--	--	--	--	--	--	1.0 U	1.0 U

Notes:

-- = Not sampled or data not available. Data collected prior to the 2000 sampling event is as reported in the Draft 1999 Annual Report by Sevee & Maher Engineers, Inc., 16 February 2000.

U = The compound was not detected at the associated numerical sample quantitation limit.

J = The associated numerical value is an estimated quantity.

UJ[1] = Estimate results due to surrogate recovery below quality control limits.

AGQS = Ambient Groundwater Quality Standards

NHDES = New Hampshire Department of Environmental Services

Groundwater samples collected in November 2005 were re-collected in December 2005 (for volatile organic compound analysis only) due to laboratory issues.

All values shown in units of micrograms per liter (parts per billion).

*Well MW-303A is not part of the Long-Term Environmental Monitoring Plan; however, is being sampled at the request of the United States Environmental Protection Agency.

^Monitoring well NUS-1-2 was sampled at more than one depth during the Fall 2006 sampling round.

The data is reported as the concentration followed by the sample depth [i.e., 1.0 U (37) / 1.0 U (42)].

Table 18

Summary of Volatile Organic Compounds in Groundwater Monitoring Wells Spring and Fall 2012 2012 Long-Term Environmental Monitoring Program Auburn Road Landfill

Compound	NHDES AGQS	GZ-1-3R		MW-102A		MW-303A		NUS-1-2	
		Spring 2012	Fall 2012	Spring 2012	Fall 2012	Spring 2012	Fall 2012	Spring 2012	Fall 2012
Benzene	5.0	NS	0.55	0.5 U	0.5/0.5 U/U	0.5 U	0.5 U	NS	0.98
2-Butanone (MEK)	4,000	NS	5.0 U	5.0 U	5.0/5.0 U/U	5.0 U	5.0 U	NS	5.0 U
Chlorobenzene	NA	NS	1.0 U	1.0 U	1.0/1.0 U/U	1.0 U	1.0 U	NS	1.5
Chloroethane	NA	NS	2.8	2.0 U	2.0/2.0 U/U	2.0 U	2.0 U	NS	2.0 U
1,1-Dichloroethane	81	NS	1.0 U	1.0 U	1.0/1.0 U/U	12.5	13.2	NS	1.0 U
1,2-Dichloroethane	5.0	NS	4.2	1.0 U	1.0/1.0 U/U	1.0 U	1.0 U	NS	1.0 U
1,1-Dichloroethene	7.0	NS	1.0 U	1.0 U	1.0/1.0 U/U	1.0 U	1.0 U	NS	1.0 U
cis-1,2-Dichloroethene	70	NS	1.0 U	17.2	18.2/18.0	1.0 U	1.0 U	NS	1.0 U
trans-1,2-Dichloroethene	100	NS	1.0 U	1.0 U	1.0/1.0 U/U	1.0 U	1.0 U	NS	1.0 U
Ethyl Ether	NA	NS	7.1	5.0 U	5.0/5.0 U/U	5.0 U	5.0 U	NS	5.0 U
Tetrachloroethene	5.0	NS	1.0 U	**71.1**	**57.3/61.3**	1.0 U	1.0 U	NS	1.0 U
Tetrahydrofuran	154	NS	18.6	10.0 U	10/10 U/U	10 U	10 U	NS	10 U
Toluene	1,000	NS	1.0 U	1.0 U	1.0/1.0 U/U	1.0 U	1.0 U	NS	1.0 U
1,1,1-Trichloroethane	200	NS	1.0 U	1.0 U	1.0/1.0 U/U	1.0 U	1.0 U	NS	1.0 U
Trichloroethene	5.0	NS	1.0 U	**52.2**	**46.5/51.4**	1.0 U	1.0 U	NS	1.0 U
Vinyl Chloride	2.0	NS	1.0 U	1.0 U	1.0/1.0 U/U	1.0 U	1.0 U	NS	1.0 U

Table 18

Summary of Volatile Organic Compounds in Groundwater Monitoring Wells Spring and Fall 2012 2012 Long-Term Environmental Monitoring Program Auburn Road Landfill

Compound	NHDES AGQS	NUS-2-2		CB-1		WPP-1		WPP-2		WPP-3	
		Spring 2012	Fall 2012	Spring 2012	Fall 2012	Spring 2012	Fall 2012	Spring 2012	Fall 2012	Spring 2012	Fall 2012
Benzene	5.0	NS	0.55	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone (MEK)	4,000	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chlorobenzene	NA	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Chloroethane	NA	NS	2.0 U	2.0 U	2.0 U	4.0	2.8	2.0 U	2.0 U	2.0 U	2.0 U
1,1-Dichloroethane	81	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	30.8	31.7	1.1	1.0 U
1,2-Dichloroethane	5.0	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1-Dichloroethene	7.0	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**10.4**	**7.8**	1.0 U	1.0 U
cis-1,2-Dichloroethene	70	NS	1.0 U	1.0 U	1.0 U	3.6	3.2	1.0 U	1.0 U	1.0 U	1.5
trans-1,2-Dichloroethene	100	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Ethyl Ether	NA	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Tetrachloroethene	5.0	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0	1.0 U	1.0 U	1.0 U
Tetrahydrofuran	154	NS	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	1,000	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	200	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	3.4	3.4	1.0 U	1.0 U
Trichloroethene	5.0	NS	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.7	1.0 U	1.0 U	1.3
Vinyl Chloride	2.0	NS	1.0 U	1.0 U	1.0 U	1.8	**3.5**	1.0 U	1.0 U	1.0 U	1.0 U

Notes:

All values shown are in units of micrograms per liter (parts per billion).

U = Not detected at the associated laboratory reporting limit.

NA = No standard listed

NS = Not sampled

Compounds are VOC contaminants of concern from EPA Record of Decision (benzene, 2-Butanone, trans-1,2-Dichloroethene, tetrachloroethene, toluene, trichloroethene, and vinyl choride) and VOCs detected during this sampling round.

Values shown in **bold** exceed NHDES AGQS.

EPA = United States Environmental Protection Agency

VOC = volatile organic compound

NHDES = New Hampshire Department of Environmental Services

AGQS = Ambient Groundwater Quality Standards

Result/Result = Original sample result/duplicate sample result

Table 19

Summary of Arsenic Concentrations in Surface Water (2000 - 2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Sample ID	Fresh Acute Criteria[1]	Fresh Chronic Criteria[1]	2000		2001		2002		2003		2004		2005	
			Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
SW-3	340	150	8.7 U	5.2 U	6.6 U	1.5 UJ[2]	2.7 U	Dry	4.0 U	4.0 U	10.0 U	7.0 B	6.5 UJ	26.3
SW-4	340	150	8.7 U	5.2 U	6.6 U	1.5 UJ[2]	2.7 U	6.7 U	4.0 U	4.0 U	10.0 U	3.1 U	4.5 UJ	4.7 U
SW-5	340	150	9.5 J	5.2 U	6.6 U	2.8 J[3]	2.7 U	6.7 U	4.0 U	4.0 U	10.0 U	3.1 U	4.5 UJ	4.7 U
SW-6	340	150	8.7 U	5.2 U	6.6 U	7.2 J[3]	2.7 U	16.0	4.0 U	4.0 U	10.0 U	7.8 B	4.5 UJ	4.7 U
SW-9	340	150	8.7 U	25	53.3	1,300 J[3]*	44.4	175	50.4	80.9	76.2	73.7	47.6	49
SW-9 FF	340	150	NS	NS	NS	NS	NS	NS	NS	73.9	52.7	15.7	43.4	30.4

Table 19

Summary of Arsenic Concentrations in Surface Water (2000 - 2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Sample ID	Fresh Acute Criteria[1]	Fresh Chronic Criteria[1]	2006		2007		2008		2009		2010		2011		2012	
			Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
SW-3	340	150	4.4 U	10.0 U	10.0 U	10 U	10 U	10 U	10 U	10 U	10 U	4 U	4 U	4 U	4.0 U	4 U
SW-4	340	150	4.4 U	10.0 U	10.0 U	10 U	10 U	10 U	10 U	10 U	10 U	4 U	4 U	4 U	4.0 U	4 U
SW-5	340	150	4.4 U	10.0 U	10.0 U	10 U	10 U	10 U	10 U	10 U	10 U	4 U	4 U	4 U	4.0 U/ 5.0	4 U
SW-6	340	150	4.4 U	10.0 U	10.0 U	10 U	10 U	10 U	10 U	10 U	10 U	10.1	NS	NS	8.5	5.4
SW-9	340	150	38.7	30.4	40.1	10 U	10 U	10 U	10 U	10 U	10 U	NS	4 U	30.1	NS	4 U/4 U
SW-9 FF	340	150	34.4	33.4	38.1	10 U	10 U	10 U	10 U	10 U	10 U	NS	4 U	NS	NS	4 U

Notes:

All values shown are in units of micrograms per liter (parts per billion). Some values are approximated due to limitations identified in the data review (Quality Control).

B = Estimated value. The result reported is below the contract reporting limit but above the instrument detection limit.

FF = Field filtered

UJ[2] = Value is non-detected and the detection limit is estimated.

J[3] =Estimated due to poor field duplicate recoveries.

NS = Not sampled as sample point was dry.

U = Not detected at the associated laboratory reporting limit.

[1] = Surface water quality regulations for arsenic from New Hampshire Department of Environmental Services Env-Ws 1700, effective 12/10/99.

* = The concentration of arsenic in the duplicate sample collected at this location was 401 J[3].

UJ = The compound was analyzed for, but not detected. The associated numerical value is estimated because the CRDL recovery criteria was not met.

Table 20

Summary of Arsenic Concentrations in Sediment (2000-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Sample ID	2000 Fall	2001 Fall	2002 Fall	2003 Fall	2004 Fall	2005 Fall	2006 Fall	2007 Fall	2008 Fall	2009 Fall	2010 Fall	2011 Fall	2012 Fall
SD-2	7.7 J	5.4 J	10.0 J[1]	12.3	14.3	20.0 J	2.7*	5.7 J	4.0	82.8	39.4	NS	3.4
SD-4	4.0 J	4.6 J	1.7 UJ	10 U	5.7	3.7 J	3.0	4.4 J	3.0 U	1.6 U	6.2	3.6	0.63 U
SD-5	2.4 J	10.5 J	28.2 J[1]	10 U	10.3	3.9 J	2.6 U	2.4 UJ	3.7	5.4	3.0	6.1	4.7/3.6
SD-9	25.8 J	12.0 J	156 J[1]	22.0	18.9	13.2 J	19.9	429 J	1230 J[1]	8.3	48.6	570	373

Notes:

All values shown are in units of milligrams/kilogram (parts per million).

Some values are approximated due to limitations identified in the data review (Quality Control).

J = Quantity is estimated due to limitations identified in the quality control review (data review).

J[1] = Estimate positive results for arsenic since field duplicate criteria was not met.

UJ = The compound was analyzed for, but not detected. The associated numerical value is estimated because the CRDL recovery criteria was not met.

U = Not detected at the associated laboratory reporting limit.

* = Laboratory data obtained from HydroGeologic, Inc. split sample.

Table 21

Summary of Sediment Toxicity Testing (1998-2012)
2012 Long-Term Environmental Monitoring Program
Auburn Road Landfill

Hyalella azteca															
Sample ID	Mean Proportion Surviving (%)														
	Fall 1998	Fall 1999	Fall 2000	Fall 2001	Fall 2002	Fall 2003	Fall 2004	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009	Fall 2010	Fall 2011	Fall 2012
SD-2	96	99	98	100	98	99	96	95	95	100	99	95	100	NS	100
SD-4	95	98	100	100	95	98	95	99	95	98	99	95	96	93.8	97.5
SD-5	91	98	99	100	94	98	95	98	96	100	99	98	99	83.8**	63.8**
SD-9	96	100	99	100	96	96	93	84**	91	96	96	100	98	97.5	92.5*
Control	95	100	99	99	98	98	91	96	100	98	98	99	99	95.0	100
	Mean Weight Over All Replicates (mg)														
SD-2	0.076	0.354	0.11	0.13	0.09	0.112	0.112	0.075	0.124*	0.063***	0.085	0.098	0.077	NS	0.059*
SD-4	0.069	0.351	0.11	0.12	0.068	0.083*	0.083	0.057*	0.125*	0.075	0.081	0.076*	0.062	0.049*	0.065*
SD-5	0.118	0.434	0.11	0.14	0.082	0.104	0.097	0.053*	0.144	0.070	0.079	0.097	0.088	0.035**	0.109
SD-9	0.072	0.334	0.12	0.14	0.075	0.076*	0.089	0.039**	0.104**	0.071	0.107	0.095	0.065	0.063	0.056**
Control	0.076	0.456	0.12	0.10	0.08	0.104	0.085	0.077	0.154	0.063	0.09	0.095	0.068	0.059	0.078
	Length (mm)														
SD-2	3.30	3.38	3.3	3.4	3.21	3.79*	3.43	3.06	3.75*	2.83	2.90	3.03*	2.99	NS	3.09**
SD-4	3.38	3.37	3.1	3.2	2.86	3.51*	3.00*	2.59*	3.59*	2.84	2.95	2.97*	2.81*	2.90*	3.27*
SD-5	3.36	3.63	3.1	3.6	2.96	3.69*	3.21	2.39**	3.71*	2.98	3.05	3.10	3.35	2.82*	3.94
SD-9	3.32	3.54	3.2	3.5	3.05	3.60*	3.19*	2.46**	3.38**	3.05	3.50	3.03*	3.15	3.12	2.89*
Control	3.10	3.46	3.1	3.1	3.29	4.04	3.42	3.18	3.93	2.69	2.92	3.21	3.09	3.19	3.54

Chironomus tentans															
Sample ID	Proportion Surviving														
	Fall 1998	Fall 1999	Fall 2000	Fall 2001	Fall 2002	Fall 2003	Fall 2004	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009	Fall 2010	Fall 2011	Fall 2012
SD-2	78	79	74	79	76	70	88	68	78*	84	73	76	74*	NS	37.5*
SD-4	61*	65	84	75	75	60	76	58*	74*	84	81	83	66*	60.0	50.0
SD-5	81	76	78	69	83	58	74*	53*	80*	74***	73	86	86	66.3*	51.3
SD-9	65*	73	76	74	78	83	69*	65	71*	79	74	70**	79*	60.0*	46.30
Control	83	80	73	68	71	64	85	80	94	78	78	85	95	77.5	53.8
	Proportion Emerged														
SD-2	78	68	64	79	75	70	83	59*	78*	84	70	76	71*	NS	31.3**
SD-4	59*	56	75	69	74	60	69*	56	73*	84	63	83	64*	57.5*	50.0
SD-5	77	60	70	66	83	58	74*	35*	78*	74***	63	84	86	66.3*	51.3
SD-9	65	68	71	74	78	83	55*	58	69*	79	63	70**	78*	60.0*	46.3
Control	74	55	68	68	70	64	85	76	94	74	76	85	94	76.3	53.8

Notes:

* = Statistically significantly different from the laboratory control sediment ($p \leq 0.05$).

** = Statistically significantly different ($p \leq 0.05$) from the laboratory control sediment and the reference control (SD4) .

*** = Statistically significant reduction ($P<0.05$) in response relative to the reference control (SD4).

Data collected prior to the 2000 sampling event is as reported to Sevee & Maher Engineers, Inc. by Aquatec Biological Services, Inc.

mg = milligrams

mm = millimeters

NS = Sediment sample was not collected.

Table 22

Statistically Significant Difference Summary/Sediment Toxicity Sampling (1998-2012)
2012 Long-term Environmental Monitoring Program
Auburn Road Landfill

	Statistically Significant Difference (P<0.05)	Hyalella azteca						Chironomus tentans			
		Proportion Surviving		Mean Weight		Mean Length		Proportion Surviving		Proportion Emerged	
		# of SSD	Ref	# of SSD	Ref	# of SSD	Ref	# of SSD	Ref	# of SSD	Ref
Fall 1998	LCS(Ct)	0	--	0	--	0	--	2	yes	1	yes
Fall 1999	None	0	--	0	--	0	--	0	--	0	--
Fall 2000	None	0	--	0	--	0	--	0	--	0	--
Fall 2001	None	0	--	0	--	0	--	0	--	0	--
Fall 2002	None	0	--	0	--	0	--	0	--	0	--
Fall 2003	LCS(Ha)	0	--	2	yes	4	yes	0	--	0	--
Fall 2004	LCS(Ct and Ha)	0	--	0	--	2	yes	2	no	3	yes
Fall 2005	LCS and Reference(Ha), LCS (Ct)	1	no	3	yes	3	yes	2	yes	2	no
Fall 2006	LCS and Reference(Ha), LCS (Ct)	0	--	3	yes	4	yes	4	yes	4	yes
Fall 2007	Reference (Ct and Ha)	0	--	1	no	0	--	1	no	1	no
Fall 2008	None	0	--	0	--	0	--	0	--	0	--
Fall 2009	LCS and Reference(Ct), LCS (Ha)	0	--	1	yes	3	yes	1	no	1	no
Fall 2010	LCS(Ct and Ha)	0	--	0	--	1	yes	3	yes	3	yes
Fall 2011	LCS(Ct and Ha), Reference (Ha)	2	no	2	yes	2	yes	2	no	3	yes
Fall 2012	LCS(Ct and Ha), Reference (Ha)	2	no	3	yes	3	yes	1	no	1	no

Notes:

LCS: Laboratory Control Sample

Ct: Chironomus tentans

Ha: Hyalella azteca

SSD: Statistically significantly different

# of SSD: Total number of SSD qualified during this assay test

Ref: Was reference/background sample qualified as SSD during this assay test

None: No samples were qualified as SSD during this years sediment toxity test.

APPENDIX A

SUMMARY OF FIELD WATER QUALITY PARAMETERS (2000-2012)

Appendix A

Summary of Field Water Quality Parameters (2000-2012)
Auburn Road Landfill

Well ID	Temperature (°C)																									
	Spring 2000	Fall 2000	Spring 2001	Fall 2001	Spring 2002	Fall 2002	Spring 2003	Fall 2003	Spring 2004	Fall 2004	Spring 2005	Fall 2005	Spring 2006	Fall 2006	Spring 2007	Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012
C-1	10.7	--	9.4	--	8.4	--	6.9	--	9.0	--	9.7	--	11.4	10.8	9.8	10.0	6.07	9.92	11.02	10.11	12.40	10.08	8.90	11.70	15.29	10.01
MW-212A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	22.23	9.27	15.07	10.71	11.01	10.21	9.15	11.78	11.98	11.60
MW-212B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	16.11	10.47	11.23	10.36	11.81	11.56	8.90	12.18	19.49	11.70
GZ-1-2R	9.4	--	7.0	--	8.1	--	7.1	--	8.3	--	7.5	--	9.6	12.7	8.0	12.5	4.71	12.19	9.00	11.94	8.89	12.40	8.00	12.59	12.02	12.88
GZ-1-3R	--	12.1	--	11.3	--	12.1	--	12.2	--	12.1	--	12.3	--	13.0	--	12.5	4.52	12.15	8.20	12.05	9.68	12.37	8.64	13.03	12.91	13.16
MW-102A	11.5	13.6	11.3	14.3	10.2	13.0	7.5	16.5	9.3	17.5	9.2	14.3	8.4	16.0	7.5	13.4	9.48	14.10	11.89	16.57	10.63	13.56	7.84	15.15	16.38	15.37
MW-109B	10.9	10.1	10	10.3	9.8	9.9	8.0	10.9	10.3	10.5	10.4	10.0	10.6	10.1	10.2	10.1	8.81	8.70	9.97	9.86	10.23	10.02	--	--	12.60	11.65
MW-213	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	15.15	11.31	13.25	13.08	--	--	13.89	13.31
MW-302A	9.8	--	8.7	--	8.9	--	6.3	--	8.9	--	9.6	--	12.1	12.8	11.7	13.0	5.45	12.86	8.95	14.31	12.31	12.14	9.76	14.56	15.57	15.31
MW-302BR	10.0	--	9.8	--	9.5	--	8.3	--	8.9	--	9.1	--	11.4	12.4	10.3	13.0	5.23	13.30	12.30	14.76	11.44	14.51	8.80	15.33	15.65	15.99
MW-303B	11.3	11.8	8.6	12.8	8.2	12.8	6.6	13.7	9.2	12.5	8.3	11.6	8.7	11.5	6.9	12.3	7.56	12.64	9.45	12.11	8.69	12.33	7.57	12.49	14.89	12.71
* NUS-1-2	10.5	12.4	12.3	15.3	--	13.4	7.6	12.8	11.0	12.2	10.3	11.4	11.1	11.21 (37)/11.32 (42)	10.1	11.4	8.90	13.40	11.04	11.51	10.75	DRY	--	--	12.48	13.81
NUS-2-2	--	12.2	--	14.6	--	11.7	--	12.3	--	13.0	--	11.4	--	11.4	--	10.9	8.97	12.65	--	12.85	--	11.24	--	--	--	12.50
GZ-6-2R	9.5	11.7	8.4	12.1	9.7	11.5	6.6	12.2	8.8	12.4	9.5	13.3	10.7	13.5	110.1	13.7	8.16	13.39	9.61	14.39	9.79	13.38	8.47	15.16	14.73	15.50
GZ-6-3R	10.2	11.5	9.0	10.8	9.4	12.1	7.7	12.5	9.5	11.2	10.0	11.3	11.1	11.5	12.8	12.2	8.95	12.30	10.76	13.38	10.16	13.18	9.52	14.16	15.15	15.15
GZ-9-4R	10.8	10.4	10.3	10.8	10.2	10.2	8.5	10.6	11.6	10.6	9.5	10.5	10.9	10.5	10.9	11.0	5.79	10.16	10.68	10.89	10.88	10.55	--	--	12.76	12.04
MW-1A	10.4	12.0	9.4	12.9	7.3	10.4	6.0	12.1	7.9	11.9	7.3	12.0	13.2	13.2	7.6	11.4	9.10	12.00	10.27	13.58	10.98	13.35	8.94	13.45	15.15	13.87
MW-1B	10.2	12.2	7.5	13.8	7.0	--	4.8	14.3	6.8	13.6	5.6	12.8	15.3	14.1	6.0	13.1	7.41	13.20	8.45	14.04	9.48	14.04	7.45	14.12	14.53	14.89
MW-101A	--	--	--	--	--	--	--	--	--	--	--	--	--	9.26	--	9.6	6.91	9.36	--	12.84	--	8.45	--	--	--	11.21
MW-101B	--	--	--	--	--	--	--	--	--	--	--	--	--	8.98	--	10.3	7.50	9.12	--	12.08	--	9.04	--	--	--	--
MW-104B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	12.3	7.27	11.16	9.18	12.16	11.13	10.31	8.33	12.68	13.08	12.39
MW-106A	--	--	--	--	--	--	--	--	--	--	--	--	--	12.89	--	13.2	8.79	13.38	--	13.02	--	13.03	--	--	--	14.45
MW-106B	--	--	--	--	--	--	--	--	--	--	--	--	--	13.27	--	13.2	7.97	13.60	--	12.54	--	14.15	--	--	--	14.69
MW-108A	--	--	--	--	--	--	--	--	--	--	--	--	--	12.19	--	9.7	7.86	12.83	--	12.10	--	11.04	--	--	--	11.62
MW-108B	--	--	--	--	--	--	--	--	--	--	--	--	--	11.39	--	9.7	9.11	11.94	--	11.33	--	10.36	--	--	--	11.17
MW-109A	--	--	--	--	--	--	--	--	--	--	--	--	--	9.86	--	10.4	8.63	9.40	--	9.56	--	10.26	--	--	--	10.22
MW-204	--	--	--	--	--	--	--	--	--	--	--	--	--	10.15	--	10.3	5.13	12.52	--	10.37	--	8.82	--	--	--	12.35
MW-207A	--	--	--	--	--	--	--	--	--	--	--	--	--	11.01	11.27	12.8	10.47	12.33	11.55	12.46	11.83	13.40	10.27	13.77	14.55	13.73
MW-207B	--	--	--	--	--	--	--	--	--	--	--	--	--	11.7	11.55	12.4	10.00	12.02	11.71	12.19	5.85	12.60	10.41	14.09	14.02	13.76
MW-210A	--	--	--	--	--	--	--	--	--	--	--	--	--	9.6	10.86	10.7	12.12	11.42	10.61	11.22	11.05	12.77	7.59	13.80	13.02	11.67
MW-210B	--	--	--	--	--	--	--	--	--	--	--	--	--	5.32	8.00	12.4	7.30	13.52	8.72	12.32	10.11	13.72	6.22	14.26	14.85	12.07
MW-303A	12.0	11.5	9.2	12.8	8.0	12.2	5.8	13.3	10.1	12.5	8.6	11.3	9.1	11.1	7.5	12.3	7.70	11.92	10.09	11.62	8.40	11.84	7.70	12.25	14.32	12.23
NUS-9-1	--	--	--	--	--	--	--	--	--	--	--	--	--	10.77 (22)/10.65 (30)	--	10.4	5.30	10.88	--	--	--	10.41	--	--	--	11.97
MW-211B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	15.09	11.10	10.81	10.43	9.73	11.78	8.40	13.21	15.90	12.21
PZ-218	9.6	--	7.4	--	7.3	--	4.4	11.5	6.2	13.4	6.8	10.9	9.6	11.5	8.7	dry	3.54	11.06	8.53	11.26	9.02	11.80	8.09	12.64	13.79	11.98
CB-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	17.81	14.29
WPP-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	14.71	12.07
WPP-2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	13.20	11.81
WPP-3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	16.83	12.12

Appendix A

Summary of Field Water Quality Parameters (2000-2012)
Auburn Road Landfill

Well ID	pH (std. units)																									
	Spring 2000	Fall 2000	Spring 2001	Fall 2001	Spring 2002	Fall 2002	Spring 2003	Fall 2003	Spring 2004	Fall 2004	Spring 2005	Fall Nov. 2005	Spring 2006	Fall 2006	Spring 2007	Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012
C-1	6.8	--	6.8	--	6.6	--	6.7	--	6.8	--	5.8	--	6.4	6.2	6.2	6.3	6.53	6.14	6.01	6.26	6.26	6.27	6.25	6.32	5.87	6.26
MW-212A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.36	6.20	4.96	6.35	6.19	6.39	6.28	6.13	6.24	6.26
MW-212B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.86	5.83	5.80	6.01	6.01	6.01	5.99	5.99	5.66	6.01
GZ-1-2R	5.9	--	6.0	--	6.0	--	6.1	--	6.2	--	5.7	--	6.2	6.0	6.0	6.0	6.08	5.87	5.90	6.04	5.98	5.95	5.94	5.93	6.02	5.95
GZ-1-3R	--	7.6	--	7.6	--	7.5	--	7.5	--	7.3	--	7.4	--	7.5	--	7.3	7.56	7.36	7.57	6.71	6.94	7.12	7.48	7.18	7.04	7.31
MW-102A	7.8	7.7	7.7	7.6	7.8	7.8	7.9	7.5	7.8	7.6	7.0	7.5	7.8	7.8	7.1	7.4	7.57	7.47	3.28	7.37	7.55	7.72	7.78	7.34	6.83	7.57
MW-109B	6.7	6.9	6.5	6.3	6.9	7.2	6.4	6.0	6.1	6.0	6.1	6.6	6.2	6.4	6.3	6.5	6.15	5.72	5.90	5.97	6.18	6.03	--	--	5.63	5.93
MW-213	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.71	6.51	6.96	6.87	--	--	5.07	6.56
MW-302A	7.4	--	7.3	--	7.3	--	7.0	--	7.2	--	7.3	--	7.5	7.2	7.2	7.1	7.15	6.89	6.79	7.14	7.23	7.09	7.14	6.73	7.06	7.28
MW-302BR	6.5	--	6.8	--	6.9	--	6.9	--	7.0	--	6.8	--	6.9	6.6	6.5	6.4	6.68	6.44	5.48	6.52	6.64	6.61	6.57	6.16	6.45	6.48
MW-303B	6.6	6.7	6.7	6.8	6.7	6.7	6.8	6.7	6.3	6.7	6.2	6.5	6.7	6.6	6.4	6.5	6.64	6.48	4.21	6.43	6.70	6.65	6.68	6.33	6.53	6.72
* NUS-1-2	6.6	6.7	6.7	6.7	--	7.0	6.8	6.7	6.7	6.7	3.8	6.8	6.9	6.59 (37) / 6.60 (42)	6.6	6.7	6.68	6.51	4.94	6.86	6.59	DRY	--	--	6.15	6.64
NUS-2-2	--	6.9	--	6.5	--	6.9	--	6.8	--	6.8	--	6.8	--	6.6	--	6.9	6.97	6.70	--	7.63	--	6.53	--	--	--	6.78
GZ-6-2R	7.0	7.0	6.9	7.0	6.9	7.2	6.9	6.9	6.8	6.8	5.8	6.9	6.9	6.7	6.7	6.7	6.79	6.62	5.53	6.51	6.83	6.77	6.80	6.61	6.57	6.74
GZ-6-3R	6.5	6.6	6.6	6.7	6.5	6.7	6.5	6.5	6.6	6.6	6.2	6.6	6.6	6.4	6.4	6.3	6.44	6.24	5.28	6.33	6.45	6.34	6.40	6.03	6.22	6.30
GZ-9-4R	6.8	6.8	7.2	6.7	6.7	6.7	6.8	6.9	6.6	6.8	7.0	6.8	6.8	6.7	6.7	6.7	6.79	6.34	5.65	6.42	7.01	6.75	--	--	6.78	6.59
MW-1A	7.5	7.6	7.6	7.7	7.8	8.0	7.8	7.7	7.8	7.7	7.0	7.6	7.9	7.5	7.5	7.8	7.62	7.56	7.24	7.58	7.47	7.55	7.60	7.49	6.98	7.59
MW-1B	6.1	6.2	6.3	6.5	6.3	--	6.4	6.2	6.6	6.3	6.4	6.2	6.1	6.1	6.4	6.3	6.37	5.97	5.64	5.73	6.52	6.26	6.53	6.40	6.68	6.52
MW-101A	--	--	--	--	--	--	--	--	--	--	--	--	--	7.26	--	7.02	7.37	6.80	--	7.03	--	7.61	--	--	--	7.04
MW-101B	--	--	--	--	--	--	--	--	--	--	--	--	--	6.49	--	6.5	6.59	6.17	--	6.36	--	6.67	--	--	--	--
MW-104B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.18	6.22	6.01	5.75	5.99	6.11	6.10	6.32	5.82	6.03	6.12
MW-106A	--	--	--	--	--	--	--	--	--	--	--	--	--	7.62	--	7.15	7.86	7.64	--	7.64	--	7.67	--	--	--	7.55
MW-106B	--	--	--	--	--	--	--	--	--	--	--	--	--	6.09	--	6.17	6.47	6.02	--	6.21	--	6.31	--	--	--	6.28
MW-108A	--	--	--	--	--	--	--	--	--	--	--	--	--	7.59	--	7.66	7.69	7.43	--	7.51	--	7.53	--	--	--	7.51
MW-108B	--	--	--	--	--	--	--	--	--	--	--	--	--	6.65	--	6.63	6.50	6.33	--	6.61	--	6.37	--	--	--	6.41
MW-109A	--	--	--	--	--	--	--	--	--	--	--	--	--	7.91	--	7.69	7.79	7.53	--	7.47	--	7.81	--	--	--	7.72
MW-204	--	--	--	--	--	--	--	--	--	--	--	--	--	7.88	--	7.61	7.42	7.24	--	6.51	--	7.82	--	--	--	7.37
MW-207A	--	--	--	--	--	--	--	--	--	--	--	--	--	8.25	11.53	11.51	9.91	9.67	6.82	9.80	11.42	11.66	11.07	10.07	9.02	10.04
MW-207B	--	--	--	--	--	--	--	--	--	--	--	--	--	6.81	6.5	6.42	6.60	6.21	5.47	6.51	6.40	6.27	6.42	5.88	6.34	6.44
MW-210A	--	--	--	--	--	--	--	--	--	--	--	--	--	8.17	8.12	8.15	7.82	7.93	6.37	7.90	7.79	7.88	8.02	7.92	7.72	8.02
MW-210B	--	--	--	--	--	--	--	--	--	--	--	--	--	7.92	6.39	6.38	5.74	6.27	4.85	6.20	6.73	6.48	6.44	6.22	6.21	6.30
MW-303A	8.1	8.1	7.9	8.0	7.7	7.7	8.0	7.8	7.9	7.6	7.3	7.6	7.8	7.8	7.3	7.7	6.93	7.32	4.96	7.29	7.57	7.31	7.48	7.36	7.31	7.44
NUS-9-1	--	--	--	--	--	--	--	--	--	--	--	--	--	5.91 (22)/5.93 (30)	--	5.9	6.14	5.82	--	--	--	5.88	--	--	--	5.91
MW-211B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.34	5.96	6.08	6.65	6.21	6.08	6.20	5.74	5.86	6.17
PZ-218	5.6	--	6.6	--	6.0	--	6.5	6.5	6.7	6.2	6.3	6.4	6.7	6.4	6.4	dry	6.06	6.12	6.08	6.47	6.51	5.81	6.40	5.51	5.86	6.02
CB-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.04	6.82
WPP-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.99	6.61
WPP-2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.23	6.34
WPP-3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.55	6.4

Appendix A

Summary of Field Water Quality Parameters (2000-2012)
Auburn Road Landfill

Well ID	Conductivity (µS/cm)																									
	Spring 2000	Fall 2000	Spring 2001	Fall 2001	Spring 2002	Fall 2002	Spring 2003	Fall 2003	Spring 2004	Fall 2004	Spring 2005	Fall Nov. 2005	Spring 2006	Fall 2006	Spring 2007	Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012
C-1	561	--	480	--	473	--	471	--	318	--	474	--	411	404	441	464	250	520	517	426	390	419	406	323	272	400
MW-212A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	430	412	469	351	288	312	334	412	428	350
MW-212B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	480	534	--	423	361	445	470	481	496	401
GZ-1-2R	525	--	354	--	377	--	358	--	243	--	403	--	255	372	280	424	216	403	415	408	290	392	343	286	392	375
GZ-1-3R	--	324	--	346	--	304	--	336	--	328	--	337.0	--	384.0	--	420	233	436	459	493	408	363	372	322	372	314
MW-102A	384	362	341	336	366	362	355	359	242	305	414	337	310	340	346	379	342	330	368	375	329	371	326	382	357	378
MW-109B	492	481	259	235	449	436	257	257	303	225	390	351	296	341	362	397	317	277	309	255	232	273	--	--	247	257
MW-213	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	420	351	299	295	--	--	393	390
MW-302A	826	--	706	--	789	--	852	--	811	--	946	--	702	705	741	667	409	723	629	626	543	618	468	622	596	577
MW-302BR	568	--	357	--	379	--	374	--	344	--	412	--	281	386	320	330	194	530	361	440	307	407	224	362	304	288
MW-303B	561	476	412	482	448	509	469	522	318	312	220	385	264	322	136	399	367	382	409	434	325	401	322	423	369	391
* NUS-1-2	587	464	463	428	--	502	545	553	429	339	439	405	370	370 (37) / 374 (42)	411	456	493	452	507	496	435	DRY	--	--	505	502
NUS-2-2	--	299	--	331	--	382	--	396	--	308	--	373	--	380	--	312	263	336	--	264	--	463	--	--	--	315
GZ-6-2R	365	351	310	333	356	363	316	377	283	260	346	320	269	230	206	391	460	411	321	435	315	205	207	298	296	287
GZ-6-3R	558	499	465	488	565	567	5.9	566	534	375	519	498	483	506	583	536	534	593	546	518	431	476	394	500	509	495
GZ-9-4R	572	610	476	577	597	558	558	491	388	450	504	403	425	388	501	534	247	430	494	487	359	391	--	--	409	458
MW-1A	299	295	264	301	328	346	352	376	377	340	436	337	310	333	258	332	307	392	415	370	321	340	308	321	324	330
MW-1B	235	231	193	282	260	--	242	356	275	310	316	251	153	228	149	260	225	343	269	243	201	262	205	252	244	244
MW-101A	--	--	--	--	--	--	--	--	--	--	--	--	--	161	--	184	169	151	--	163	--	162	--	--	--	133
MW-101B	--	--	--	--	--	--	--	--	--	--	--	--	--	48	--	69	61	53	--	56	--	56	--	--	--	--
MW-104B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	464	369	414	483	453	324	391	316	409	430	373
MW-106A	--	--	--	--	--	--	--	--	--	--	--	--	--	335	--	326	361	343	--	373	--	353	--	--	--	381
MW-106B	--	--	--	--	--	--	--	--	--	--	--	--	--	257	--	318	280	332	--	333	--	255	--	--	--	302
MW-108A	--	--	--	--	--	--	--	--	--	--	--	--	--	411	--	441	435	559	--	454	--	414	--	--	--	382
MW-108B	--	--	--	--	--	--	--	--	--	--	--	--	--	245	--	280	278	280	--	277	--	258	--	--	--	219
MW-109A	--	--	--	--	--	--	--	--	--	--	--	--	--	322	--	319	348	334	--	362	--	340	--	--	--	309
MW-204	--	--	--	--	--	--	--	--	--	--	--	--	--	377	--	409	223	362	--	288	--	367	--	--	--	327
MW-207A	--	--	--	--	--	--	--	--	--	--	--	--	--	350	519	878	461	499	467	464	596	1403	487	480	395	431
MW-207B	--	--	--	--	--	--	--	--	--	--	--	--	--	246	305	281	280	365	331	305	282	310	244	323	295	306
MW-210A	--	--	--	--	--	--	--	--	--	--	--	--	--	219	304	297	260	370	334	320	296	333	259	303	317	327
MW-210B	--	--	--	--	--	--	--	--	--	--	--	--	--	50	93	203	122	238	191	150	158	119	134	75	115	131
MW-303A	268	246	233	248	254	214	250	258	176	185	279	229	219	242	237	237	228	212	257	258	238	218	225	271	244	245
NUS-9-1	--	--	--	--	--	--	--	--	--	--	--	--	--	268 (22)/274 (30)	--	268	161	239	--	--	--	226	--	--	--	290
MW-211B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	326	201	300	313	199	146	235	240	158	144
PZ-218	34	--	316	--	190	--	231	314	166	253	282	246	284	284	292	dry	279	294	347	268	254	106	288	52	272	176
CB-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	326	370
WPP-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	378	388
WPP-2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	390	387
WPP-3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	348	296

Appendix A

Summary of Field Water Quality Parameters (2000-2012)
Auburn Road Landfill

Well ID	ORP (mV)																									
	Spring 2000	Fall 2000	Spring 2001	Fall 2001	Spring 2002	Fall 2002	Spring 2003	Fall 2003	Spring 2004	Fall 2004	Spring 2005	Fall Nov. 2005	Spring 2006	Fall 2006	Spring 2007	Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012
C-1	-37	--	-61	--	-8.6	--	-58.1	--	-156.0	--	84.3	--	-44.5	10.2	-58.4	-122.6	-59.8	-136.2	-43.0	-93.3	-68.2	-36.6	55.3	-43.3	131.1	-55.5
MW-212A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	72.2	-11.9	145.8	-72.3	-18.9	-28.5	4.7	-42.0	-30.0	-27.5
MW-212B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-53.3	-89.5	-21.3	-96.1	-25.3	-32.8	-42.6	-49.0	-37.1	-17.9
GZ-1-2R	-3	--	57.6	--	-59	--	-110.1	--	-66.4	--	91.8	--	14.7	33.2	-9.6	-44.6	-27.7	-64.4	-11.4	-55.6	-9.7	-12.8	-4.0	-17.1	-50.7	-32.1
GZ-1-3R	--	-62	--	-109	--	-121	--	-198.0	--	-122.0	--	-116.0	--	-80.2	--	-168.1	-171.4	-184.3	-171.4	-140.1	-124.2	-150.1	-130.4	-164.8	-107.5	-141.6
MW-102A	152	6	221	214	182	-51	119	-6.8	88.6	-252.7	503.0	-65.0	210.5	144.8	98.1	-17.0	29.2	-108.2	588.9	45.6	54.0	85.7	-135.5	12.8	434.9	78.3
MW-109B	-60	-134	178	235	-96.2	-36.8	202.3	206.7	124.0	45.7	67.2	124.1	240.9	150.4	179.0	29.2	160.3	168.2	311.1	120.5	143.2	158.0	--	--	511.1	124.1
MW-213	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-107.0	-97.7	-119.1	-113.2	--	--	-70.6	-89.5
MW-302A	-93	--	-72	--	-94.2	--	-111.7	--	-83.0	--	-21.6	--	-160.8	-85.2	-84.7	-150.4	-107.1	-185.5	66.5	-162.8	-109.1	-172.9	-65.3	-127.3	-96.2	-153.2
MW-302BR	-63	--	84	--	182	--	121.9	--	39.0	--	421.0	--	101.6	7.9	116.1	81.6	32.6	-124.0	71.3	-103.9	-36.8	-114.2	66.5	-31.5	-21.9	103.3
MW-303B	-45	-93	-71	-61	-69.8	-80.1	-86.3	-79.2	-26.4	-87.9	482.0	-36.3	2.0	36.4	-11.3	-72.8	-95.7	-54.0	-35.9	-83.6	-82.6	-94.6	-137.9	-67.0	-79.7	-78.0
* NUS-1-2	-68	-128	-83	-98	--	4.6	-87	-67.2	-55.0	-104.1	114.1	-81.0	-67.5	[-15.1 (37)] / [(-12.4 (42)]	-32.3	-99.9	-43.4	-173.3	-18.5	-122.3	-80.1	DRY	--	--	-84.2	-73.6
NUS-2-2	--	-143	--	-93	--	-27.9	--	-72.7	--	-56.4	--	-85.1	--	-26.7	--	-103.0	-72.1	-186.5	--	-195.3	--	-65.0	--	--	--	-77.5
GZ-6-2R	-121	-158	-68	-129	-41.2	-16.2	-28.6	-78.3	44.3	-81.1	-26.4	-100.0	-40.1	-45.3	88.4	-133.7	-107.2	-140.1	93.9	-109.8	-107.9	-124.1	-11.0	-101.3	-15.6	-4.9
GZ-6-3R	-53	-103	-49	-37	-18.1	-18	-42.6	-36.2	-54.0	-50.0	24.8	-59.0	-26.0	2.2	-41.9	-63.5	-42.8	-91.0	-26.4	-70.1	-50.1	-54.8	-30.5	-34.9	-28.4	-48.0
GZ-9-4R	-78	-102	85	-80	-83	-83.2	-80.4	58.0	-69.9	89.6	362.0	85.1	-47.7	125.8	-68.6	-87.8	19.8	-66.6	-53.7	-68.0	71.4	-35.9	--	--	2.00	-57.4
MW-1A	193	44	128	118	339	94.6	226.3	234.0	87.0	-92.0	257.0	-43.0	60.5	51.7	124.1	-51.1	225.1	99.2	328.8	-133.7	48.2	-140.5	-137.8	-23.9	-177.3	-172.8
MW-1B	218	140	171	136	413	--	286.4	63.6	108.0	61.2	235.0	222.0	172.4	130.3	163.0	-43.7	183.7	-126.9	318.9	160.7	42.1	90.9	-141.1	125.2	-141	-129.6
MW-101A	--	--	--	--	--	--	--	--	--	--	--	--	--	156.0	--	-9.6	84.6	128.5	--	63.6	--	227.0	--	--	--	101.2
MW-101B	--	--	--	--	--	--	--	--	--	--	--	--	--	156.0	--	15.1	174.5	159.6	--	146.2	--	70.9	--	--	--	--
MW-104B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-49.8	-26.3	-26.6	2.3	-33.2	-20.2	-60.0	10.6	-15.5	-18.3	-33.1
MW-106A	--	--	--	--	--	--	--	--	--	--	--	--	--	22.8	--	351.7	105.4	-63.2	--	-24.3	--	39.4	--	--	--	67.1
MW-106B	--	--	--	--	--	--	--	--	--	--	--	--	--	62.2	--	34.7	-6.2	-32.6	--	16.0	--	-9.6	--	--	--	-13.1
MW-108A	--	--	--	--	--	--	--	--	--	--	--	--	--	86.4	--	160.4	54.7	121.9	--	-7.2	--	-8.2	--	--	--	100.4
MW-108B	--	--	--	--	--	--	--	--	--	--	--	--	--	74.7	--	-36.7	55.2	-19.6	--	67.2	--	122.4	--	--	--	117.1
MW-109A	--	--	--	--	--	--	--	--	--	--	--	--	--	-22.3	--	-125.8	-117.6	-150.1	--	-133.9	--	-78.2	--	--	--	-147.1
MW-204	--	--	--	--	--	--	--	--	--	--	--	--	--	-66.8	--	-123.2	21.9	-97.3	--	110.9	--	-141.7	--	--	--	16.4
MW-207A	--	--	--	--	--	--	--	--	--	--	--	--	--	-80.7	-16.7	-329.3	-145.2	-249.8	349.2	-264.6	-3.1	-196.4	55.2	93.8	320	-13.1
MW-207B	--	--	--	--	--	--	--	--	--	--	--	--	--	100.2	117.7	122.2	60.6	68.7	344.2	89.0	45.4	159.0	47.3	114.7	225.2	69.5
MW-210A	--	--	--	--	--	--	--	--	--	--	--	--	--	-16.9	-113.9	-129.4	235.0	-169.8	488.6	155.9	69.4	74.6	28.7	87.4	430.9	117.1
MW-210B	--	--	--	--	--	--	--	--	--	--	--	--	--	116.6	147.1	117.7	350.1	208.1	488.2	172.8	122.1	130.6	57.2	182.5	488.5	157.2
MW-303A	128	67	191	142	32	-51	55.5	89.0	197.7	-87.1	491.0	0.4	-37.1	-36.9	-31.7	-107.4	304.1	17.1	554.5	-90.7	-13.4	4.9	-138.6	-85.3	-94.2	-145.7
NUS-9-1	--	--	--	--	--	--	--	--	--	--	--	--	--	116.7 (22)/148.4 (30)	--	185.0	70.1	128.8	--	--	--	134.0	--	--	--	163.1
MW-211B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-64.2	-38.8	-29.0	-99.3	-33.9	52.9	18.0	80.2	48.7	49.7
PZ-218	18	--	-62	--	82	--	-7.1	-61.0	-14.8	18.0	85.6	-41.9	-47.8	-0.1	-75.7	dry	-67.9	-45.4	-53.8	-72.1	-61.0	70.6	-28.1	78.9	-28.8	37.7
CB-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-60.8	-94.5
WPP-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-113.4	-60.2
WPP-2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-40.1	57.0
WPP-3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	104.2	-221.1

Appendix A

Summary of Field Water Quality Parameters (2000-2012)
Auburn Road Landfill

Well ID	DO (mg/L)																									
	Spring 2000	Fall 2000	Spring 2001	Fall 2001	Spring 2002	Fall 2002	Spring 2003	Fall 2003	Spring 2004	Fall 2004	Spring 2005	Fall Nov. 2005	Spring 2006	Fall 2006	Spring 2007	Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012
C-1	1.3	--	0.7	--	0.6	--	0.3	--	0.3	--	0.3	--	0.3	1.9	0.12	0.17	0.28	1.57	0.20	0.20	1.00	1.24	0.22	0.26	0.10	0.56
MW-212A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.34	0.22	0.75	0.53	0.49	0.99	0.55	0.61	0.69	0.71
MW-212B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.20	1.91	0.23	0.27	0.40	1.26	0.77	0.64	0.48	0.78
GZ-1-2R	0.4	--	0.6	--	1.1	--	0.2	--	0.3	--	0.4	--	0.4	1.3	0.29	0.20	0.63	--	0.20	0.16	0.25	1.37	0.20	0.37	0.16	0.39
GZ-1-3R	--	1.0	--	1.3	--	0.7	--	0.4	--	0.8	--	0.1	--	1.6	--	0.22	0.38	0.14	0.15	0.10	0.12	0.51	0.17	0.34	0.09	0.21
MW-102A	3.3	2.3	4.7	2.9	7.2	3.6	5.4	0.5	3.2	0.2	0.4	1.2	1.1	5.0	4.25	1.21	3.33	0.89	3.16	1.90	3.16	5.21	4.63	4.00	2.55	3.31
MW-109B	0.5	0.4	3.6	1.0	0.4	0.5	0.5	0.2	4.8	5.5	1.3	0.4	5.3	4.5	4.71	0.38	7.14	3.72	0.30	1.93	5.60	6.00	--	--	3.60	4.33
MW-213	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.22	0.29	0.29	0.72	--	--	0.96	0.77
MW-302A	0.2	--	0.9	--	0.3	--	0.4	--	0.4	--	0.3	--	0.2	0.2	0.11	0.20	0.52	0.11	0.23	0.32	1.16	0.63	0.26	0.14	0.23	0.39
MW-302BR	0.5	--	1.6	--	0.7	--	2.1	--	1.4	--	0.1	--	0.1	0.2	0.31	0.23	0.59	0.76	0.30	0.27	0.83	0.38	0.28	0.19	0.21	0.39
MW-303B	0.9	0.2	0.7	1.2	0.6	0.7	0.3	0.4	0.5	0.6	0.3	0.3	0.3	0.4	0.54	0.23	0.50	0.29	0.43	0.47	0.56	0.40	0.49	0.49	0.60	0.50
* NUS-1-2	0.4	0.8	0.3	1.0	--	0.6	0.3	0.2	0.8	0.5	0.5	0.3	0.3	1.46 (37) / 0.91 (42)	0.24	9.59	1.31	0.21	0.38	0.34	1.31	DRY	--	--	0.10	0.29
NUS-2-2	--	0.5	--	1.7	--	0.6	--	0.6	--	6.8	--	0.3	--	0.5	--	0.23	0.60	0.11	--	0.12	--	0.57	--	--	--	0.13
GZ-6-2R	0.3	0.3	1.2	0.3	1.0	0.6	2.3	0.2	3.0	0.3	0.5	0.2	0.1	0.4	0.38	0.27	0.25	0.45	0.14	0.15	0.69	1.68	0.21	0.19	0.17	0.34
GZ-6-3R	0.3	0.5	0.7	1.2	0.2	0.6	0.5	0.3	0.3	0.4	0.5	0.3	0.3	1.3	0.49	0.38	0.58	0.99	0.50	0.42	6.45	1.18	0.59	0.30	0.50	1.59
GZ-9-4R	1.3	0.3	3.2	0.2	0.4	0.7	0.3	0.3	0.4	0.6	1.2	0.3	0.2	0.3	0.31	0.28	2.04	0.19	0.97	0.14	4.82	0.97	--	--	5.33	0.63
MW-1A	4.0	1.7	5.0	3.7	10.3	5.0	6.7	1.5	4.4	1.8	1.7	0.1	0.7	1.0	4.92	0.43	3.99	0.13	4.39	0.30	2.01	0.27	3.79	0.49	0.21	0.26
MW-1B	2.8	1.4	5.9	1.9	2.9	--	5.4	1.1	0.9	0.9	1.2	0.3	0.2	0.6	0.15	0.15	1.40	0.12	0.38	1.19	0.14	0.33	0.68	0.52	0.35	0.47
MW-101A	--	--	--	--	--	--	--	--	--	--	--	--	--	4.87	--	0.48	3.15	1.48	--	4.13	--	3.81	--	--	--	3.12
MW-101B	--	--	--	--	--	--	--	--	--	--	--	--	--	5.37	--	4.71	6.89	5.60	--	6.09	--	4.15	--	--	--	--
MW-104B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.89	1.48	1.25	0.27	1.90	0.90	0.85	0.85	0.30	0.86	0.39
MW-106A	--	--	--	--	--	--	--	--	--	--	--	--	--	2.45	--	0.67	7.03	0.51	--	1.52	--	1.57	--	--	--	1.58
MW-106B	--	--	--	--	--	--	--	--	--	--	--	--	--	0.53	--	1.69	1.42	1.67	--	1.69	--	0.73	--	--	--	0.40
MW-108A	--	--	--	--	--	--	--	--	--	--	--	--	--	0.69	--	3.38	2.44	3.08	--	0.35	--	2.67	--	--	--	2.52
MW-108B	--	--	--	--	--	--	--	--	--	--	--	--	--	0.16	--	0.49	0.40	0.49	--	0.81	--	0.78	--	--	--	1.04
MW-109A	--	--	--	--	--	--	--	--	--	--	--	--	--	0.74	--	0.53	0.70	0.14	--	0.24	--	0.26	--	--	--	0.34
MW-204	--	--	--	--	--	--	--	--	--	--	--	--	--	0.32	--	0.43	9.67	0.44	--	1.24	--	0.46	--	--	--	1.34
MW-207A	--	--	--	--	--	--	--	--	--	--	--	--	--	0.45	8.86	0.26	0.26	0.13	0.20	0.13	5.09	1.25	1.42	0.12	1.23	0.10
MW-207B	--	--	--	--	--	--	--	--	--	--	--	--	--	0.41	0.53	0.15	0.26	0.40	0.21	0.17	0.13	0.61	0.22	0.21	0.31	0.14
MW-210A	--	--	--	--	--	--	--	--	--	--	--	--	--	0.31	0.33	0.43	0.32	0.19	4.75	0.91	4.18	2.90	4.56	3.79	6.50	3.64
MW-210B	--	--	--	--	--	--	--	--	--	--	--	--	--	10.55	11.30	4.18	0.42	4.65	8.90	4.18	8.11	8.66	9.17	7.65	5.82	7.43
MW-303A	5.3	7.0	3.5	3.2	5.3	6.2	4.2	1.6	5.6	1.8	4.5	2.5	0.2	0.2	0.10	1.02	0.80	0.69	0.29	0.69	0.25	1.14	0.47	1.38	0.15	0.81
NUS-9-1	--	--	--	--	--	--	--	--	--	--	--	--	--	9.57 (22)/9.61 (30)	--	7.00	9.40	3.23	--	--	--	6.33	--	--	--	7.02
MW-211B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.32	0.61	0.31	1.03	0.60	4.38	1.04	0.52	3.09	6.16
PZ-218	1.3	--	0.7	--	0.5	--	0.4	0.5	0.4	0.5	0.9	0.3	0.1	1.0	0.18	dry	0.24	0.63	0.20	0.51	0.42	4.88	0.21	0.52	0.14	1.62
CB-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.34	6.39
WPP-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.89	3.98
WPP-2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.27	0.32
WPP-3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.33	0.28

Appendix A

Summary of Field Water Quality Parameters (2000-2012)
Auburn Road Landfill

Well ID	Turbidity (NTUs)																									
	Spring 2000	Fall 2000	Spring 2001	Fall 2001	Spring 2002	Fall 2002	Spring 2003	Fall 2003	Spring 2004	Fall 2004	Spring 2005	Fall Nov. 2005	Spring 2006	Fall 2006	Spring 2007	Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012
C-1	0.1	--	6.2	--	6.6	--	0.5	--	0.9	--	0.0	--	17.0	1.7	1.1	0.36	3.15	0.21	<1	0.44	9.60	5.25	9.78	0.80	4.96	4.27
MW-212A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	NM	5.42	4.87	1.98	3.13	2.11	0.95	2.50	9.39	4.46
MW-212B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.14	0.50	<1	0.61	3.45	2.49	4.37	12.20	4.77	2.66
GZ-1-2R	<5	--	5.8	--	8.2	--	0.9	--	0.6	--	0.0	--	6.2	1.6	0.6	3.00	0.98	0.36	<1	1.4	<1	16.4	4.68	0.88	< 1.0	0.49
GZ-1-3R	--	32	--	1.6	--	3.6	--	1.8	--	1.4	--	1.5	--	7.8	--	0.56	0.41	0.10	1.93	9.8	2.42	1.72	0.88	3.01	< 1.0	0.98
MW-102A	0.4	2.8	4.3	0	6.8	3.1	0.0	1.6	0.1	0.0	1.1	0.1	3.4	1.2	0.8	1.57	0.90	0.45	<1	<1	<1	<1	1.45	0.91	0.69	< 1.0
MW-109B	1.6	5.6	3.2	0.7	0.1	1.0	22.0	1.3	0.6	0.0	4.9	1.3	3.7	0.9	0.4	0.90	0.90	0.56	<1	<1	0.49	0.19	--	--	0.77	0.99
MW-213	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.20	18.5	2.20	4.63	--	--	0.98	4.03
MW-302A	0.8	--	150	--	1.3	--	3.1	--	2.8	--	6.1	--	3.8	1.3	10.0	0.47	0.11	0.37	5.70	0.84	3.93	0.62	4.0	0.48	< 1.0	0.66
MW-302BR	0.6	--	4.2	--	0.4	--	0.3	--	1.0	--	4.1	--	3.8	0.7	3.9	1.39	0.98	0.09	6.23	1.47	56.9	1.58	7.0	1.10	< 1.0	1.59
MW-303B	1.3	11.8	8.5	2.1	6.1	6.9	0.5	9.6	19.5	24.0	0.9	10.0	82.0	5.6	27.2	4.26	1.71	12.10	3.49	1.0	2.56	23.0	47.8	5.08	10.1	< 1.0
* NUS-1-2	8.8	4.8	15	1.4	--	16.0	1.4	1.3	4.6	0.0	0.0	0.0	4.6	1.3 (37) / 0.65 (42)	0.9	2.34	1.87	0.97	<1	4.9	0.36	DRY	--	--	1.92	< 1.0
NUS-2-2	--	4.8	--	0	--	0.0	--	0.0	--	0.0	--	1.3	--	1.1	--	NM	0.35	0.25	--	43.2	--	0.41	--	--	--	< 1.0
GZ-6-2R	<5	3.7	2.9	2.2	3.4	15.0	16.0	18.0	9.1	0.0	0.0	6.9	3.2	1.3	10.0	2.34	4.49	0.34	5.69	<1	4.33	0.25	3.00	0.18	1.0	0.51
GZ-6-3R	<5	5.6	4.2	6.2	5.5	0.0	0.1	3.8	0.7	0.0	4.9	2.1	4.8	2.1	0.6	2.96	0.90	1.22	<1	2.39	0.25	2.18	< 1.0	3.97	2.0	0.61
GZ-9-4R	6.8	2.2	5.8	3.1	4.8	3.1	3.5	2.1	4.7	1.5	1.2	0.2	6.4	3.5	5.9	2.21	4.19	0.72	4.56	<1	4.88	2.28	--	--	< 1.0	0.79
MW-1A	1.9	0.9	0.9	1.6	1.6	0.3	0.0	0.7	2.1	0.9	6.1	0.5	12.0	1.7	0.4	0.30	0.20	0.20	<1	0.4	<1	1.40	0.51	0.67	0.75	< 1.0
MW-1B	1.5	0.4	1.4	1.8	0.0	--	0.7	0.3	2.0	1.9	17.2	0.0	4.5	2.1	0.3	1.03	0.20	0.48	<1	0.6	<1	1.28	0.48	2.41	0.48	< 1.0
MW-101A	--	--	--	--	--	--	--	--	--	--	--	--	--	3.7	--	3.22	0.90	0.98	--	1.75	--	0.48	--	--	--	2.69
MW-101B	--	--	--	--	--	--	--	--	--	--	--	--	--	1.9	--	1.80	0.67	0.53	--	<1	--	4.35	--	--	--	--
MW-104B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	NM	4.91	2.72	<1	4.97	34.0	5.20	58.4	12.10	< 1.0	10.30
MW-106A	--	--	--	--	--	--	--	--	--	--	--	--	--	1.4	--	0.89	0.41	0.46	--	0.3	--	1.24	--	--	--	< 1.0
MW-106B	--	--	--	--	--	--	--	--	--	--	--	--	--	1.1	--	MN	0.90	1.60	--	5.4	--	4.29	--	--	--	6.14
MW-108A	--	--	--	--	--	--	--	--	--	--	--	--	--	5.68	--	3.43	0.53	2.91	--	4.4	--	2.11	--	--	--	0.69
MW-108B	--	--	--	--	--	--	--	--	--	--	--	--	--	8.5	--	9.37	5.19	3.16	--	2.3	--	2.39	--	--	--	0.79
MW-109A	--	--	--	--	--	--	--	--	--	--	--	--	--	1.06	--	0.31	0.95	0.59	--	2.7	--	0.68	--	--	--	0.59
MW-204	--	--	--	--	--	--	--	--	--	--	--	--	--	1.8	--	3.71	0.58	1.62	--	9.7	--	4.89	--	--	--	2.41
MW-207A	--	--	--	--	--	--	--	--	--	--	--	--	--	2.8	7.97	0.57	1.44	0.81	<1	1.1	1.81	10.6	< 1.0	0.4	0.8	< 1.0
MW-207B	--	--	--	--	--	--	--	--	--	--	--	--	--	11.3	1.14	0.48	0.90	0.63	<1	<1	1.23	4.91	< 1.0	0.20	0.79	< 1.0
MW-210A	--	--	--	--	--	--	--	--	--	--	--	--	--	1.05	2.19	1.19	0.97	0.21	<1	<1	<1	2.89	< 1.0	1.31	0.87	< 1.0
MW-210B	--	--	--	--	--	--	--	--	--	--	--	--	--	140	2.05	0.73	0.42	0.22	<1	<1	<1	44.1	< 1.0	0.21	2.09	< 1.0
MW-303A	0	2.3	6.0	1.2	7.6	5.1	0.0	5.2	1.8	0.0	8.2	0.3	3.7	1.4	0.6	1.15	0.44	1.41	<1	1.2	0.49	<1	0.21	1.87	0.76	< 1.0
NUS-9-1	--	--	--	--	--	--	--	--	--	--	--	--	--	0.93 (22)/1.13 (30)	--	0.90	0.41	3.11	--	--	--	0.16	--	--	--	< 1.0
MW-211B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	NM	0.16	<1	116	8.36	113.0	5.43	22.8	77.3	56.9
PZ-218	2.6	--	8.6	--	7.2	--	0.5	1.6	6.3	2.0	3.3	2.2	28.0	3.4	1.3	dry	19.6	0.8	<1	0.84	18.2	12.2	1.48	2.5	2.53	10.7
CB-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.8	99.3
WPP-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.5	< 1.0
WPP-2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 1.0	< 1.0
WPP-3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.0	16.1

Appendix A

Summary of Field Water Quality Parameters (2000-2012)
Auburn Road Landfill

Well ID	Alkalinity (mg/L)																									
	Spring 2000	Fall 2000	Spring 2001	Fall 2001	Spring 2002	Fall 2002	Spring 2003	Fall 2003	Spring 2004	Fall 2004	Spring 2005	Fall Nov. 2005	Spring 2006	Fall 2006	Spring 2007	Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012
C-1	30	--	260	--	240	--	220	--	280	--	260	--	240	240	240	50	20	180	240	175	145	200	150	800	110	170
MW-212A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	NM	200	240	130	140	130	125	720	--	160
MW-212B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	NM	240	260	120	200	195	200	720	215	175
GZ-1-2R	100	--	200	--	220	--	180	--	200	--	200	--	160	220	160	65	15	220	180	120	115	170	135	500	240	105
GZ-1-3R	--	140	--	140	--	160	--	140	--	140	--	140	--	80	--	100	45	120	160	165	160	135	135	600	200	125
MW-102A	125	140	140	160	120	140	140	140	98	160	180	120	120	60	140	105	115	140	0	125	NM	120	120	180	110	120
MW-109B	210	80	100	80	140	100	40	80	60	40	140	180	40	120	20	90	25	40	40	20	5	35	--	--	160	15
MW-213	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	70	65	20	65	--	--	130	135
MW-302A	340	--	480	--	--	--	460	--	400	--	240	--	440	360	NM	80	35	280	0	235	75	220	320	480	340	205
MW-302BR	320	--	240	--	140	--	180	--	160	--	220	--	160	220	35	160	15	200	135	150	30	145	160	240	160	100
MW-303B	180	160	160	180	180	160	120	180	200	180	200	160	140	120	60	210	125	140	0	125	90	130	130	200	180	140
* NUS-1-2	340	260	340	260	--	120	280	280	200	260	220	200	240	240 (37) / 220 (42)	45	NM	225	200	0	155	60	DRY	--	--	205	260
NUS-2-2	--	80	--	80	--	140	--	120	--	180	--	140	--	210	--	0	50	40	--	45	--	210	--	--	--	120
GZ-6-2R	100	220	200	200	200	240	160	160	160	160	160	140	160	120	30	100	250	180	0	200	50	190	160	160	200	140
GZ-6-3R	100	320	340	300	240	300	320	320	300	220	260	240	300	300	70	280	295	260	0	245	50	170	280	400	340	155
GZ-9-4R	300	240	300	300	280	300	--	260	260	240	270	160	280	220	60	330	100	280	0	195	45	195	--	--	200	115
MW-1A	95	100	120	100	100	80	100	300	360	280	280	80	80	80	80	NM	75	60	100	32.5	60	90	80	340	120	100
MW-1B	25	40	40	80	40	--	--	60	320	250	260	60	80	60	40	25	20	25	40	20	40	30	30	140	110	60
MW-101A	--	--	--	--	--	--	--	--	--	--	--	--	--	80	--	20	75	80	--	75	--	75	--	--	--	60
MW-101B	--	--	--	--	--	--	--	--	--	--	--	--	--	40	--	10	25	40	--	20	--	20	--	--	--	--
MW-104B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	200	190	260	240	240	160	210	105	300	260	155
MW-106A	--	--	--	--	--	--	--	--	--	--	--	--	--	140	--	90	125	125	--	100	--	115	--	--	--	--
MW-106B	--	--	--	--	--	--	--	--	--	--	--	--	--	60	--	45	35	80	--	45	--	60	--	--	--	60
MW-108A	--	--	--	--	--	--	--	--	--	--	--	--	--	140	--	120	85	NM	--	110	--	130	--	--	--	110
MW-108B	--	--	--	--	--	--	--	--	--	--	--	--	--	60	--	35	45	80	--	25	--	30	--	--	--	40
MW-109A	--	--	--	--	--	--	--	--	--	--	--	--	--	160	--	120	130	120	--	115	--	70	--	--	--	105
MW-204	--	--	--	--	--	--	--	--	--	--	--	--	--	160	--	100	20	160	--	20	--	110	--	--	--	105
MW-207A	--	--	--	--	--	--	--	--	--	--	--	--	--	140	40	150	105	120	110	145	140	225	120	140	100	60
MW-207B	--	--	--	--	--	--	--	--	--	--	--	--	--	40	10	40	80	80	70	70	60	50	100	140	75	100
MW-210A	--	--	--	--	--	--	--	--	--	--	--	--	--	160	40	NM	135	140	150	120	140	100	130	500	180	120
MW-210B	--	--	--	--	--	--	--	--	--	--	--	--	--	60	10	35	25	80	50	50	60	50	55	100	100	--
MW-303A	160	160	160	120	180	120	120	200	60	100	120	140	140	160	120	75	110	120	0	110	NM	100	110	200	120	140
NUS-9-1	--	--	--	--	--	--	--	--	--	--	--	--	--	40	--	15	20	40	--	--	--	20	--	--	--	40
MW-211B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	NM	80	160	135	90	75	75	400	70	65
PZ-218	20	--	200	--	180	--	120	100	180	160	120	120	160	200	160	dry	20	120	160	105	105	100	100	60	120	50
CB-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	110	--
WPP-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	180	140
WPP-2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	180	140
WPP-3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	75

µS/cm = micro sieme'-- per centimeter

NM = not measured

-- = not sampled

-- = Not sampled or data not available.

Select monitoring wells were resampled for volatile organic compounds only during the December 2005 Fall sampling round due to laboratory errors.

"*" indicates that the well was sampled at more than one depth during the Fall 2006 sampling round. The data is reported as the concentration followed by the sample depth [i.e., 11.32 (42)/11.21 (37)].

Well MW-211B is the replacement well for PZ-218 and wells MW-212A/212B are the couplet replacement wells for C-1. The Spring 2008 field parameters for MW-211B, MW-212A/212B were from initial sampling after i'--tallation in July 2008.

APPENDIX B

SUMMARY OF HISTORICAL ARSENIC CONCENTRATIONS IN GROUNDWATER MONITORING WELLS (1993-1999)

Appendix B

Summary of Historical Arsenic Concentrations in Groundwater Monitoring Wells (1993 - 1999)
Auburn Road Landfill

Well ID	NHDES AGQS[1]	1993				1994				1995				1996			
		Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
C-1	10	379	457	494	445	432	430	454	--	404	382	354	--	386	354	--	--
GZ-1-2	10	92.7	107	122	93.1	57.3	87.5	101	--	74	89.1	93.9	--	48.6	79	--	--
MW-102A	10	ND	ND	ND	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	ND	--	--
MW-109B	10	185	187	189	190	201	217	188	--	175	188	174	--	177	166	--	--
MW-205	10	10.9	10.7 J	12.7	10.6	8.6	9.4 J	7.2	--	7.8	6.4	8.1	--	11.2	8.1	--	--
MW-302A	10	61.5	67.2	56.9	57.1	57.3	58.9	62.9	--	63.2	47.3	55.4	--	40.8	46.5	--	--
MW-302B	10	207	197	194	200	158	199	233	--	210	219	227	--	202	200	--	--
MW-303B	10	14.1	34.4	41.5	15.5	10.4	23	26.2	--	28	44.6	25.4	--	14.4	33.2	--	--
NUS-1-2	10	392	346	364	366	338	381	339	--	325	312	318	--	268	298	--	--
NUS-2-2	10	129	139	124	120	146	157	152	--	134	125	122	--	105	122	--	--
GZ-6-2R	10	--	--	--	385	395	369	391	--	361	307	298	--	436	317	--	--
GZ-6-3R	10	--	--	153	--	148	162 J	160	--	153	131	--	155	169	146	--	--
GZ-9-4R	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-1A	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-1B	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-303A	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PZ-218	10	599	--	--	--	--	--	--	--	976	540	--	--	948	912	--	--

Appendix B

Summary of Historical Arsenic Concentrations in Groundwater Monitoring Wells (1993 - 1999)
Auburn Road Landfill

Well ID	NHDES AGQS[1]	1997				1998				1999			
		Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
C-1	10	370	--	--	--	344	--	--	--	--	409	--	--
GZ-1-2	10	45	--	--	--	48.8	--	--	--	--	61.2	--	--
MW-102A	10	ND	--	--	ND	ND	--	ND	--	--	ND	ND	--
MW-109B	10	160	--	--	173	2.6	--	76.1	--	--	159	182	--
MW-205	10	--	--	--	9.8	--	--	8.3	--	--	--	--	--
MW-302A	10	36	--	--	--	48.1	--	--	--	--	37.4	--	--
MW-302B	10	210	--	--	--	239	--	--	--	--	211	--	--
MW-303B	10	9	--	--	25.3	17.8	--	41	--	--	36.7	40.2	--
NUS-1-2	10	--	--	--	390	355	--	311	--	--	322	350	--
NUS-2-2	10	130	--	--	173	--	--	141	--	--	--	114	--
GZ-6-2R	10	--	--	--	--	--	--	--	--	--	--	--	--
GZ-6-3R	10	--	--	--	--	--	--	--	--	--	--	--	--
GZ-9-4R	10	--	--	--	--	--	--	--	--	--	--	--	--
MW-1A	10	--	--	--	--	--	--	--	--	--	--	--	--
MW-1B	10	--	--	--	--	--	--	--	--	--	--	--	--
MW-303A	10	--	--	--	--	--	--	--	--	--	--	--	--
PZ-218	10	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

-- = Not sampled or data not available. Results shown are as reported in the Draft 1999 Annual Report by Sevee & Maher Engineers, Inc., 16 February 2000.

All values shown are in units of micrograms per liter (parts per billion).

[1] AGQS = Ambient Groundwater Quality Standard, Effective January 2004.

J = Quantity is estimated due to limitations identified in the quality control review (data review).

ND = not detected

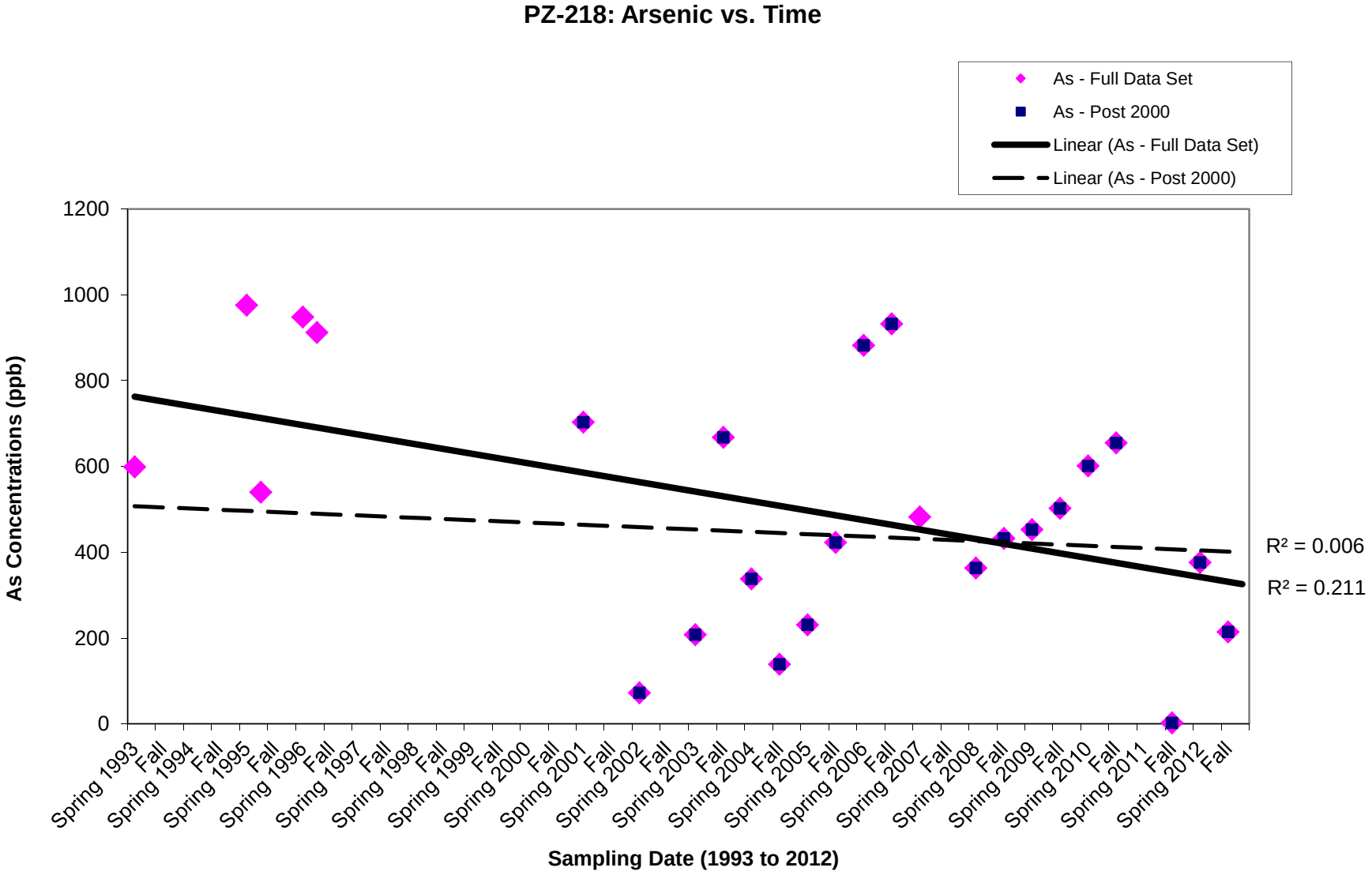
NHDES = New Hampshire Department of Environmental Services

APPENDIX C

TIME VERSUS ARSENIC CONCENTRATION PLOTS FOR SELECTED WELLS (1993-2012 AND 2000-2012)

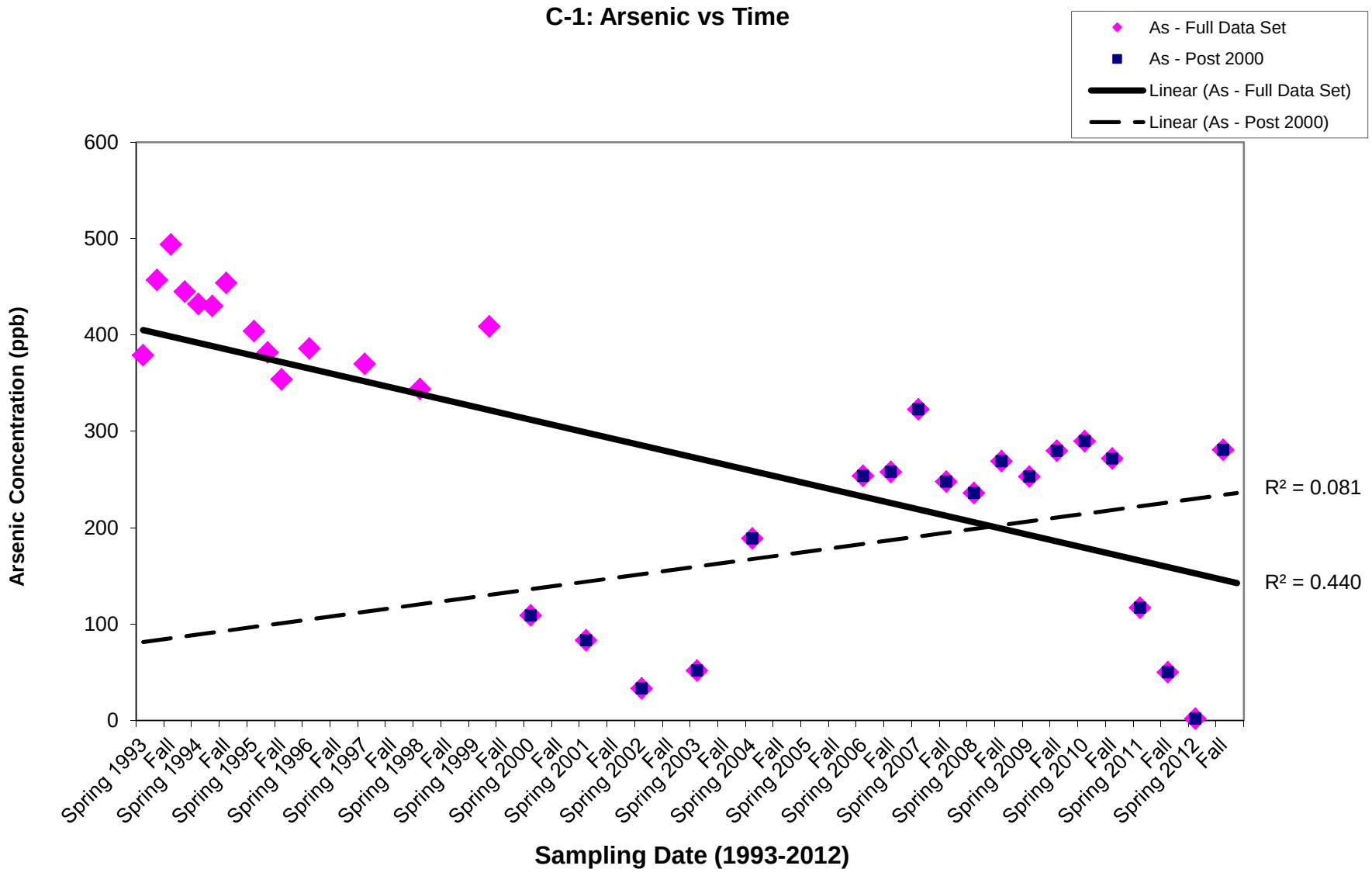
Trend Graph C-1

Piezometer PZ-218 Arsenic Concentrations (1993-2012)



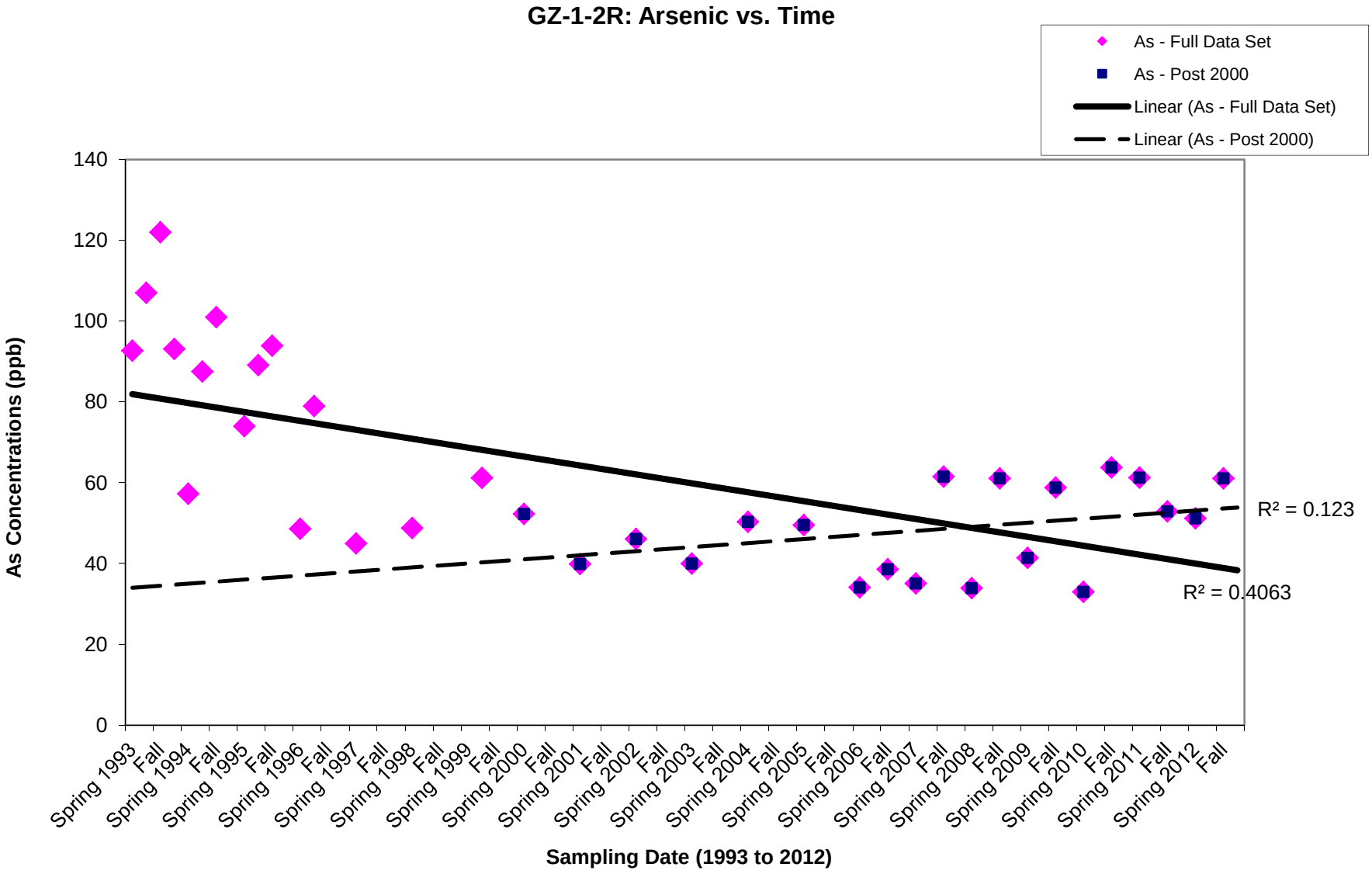
Trend Graph C-2

Bedrock Monitoring Well C-1 Arsenic Concentrations (1993-2012)



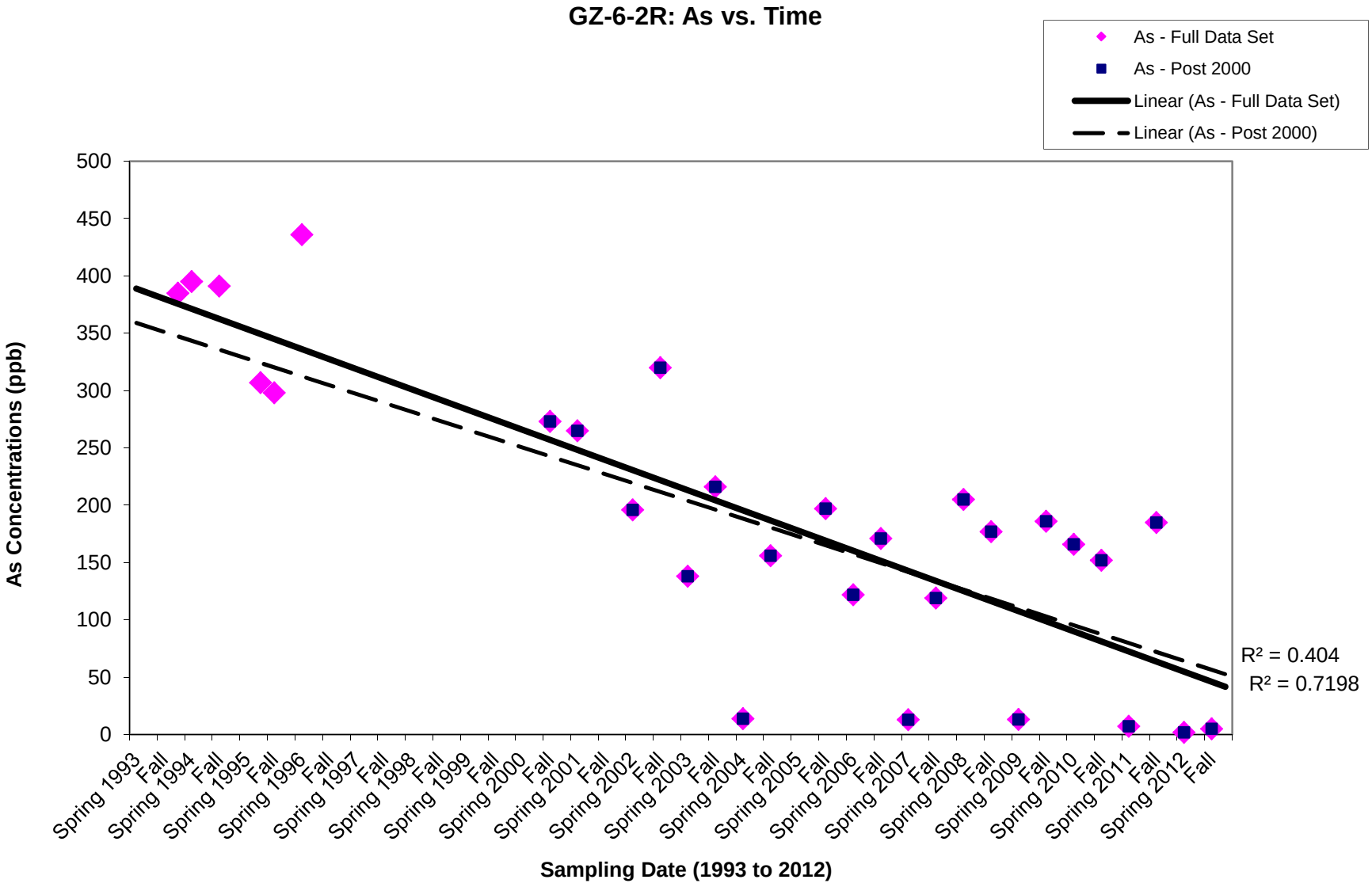
Trend Graph C-3

Overburden Monitoring Well GZ-1-2R Arsenic Concentrations (1993-2012)



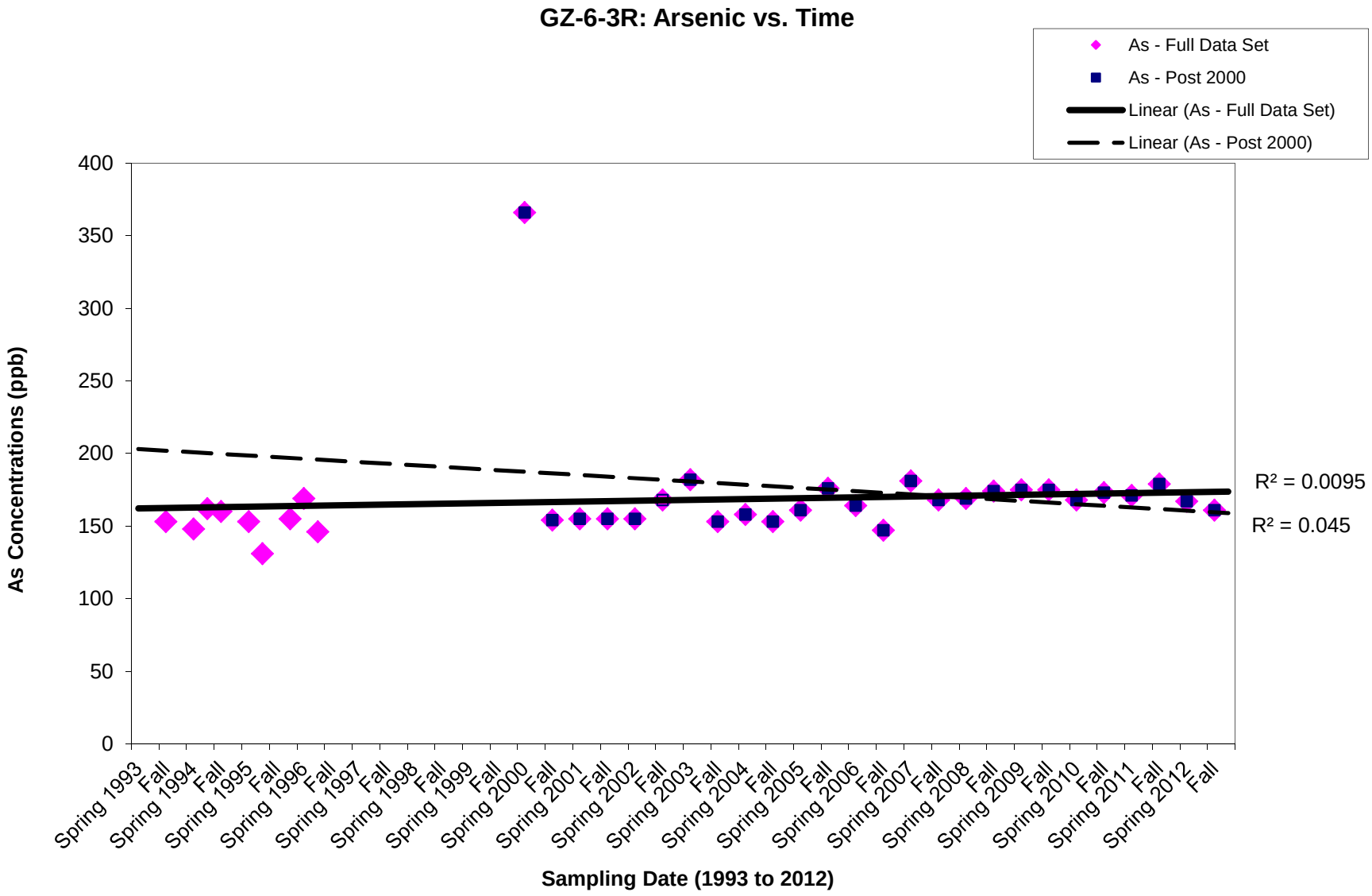
Trend Graph C-4

Overburden Monitoring Well GZ-6-2R Arsenic Concentrations (1993-2012)



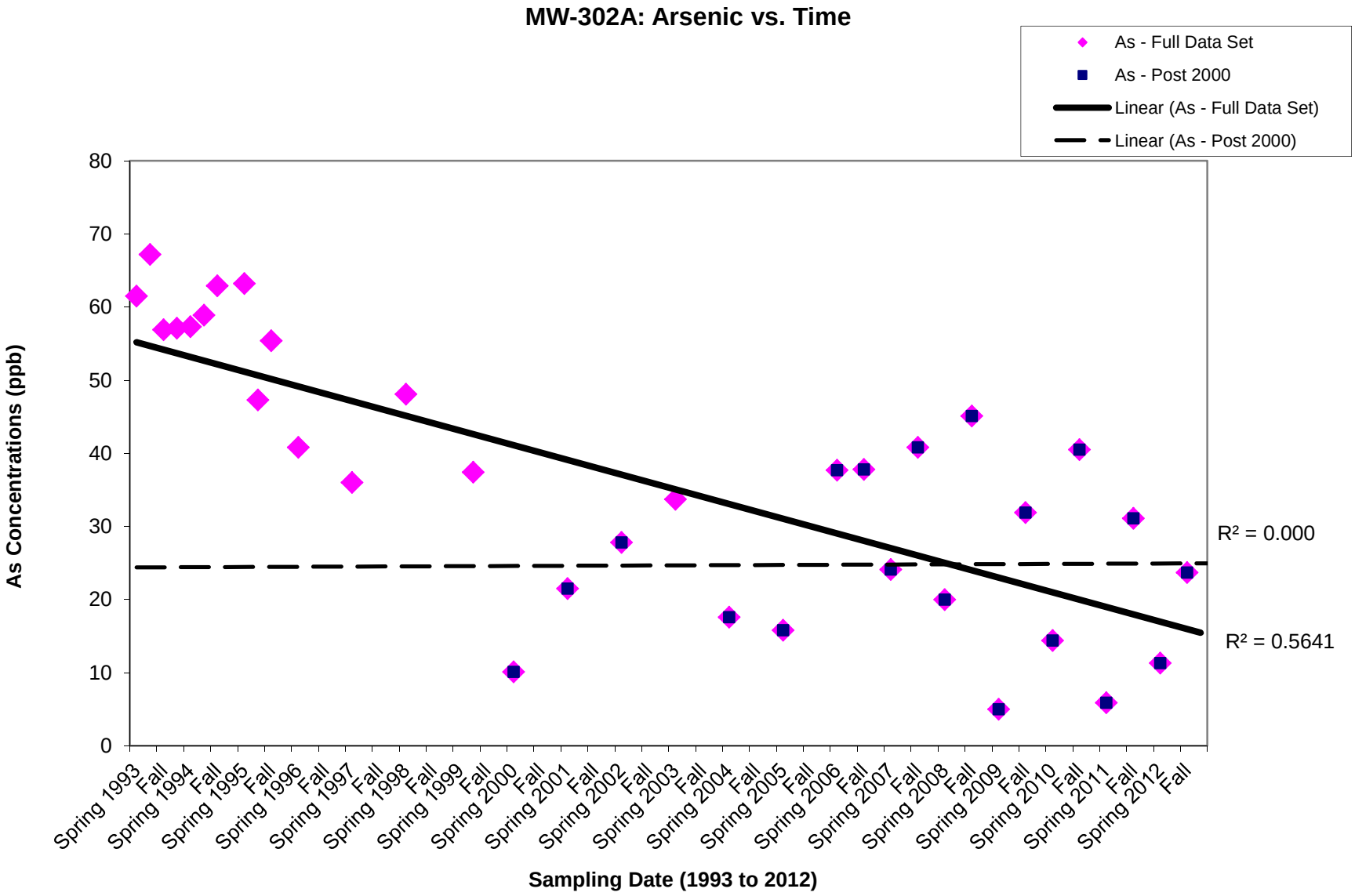
Trend Graph C-5

Overburden Monitoring Well GZ-6-3R Arsenic Concentrations (1993-2012)



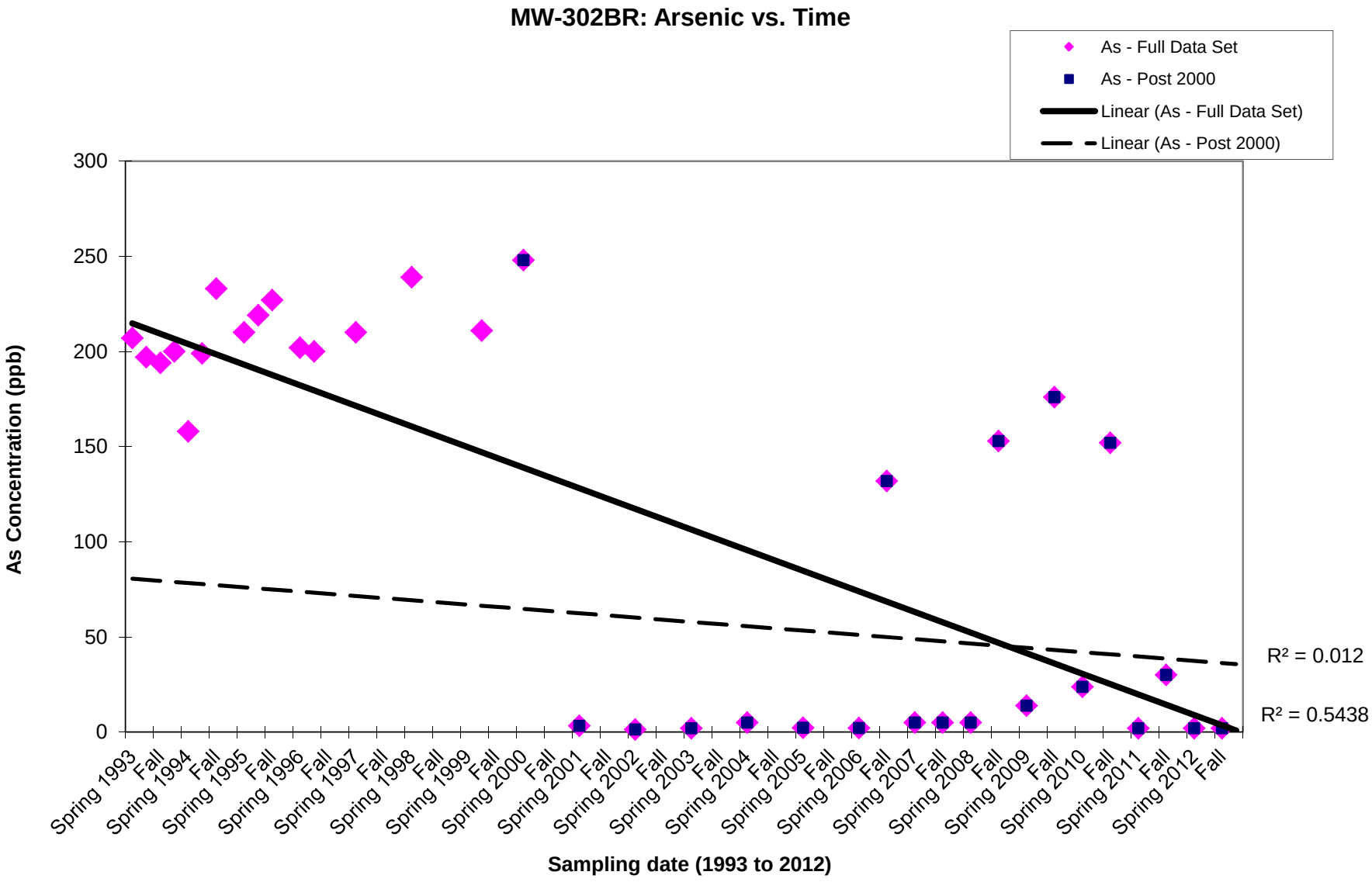
Trend Graph C-6

Bedrock Monitoring Well MW-302A Arsenic Concentrations (1993-2012)



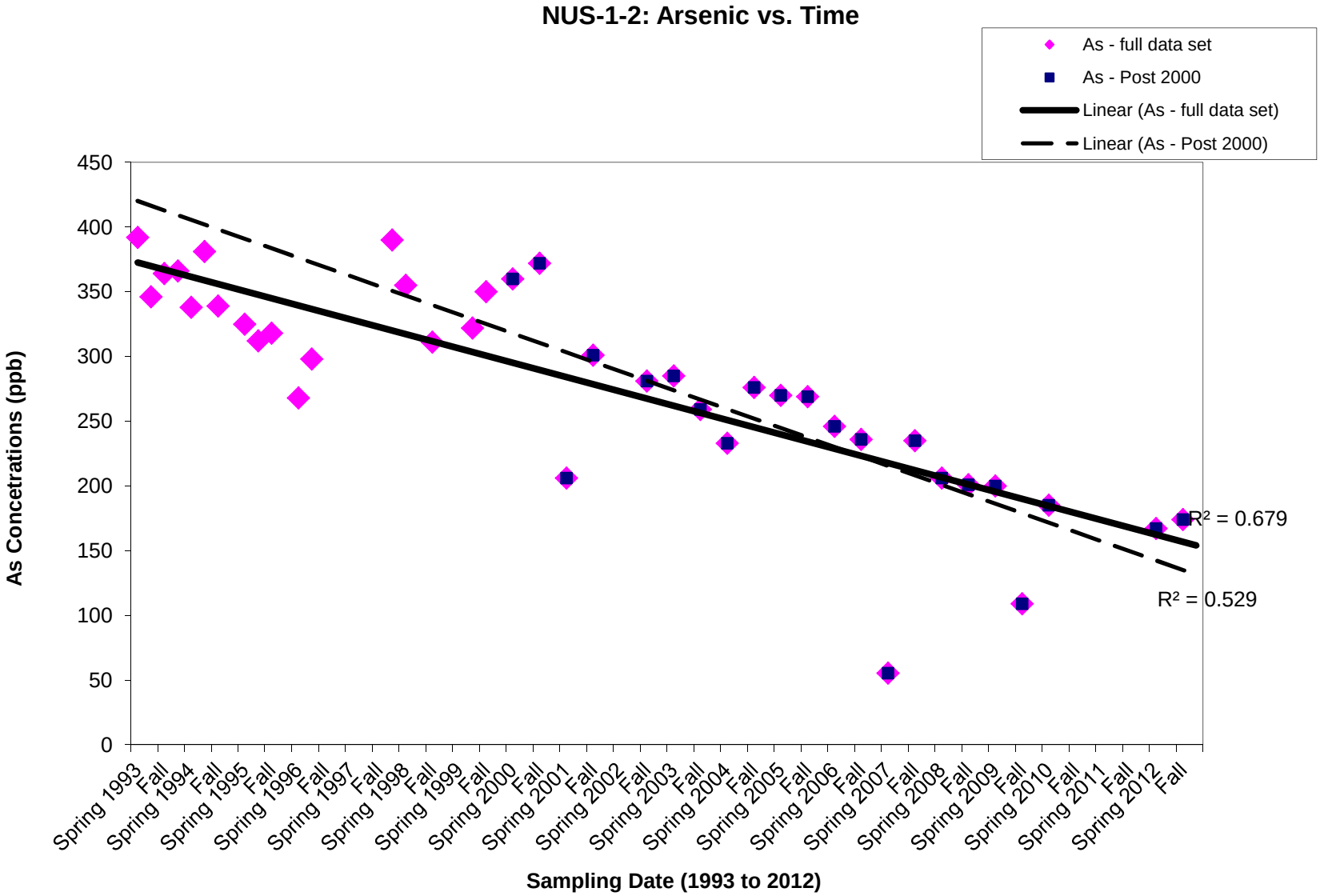
Trend Graph C-7

Overburden Monitoring Well MW-302BR Arsenic Concentrations (1993-2012)



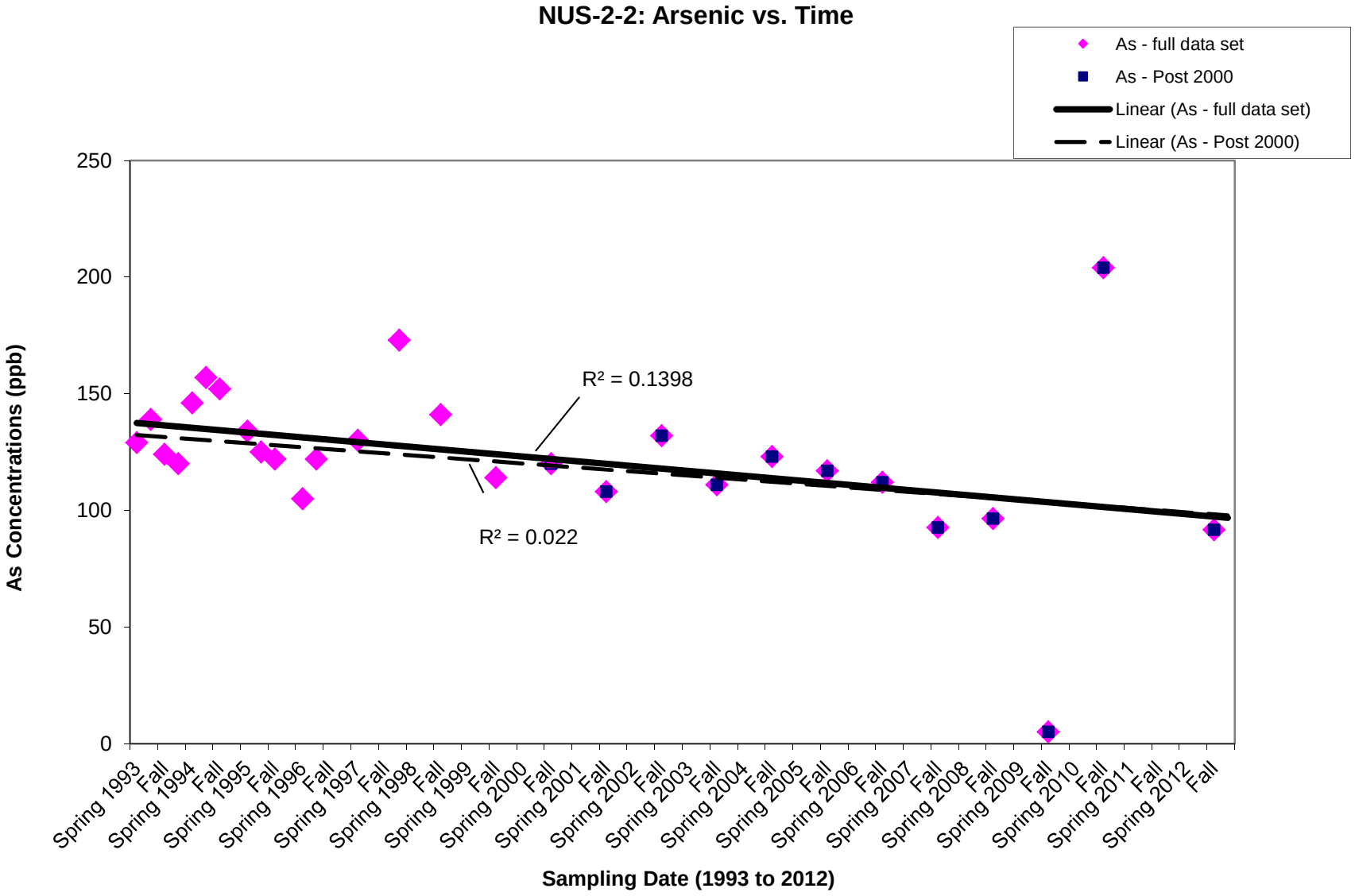
Trend Graph C-8

Overburden Monitoring Well NUS-1-2 Arsenic Concentrations (1993-2012)



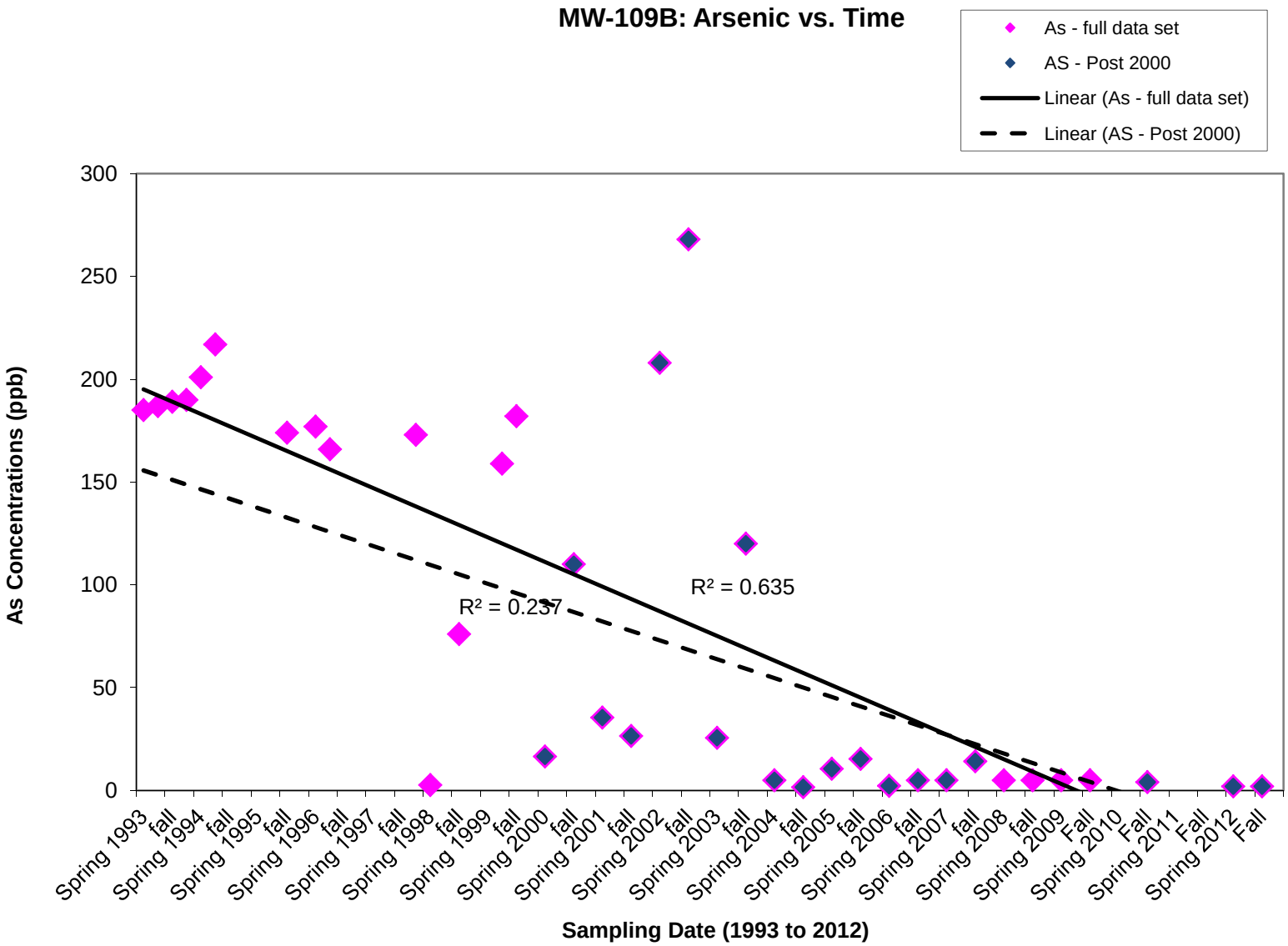
Trend Graph C-9

Overburden Monitoring Well NUS 2-2 Arsenic Concentrations (1993-2012)



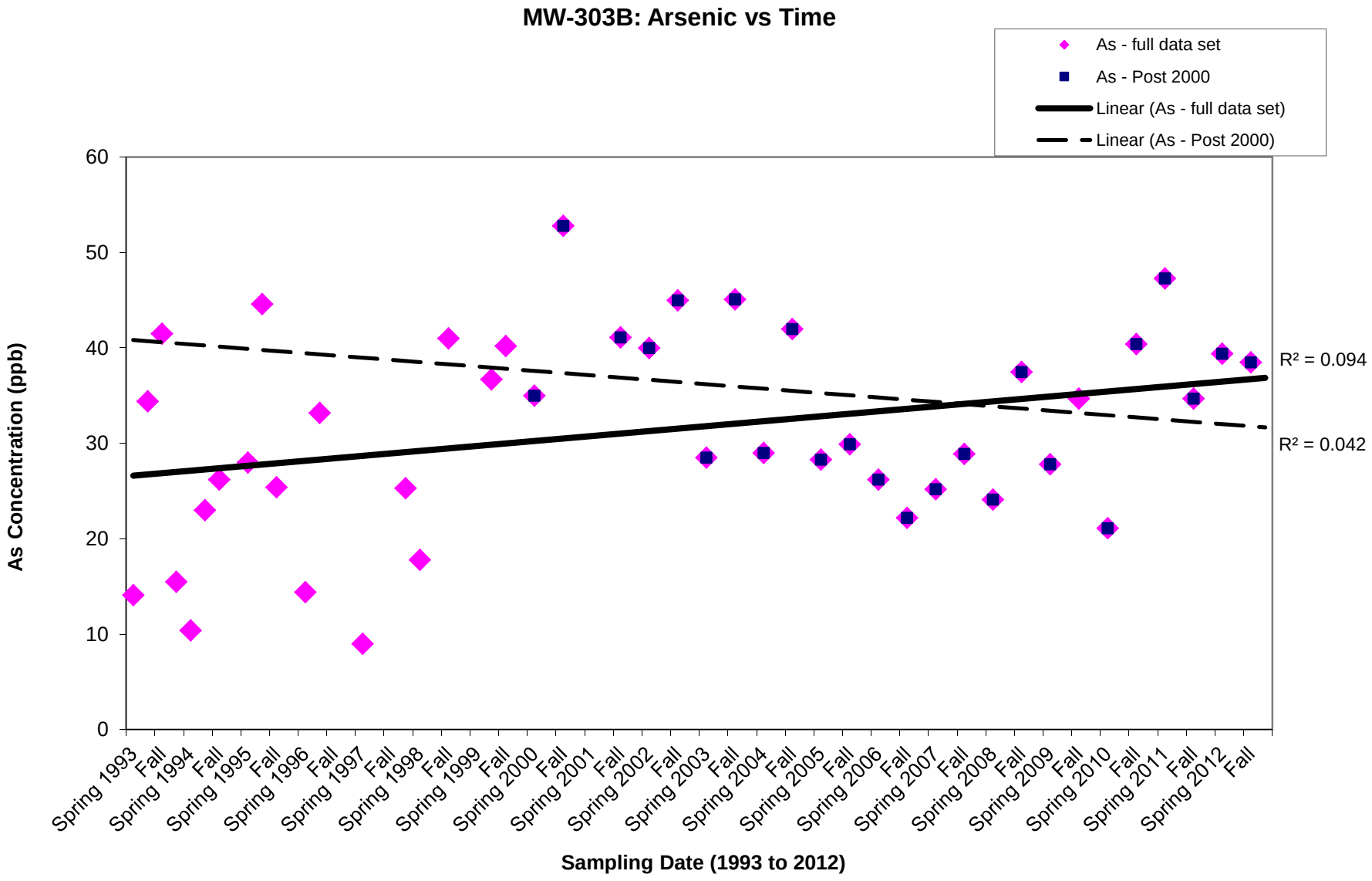
Trend Graph C-10

Overburden Monitoring Well MW-109B Arsenic Concentrations (1993-2012)



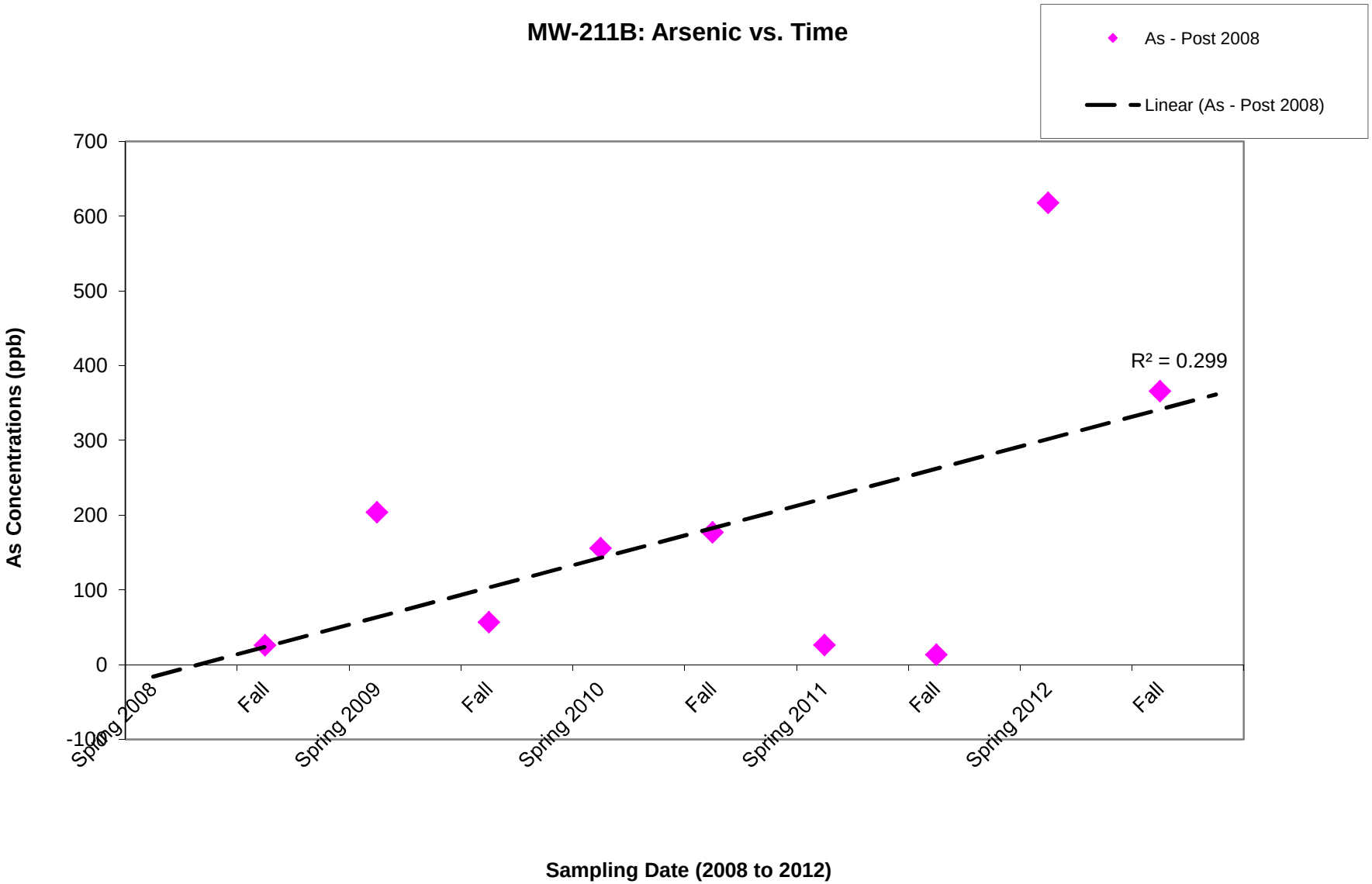
Trend Graph C-11

Overburden Monitoring Well MW-303B Arsenic Concentrations (1993-2012)



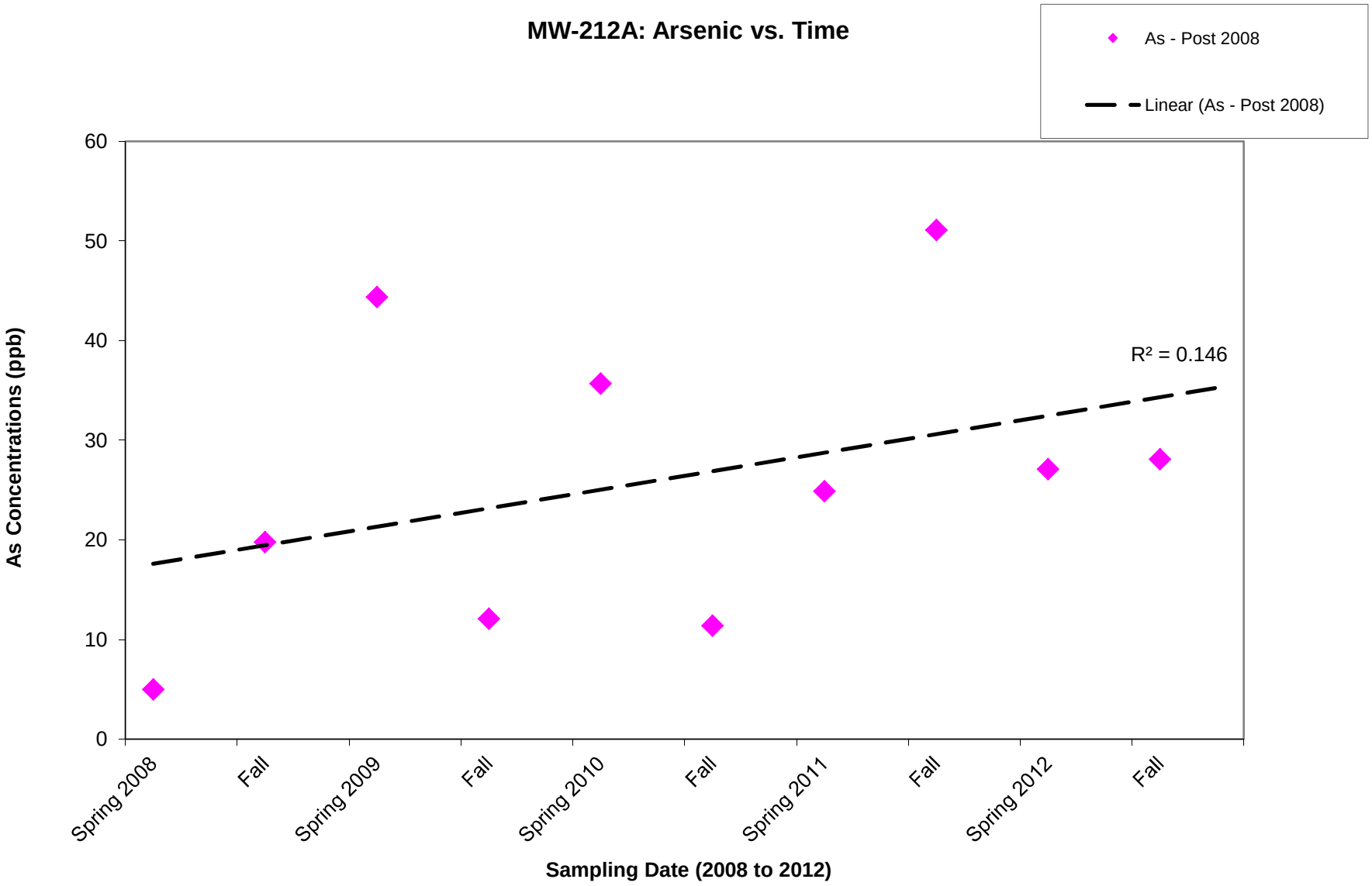
Trend Graph C-12

Overburden Monitoring Well MW-211B Arsenic Concentrations (1993-2012)



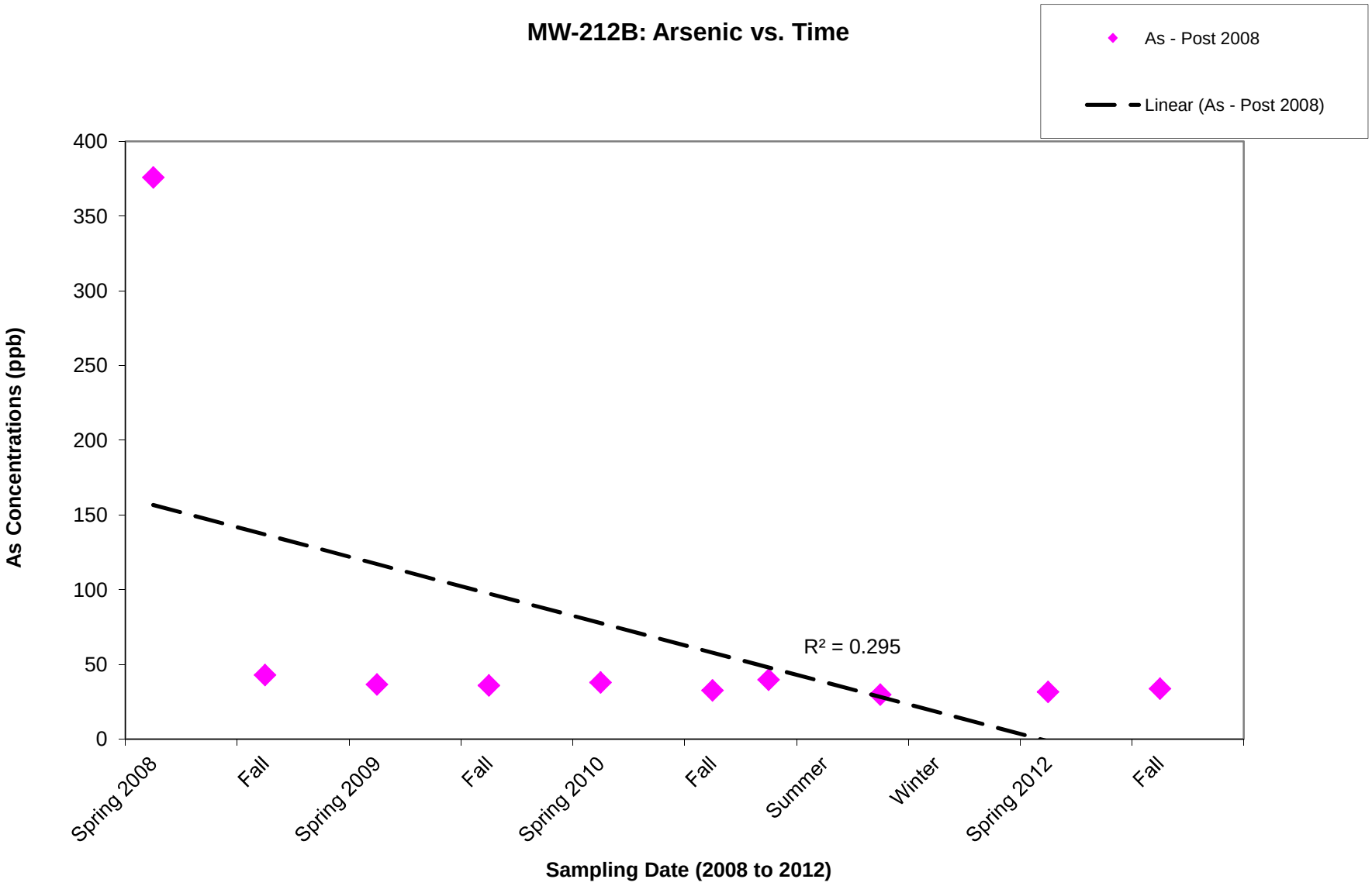
Trend Graph C-13

Bedrock Monitoring Well MW-212A Arsenic Concentrations (1993-2012)



Trend Graph C-14

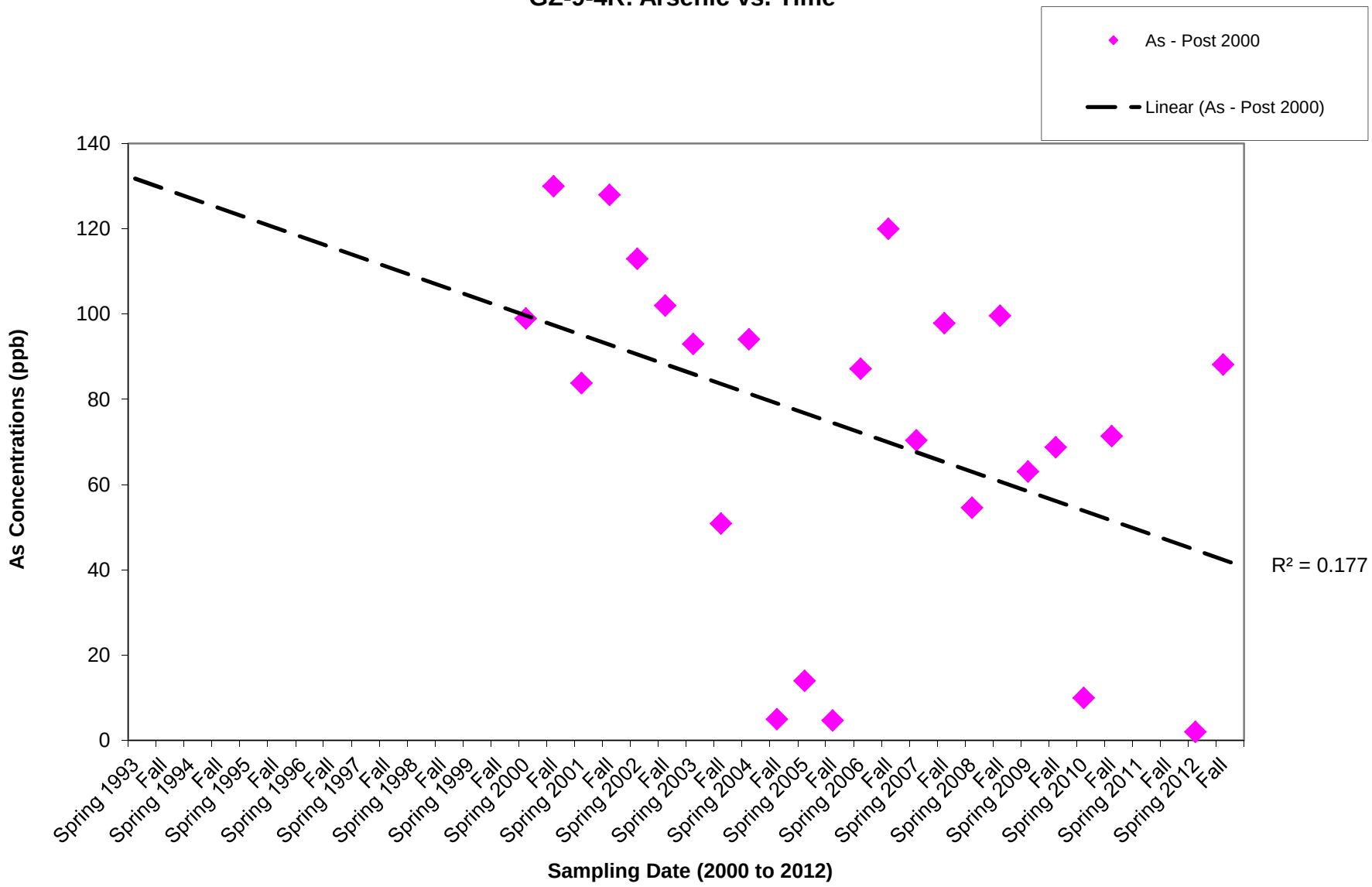
Overburden Monitoring Well MW-212B Arsenic Concentrations (1993-2012)



Trend Graph C-15

Overburden Monitoring Well GZ-9-4R Arsenic Concentrations (1993-2012)

GZ-9-4R: Arsenic vs. Time



APPENDIX D

SUMMARY OF HISTORICAL VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN GROUNDWATER MONITORING WELLS (1993-1999), TIME VERSUS VOLATILE ORGANIC COMPOUND CONCENTRATION PLOTS FOR SELECTED WELLS (1993-2012 AND 2000-2012)

Appendix D

Summary of Vinyl Chloride Concentrations in Groundwater Monitoring Wells (1993 - 1999)
Auburn Road Landfill

Well	NHDES	1993				1994				1995				1996			
ID	AGQS	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
GZ-1-3R	2	--	4 U	1 J	5 U	6 U	3 U	4 U	--	--	--	--	--	--	--	--	--
MW-102A	2	--	--	--	--	--	2 U	4 U	--	2 U	2 U	2 U	--	2 UJ	2 U	--	--
MW-205	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-1-2	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-2-2	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-303A*	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Appendix D

Summary of Vinyl Chloride Concentrations in Groundwater Monitoring Wells (1993 - 1999)
Auburn Road Landfill

Well ID	NHDES AGQS	1997				1998				1999			
		Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
GZ-1-3R	2	1 U	--	--	2 U	--	--	2 U	--	--	--	1 U	--
MW-102A	2	0.5 U	--	--	2 U	2 U	--	2 U	--	--	3.3 U	1 U	--
MW-205	2	--	--	--	2 UJ	--	--	2 U	--	--	--	1 U	--
NUS-1-2	2	--	--	--	2 U	--	--	1 J	--	--	--	1 U	--
NUS-2-2	2	0.5 U	--	--	2 U	--	--	1 J	--	--	--	1 U	--
MW-303A*	2	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

-- = Not sampled or data not available. Data collected prior to the 2000 sampling event is as reported in the

U = The compound was not detected and the associated numerical sample quantitation limit.

J = The associated numerical value is an estimated quantity.

NHDES AGQS = New Hampshire Department of Environmental Services Ambient Groundwater Quality Standard

All values shown in units of micrograms per Liter (parts per billion).

*Well MW-303A is not part of the Long-Term Environmental Monitoring Plan; however, it was sampled in 2000-2002 at the request of the United States Environmental Protection Agency.

UJ = Compound was not detected and the associated numerical sample quantitation limit was estimated.

Appendix D

Summary of Trans-1,2-Dichloroethylene Concentrations in Groundwater Monitoring Wells (1993 - 1999)
Auburn Road Landfill

Well	NHDES	1993				1994				1995			
ID	AGQS	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
GZ-1-3R	100	--	2 U	2U	2U	2U	2 U	2 U	--	--	--	--	--
MW-102A	100	--	--	--	--	--	1 U	2 U	--	1 U	1 U	2 U	--
MW-205	100	--	--	--	--	--	--	--	--	--	--	--	--
NUS-1-2	100	--	--	--	--	--	--	--	--	--	--	--	--
NUS-2-2	100	--	--	--	--	--	--	--	--	--	--	--	--
MW-303A*	100	--	--	--	--	--	--	--	--	--	--	--	--

Appendix D

Summary of Trans-1,2-Dichloroethylene Concentrations in Groundwater Monitoring Wells (1993 - 1999)
Auburn Road Landfill

Well	NHDES	1996				1997				1998				1999			
ID	AGQS	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
GZ-1-3R	100	--	--	--	--	1 U	--	2 U	--	--	--	2 U	--	--	--	1 U	--
MW-102A	100	1 UJ	1 U	--	--	0.5 U	--	--	2 U	2 U	--	2 U	--	--	3.3 U	1 U	--
MW-205	100	--	--	--	--	--	--	--	2 U	--	--	2 U	--	--	--	1 U	--
NUS-1-2	100	--	--	--	--	--	--	--	2 U	--	--	2 U	--	--	--	1 U	--
NUS-2-2	100	--	--	--	--	0.5 U	--	--	2 U	--	--	2 U	--	--	--	1 U	--
MW-303A*	100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

-- = Not sampled or data not available. Data collected prior to the 2000 sampling event is as reported in the Draft 1999 Annual Report by Sevee & Maher Engineers, Inc., 16 February 2000.

U = The compound was not detected at the associated numerical sample quantitation limit.

NHDES AGQS = New Hampshire Department of Environmental Services Ambient Groundwater Quality Standard

All values shown in units of micrograms per Liter (parts per billion).

*Well MW-303A is not part of the Long-Term Environmental Monitoring Plan; however, it was sampled in 2000-2002 at the request of the United States Environmental Protection Agency.

Appendix D

Summary of 2-Butanone Concentrations in Groundwater Monitoring Wells (1993 - 1999)
Auburn Road Landfill

Well	NHDES	1993				1994				1995				1996			
ID	AGQS	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
GZ-1-3R	170	--	***330 D***	***350 D***	***430 D***	***320 D***	***210 D***	***250 D***	--	--	--	--	--	--	--	--	--
MW-102A	170	--	--	--	--	--	5 U	10 U	--	5 U	5 U	2 U	--	2 UJ	2 U	--	--
MW-205	170	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-1-2	170	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-2-2	170	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-303A*	170	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Appendix D

Summary of 2-Butanone Concentrations in Groundwater Monitoring Wells (1993 - 1999)
Auburn Road Landfill

Well	NHDES	1997				1998				1999			
ID	AGQS	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
GZ-1-3R	170	110	--	--	40	--	--	52	--	--	--	32	--
MW-102A	170	5 U	--	--	5 U	5 U	--	--	5 U	--	16 U	5 U	--
MW-205	170	--	--	--	5 U	--	--	5 U	--	--	--	5 U	--
NUS-1-2	170	--	--	--	5 U	--	--	5 U	--	--	--	5 U	--
NUS-2-2	170	5 U	--	--	5 U	--	--	5 U	--	--	--	5 U	--
MW-303A*	170	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

-- = Not sampled or data not available. Data collected prior to the 2000 sampling event is as reported in the Draft 1999 Annual Report by Sevee & Maher Engineers, Inc., 16 February 2000.

D = Compound concentration determined in analysis at secondary dilution factor.

U = The compound was not detected at the associated numerical sample quantitation limit.

UJ = Compound was not detected and the associated numerical sample quantitation limit was estimated.

NHDES AGQS = New Hampshire Department of Environmental Services Ambient Groundwater Quality Standard

Values shown in ***Bold*** indicate that the compound was detected om excess of NHDES AGQS.

All values shown in units of micrograms per Liter (parts per billion).

*Well MW-303A is not part of the Long-Term Environmental Monitoring Plan; however, it was sampled in 2000-2002 at the request of the United States Environmental Protection Agency.

Appendix D

Summary of Trichloroethylene Concentrations in Groundwater Monitoring Wells (1993 - 1999)
Auburn Road Landfill

Well	NHDES	1993				1994				1995				1996			
ID	AGQS	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
GZ-1-3R	5	--	2	2	2 U	3 U	2 U	2 J	--	--	--	--	--	--	--	--	--
MW-102A	5	--	--	--	--	--	***34***	***62***	--	***44 D***	***39 D***	***44 D***	--	***32 D***	***52 D***	--	--
MW-205	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-1-2	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-2-2	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-303A*	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Appendix D

Summary of Trichloroethylene Concentrations in Groundwater Monitoring Wells (1993 - 1999)
Auburn Road Landfill

Well	NHDES	1997				1998				1999			
ID	AGQS	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
GZ-1-3R	5	1 U	--	--	3	--	--	2	--	--	--	2.5	--
MW-102A	5	***38 D***	--	--	***63***	***63***	--	***61***	--	--	***56***	***64 D***	--
MW-205	5	--	--	--	1 U	--	--	1 U	--	--	--	1 U	--
NUS-1-2	5	--	--	--	0.6 J	--	--	1 B	--	--	--	1 U	--
NUS-2-2	5	0.5 U	--	--	1 U	--	--	2 B	--	--	--	1 U	--
MW-303A*	5	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

-- = Not sampled or data not available. Data collected prior to the 2000 sampling event is as reported in the Draft 1999 Annual Report by Sevee & Maher Engineers, Inc., 16 February 2000.

U = The compound was not detected at the associated numerical sample quantitation limit.

J = The associated numerical value is an estimated quantity.

NHDES AGQS = New Hampshire Department of Environmental Services Ambient Groundwater Quality Standard

D = Compound concentration determined in analysis at secondary dilution factor.

B = The analyte was found in the blank as well as in the sample.

Values shown in ***Bold*** indicate that the compound was detected om excess of NHDES AGQS.

*Well MW-303A is not part of the Long-Term Environmental Monitoring Plan; however, it was sampled in 2000-2002 at the request of the United States Environmental Protection Agency.

Appendix D

Summary of Benzene Concentrations in Groundwater Monitoring Wells (1993 - 1999)
Auburn Road Landfill

Well	NHDES	1993				1994				1995				1996			
ID	AGQS	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
GZ-1-3R	5	--	***5***	***5***	***5***	***5***	4	4 J	--	--	--	--	--	--	--	--	--
MW-102A	5	--	--	--	--	--	1 U	2 U	--	1 U	1 U	2 U	--	1 UJ	1 U	--	--
MW-205	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-1-2	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-2-2	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-303A*	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Appendix D

Summary of Benzene Concentrations in Groundwater Monitoring Wells (1993 - 1999)
Auburn Road Landfill

Well ID	NHDES AGQS	1997				1998				1999			
		Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
GZ-1-3R	5	***5***	--	--	3	--	--	4	--	--	--	2.8	--
MW-102A	5	0.5 U	--	--	1 U	1 U	--	1 U	--	--	3.3 U	1 U	--
MW-205	5	--	--	--	1 U	--	--	1 U	--	--	--	1 U	--
NUS-1-2	5	--	--	--	2	--	--	2	--	--	--	1.8	--
NUS-2-2	5	1	--	--	1	--	--	2	--	--	--	1 U	--
MW-303A*	5	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

-- = Not sampled or data not available. Data collected prior to the 2000 sampling event is as reported in the Draft 1999 Annual Report by Sevee & Maher Engineers, Inc., 16 February 2000.

U = The compound was not detected at the associated numerical sample quantitation limit.

J = The associated numerical value is an estimated quantity.

UJ = Compound was not detected and the associated numerical sample quantitation limit was estimated.

NHDES AGQS = New Hampshire Department of Environmental Services Ambient Groundwater Quality Standard

Values shown in ***Bold*** indicate that the compound was detected om excess of NHDES AGQS.

All values shown in units of micrograms per Liter (parts per billion).

*Well MW-303A is not part of the Long-Term Environmental Monitoring Plan; however, it was sampled in 2000-2002 at the request of the United States Environmental Protection Agency.

Appendix D

Summary of Tetrachloroethylene Concentrations in Groundwater Monitoring Wells (1993 - 1999)
Auburn Road Landfill

Well	NHDES	1993				1994				1995				1996			
ID	AGQS	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
GZ-1-3R	5	--	2 U	2 U	2 U	3 U	2 U	2 U	--	--	--	--	--	--	--	--	--
MW-102A	5	--	--	--	--	--	***77 D***	***160 D***	--	***150 D***	***78 D***	***100 D***	--	***64 D***	***92 D***	--	--
MW-205	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-1-2	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-2-2	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-303A*	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Appendix D

Summary of Tetrachloroethylene Concentrations in Groundwater Monitoring Wells (1993 - 1999)
Auburn Road Landfill

Well ID	NHDES AGQS	1997				1998				1999			
		Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
GZ-1-3R	5	1 U	--	--	1 U	--	--	1 U	--	--	--	1 U	--
MW-102A	5	***82 D***	--	--	***150***	***130***	--	***110 B***	--	--	***99***	***110 D***	--
MW-205	5	--	--	--	1 U	--	--	2 B	--	--	--	1 U	--
NUS-1-2	5	--	--	--	1 U	--	--	1 U	--	--	--	1 U	--
NUS-2-2	5	0.5 U	--	--	1 U	--	--	1 U	--	--	--	1 U	--
MW-303A*	5	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

-- = Not sampled or data not available. Data collected prior to the 2000 sampling event is as reported in the Draft 1999 Annual Report by Sevee & Maher Engineers, Inc., 16 February 2000.

U = The compound was not detected at the associated numerical sample quantitation limit.

D = Compound concentration determined in analysis at secondary dilution factor.

B = The analyte was found in the blank as well as in the sample.

NHDES AGQS = New Hampshire Department of Environmental Services Ambient Groundwater Quality Standard

Values shown in ***Bold*** indicate that the compound was detected om excess of NHDES AGQS.

All values shown in units of micrograms per Liter (parts per billion).

*Well MW-303A is not part of the Long-Term Environmental Monitoring Plan; however, it was sampled in 2000-2002 at the request of the United States Environmental Protection Agency.

Appendix D

Summary of Toluene Concentrations in Groundwater Monitoring Wells (1993 - 1999)
Auburn Road Landfill

Well	NHDES	1993				1994				1995				1996			
ID	AGQS	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
GZ-1-3R	1,000	--	380 DJ	340 D	340 D	310 D	240 D	190 D	--	--	--	--	--	--	--	--	--
MW-102A	1,000	--	--	--	--	--	1 U	2 U	--	1 U	1 U	2 U	--	1 U	0.6 J	--	--
MW-205	1,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-1-2	1,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NUS-2-2	1,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-303A*	1,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Appendix D

Summary of Toluene Concentrations in Groundwater Monitoring Wells (1993 - 1999)
Auburn Road Landfill

Well	NHDES	1997				1998				1999			
ID	AGQS	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
GZ-1-3R	1,000	92	--	--	65	--	--	59	--	--	--	27	--
MW-102A	1,000	0.5 U	--	--	1 U	1 U	--	1 U	--	--	3.3 U	1 U	--
MW-205	1,000	--	--	--	1 U	--	--	1 U	--	--	--	1 U	--
NUS-1-2	1,000	--	--	--	0.5 J	--	--	0.6 J	--	--	--	0.34 J	--
NUS-2-2	1,000	0.5 U	--	--	1 U	--	--	1 U	--	--	--	1 U	--
MW-303A*	1,000	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

-- = Not sampled or data not available. Data collected prior to the 2000 sampling event is as reported in the Draft 1999 Annual Report by Sevee & Maher Engineers, Inc., 16 February 2000.

U = The compound was not detected at the associated numerical sample quantitation limit.

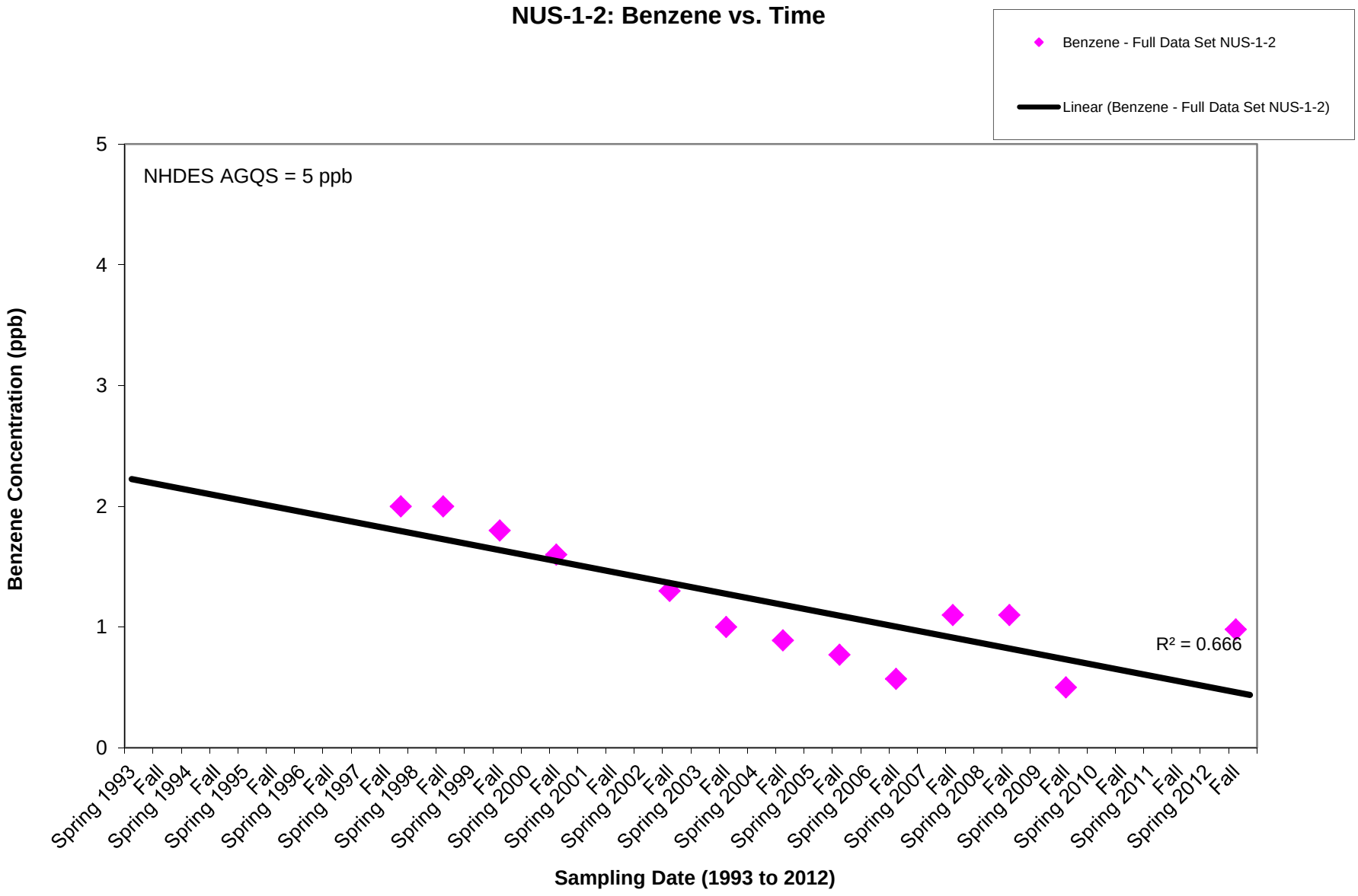
J = The associated numerical value is an estimated quantity.

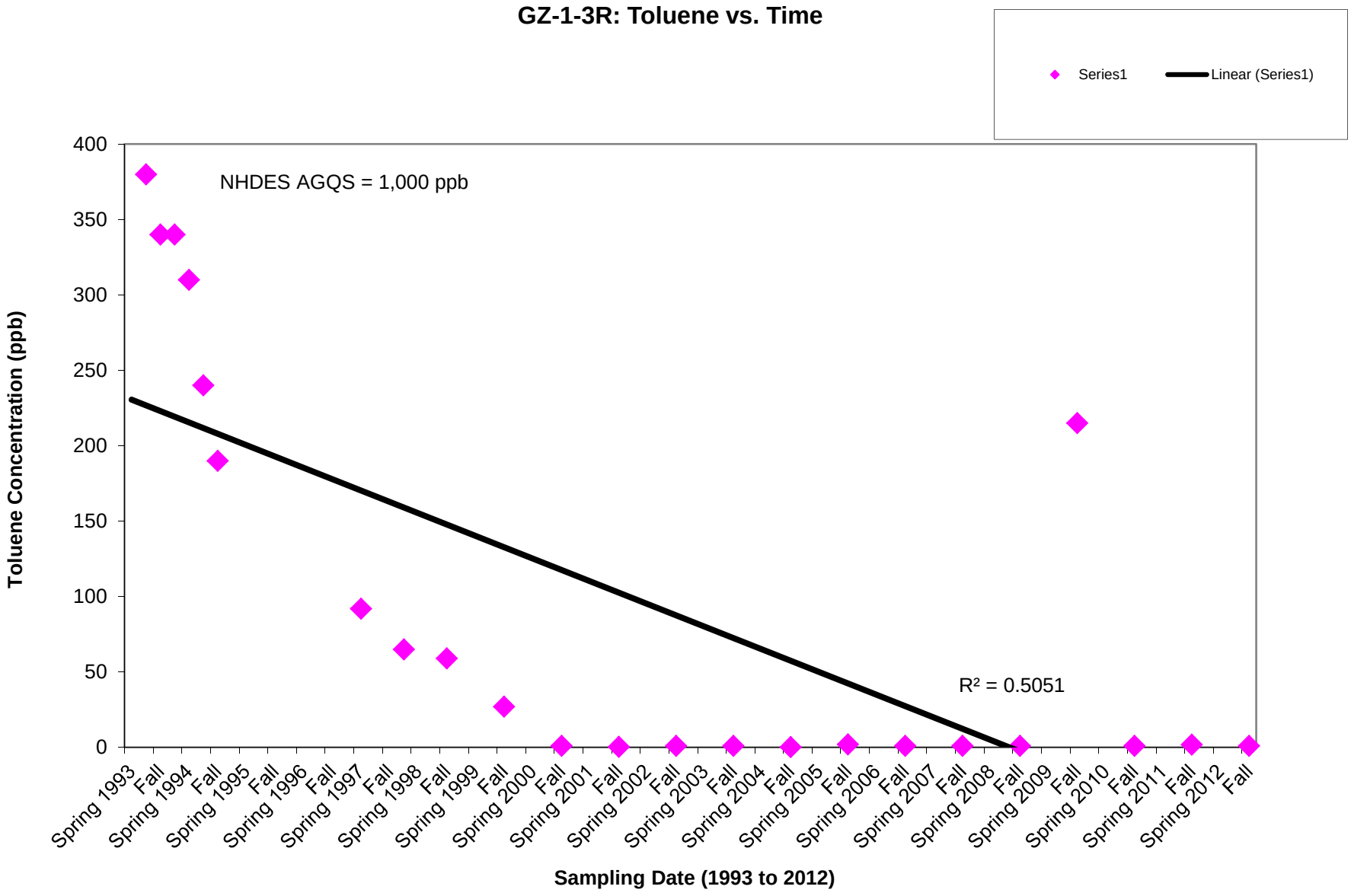
D = Compound concentration determined in analysis at secondary dilution factor.

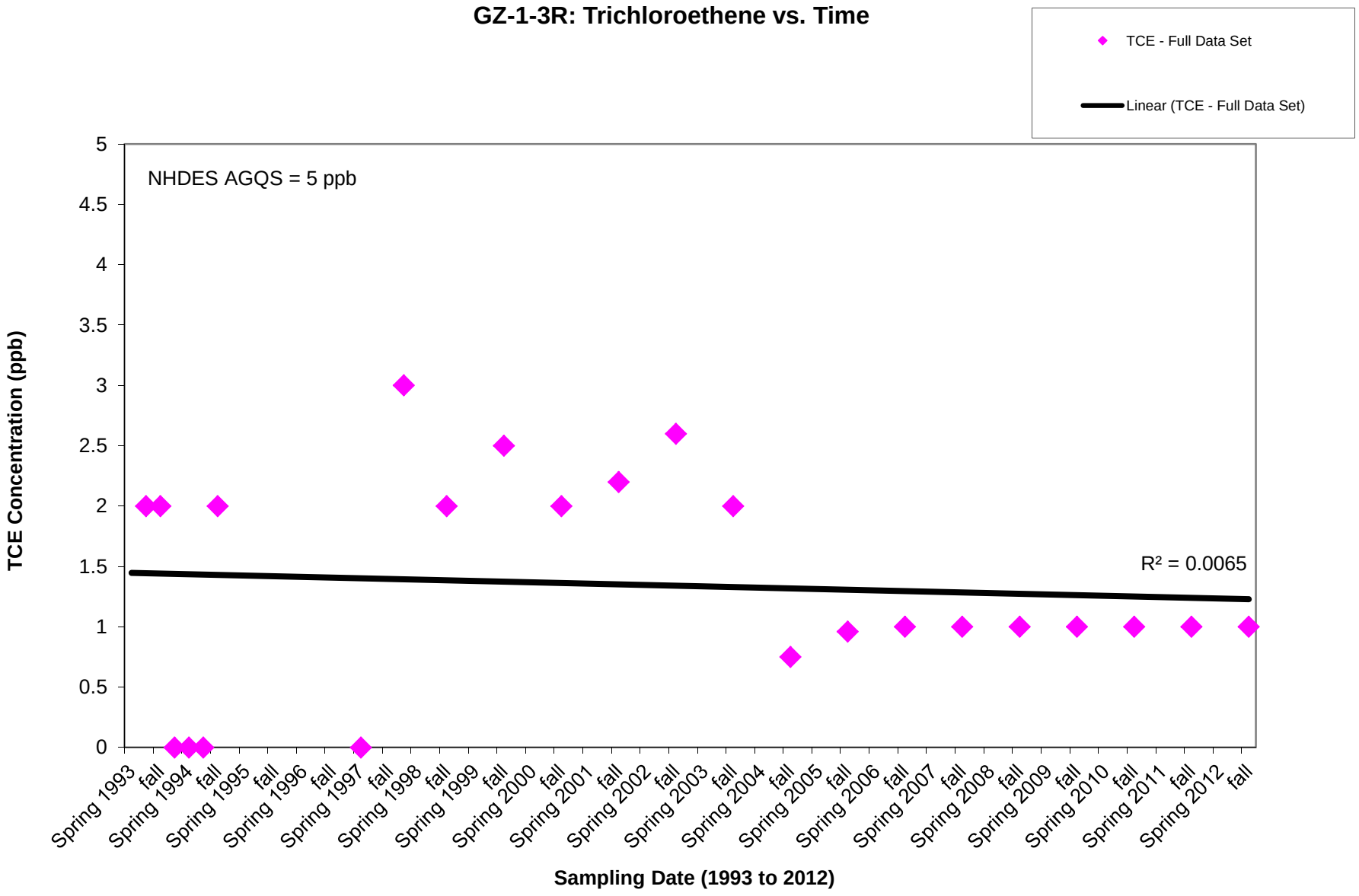
NHDES AGQS = New Hampshire Department of Environmental Services Ambient Groundwater Quality Standard

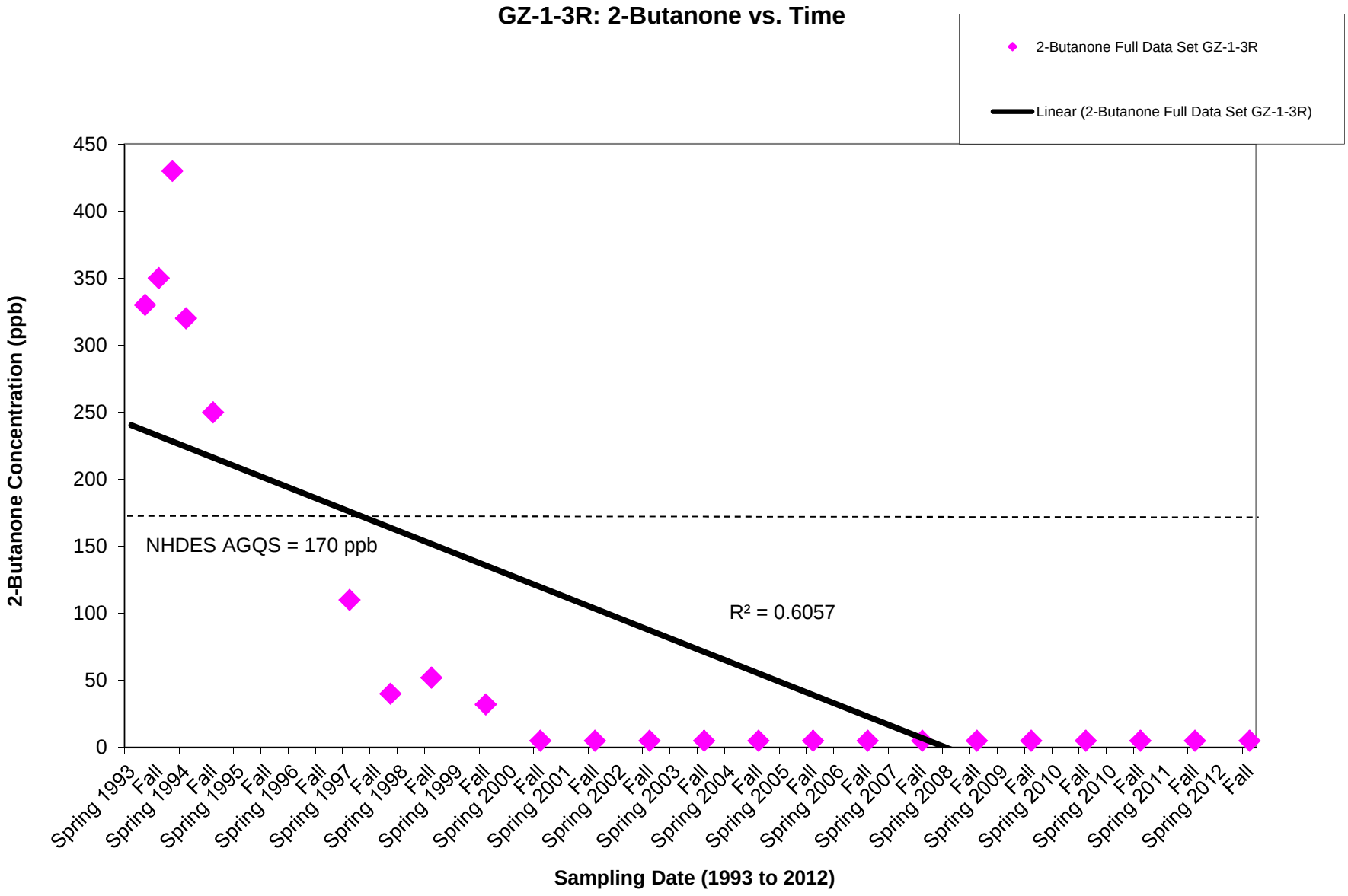
All values shown in units of micrograms per Liter (parts per billion).

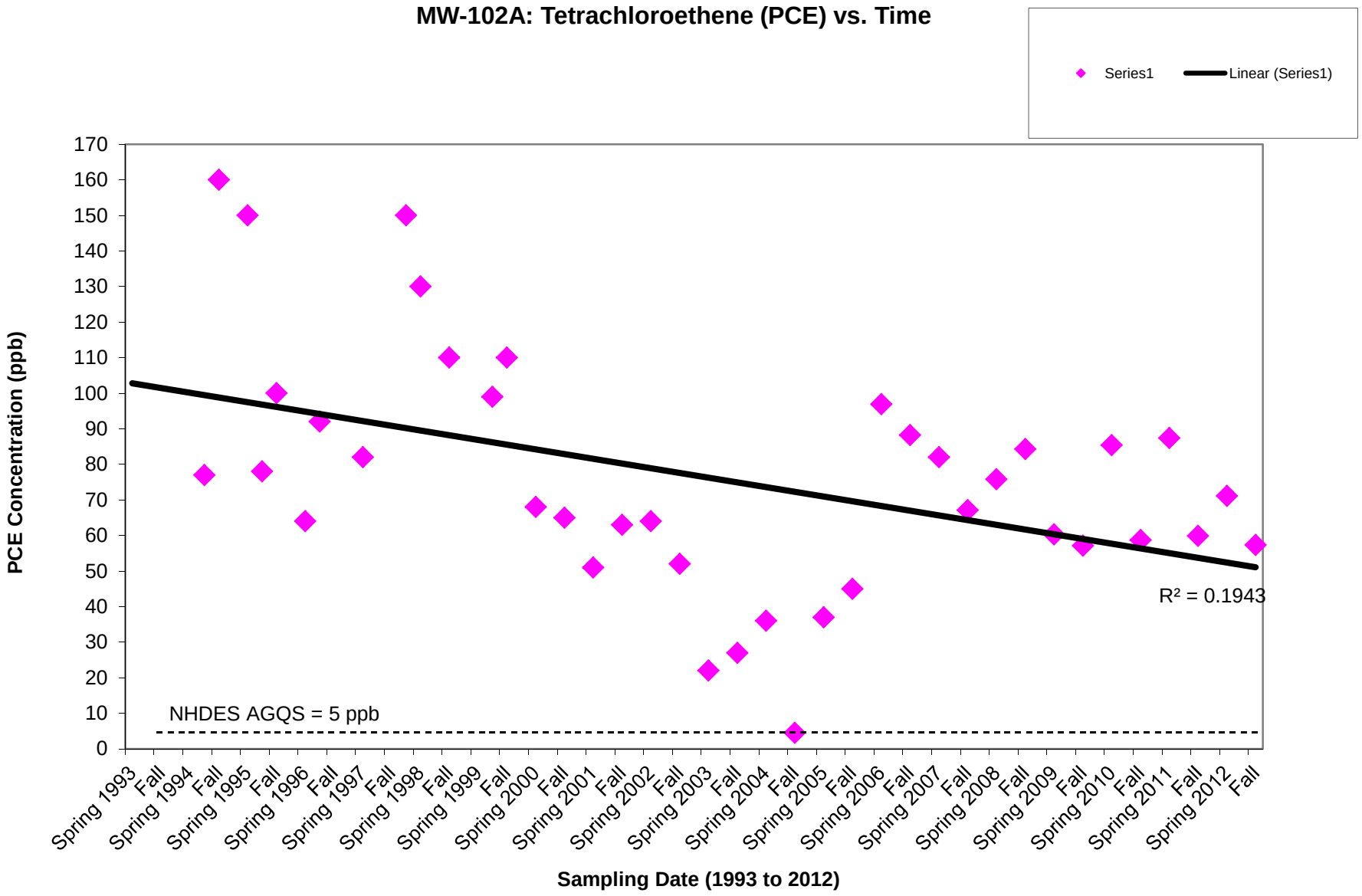
*Well MW-303A is not part of the Long-Term Environmental Monitoring Plan; however, it was sampled in 2000-2002 at the request of the United States Environmental Protection Agency.

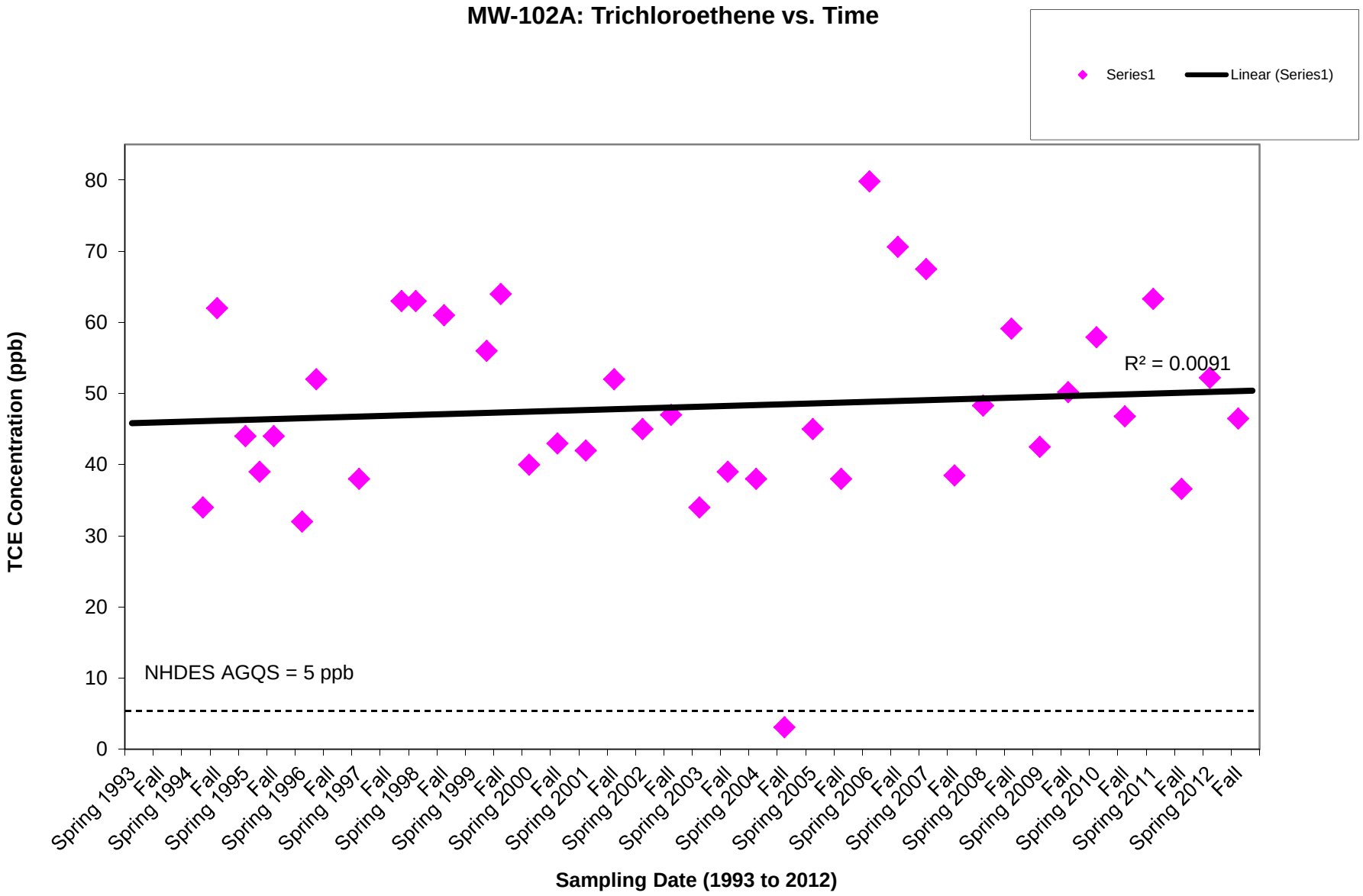

NUS-1-2: Benzene vs. Time
Benzene - Full Data Set NUS-1-2
Linear (Benzene - Full Data Set NUS-1-2)
NHDES AGQS = 5 ppb
R² = 0.666
Benzene Concentration (ppb)
0
1
2
3
4
5
Spring 1993
Fall
Spring 1994
Fall
Spring 1995
Fall
Spring 1996
Fall
Spring 1997
Fall
Spring 1998
Fall
Spring 1999
Fall
Spring 2000
Fall
Spring 2001
Fall
Spring 2002
Fall
Spring 2003
Fall
Spring 2004
Fall
Spring 2005
Fall
Spring 2006
Fall
Spring 2007
Fall
Spring 2008
Fall
Spring 2009
Fall
Spring 2010
Fall
Spring 2011
Fall
Spring 2012
Fall
Sampling Date (1993 to 2012)

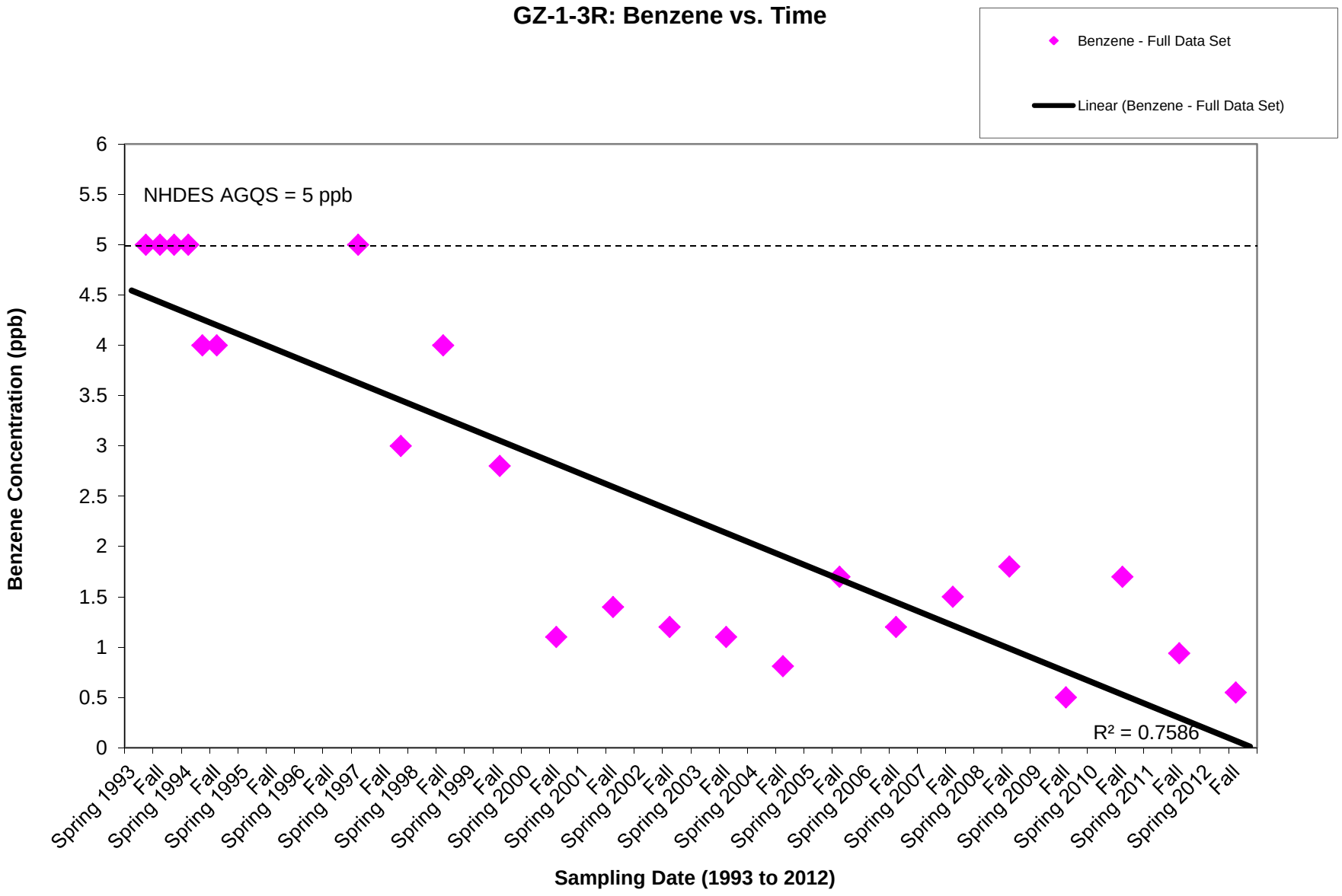

GZ-1-3R: Toluene vs. Time
Series1
Linear (Series1)
NHDES AGQS = 1,000 ppb
R² = 0.5051
Toluene Concentration (ppb)
400
350
300
250
200
150
100
50
0
Spring 1993
Fall
Spring 1994
Fall
Spring 1995
Fall
Spring 1996
Fall
Spring 1997
Fall
Spring 1998
Fall
Spring 1999
Fall
Spring 2000
Fall
Spring 2001
Fall
Spring 2002
Fall
Spring 2003
Fall
Spring 2004
Fall
Spring 2005
Fall
Spring 2006
Fall
Spring 2007
Fall
Spring 2008
Fall
Spring 2009
Fall
Spring 2010
Fall
Spring 2011
Fall
Spring 2012
Fall
Sampling Date (1993 to 2012)


GZ-1-3R: Trichloroethene vs. Time
TCE - Full Data Set
Linear (TCE - Full Data Set)
NHDES AGQS = 5 ppb
R² = 0.0065
TCE Concentration (ppb)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Spring 1993
fall
Spring 1994
fall
Spring 1995
fall
Spring 1996
fall
Spring 1997
fall
Spring 1998
fall
Spring 1999
fall
Spring 2000
fall
Spring 2001
fall
Spring 2002
fall
Spring 2003
fall
Spring 2004
fall
Spring 2005
fall
Spring 2006
fall
Spring 2007
fall
Spring 2008
fall
Spring 2009
fall
Spring 2010
fall
Spring 2011
fall
Spring 2012
fall
Sampling Date (1993 to 2012)


GZ-1-3R: 2-Butanone vs. Time
2-Butanone Full Data Set GZ-1-3R
Linear (2-Butanone Full Data Set GZ-1-3R)
2-Butanone Concentration (ppb)
450
400
350
300
250
200
150
100
50
0
NHDES AGQS = 170 ppb
R² = 0.6057
Spring 1993
Fall
Spring 1994
Fall
Spring 1995
Fall
Spring 1996
Fall
Spring 1997
Fall
Spring 1998
Fall
Spring 1999
Fall
Spring 2000
Fall
Spring 2001
Fall
Spring 2002
Fall
Spring 2003
Fall
Spring 2004
Fall
Spring 2005
Fall
Spring 2006
Fall
Spring 2007
Fall
Spring 2008
Fall
Spring 2009
Fall
Spring 2010
Fall
Spring 2010
Fall
Spring 2011
Fall
Spring 2012
Fall
Sampling Date (1993 to 2012)


MW-102A: Tetrachloroethene (PCE) vs. Time
Series1
Linear (Series1)
PCE Concentration (ppb)
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
NHDES AGQS = 5 ppb
R² = 0.1943
Spring 1993
Fall
Spring 1994
Fall
Spring 1995
Fall
Spring 1996
Fall
Spring 1997
Fall
Spring 1998
Fall
Spring 1999
Fall
Spring 2000
Fall
Spring 2001
Fall
Spring 2002
Fall
Spring 2003
Fall
Spring 2004
Fall
Spring 2005
Fall
Spring 2006
Fall
Spring 2007
Fall
Spring 2008
Fall
Spring 2009
Fall
Spring 2010
Fall
Spring 2011
Fall
Spring 2012
Fall
Sampling Date (1993 to 2012)


MW-102A: Trichloroethene vs. Time
Series1
Linear (Series1)
TCE Concentration (ppb)
80
70
60
50
40
30
20
10
0
R² = 0.0091
NHDES AGQS = 5 ppb
Spring 1993
Fall
Spring 1994
Fall
Spring 1995
Fall
Spring 1996
Fall
Spring 1997
Fall
Spring 1998
Fall
Spring 1999
Fall
Spring 2000
Fall
Spring 2001
Fall
Spring 2002
Fall
Spring 2003
Fall
Spring 2004
Fall
Spring 2005
Fall
Spring 2006
Fall
Spring 2007
Fall
Spring 2008
Fall
Spring 2009
Fall
Spring 2010
Fall
Spring 2011
Fall
Spring 2012
Fall
Sampling Date (1993 to 2012)


GZ-1-3R: Benzene vs. Time
Benzene - Full Data Set
Linear (Benzene - Full Data Set)
NHDES AGQS = 5 ppb
R² = 0.7586
Benzene Concentration (ppb)
Sampling Date (1993 to 2012)
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Spring 1993
Fall
Spring 1994
Fall
Spring 1995
Fall
Spring 1996
Fall
Spring 1997
Fall
Spring 1998
Fall
Spring 1999
Fall
Spring 2000
Fall
Spring 2001
Fall
Spring 2002
Fall
Spring 2003
Fall
Spring 2004
Fall
Spring 2005
Fall
Spring 2006
Fall
Spring 2007
Fall
Spring 2008
Fall
Spring 2009
Fall
Spring 2010
Fall
Spring 2011
Fall
Spring 2012
Fall

APPENDIX E

SUMMARY OF HISTORICAL ARSENIC CONCENTRATIONS IN SURFACE WATER (1993-1999), TIME VERSUS ARSENIC CONCENTRATION PLOTS IN SURFACE WATER (1993-2012 AND 2000-2012)

Appendix E

Summary of Arsenic Concentrations in Surface Water (1993 - 1999)
Auburn Road Landfill

Sample ID	Fresh Acute Criteria[1]	Fresh Chronic Criteria[1]	1993				1994				1995			
			Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
SW-3	340	150	3.6	--	--	--	--	--	1.3	--	--	1.9 U	--	--
SW-4	340	150	--	--	2.5	--	--	--	3.2	--	--	--	--	--
SW-5	340	150	--	--	4.1	--	--	--	3.4	--	--	14	--	--
SW-6	340	150	--	--	--	--	--	--	--	--	--	6	--	--
SW-9	340	150	--	--	--	--	--	--	--	--	--	--	--	--

Appendix E

Summary of Arsenic Concentrations in Surface Water (1993 - 1999)
Auburn Road Landfill

Sample ID	Fresh Acute Criteria[1]	Fresh Chronic Criteria[1]	1996				1997				1998				1999			
			Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
SW-3	340	150	--	--	2 U	--	--	2 U	--	2 U	--	2 U	2 U	--	--	2.5 U	2.5 U	--
SW-4	340	150	--	--	--	--	2 U	--	--	2 U	2 U	--	2 U	--	--	4.8	2.5 U	--
SW-5	340	150	--	--	8.7	--	2 U	--	--	2.4	2 U	--	3.2	--	--	9.2	5.9	--
SW-6	340	150	--	--	10.7	--	2 U	--	--	--	2.7	--	8.4	--	--	6.4	5.3	--
SW-9	340	150	--	--	--	--	2 U	--	--	7.3	2 U	--	2.8	--	--	11.1	2.7	--

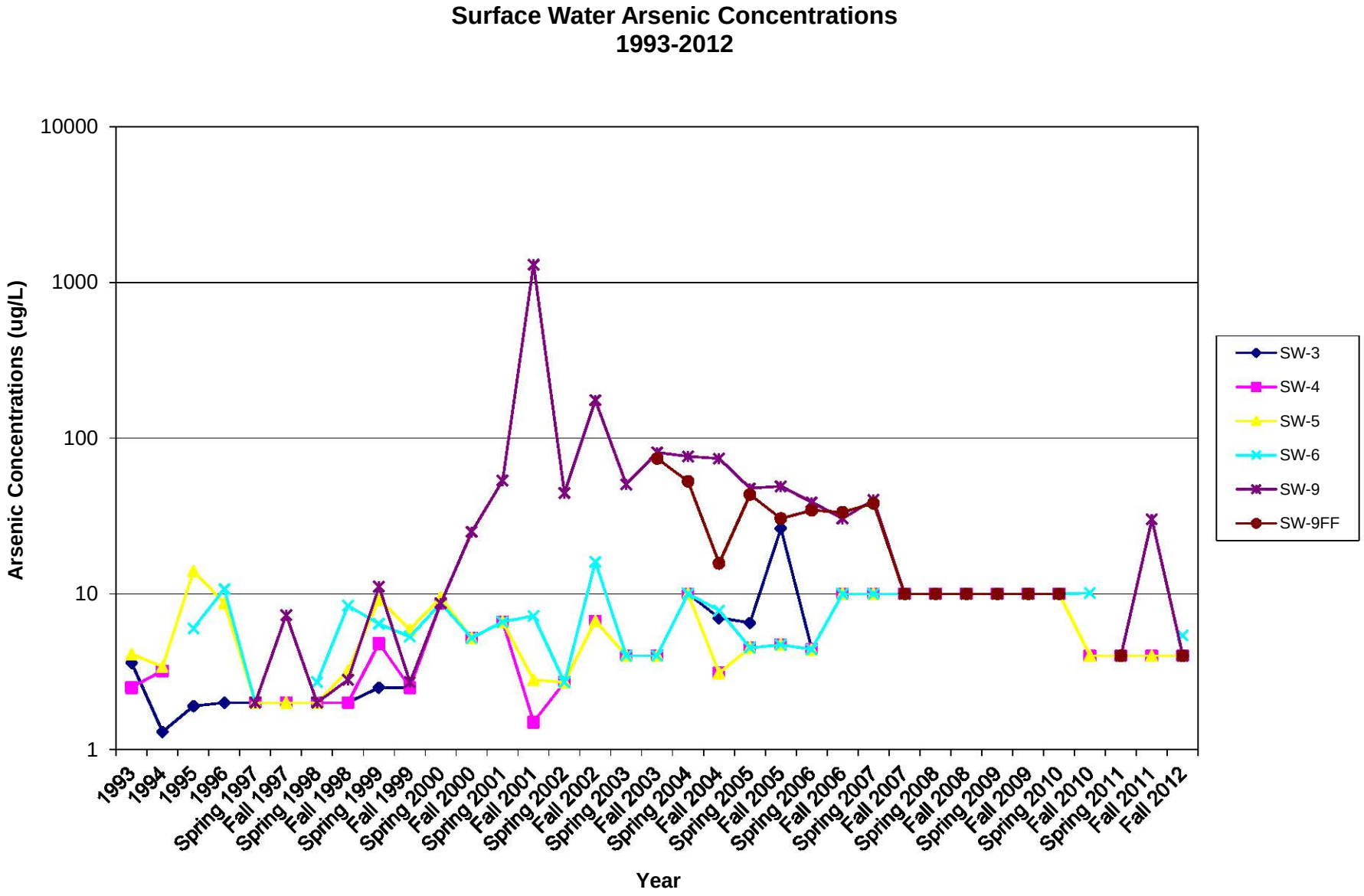
Notes:

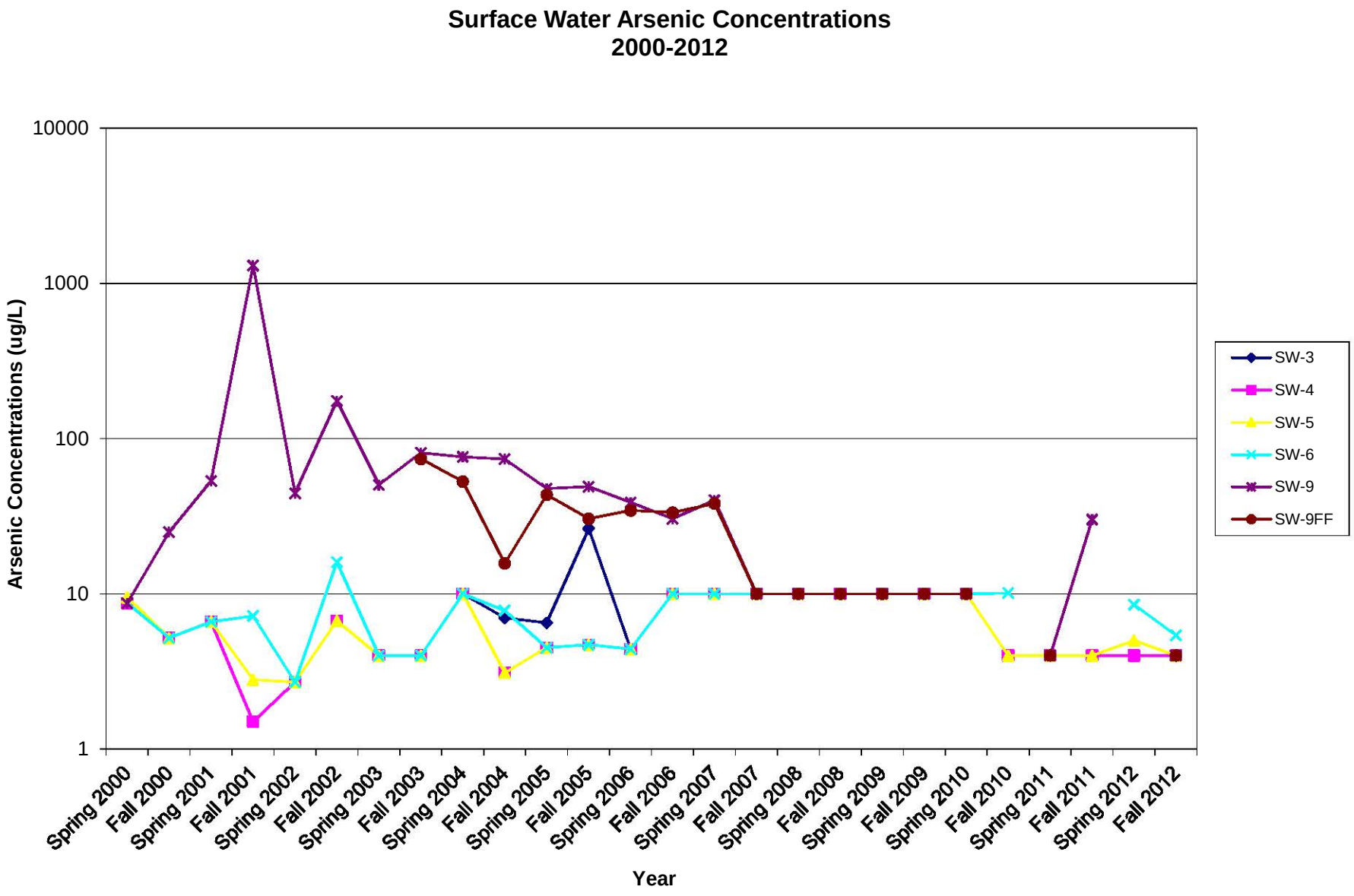
-- = Not sampled or data not available. Data collected prior to the 2000 sampling event is as reported in the Draft 1999 Annual Report by Sevee & Maher Engineers, Inc., 15 February 2000.

All values shown are in units of micrograms per liter (parts per billion). Some values are approximated due to limitations identified in the data review (Quality Control).

[1] = Surface water quality regulations for arsenic from New Hampshire Department of Environmental Services Env-Ws 1700, effective 12/10/99.

U = Not detected at the associated laboratory reporting limit.


Surface Water Arsenic Concentrations
1993-2012
Arsenic Concentrations (ug/L)
10000
1000
100
10
1
1993
1994
1995
1996
Spring 1997
Fall 1997
Spring 1998
Fall 1998
Spring 1999
Fall 1999
Spring 2000
Fall 2000
Spring 2001
Fall 2001
Spring 2002
Fall 2002
Spring 2003
Fall 2003
Spring 2004
Fall 2004
Spring 2005
Fall 2005
Spring 2006
Fall 2006
Spring 2007
Fall 2007
Spring 2008
Fall 2008
Spring 2009
Fall 2009
Spring 2010
Fall 2010
Spring 2011
Fall 2011
Fall 2012
Year
SW-3
SW-4
SW-5
SW-6
SW-9
SW-9FF


Surface Water Arsenic Concentrations
2000-2012
Arsenic Concentrations (ug/L)
10000
1000
100
10
1
Spring 2000
Fall 2000
Spring 2001
Fall 2001
Spring 2002
Fall 2002
Spring 2003
Fall 2003
Spring 2004
Fall 2004
Spring 2005
Fall 2005
Spring 2006
Fall 2006
Spring 2007
Fall 2007
Spring 2008
Fall 2008
Spring 2009
Fall 2009
Spring 2010
Fall 2010
Spring 2011
Fall 2011
Spring 2012
Fall 2012
Year
SW-3
SW-4
SW-5
SW-6
SW-9
SW-9FF

APPENDIX F

SUMMARY OF HISTORICAL ARSENIC CONCENTRATIONS IN SEDIMENT (1993-1999) TIME VERSUS ARSENIC CONCENTRATION PLOTS IN SEDIMENT (1993-2012 AND 2000-2012)

Appendix F

Summary of Arsenic Concentrations in Sediment (1993-1999)
Auburn Road Landfill

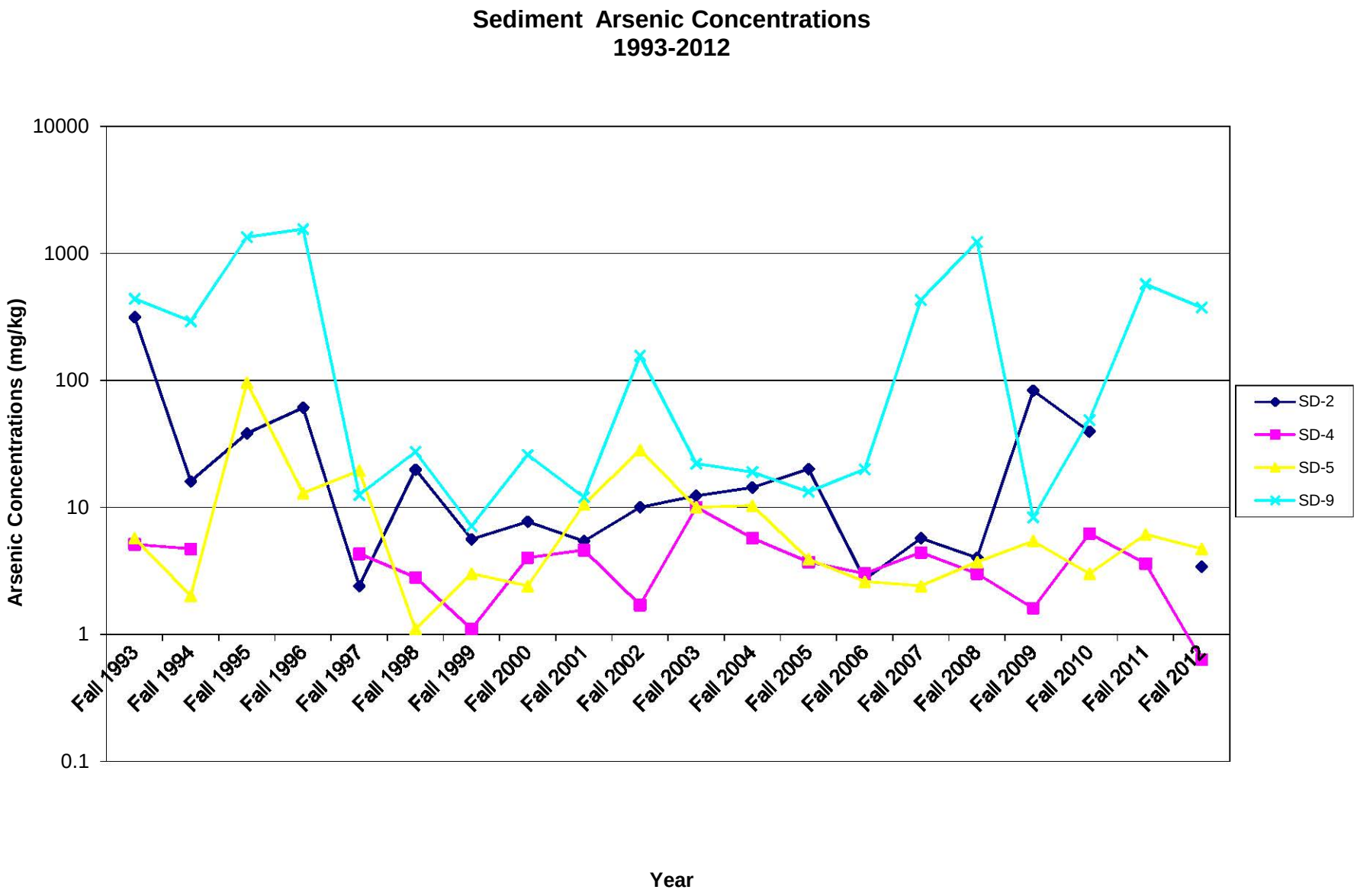
Sample ID	1993 Fall	1994 Fall	1995 Summer	1996 Spring	1997 Fall	1998 Fall	1999 Fall
SD-2	317	16	38.1	60.8	2.4	19.8	5.6
SD-4	5.1 J	4.7	--	--	4.3	2.8	1.1
SD-5	5.7 J	2.0	95.5	12.9	19.4	1.1	3.0
SD-9	438 J	292	1,340	1,550	12.5	25.5	27.3

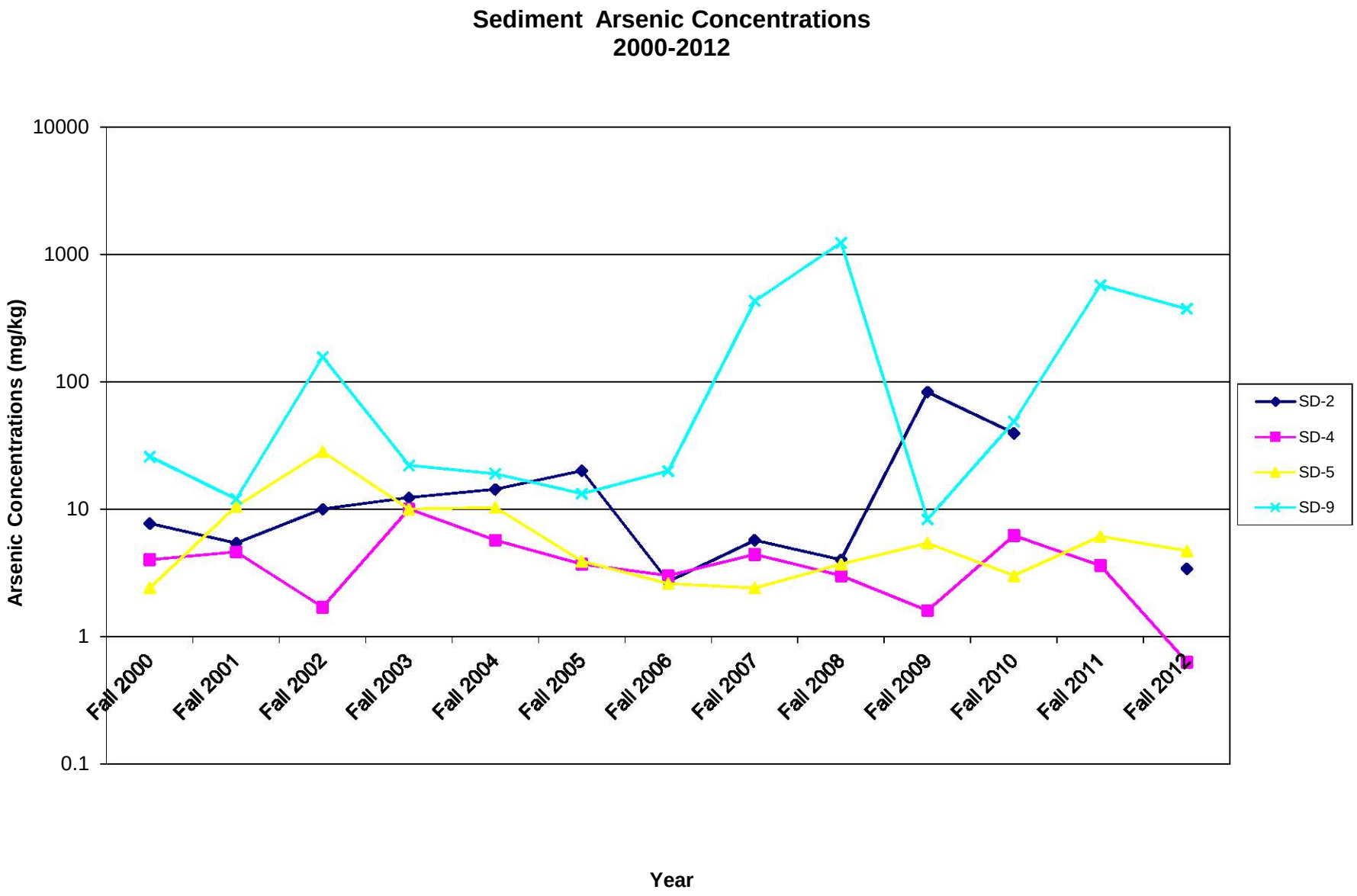
Notes:

-- = Not sampled or data not available. Data collected prior to the 2000 sampling event is as reported in the Draft 1999 Annual Report by Sevee & Maher Engineers, Inc., 16 February 2000.

All values shown are in units of milligrams/kilogram (parts per million). Some values are approximated due to limitations identified in the data review (Quality Control).

J = Quantity is estimated due to limitations identified in the quality control review (data review).


Sediment Arsenic Concentrations
1993-2012
Arsenic Concentrations (mg/kg)
10000
1000
100
10
1
0.1
Fall 1993
Fall 1994
Fall 1995
Fall 1996
Fall 1997
Fall 1998
Fall 1999
Fall 2000
Fall 2001
Fall 2002
Fall 2003
Fall 2004
Fall 2005
Fall 2006
Fall 2007
Fall 2008
Fall 2009
Fall 2010
Fall 2011
Fall 2012
SD-2
SD-4
SD-5
SD-9
Year


Sediment Arsenic Concentrations
2000-2012
Arsenic Concentrations (mg/kg)
10000
1000
100
10
1
0.1
Fall 2000
Fall 2001
Fall 2002
Fall 2003
Fall 2004
Fall 2005
Fall 2006
Fall 2007
Fall 2008
Fall 2009
Fall 2010
Fall 2011
Fall 2012
SD-2
SD-4
SD-5
SD-9
Year

APPENDIX G

AQUATEC BIOLOGICAL SCIENCES
SEDIMENT TOXICITY REPORT

Aquatec Biological Sciences, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 1638 Fax: (802) 658 - 3189

SDG: 13339
Project: 12051

Weston Solutions, Inc.
45 Constitution Avenue
Suite 100
Concord, NH 03301

Tel: (603) 656-5453
Fax: (603) 656-5401

E-Mail: s.combs@westonsolutions.com

Toxicity Summary Report

Project: Auburn Road Landfill

100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: TOX3-001

Sample ID	Sample Name	Control Group	Mean Percent		Mean Weight (mg) Growth		Mean Organism Length (mm)	
043661	Control	A	100.0		0.078		3.54	
043662	SD2-1012	A	100.0		0.059	a	3.09	ab
043663	SD4-1012	A	97.5		0.065	a	3.27	a
043664	SD5-1012	A	63.8	ab	0.109		3.94	
043665	SD9-1012	A	92.5	a	0.056	ab	2.89	ab

a: Indicates a statistically significant reduction (P<0.05) in the response relative to the corresponding response in the laboratory control sample.

b: Indicates a statistically significant reduction (P<0.05) in the response relative to the corresponding response in the reference control sample.

Samples Received

Number	Sample Name	Date Time and Collected	Type
43661	Control	10/26/2012 8:00:00 AM	Sediment
43662	SD2-1012	10/24/2012 3:50:00 PM	Sediment
43663	SD4-1012	10/24/2012 4:30:00 PM	Sediment
43664	SD5-1012	10/25/2012 8:15:00 AM	Sediment
43665	SD9-1012	10/25/2012 9:15:00 AM	Sediment

Submitted By: _____

Monday, January 07, 2013

Aquatec Biological Sciences, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 1638 Fax: (802) 658 - 3189

SDG: 13339
Project: 12051

Weston Solutions, Inc.
45 Constitution Avenue
Suite 100
Concord, NH 03301

Tel: (603) 656-5453
Fax: (603) 656-5401

E-Mail: s.combs@westonsolutions.com

Toxicity Summary Report

Project: Auburn Road Landfill

100.5-28C Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

Sample ID	Sample Name	Control Group	Mean Percent Surviving (%)	Mean Percent Emerged (%)
043661	Control	A	53.8	53.8
043662	SD2-1012	A	37.5 a	31.3 ab
043663	SD4-1012	A	50.0	50.0
043664	SD5-1012	A	51.3	51.3
043665	SD9-1012	A	46.3	46.3

a: Indicates a statistically significant reduction (P<0.05) in the response relative to the corresponding response in the laboratory control sample.

b: Indicates a statistically significant reduction (P<0.05) in the response relative to the corresponding response in the reference control sample.

Samples Received

Number	Sample Name	Date Time and Collected		Type
43661	Control	10/26/2012	8:00:00 AM	Sediment
43662	SD2-1012	10/24/2012	3:50:00 PM	Sediment
43663	SD4-1012	10/24/2012	4:30:00 PM	Sediment
43664	SD5-1012	10/25/2012	8:15:00 AM	Sediment
43665	SD9-1012	10/25/2012	9:15:00 AM	Sediment

Submitted By: _____

Aquatec Biological Sciences, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 1638 Fax: (802) 658 - 3189

SDG: 13339
Project: 12051

Weston Solutions, Inc.
45 Constitution Avenue
Suite 100
Concord, NH 03301

Tel: (603) 656-5453
Fax: (603) 656-5401

E-Mail: s.combs@westonsolutions.com

Toxicity Detail Report

Project: Auburn Road Landfill

100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: TOX3-001

Sample ID: **43661 : Control** Species: ***Hyalella azteca***

Replicate	Start Count	Total Surviving	Percent Surviving (%)	Pan Weight	Dry Weight	Weighed	Mean Replicate Weight (mg)	Mean Replicate Length (mm)
A	10	10	100	25.84	26.59	10	0.075	3.10
B	10	10	100	28.86	29.62	10	0.076	3.50
C	10	10	100	23.37	24.09	10	0.072	3.48
D	10	10	100	24.94	25.78	10	0.084	3.80
E	10	10	100	24.86	25.66	10	0.080	3.67
F	10	10	100	27.24	28.04	10	0.080	3.66
G	10	10	100	24.38	25.05	10	0.067	3.42
H	10	10	100	25.66	26.52	10	0.086	3.68

Mean Percent Surviving (%): **100.0** Mean Growth Weight (mg): **0.078** Mean Organism Length (mm): **3.54**

Sample ID: **43662 : SD2-1012** Species: ***Hyalella azteca***

Replicate	Start Count	Total Surviving	Percent Surviving (%)	Pan Weight	Dry Weight	Weighed	Mean Replicate Weight (mg)	Mean Replicate Length (mm)
A	10	10	100	32.19	32.75	10	0.056	2.91
B	10	10	100	25.74	26.32	10	0.058	2.94
C	10	10	100	25.23	25.76	10	0.053	2.89
D	10	10	100	28.94	29.61	10	0.067	3.42
E	10	10	100	29.92	30.61	10	0.069	3.32
F	10	10	100	29.74	30.24	10	0.050	3.18
G	10	10	100	30.40	30.99	10	0.059	2.92
H	10	10	100	30.82	31.45	10	0.063	3.17

Mean Percent Surviving (%): **100.0** Mean Growth Weight (mg): **0.059** Mean Organism Length (mm): **3.09**

Toxicity Detail Report

Project: Auburn Road Landfill

100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: TOX3-001

Sample ID: **43663 : SD4-1012** Species: ***Hyalella azteca***

Replicate	Start Count	Total Surviving	Percent Surviving (%)	Pan Weight	Dry Weight	Weighed	Mean Replicate Weight (mg)	Mean Replicate Length (mm)
A	10	10	100	29.74	30.46	10	0.072	3.18
B	10	10	100	24.34	25.08	10	0.074	3.18
C	10	10	100	24.81	25.42	10	0.061	3.24
D	10	10	100	28.30	28.92	10	0.062	3.05
E	10	10	100	26.13	26.72	10	0.059	3.39
F	10	10	100	27.15	27.65	10	0.050	3.10
G	10	10	100	23.15	23.88	10	0.073	3.53
H	10	8	80	27.73	28.29	8	0.070	3.51

Mean Percent Surviving (%): **97.5** Mean Growth Weight (mg): **0.065** Mean Organism Length (mm): **3.27**

Sample ID: **43664 : SD5-1012** Species: ***Hyalella azteca***

Replicate	Start Count	Total Surviving	Percent Surviving (%)	Pan Weight	Dry Weight	Weighed	Mean Replicate Weight (mg)	Mean Replicate Length (mm)
A	10	10	100	29.56	30.58	10	0.102	3.62
B	10	8	80	28.88	29.82	8	0.118	3.90
C	10	1	10	30.83	30.93	1	0.100	3.87
D	10	0	0					
E	10	9	90	26.85	28.00	9	0.128	4.38
F	10	8	80	29.13	30.13	8	0.125	4.01
G	10	5	50	29.19	29.65	5	0.092	3.81
H	10	10	100	29.08	30.08	10	0.100	3.98

Mean Percent Surviving (%): **63.8** Mean Growth Weight (mg): **0.109** Mean Organism Length (mm): **3.94**

Sample ID: **43665 : SD9-1012** Species: ***Hyalella azteca***

Replicate	Start Count	Total Surviving	Percent Surviving (%)	Pan Weight	Dry Weight	Weighed	Mean Replicate Weight (mg)	Mean Replicate Length (mm)
A	10	10	100	23.17	23.60	10	0.043	2.94
B	10	9	90	28.97	29.50	9	0.059	2.90
C	10	9	90	28.83	29.43	9	0.067	3.09
D	10	10	100	30.35	30.86	10	0.051	2.88
E	10	10	100	29.83	30.40	10	0.057	2.70
F	10	9	90	26.53	27.03	9	0.056	2.83
G	10	8	80	29.87	30.36	8	0.061	3.02
H	10	9	90	29.99	30.46	9	0.052	2.79

Mean Percent Surviving (%): **92.5** Mean Growth Weight (mg): **0.056** Mean Organism Length (mm): **2.89**

Aquatec Biological Sciences, Inc.

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SDG: 13339
Project: 12051

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Concord, NH 03301

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Toxicity Detail Report

Project: Auburn Road Landfill

100.5-28Ct Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

Sample ID: **43661 : Control** Species: ***Chironomus dilutus***

Replicate	Start Count	Total Surviving	Total Emerged	Percent Surviving (%)	Percent Emerged (%)
A	10	5	5	50	50
B	10	9	9	90	90
C	10	6	6	60	60
D	10	5	5	50	50
E	10	3	3	30	30
F	10	2	2	20	20
G	10	7	7	70	70
H	10	6	6	60	60

Mean Percent Surviving (%) **53.8** Mean Percent Emerged (%): **53.8**

Sample ID: **43662 : SD2-1012** Species: ***Chironomus dilutus***

Replicate	Start Count	Total Surviving	Total Emerged	Percent Surviving (%)	Percent Emerged (%)
A	10	3	3	30	30
B	10	4	2	40	20
C	10	4	4	40	40
D	10	1	1	10	10
E	10	4	3	40	30
F	10	5	5	50	50
G	10	5	5	50	50
H	10	4	2	40	20

Mean Percent Surviving (%) **37.5** Mean Percent Emerged (%): **31.3**

Toxicity Detail Report

Project: Auburn Road Landfill

100.5-28Ct Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

Sample ID: **43663 : SD4-1012** Species: ***Chironomus dilutus***

Replicate	Start Count	Total Surviving	Total Emerged	Percent Surviving (%)	Percent Emerged (%)
A	10	5	5	50	50
B	10	3	3	30	30
C	10	5	5	50	50
D	10	8	8	80	80
E	10	4	4	40	40
F	10	4	4	40	40
G	10	7	7	70	70
H	10	4	4	40	40

Mean Percent Surviving (%) **50.0** Mean Percent Emerged (%): **50.0**

Sample ID: **43664 : SD5-1012** Species: ***Chironomus dilutus***

Replicate	Start Count	Total Surviving	Total Emerged	Percent Surviving (%)	Percent Emerged (%)
A	10	2	2	20	20
B	10	7	7	70	70
C	10	4	4	40	40
D	10	3	3	30	30
E	10	6	6	60	60
F	10	5	5	50	50
G	10	7	7	70	70
H	10	7	7	70	70

Mean Percent Surviving (%) **51.3** Mean Percent Emerged (%): **51.3**

Sample ID: **43665 : SD9-1012** Species: ***Chironomus dilutus***

Replicate	Start Count	Total Surviving	Total Emerged	Percent Surviving (%)	Percent Emerged (%)
A	10	5	5	50	50
B	10	2	2	20	20
C	10	4	4	40	40
D	10	7	7	70	70
E	10	5	5	50	50
F	10	4	4	40	40
G	10	4	4	40	40
H	10	6	6	60	60

Mean Percent Surviving (%) **46.3** Mean Percent Emerged (%): **46.3**

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Aquatec Biological Sciences
Certification Number 1737

Quality Assurance Report

SDG: 13339
Project: 12051

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Project: **Auburn Road Landfill**

Narrative

Sediments were received on October 26, 2012 (SD2, SD4, SD5, and SD9). Prior to initiating the toxicity tests, the sediments were sieved to remove vegetative material and as a measure to ensure that indigenous organisms were not introduced to the testing system (no indigenous organisms were seen). The SD2, SD4, and SD9 samples were press-sieved through a 1-mm mesh screen while the SD5 sample was press-sieved through a 2.8-mm mesh screen since it consisted of coarse and medium sand and stones. Sediments and overlying water for the Hyalella azteca 10-day survival and growth test were distributed to replicate test beakers on November 1, 2012. Sediments and overlying water for the Chironomus tentans 28-day survival and emergence test were distributed to replicate test beakers on November 5, 2012. Organisms were added to test replicates the day following sediment loading for each species (November 2 for Hyalella azteca and November 6 for Chironomus dilutus).

Hyalella azteca
The tests Hyalella azteca tests were ended on November 12, 2012, when surviving amphipods were recovered from each replicate for the survival, growth (by length) and growth (by dry weight) assessments. The Hyalella azteca 10-day test did not require aeration of replicates to maintain dissolved oxygen within acceptable ranges.

Statistical analyses on survival, growth (by dry weight), and growth (by length) were performed relative to the Control (Sample 43661) and the Reference Site (Sample 43663, SD4).

Chironomus tentans
Aeration was provided to all test replicates on Day 5 when declining dissolved oxygen concentrations were observed. Emergence traps were placed on all test replicates on Day 9. Throughout the remainder of the test, flies that were fully or partially emerged were scored as emerged.

The tests were ended on Day 28, December 4, 2012, when any un-emerged surviving midge larvae or pupae were recovered from test replicates for the survival assessment. Any flies that emerged up through Day 28 were included in the cumulative emergence tabulation. Live larvae or pupae recovered on Day 28 were included in the survival tabulation but not in the emergence tabulation. Statistical analyses of survival and emergence data were performed relative to the Control (Sample 43661) and the Reference Site (Sample 43663, SD4).

A standard reference toxicant test initiated with a subsample of the culture population used for

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Project: **Auburn Road Landfill**

the project sediment tests resulted in a 96-h LC50 that was below the cumulative control chart limits plotted from the most recent twenty tests. This result may indicate that the batch of organisms used for testing were more sensitive than normal, however, statistically it is expected that the LC50 of one out of twenty tests will fall outside the control chart limits.

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Project: **Auburn Road Landfill**

TOXICITY TEST REPORT CERTIFICATION

The results reported relate only to the the samples submitted as received.

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

Executed on: 1/8/13
(Date)

(Authorized signature)

John Williams
Toxicity Laboratory Manager
Aquatec Biological Sciences, Inc.

Supportive Documentation

Chain-Of-Custody

Toxicity Test Methods

100.1 - Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

100.5-28Ct - Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Standard Reference Toxicant Control Charts

Chain-Of-Custody

Aquatec Biological Sciences

Chain-of-Custody-Record

273 Commerce Street
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FAX: (802) 658-3189

COMPANY INFORMATION	COMPANY'S PROJECT INFORMATION	SHIPPING INFORMATION	VOLUME/CONTAINER TYPE/ PRESERVATIVE
Name: Weston Solutions	Project Name: AUBURN ROAD LANDFILL	Carrier: FEDEX	5gal plastic bucket / 4°C
Address 45 Constitution Ave Ste 100	Project Number: 12438.001.024	Airbill Number: 800952780445	
City/State/Zip: Concord, NH 03301	Sampler Name(s): Andrew Klapphotz	Date Shipped: 10/25/2012	
Telephone: 603-656-5400			
Facsimile: 603-656-5401			
Contact Name: Sean Combs	Quote #: _____ Client Code: _____	Hand Delivered: ☐ Yes ☒ No	

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	GRAB	COMPOSITE	MATRIX	ANALYSIS/REMARKS	NUMBER OF CONTAINERS
SD2-1012	10/24/12	1550	X		SED	Hyallela EPA 100.1/100.5	1
SD4-1012	10/24/12	1630	X		SED	+Chironomous tetans	1
SD5-1012	10/25/12	0815	X		SED	↓ ↓ ↓	1
SD9-1012	10/25/12	0915	X		SED		1

Relinquished by: (signature)	DATE	TIME	Recieved by: (signature)
[signature]	10/25/12	1300	FEDEX
Relinquished by: (signature)	DATE	TIME	Recieved by: (signature)
	10/24/12	1000	Raven Turney
Relinquished by: (signature)	DATE	TIME	Recieved by: (signature)

NOTES TO SAMPLER(S): Temp- 0.3°C

NOTES TO LAB: As per contract.

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

Aquatec Biological Sciences

Chain-of-Custody-Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860-1638
FAX: (802) 658-3189

COMPANY INFORMATION	COMPANY'S PROJECT INFORMATION	SHIPPING INFORMATION	VOLUME/CONTAINER TYPE/ PRESERVATIVE
Name: See Above.	Project Name:	Carrier:	
Address	Project Number:	Airbill Number:	
City/State/Zip:	Sampler Name(s): John Williams	Date Shipped:	
Telephone:			
Facsimile:			
Contact Name:	Quote #: _____ Client Code: _____	Hand Delivered: ☐ Yes ☐ No	

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	GRAB	COMPOSITE	MATRIX	ANALYSIS/REMARKS	NUMBER OF CONTAINERS
Lake Arrowhead, VT	9/18/12	19:00	X		SED	Soft Control sediment	2-3 L
Lamoille River, VT	9/19/12	07:15	X		SED	Sandy Control sediment	2-3 L
						Sediments 0.5-mm	
						sieved in the field	
						In lab soft &	
						sandy sediments	
						combined to create	
						control sediment.	

Relinquished by: (signature)	DATE	TIME	Recieved by: (signature)
	9/19/12	08:15	
Relinquished by: (signature)	DATE	TIME	Recieved by: (signature)
Relinquished by: (signature)	DATE	TIME	Recieved by: (signature)

NOTES TO SAMPLER(S):

NOTES TO LAB:

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

Toxicity Test Methods

1	Test type:	Whole-sediment toxicity test with renewal of overlying water
2	Temperature:	23 +/- 1C
3	Light quality:	Wide-spectrum fluorescent lights
4	Illuminance:	About 100 to 1000lux
5	Photoperiod:	16L:8D
6	Test chamber:	300 mL high-form lipless beaker
7	Sediment volume:	100 mL
8	Overlying water volume:	175 mL
9	Renewal of overlying water:	2 volume additions/day (e.g. 1 volume addition every 12h)
10	Age of organisms:	7 to 14 day old at the start of the test (1-2 day in range)
11	No. of organisms/chamber:	10
12	No. of replicate chambers/treatment:	8
13	Feeding:	YCT food, fed 1.0 mL daily (1800 mg/L stock) to each test chamber.
14	Aeration:	None, unless dissolved oxygen in overlying water drops below 2.5 mg/L
15	Overlying water:	Sed. Reconstituted Water
16	Test chamber cleaning:	If screens become clogged during a test, gently brush the outside of the screen
17	Overlying water quality:	Hardness, alkalinity, conductivity, pH, and ammonia at the beginning and end of a test (e.g. Days 0 and 9 or 10). Temperature and dissolved oxygen daily.
18	Test duration:	10 days
19	Endpoints:	Survival and growth
20	Test acceptability:	Minimum mean control survival of 80% and measurable growth of test organisms in the control sediment.

1	Test type:	Whole-sediment toxicity test with renewal of overlying water
2	Temperature:	23 +/- 1C
3	Light quality:	Wide-spectrum fluorescent lights
4	Illuminance:	About 100 to 1000lux
5	Photoperiod:	16L:8D
6	Test chamber:	300mL high-form lipless beaker
7	Sediment volume:	100mL
8	Overlying water volume:	175mL
9	Renewal of overlying water:	2 volume additions/day (e.g. 1 volume addition every 12h)
10	Age of organisms:	Second instar larvae
11	No. of organisms/chamber:	10
12	No. of replicates/treatment:	8
13	Feeding:	Tetrafin goldfish food, fed 1.5mL daily
14	Aeration:	Aerated when declining dissolved oxygen trend observed to maintain D.O. above 2.5mg/L
15	Overlying water:	Sed. Reconstituted Water
16	Test chamber cleaning:	If screens become clogged during a test, gently brush the outside of the screen
17	Overlying water quality:	Hardness, alkalinity, conductivity, and ammonia at the beginning, and at the end of a test. Temperature daily (ideally continuously). Dissolved oxygen (DO) and pH three times/week. Conductivity weekly.
18	Test duration:	28 Days
19	Endpoints:	Survival and cumulative emergence
20	Test acceptability:	50% or greater cumulative emergence and performance-based criteria

100.1 - Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

CETIS Summary Report

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Batch ID:	16-5035-1257	**Test Type:**	Survival-Growth	**Analyst:**	
Start Date:	02 Nov-12 10:40	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Reconstituted Water
Ending Date:	12 Nov-12 09:30	**Species:**	Hyalella azteca	**Brine:**	
Duration:	9d 23h	**Source:**	Aquatic Biosystems, CO	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
43661	09-9038-3902	19 Sep-12 07:15	19 Sep-12 08:15	44d 3h	Weston Solutions, Inc.	
43662	03-8789-8795	24 Oct-12 15:50	26 Oct-12 10:00	8d 19h		
43663	09-1086-2928	24 Oct-12 16:30	26 Oct-12 10:00	8d 18h		
43664	00-7258-0456	24 Oct-12 08:15	26 Oct-12 10:00	9d 2h		
43665	11-9899-1264	24 Oct-12 09:15	26 Oct-12 10:00	9d 1h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
43661	Control Sediment	CONTROL	CONTROL		
43662	Sediment	Auburn Rd	SD2		
43663	Sediment	Auburn Rd	SD4		
43664	Sediment	Auburn Rd	SD5		
43665	Sediment	Auburn Rd	SD9		

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
05-7472-9522	Survival Rate	Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria
11-2943-4118	Survival Rate	Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria
12-7277-0005	Survival Rate	Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria
14-6485-8664	Survival Rate	Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria

Mean Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
43661	8	0.0775	0.0752	0.0798	0.067	0.086	0.00222	0.00628	8.1%	0.0%
43662	8	0.0594	0.0569	0.0618	0.05	0.069	0.00234	0.00661	11.1%	23.4%
43663	8	0.0651	0.062	0.0683	0.05	0.074	0.003	0.00849	13.0%	16.0%
43664	7	0.109	0.104	0.114	0.092	0.128	0.0053	0.014	12.8%	-40.9%
43665	8	0.0557	0.053	0.0584	0.043	0.0667	0.00253	0.00716	12.8%	28.1%

Mean Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
43661	8	3.54	3.46	3.62	3.1	3.8	0.077	0.218	6.15%	0.0%
43662	8	3.09	3.02	3.17	2.89	3.42	0.0732	0.207	6.69%	12.6%
43663	8	3.27	3.2	3.34	3.05	3.53	0.0646	0.183	5.59%	7.52%
43664	7	3.94	3.85	4.03	3.62	4.38	0.0881	0.233	5.92%	-11.3%
43665	8	2.89	2.85	2.94	2.7	3.09	0.0442	0.125	4.32%	18.2%

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
43661	8	1	1	1	1	1	0	0	0.0%	0.0%
43662	8	1	1	1	1	1	0	0	0.0%	0.0%
43663	8	0.975	0.949	1	0.8	1	0.025	0.0707	7.25%	2.5%
43664	8	0.638	0.49	0.785	0	1	0.14	0.396	62.1%	36.3%
43665	8	0.925	0.899	0.951	0.8	1	0.025	0.0707	7.64%	7.5%

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.075	0.076	0.072	0.084	0.08	0.08	0.067	0.086
43662	0.056	0.058	0.053	0.067	0.069	0.05	0.059	0.063
43663	0.072	0.074	0.061	0.062	0.059	0.05	0.073	0.07
43664	0.102	0.118	0.1	0.128	0.125	0.092	0.1	
43665	0.043	0.0589	0.0667	0.051	0.057	0.0556	0.0612	0.0522

Mean Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	3.1	3.5	3.48	3.8	3.67	3.66	3.42	3.68
43662	2.91	2.94	2.89	3.42	3.32	3.18	2.92	3.17
43663	3.18	3.18	3.24	3.05	3.39	3.1	3.53	3.51
43664	3.62	3.9	3.87		4.38	4.01	3.81	3.98
43665	2.94	2.9	3.09	2.88	2.7	2.83	3.02	2.79

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	1	1	1	1	1	1	1	1
43662	1	1	1	1	1	1	1	1
43663	1	1	1	1	1	1	1	0.8
43664	1	0.8	0.1	0	0.9	0.8	0.5	1
43665	1	0.9	0.9	1	1	0.9	0.8	0.9

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10
43662	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10
43663	10/10	10/10	10/10	10/10	10/10	10/10	10/10	8/10
43664	10/10	8/10	1/10	0/10	9/10	8/10	5/10	10/10
43665	10/10	9/10	9/10	10/10	10/10	9/10	8/10	9/10

CETIS Analytical Report

Report Date: 03 Jan-13 16:34 (p 1 of 1)
Test Code: 65294 | 17-0773-4840

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID: 11-2943-4118 **Endpoint:** Survival Rate **CETIS Version:** CETISv1.8.4
Analyzed: 03 Jan-13 16:33 **Analysis:** Parametric-Two Sample **Official Results:** Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	2.5%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43661		43662	0	1.76	1E-08	14	0.5000	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0	0	1	0	1.0000	Non-Significant Effect
Error	3.552714E-15	2.537653E-16	14			
Total	3.552714E-15		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1	8.89	1.0000	Equal Variances

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	1	1	1	1	1	1	0	0.0%	0.0%
43662	8	1	1	1	1	1	1	0	0.0%	0.0%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	1.41	1.41	1.41	1.41	1.41	1.41	0	0.0%	0.0%
43662	8	1.41	1.41	1.41	1.41	1.41	1.41	0	0.0%	0.0%

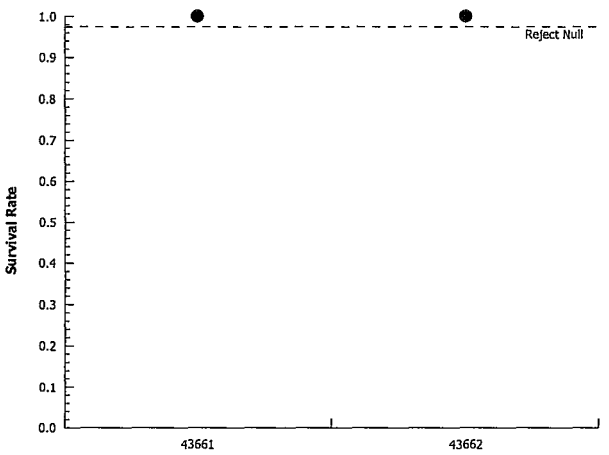
Survival Rate Detail

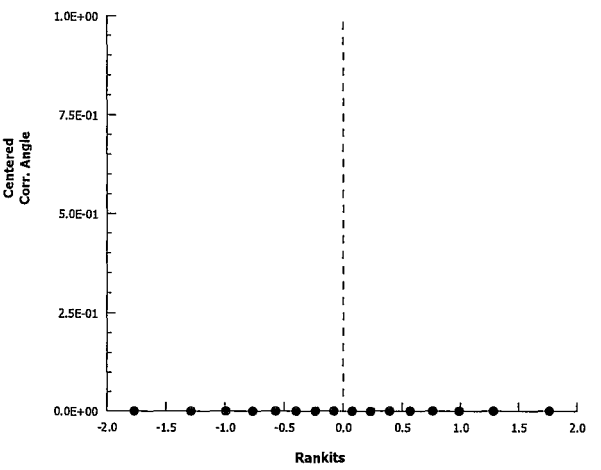
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	1	1	1	1	1	1	1	1
43662	1	1	1	1	1	1	1	1

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41
43662	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41

Graphics





CETIS Analytical Report

Report Date: 03 Jan-13 16:35 (p 1 of 1)
Test Code: 65294 | 17-0773-4840

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID: 05-7472-9522 **Endpoint:** Survival Rate **CETIS Version:** CETISv1.8.4
Analyzed: 03 Jan-13 16:33 **Analysis:** Nonparametric-Two Sample **Official Results:** Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	5.02%

Wilcoxon Rank Sum Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
43661		43663	64	NA	1	14	0.5000	Exact	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.005809008	0.005809008	1	1	0.3343	Non-Significant Effect
Error	0.08132611	0.005809008	14			
Total	0.08713512		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	4.58E+13	8.89	<0.0001	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.469	0.841	<0.0001	Non-normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	1	1	1	1	1	1	0	0.0%	0.0%
43663	8	0.975	0.916	1	1	0.8	1	0.025	7.25%	2.5%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	1.41	1.41	1.41	1.41	1.41	1.41	0	0.0%	0.0%
43663	8	1.37	1.28	1.46	1.41	1.11	1.41	0.0381	7.85%	2.7%

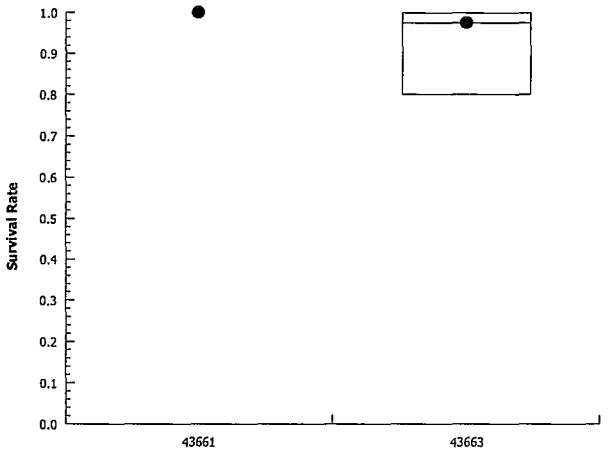
Survival Rate Detail

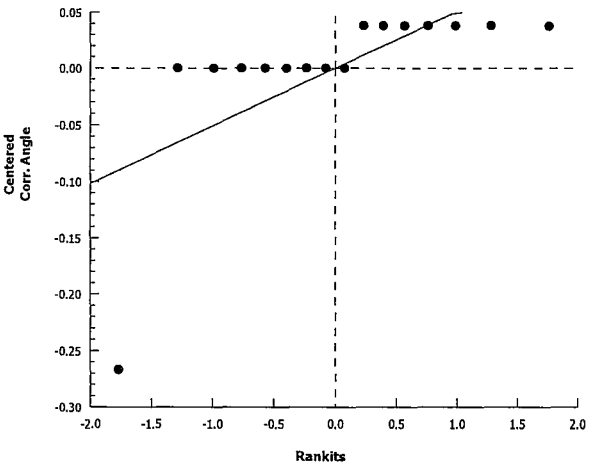
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	1	1	1	1	1	1	1	1
43663	1	1	1	1	1	1	1	0.8

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41
43663	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.11

Graphics





CETIS Analytical Report

Report Date: 03 Jan-13 16:35 (p 1 of 1)
Test Code: 65294 | 17-0773-4840

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID: 14-6485-8664 **Endpoint:** Survival Rate **CETIS Version:** CETISv1.8.4
Analyzed: 03 Jan-13 16:33 **Analysis:** Nonparametric-Two Sample **Official Results:** Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	19.5%

Wilcoxon Rank Sum Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
43661		43664	44	NA	1	14	0.0035	Exact	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.875546	0.875546	1	7.6	0.0154	Significant Effect
Error	1.613285	0.1152346	14			
Total	2.488831		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	9.08E+14	8.89	<0.0001	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.841	0.841	0.0100	Non-normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	1	1	1	1	1	1	0	0.0%	0.0%
43664	8	0.638	0.306	0.969	0.8	0	1	0.14	62.1%	36.3%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	1.41	1.41	1.41	1.41	1.41	1.41	0	0.0%	0.0%
43664	8	0.944	0.543	1.35	1.11	0.159	1.41	0.17	50.8%	33.1%

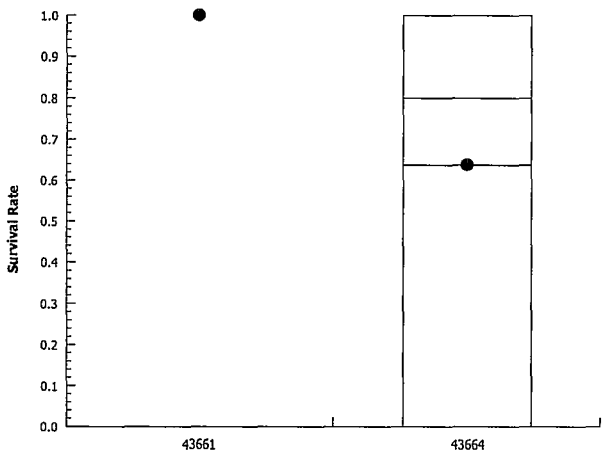
Survival Rate Detail

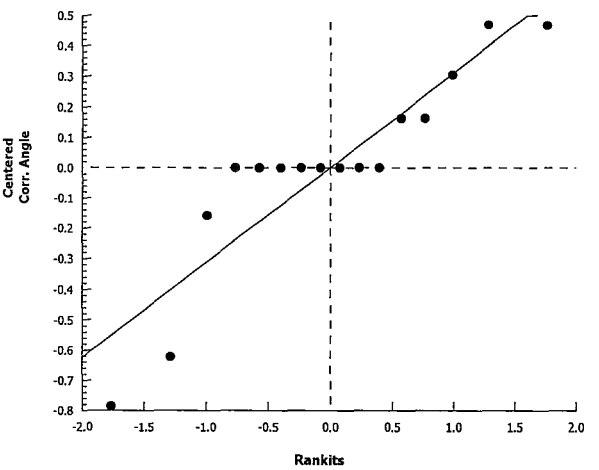
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	1	1	1	1	1	1	1	1
43664	1	0.8	0.1	0	0.9	0.8	0.5	1

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41
43664	1.41	1.11	0.322	0.159	1.25	1.11	0.785	1.41

Graphics





CETIS Analytical Report

Report Date:	03 Jan-13 16:34 (p 1 of 1)
Test Code:	65294 | 17-0773-4840

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	12-7277-0005	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.4
Analyzed:	03 Jan-13 16:33	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	5.08%

Wilcoxon Rank Sum Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
43661		43665	48	NA	1	14	0.0128	Exact	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.05721051	0.05721051	1	9.45	0.0082	Significant Effect
Error	0.08476043	0.006054317	14			
Total	0.1419709		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	4.77E+13	8.89	<0.0001	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.819	0.841	0.0049	Non-normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	1	1	1	1	1	1	0	0.0%	0.0%
43665	8	0.925	0.866	0.984	0.9	0.8	1	0.025	7.64%	7.5%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	1.41	1.41	1.41	1.41	1.41	1.41	0	0.0%	0.0%
43665	8	1.29	1.2	1.38	1.25	1.11	1.41	0.0389	8.51%	8.47%

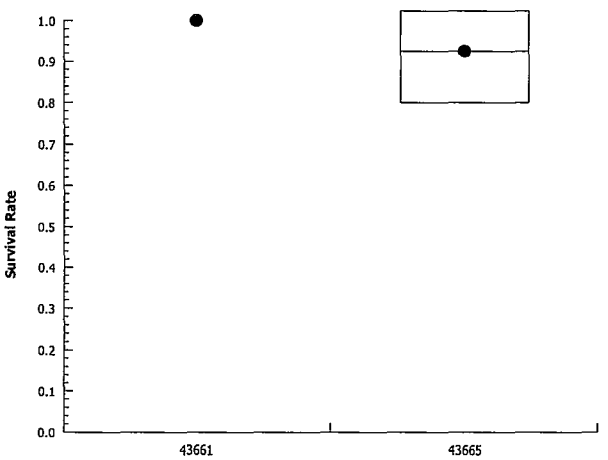
Survival Rate Detail

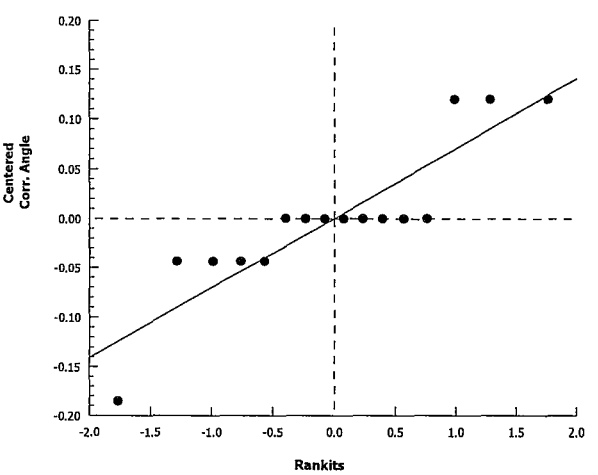
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	1	1	1	1	1	1	1	1
43665	1	0.9	0.9	1	1	0.9	0.8	0.9

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41
43665	1.41	1.25	1.25	1.41	1.41	1.25	1.11	1.25

Graphics





CETIS Analytical Report

Report Date:	03 Jan-13 16:34 (p 1 of 1)
Test Code:	65294 | 17-0773-4840

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	10-8550-8916	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.4
Analyzed:	03 Jan-13 16:33	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Untransformed	NA	C > T	NA	NA	7.33%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43661		43662	5.62	1.76	0.006	14	<0.0001	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.001314057	0.001314057	1	31.6	<0.0001	Significant Effect
Error	0.000581877	4.156265E-05	14			
Total	0.001895934		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.11	8.89	0.8956	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.964	0.841	0.7365	Normal Distribution

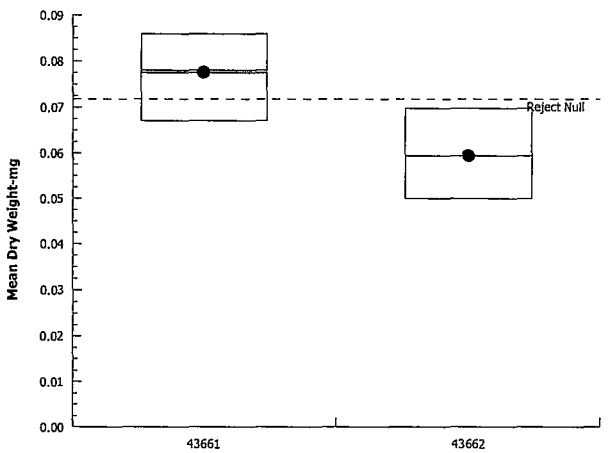
Mean Dry Weight-mg Summary

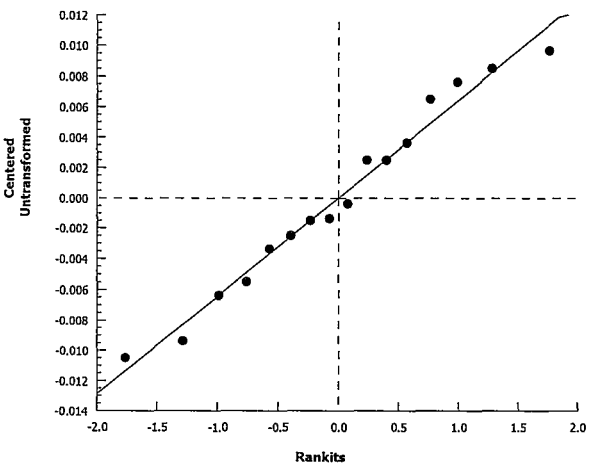
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.0775	0.0723	0.0827	0.078	0.067	0.086	0.00222	8.1%	0.0%
43662	8	0.0594	0.0538	0.0649	0.0585	0.05	0.069	0.00234	11.1%	23.4%

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.075	0.076	0.072	0.084	0.08	0.08	0.067	0.086
43662	0.056	0.058	0.053	0.067	0.069	0.05	0.059	0.063

Graphics





CETIS Analytical Report

Report Date:	03 Jan-13 16:34 (p 1 of 1)
Test Code:	65294 | 17-0773-4840

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	10-0528-1522	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.4
Analyzed:	03 Jan-13 16:33	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Untransformed	NA	C > T	NA	NA	8.49%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43661		43663	3.31	1.76	0.007	14	0.0026	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0006125611	0.0006125611	1	11	0.0051	Significant Effect
Error	0.0007808753	5.577681E-05	14			
Total	0.001393436		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.83	8.89	0.4440	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.936	0.841	0.3014	Normal Distribution

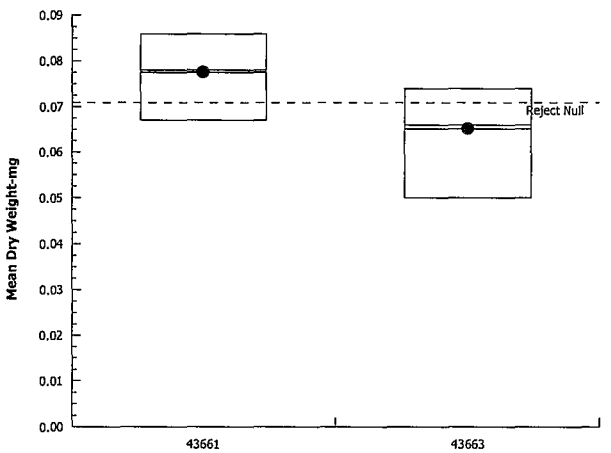
Mean Dry Weight-mg Summary

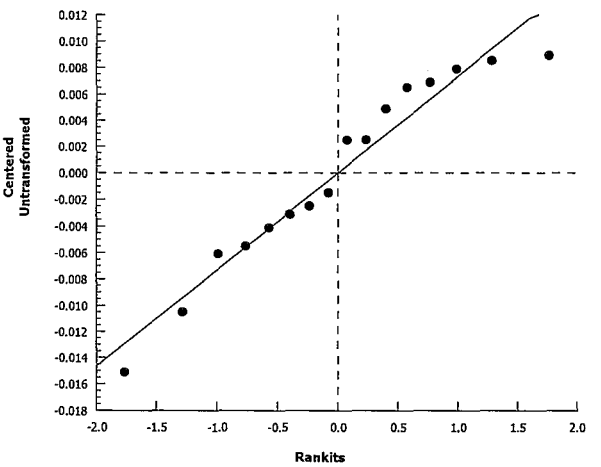
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.0775	0.0723	0.0827	0.078	0.067	0.086	0.00222	8.1%	0.0%
43663	8	0.0651	0.058	0.0722	0.066	0.05	0.074	0.003	13.0%	16.0%

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.075	0.076	0.072	0.084	0.08	0.08	0.067	0.086
43663	0.072	0.074	0.061	0.062	0.059	0.05	0.073	0.07

Graphics





CETIS Analytical Report

Report Date:	03 Jan-13 16:34 (p 1 of 1)
Test Code:	65294 | 17-0773-4840

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	08-6727-9954	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.4
Analyzed:	03 Jan-13 16:33	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Untransformed	NA	C > T	NA	NA	12.5%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43661		43664	-5.78	1.77	0.01	13	1.0000	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.003747464	0.003747464	1	33.4	<0.0001	Significant Effect
Error	0.001456622	0.0001120479	13			
Total	0.005204087		14			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	4.99	9.16	0.0534	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.971	0.833	0.8666	Normal Distribution

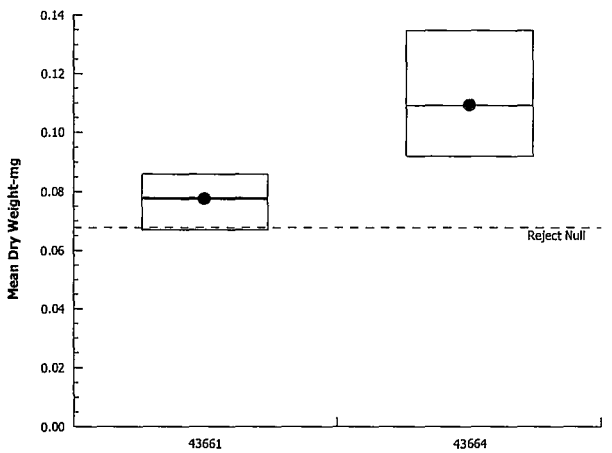
Mean Dry Weight-mg Summary

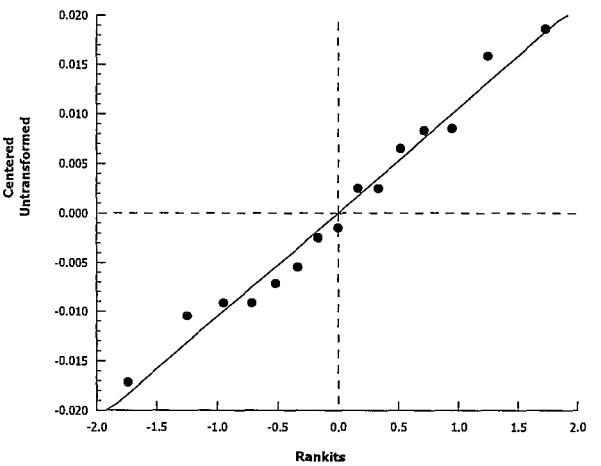
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.0775	0.0723	0.0827	0.078	0.067	0.086	0.00222	8.1%	0.0%
43664	7	0.109	0.0962	0.122	0.102	0.092	0.128	0.0053	12.8%	-40.9%

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.075	0.076	0.072	0.084	0.08	0.08	0.067	0.086
43664	0.102	0.118	0.1	0.128	0.125	0.092	0.1	

Graphics





CETIS Analytical Report

Report Date:	03 Jan-13 16:34 (p 1 of 1)
Test Code:	65294 | 17-0773-4840

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	08-5096-6667	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.4
Analyzed:	03 Jan-13 16:33	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Untransformed	NA	C > T	NA	NA	7.65%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43661		43665	6.48	1.76	0.006	14	<0.0001	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.001901324	0.001901324	1	42	<0.0001	Significant Effect
Error	0.0006344275	4.531625E-05	14			
Total	0.002535752		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.3	8.89	0.7390	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.982	0.841	0.9796	Normal Distribution

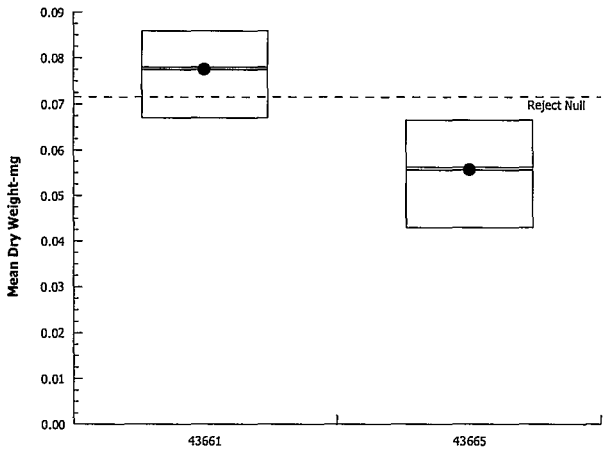
Mean Dry Weight-mg Summary

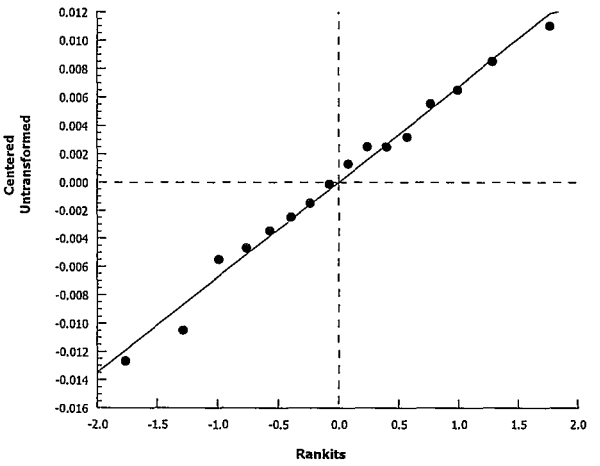
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.0775	0.0723	0.0827	0.078	0.067	0.086	0.00222	8.1%	0.0%
43665	8	0.0557	0.0497	0.0617	0.0563	0.043	0.0667	0.00253	12.8%	28.1%

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.075	0.076	0.072	0.084	0.08	0.08	0.067	0.086
43665	0.043	0.0589	0.0667	0.051	0.057	0.0556	0.0612	0.0522

Graphics





CETIS Analytical Report

Report Date:	03 Jan-13 16:34 (p 1 of 1)
Test Code:	65294 | 17-0773-4840

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	08-2412-6308	**Endpoint:**	Mean Length-mm	**CETIS Version:**	CETISv1.8.4
Analyzed:	03 Jan-13 16:33	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Untransformed	NA	C > T	NA	NA	5.29%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43661		43662	4.19	1.76	0.187	14	0.0005	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.7920999	0.7920999	1	17.6	0.0009	Significant Effect
Error	0.631675	0.04511964	14			
Total	1.423775		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.11	8.89	0.8980	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.964	0.841	0.7393	Normal Distribution

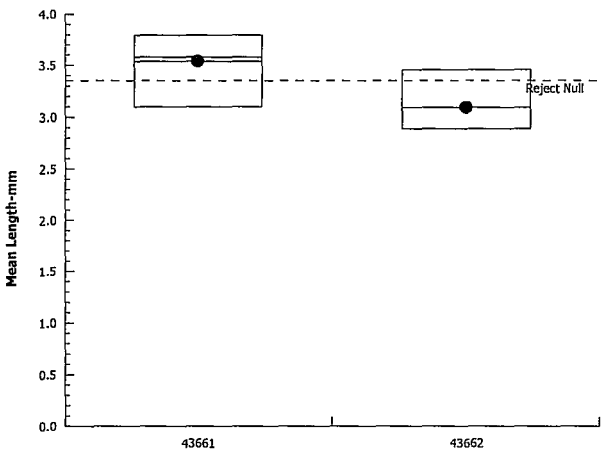
Mean Length-mm Summary

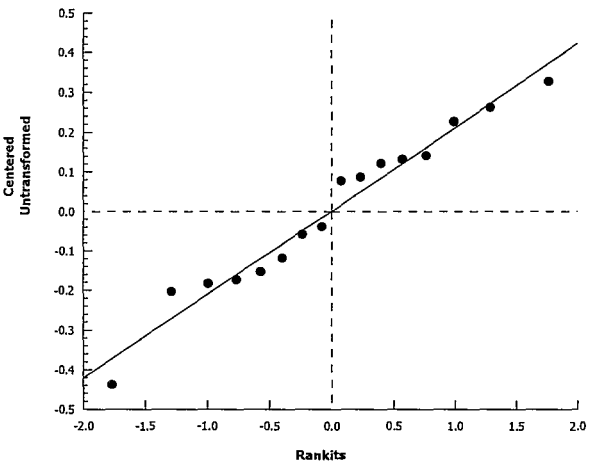
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	3.54	3.36	3.72	3.58	3.1	3.8	0.077	6.15%	0.0%
43662	8	3.09	2.92	3.27	3.06	2.89	3.42	0.0732	6.69%	12.6%

Mean Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	3.1	3.5	3.48	3.8	3.67	3.66	3.42	3.68
43662	2.91	2.94	2.89	3.42	3.32	3.18	2.92	3.17

Graphics





CETIS Analytical Report

Report Date:	03 Jan-13 16:34 (p 1 of 1)
Test Code:	65294 | 17-0773-4840

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	14-2524-7034	**Endpoint:**	Mean Length-mm	**CETIS Version:**	CETISv1.8.4
Analyzed:	03 Jan-13 16:33	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Untransformed	NA	C > T	NA	NA	5.0%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43661		43663	2.65	1.76	0.177	14	0.0095	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.2835563	0.2835563	1	7.02	0.0191	Significant Effect
Error	0.5656376	0.04040269	14			
Total	0.8491939		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.42	8.89	0.6566	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.942	0.841	0.3783	Normal Distribution

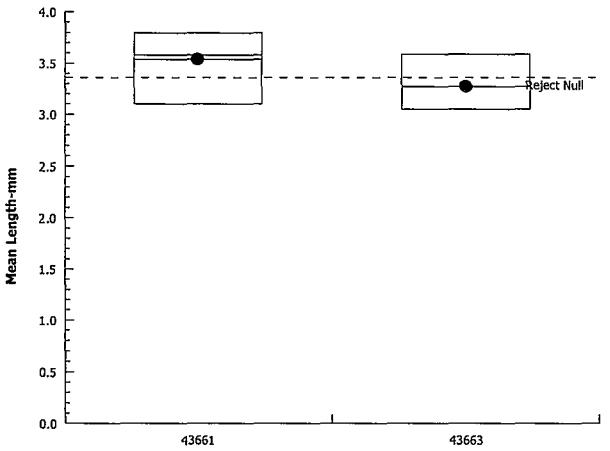
Mean Length-mm Summary

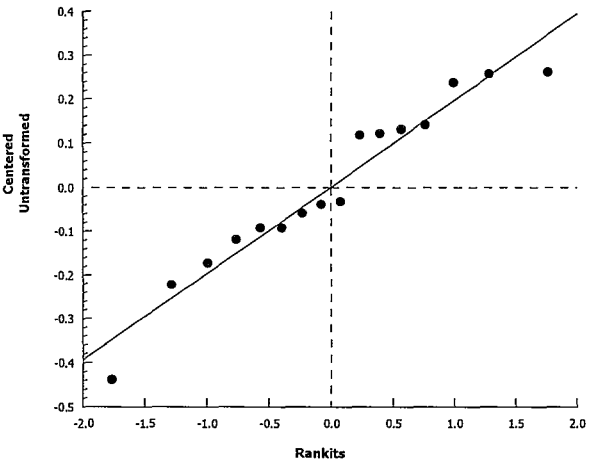
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	3.54	3.36	3.72	3.58	3.1	3.8	0.077	6.15%	0.0%
43663	8	3.27	3.12	3.43	3.21	3.05	3.53	0.0646	5.59%	7.52%

Mean Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	3.1	3.5	3.48	3.8	3.67	3.66	3.42	3.68
43663	3.18	3.18	3.24	3.05	3.39	3.1	3.53	3.51

Graphics





Analyst: _____ QA: 1/7/13

CETIS Analytical Report

Report Date:	03 Jan-13 16:34 (p 1 of 1)
Test Code:	65294 | 17-0773-4840

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	06-9662-8219	**Endpoint:**	Mean Length-mm	**CETIS Version:**	CETISv1.8.4
Analyzed:	03 Jan-13 16:33	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Untransformed	NA	C > T	NA	NA	5.83%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43661		43664	-3.43	1.77	0.206	13	0.9978	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.5968001	0.5968001	1	11.8	0.0044	Significant Effect
Error	0.6575735	0.05058258	13			
Total	1.254374		14			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.15	9.16	0.8511	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.973	0.833	0.9022	Normal Distribution

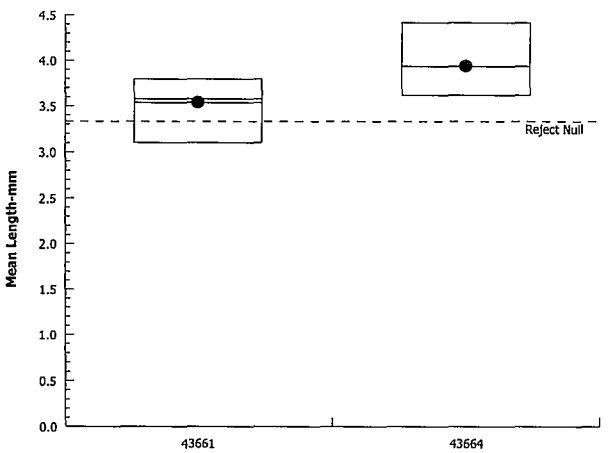
Mean Length-mm Summary

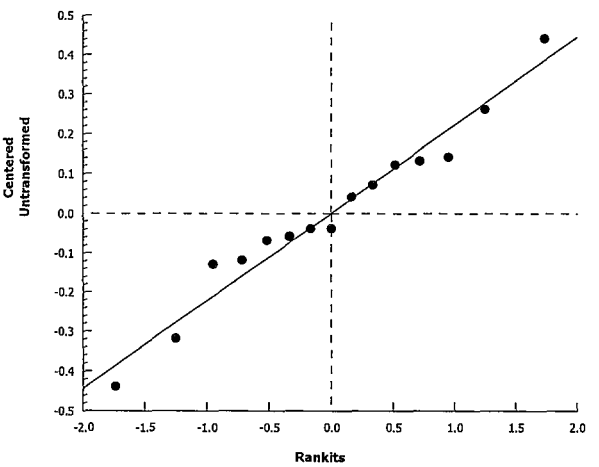
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	3.54	3.36	3.72	3.58	3.1	3.8	0.077	6.15%	0.0%
43664	7	3.94	3.72	4.15	3.9	3.62	4.38	0.0881	5.92%	-11.3%

Mean Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	3.1	3.5	3.48	3.8	3.67	3.66	3.42	3.68
43664	3.62	3.9	3.87	4.38	4.01	3.81	3.98	

Graphics





CETIS Analytical Report

Report Date:	03 Jan-13 16:34 (p 1 of 1)
Test Code:	65294 | 17-0773-4840

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	08-8236-0947	**Endpoint:**	Mean Length-mm	**CETIS Version:**	CETISv1.8.4
Analyzed:	03 Jan-13 16:33	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Untransformed	NA	C > T	NA	NA	4.42%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43661		43665	7.27	1.76	0.156	14	<0.0001	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.6641	1.6641	1	52.8	<0.0001	Significant Effect
Error	0.4408751	0.03149107	14			
Total	2.104975		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	3.04	8.89	0.1659	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.942	0.841	0.3734	Normal Distribution

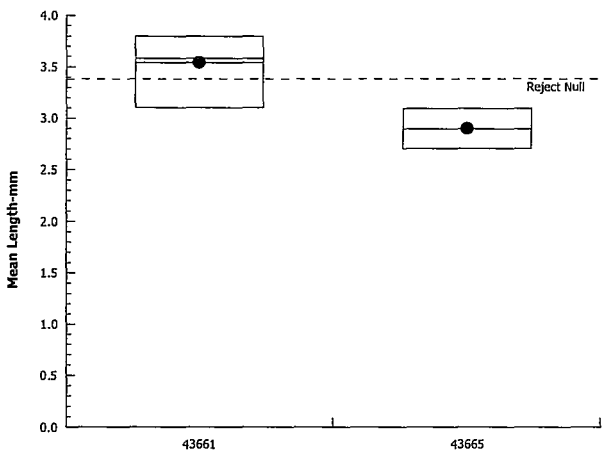
Mean Length-mm Summary

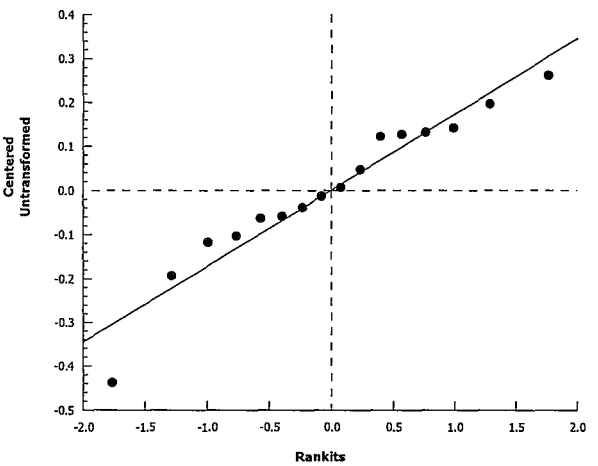
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	3.54	3.36	3.72	3.58	3.1	3.8	0.077	6.15%	0.0%
43665	8	2.89	2.79	3	2.89	2.7	3.09	0.0442	4.32%	18.2%

Mean Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	3.1	3.5	3.48	3.8	3.67	3.66	3.42	3.68
43665	2.94	2.9	3.09	2.88	2.7	2.83	3.02	2.79

Graphics





CETIS Test Data Worksheet

Report Date: 03 Jan-13 16:32 (p 1 of 1)
Test Code: 17-0773-4840/65294

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Start Date: 02 Nov-12 10:40 **Species:** Hyalella azteca **Sample Code:** 43661
End Date: 12 Nov-12 09:30 **Protocol:** EPA/600/R-99/064 (2000) **Sample Source:** CONTROL
Sample Date: 19 Sep-12 07:15 **Material:** Control Sediment **Sample Station:** CONTROL

Sample Code	Rep	Pos	# Exposed	# Survived	Total Weight-mg	Tare Weight-mg	Pan Count	Mean Length-mm	Notes
43661	1	18	10	10	26.59	25.84	10	3.1	
43661	2	28	10	10	29.62	28.86	10	3.5	
43661	3	39	10	10	24.09	23.37	10	3.48	
43661	4	12	10	10	25.78	24.94	10	3.8	
43661	5	20	10	10	25.66	24.86	10	3.67	
43661	6	23	10	10	28.04	27.24	10	3.66	
43661	7	24	10	10	25.05	24.38	10	3.42	
43661	8	11	10	10	26.52	25.66	10	3.68	
43662	1	7	10	10	32.75	32.19	10	2.91	
43662	2	25	10	10	26.32	25.74	10	2.94	
43662	3	19	10	10	25.76	25.23	10	2.89	
43662	4	1	10	10	29.61	28.94	10	3.42	
43662	5	6	10	10	30.61	29.92	10	3.32	
43662	6	40	10	10	30.24	29.74	10	3.18	
43662	7	2	10	10	30.99	30.4	10	2.92	
43662	8	33	10	10	31.45	30.82	10	3.17	
43663	1	4	10	10	30.46	29.74	10	3.18	
43663	2	29	10	10	25.08	24.34	10	3.18	
43663	3	31	10	10	25.42	24.81	10	3.24	
43663	4	22	10	10	28.92	28.3	10	3.05	
43663	5	21	10	10	26.72	26.13	10	3.39	
43663	6	37	10	10	27.65	27.15	10	3.1	
43663	7	26	10	10	23.88	23.15	10	3.53	
43663	8	30	10	8	28.29	27.73	8	3.51	
43664	1	5	10	10	30.58	29.56	10	3.62	
43664	2	3	10	8	29.82	28.88	8	3.9	
43664	3	17	10	1	30.93	30.83	1	3.87	
43664	4	27	10	0					
43664	5	8	10	9	28	26.85	9	4.38	
43664	6	35	10	8	30.13	29.13	8	4.01	
43664	7	36	10	5	29.65	29.19	5	3.81	
43664	8	15	10	10	30.08	29.08	10	3.98	
43665	1	16	10	10	23.6	23.17	10	2.94	
43665	2	9	10	9	29.5	28.97	9	2.9	
43665	3	32	10	9	29.43	28.83	9	3.09	
43665	4	38	10	10	30.86	30.35	10	2.88	
43665	5	13	10	10	30.4	29.83	10	2.7	
43665	6	14	10	9	27.03	26.53	9	2.83	
43665	7	10	10	8	30.36	29.87	8	3.02	
43665	8	34	10	9	30.46	29.99	9	2.79	

Project: Auburn Road Landfill

100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: TOX3-001

SEDIMENT TEST DATA:

Test ID: **65294**

Sample Number	Rep.	Surviving Number	Initials	Repick	Initials	Total Surviving	Number weighed	Initial Pan Weight	Final Pan Weight
43661 Control	A	10	J	—	—	10	10	25.84	26.59
	B	10	J	—	—	10	10	28.86	29.62
	C	10	KK	—	—	10	10	23.37	24.09
	D	10	KK	—	—	10	10	24.94	25.78
	E	10	J	—	—	10	10	24.86	25.66
	F	10	J	—	—	10	10	27.24	28.04
	G	10	KK	—	—	10	10	24.38	25.05
	H	10	KK	—	—	10	10	25.66	26.52
43662 SD2-1012	A	10	KK	—	—	10	10	32.19	32.75
	B	10	KK	—	—	10	10	25.74	26.32
	C	10	J	—	—	10	10	25.23	25.76
	D	10	J	—	—	10	10	28.94	29.61
	E	10	KK	—	—	10	10	29.92	30.61
	F	10	KK	—	—	10	10	29.74	30.24
	G	10	KK	—	—	10	10	30.40	30.99
	H	10	KK	—	—	10	10	30.82	31.45
43663 SD4-1012	A	10	J	—	—	10	10	29.74	30.46
	B	10	J	—	—	10	10	24.34	25.08
	C	10	KK	—	—	10	10	24.81	25.42
	D	10	KK	—	—	10	10	28.30	28.92
	E	10	KK	—	—	10	10	26.13	26.72
	F	10	KK	—	—	10	10	27.15	27.65
	G	10	JR	—	—	10	10	23.15	23.88
	H	9	J	—	—	(1) 9 8	8	27.73	28.29
43664 SD5-1012	A	10	KK	—	—	10	10	29.56	30.58
	B	8	KK	—	—	8	8	28.88	29.82
	C	1	JR	0	J	1	1	30.83	30.93
	D	0	J	0	JR	0	0	29.61	29.61
	E	9	KK	—	—	9	9	26.85	28.00
	F	8	KK	—	—	8	8	29.13	30.13
	G	5	J	0	JR	5	5	29.19	29.65
	H	10	JR	—	—	10	10	29.08	30.08

NOTES: 43664 C: 1 dead H.a. (1) One appears to be a molt casing. JW

Date/Init (Initial Pan Weights):
11/8/12 15:00 JR
IN (Date/Time/Temp/Init):
OUT (Date/Time/Temp/Init):
11/13/12 11:10 JR 80°

Aquatec Biological Sciences, Inc.

Reviewed by: J Date: 11/20/12

SDG: 13339

Project: 12051

Project: Auburn Road Landfill

100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: TOX3-001

SEDIMENT TEST DATA: Test ID: **65302**

Sample Number	Rep.	Surviving Number	Initials	Repick	Initials	Total Surviving	Number weighed	Initial Pan Weight	Final Pan Weight
43665	A	10	JR	—	—	10	10	23.17	23.60
SD9-1012	B	9	J	0	JR	9	9	28.97	29.50
	C	9	KK	—	—	9	9	28.83	29.43
	D	10	KK	—	—	10	10	30.35	30.86
	E	10	JR	—	—	10	10	29.83	30.40
	F	9	J	—	—	9	9	26.53	27.03
	G	8	JR	0	J	8	8	29.87	30.36
	H	9	J	0	JR	9	9	29.99	30.46

NOTES: Test end: 06:30 - 09:30 11/12/12 JR

Date/Init (Initial Pan Weights):	11/8/12 15:00 JR
IN (Date/Time/Temp/Init):	11/12/12 13:03 8.0°C KD
OUT (Date/Time/Temp/Init):	11/13/12 11:10 JR

Aquatec Biological Sciences, Inc.

Reviewed by: J Date: 12/20/12

SDG: 13339

Project: 12051

Amphipod (Hyalella azteca) Sediment Toxicity Test Results
Organism Body Lengths

Project: 12051
SDG: 13339

Sample Number: **Intial Lengths**

Capture #: Initial A	
Rep	Length (mm)
A - 1	2.10
A - 2	1.96
A - 3	1.83
A - 4	2.07
A - 5	1.80
A - 6	2.22
A - 7	2.29
A - 8	2.09
A - 9	1.96
A - 10	2.83
	2.12

Capture #: Initial B	
Rep	Length (mm)
B - 1	1.93
B - 2	1.96
B - 3	1.77
B - 4	1.80
B - 5	1.70
B - 6	2.05
B - 7	2.55
B - 8	2.55
B - 9	2.20
B - 10	2.29
	2.08

Capture #: Initial C	
Rep	Length (mm)
C - 1	1.91
C - 2	1.90
C - 3	1.99
C - 4	1.76
C - 5	2.10
C - 6	2.31
C - 7	2.15
C - 8	1.68
C - 9	2.07
C - 10	1.71
	1.96

Capture #: Initial D	
Rep	Length (mm)
D - 1	1.65
D - 2	1.61
D - 3	2.20
D - 4	2.43
D - 5	2.17
D - 6	1.53
D - 7	2.75
D - 8	1.82
D - 9	2.64
D - 10	2.24
	2.10

Aquatec Biological Sciences, Inc.
Reviewed by: [illegible] Date: 12/20/12

Aquatec Biological Sciences, Inc.

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Concord, NH 03301

Tel: (603) 656-5453
Fax: (603) 656-5401

E-Mail: s.combs@westonso

INITIAL LENGTHS

Species: *Hyalella azteca*
Supplier: ARO
Condition: Normal/Active

Date Received: 11/1/12
Age of Organisms 12 d
Culture ID: 110112 Ha

Photo ID: Initial A		Photo ID: Initial B		Photo ID: Initial C		Photo ID: Initial D	
Rep	Length (mm)	Rep	Length (mm)	Rep	Length (mm)	Rep	Length (mm)
A - 1	2.10	B - 1	1.93	C - 1	1.91	D - 1	1.65
A - 2	1.96	B - 2	1.96	C - 2	1.90	D - 2	1.61
A - 3	1.83	B - 3	1.77	C - 3	1.99	D - 3	2.20
A - 4	2.07	B - 4	1.80	C - 4	1.76	D - 4	2.43
A - 5	1.80	B - 5	1.70	C - 5	2.10	D - 5	2.17
A - 6	2.22	B - 6	2.05	C - 6	2.31	D - 6	1.53
A - 7	2.29	B - 7	2.55	C - 7	2.15	D - 7	2.75
A - 8	2.09	B - 8	2.55	C - 8	1.68	D - 8	1.82
A - 9	1.96	B - 9	2.20	C - 9	2.07	D - 9	2.64
A - 10	2.83	B - 10	2.29	C - 10	1.71	D - 10	2.24

Amphipod (Hyalella azteca) Sediment Toxicity Test Results

Organism Body Lengths

Project: 12051
SDG: 13339

Rep	43661 Length (mm)	43662 Length (mm)	43663 Length (mm)	43664 Length (mm)	43665 Length (mm)
A - 1	3.09	3.17	3.49	3.34	2.28
A - 2	2.96	2.64	3.71	3.37	3.14
A - 3	3.15	2.65	2.90	3.86	3.83
A - 4	2.77	3.26	2.94	3.82	2.21
A - 5	3.55	2.75	3.35	3.39	2.94
A - 6	2.93	3.29	3.36	4.26	2.65
A - 7	3.05	3.28	2.38	3.40	3.39
A - 8	3.17	2.70	2.77	3.76	3.11
A - 9	3.09	2.37	3.42	3.82	2.73
A - 10	3.25	3.01	3.44	3.16	3.09
B - 1	4.20	2.97	3.74	3.85	2.92
B - 2	2.62	3.14	3.31	3.84	3.26
B - 3	3.31	3.01	2.63	3.57	2.95
B - 4	3.12	2.69	3.06	3.24	2.50
B - 5	4.07	2.85	3.44	3.44	3.14
B - 6	3.37	3.17	2.38	4.88	2.58
B - 7	3.60	2.72	3.65	4.44	2.67
B - 8	3.37	3.05	3.32	3.93	3.00
B - 9	3.56	2.62	2.95		3.07
B - 10	3.76	3.16	3.36		
C - 1	4.32	3.37	3.41	3.87	3.19
C - 2	3.31	3.24	3.37		2.94
C - 3	3.04	3.17	3.48		3.67
C - 4	3.58	2.41	3.02		3.43
C - 5	4.00	3.27	2.99		2.07
C - 6	2.67	2.20	3.14		3.52
C - 7	2.99	2.93	3.31		2.90
C - 8	3.60	2.70	3.03		2.91
C - 9	3.78	2.99	3.57		3.15
C - 10	3.47	2.59	3.09		
D - 1	3.32	3.36	2.30		2.81
D - 2	4.42	3.37	2.97		3.17
D - 3	3.39	3.42	3.55		3.08
D - 4	3.66	3.52	3.13		3.12
D - 5	3.95	3.48	2.79		2.68
D - 6	3.91	3.20	3.50		2.43
D - 7	2.95	3.48	3.02		3.23
D - 8	4.33	3.24	3.43		2.23
D - 9	3.74	3.38	2.78		3.02
D - 10	4.34	3.75	3.05		3.01
E - 1	3.16	3.51	3.11	4.31	2.79
E - 2	4.03	3.48	3.00	4.47	3.15
E - 3	3.59	3.15	3.21	4.44	2.75
E - 4	3.56	3.18	3.85	4.18	3.32
E - 5	4.50	3.65	3.60	4.22	2.47
E - 6	3.55	2.56	3.33	4.71	2.01
E - 7	3.89	3.55	3.27	4.56	2.66
E - 8	3.77	3.43	3.51	4.10	2.51
E - 9	3.93	3.41	3.83	4.44	2.31
E - 10	2.69	3.27	3.18		3.04

Aquatec Biological Sciences, Inc.
Reviewed by: JJ Date: 1/7/13

Amphipod (Hyalella azteca) Sediment Toxicity Test Results

Project: 12051
SDG: 13339

Organism Body Lengths

Rep	43661 Length (mm)	43662 Length (mm)	43663 Length (mm)	43664 Length (mm)	43665 Length (mm)
F - 1	2.31	3.17	2.97	4.05	2.46
F - 2	3.88	3.22	3.05	3.54	3.64
F - 3	4.26	3.63	3.11	4.62	1.95
F - 4	4.00	2.91	2.96	4.57	2.35
F - 5	3.06	2.40	3.10	4.47	2.57
F - 6	3.22	3.66	3.20	3.69	2.86
F - 7	4.03	3.40	3.63	3.54	3.12
F - 8	3.79	2.55	2.73	3.60	3.32
F - 9	4.48	3.84	3.02		3.24
F - 10	3.56	3.02	3.19		
G - 1	2.55	2.69	3.89	4.13	2.51
G - 2	3.36	2.88	3.74	3.82	2.87
G - 3	3.36	3.40	3.73	4.31	2.83
G - 4	4.09	2.42	3.38	3.32	3.08
G - 5	3.36	3.19	3.59	3.45	2.99
G - 6	3.16	2.99	4.64		3.30
G - 7	3.68	2.77	2.98		3.39
G - 8	3.18	2.87	2.32		3.15
G - 9	4.06	3.06	2.95		
G - 10	3.38	2.96	4.11		
H - 1	4.27	3.32	3.88	4.68	2.73
H - 2	2.66	3.13	3.35	4.25	2.70
H - 3	3.79	2.52	3.61	3.78	2.96
H - 4	4.18	2.87	3.57	3.89	2.97
H - 5	4.45	2.89	3.82	4.16	2.65
H - 6	3.61	3.17	3.12	4.43	2.18
H - 7	3.46	3.61	3.66	3.51	3.34
H - 8	3.86	2.87	3.03	3.81	2.57
H - 9	2.95	3.67		3.54	3.00
H - 10	3.54	3.60		3.79	

Rep	43661 Average Length (mm)	43662 Average Length (mm)	43663 Average Length (mm)	43664 Average Length (mm)	43665 Average Length (mm)
A	**3.10**	**2.91**	**3.18**	**3.62**	**2.94**
B	**3.50**	**2.94**	**3.18**	**3.90**	**2.90**
C	**3.48**	**2.89**	**3.24**	**3.87**	**3.09**
D	**3.80**	**3.42**	**3.05**	**0.00**	**2.88**
E	**3.67**	**3.32**	**3.39**	**4.38**	**2.70**
F	**3.66**	**3.18**	**3.10**	**4.01**	**2.83**
G	**3.42**	**2.92**	**3.53**	**3.81**	**3.02**
H	**3.68**	**3.17**	**3.51**	**3.98**	**2.79**

Aquatec Biological Sciences, Inc.
Reviewed by: [illegible] Date: 1/7/13

Project: Auburn Road Landfill

100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: TOX3-001

LENGTH DATA:

43661 Control

Photo ID: 43661-A

Rep	Length (mm)
A - 1	3.09
A - 2	2.96
A - 3	3.15
A - 4	2.77
A - 5	3.55
A - 6	2.93
A - 7	3.05
A - 8	3.17
A - 9	3.09
A - 10	3.25

Photo ID: 43661-B

Rep	Length (mm)
B - 1	4.20
B - 2	2.62
B - 3	3.31
B - 4	3.12
B - 5	4.07
B - 6	3.37
B - 7	3.60
B - 8	3.37
B - 9	3.56
B - 10	3.76

Photo ID: 43661-C

Rep	Length (mm)
C - 1	4.32
C - 2	3.31
C - 3	3.04
C - 4	3.58
C - 5	4.00
C - 6	2.67
C - 7	2.99
C - 8	3.60
C - 9	3.78
C - 10	3.47

Photo ID: 43661-D

Rep	Length (mm)
D - 1	3.32
D - 2	4.42
D - 3	3.39
D - 4	3.66
D - 5	3.95
D - 6	3.91
D - 7	2.95
D - 8	4.33
D - 9	3.74
D - 10	4.34

Photo ID: 43661-E

Rep	Length (mm)
E - 1	3.16
E - 2	4.03
E - 3	3.59
E - 4	3.56
E - 5	4.50
E - 6	3.55
E - 7	3.89
E - 8	3.77
E - 9	3.93
E - 10	2.69

Photo ID: 43661-F

Rep	Length (mm)
F - 1	2.31
F - 2	3.88
F - 3	4.26
F - 4	4.00
F - 5	3.06
F - 6	3.22
F - 7	4.03
F - 8	3.79
F - 9	4.48
F - 10	3.56

Photo ID: 43661-G

Rep	Length (mm)
G - 1	2.55
G - 2	3.36
G - 3	3.36
G - 4	4.09
G - 5	3.36
G - 6	3.16
G - 7	3.68
G - 8	3.18
G - 9	4.06
G - 10	3.38

Photo ID: 43661-H

Rep	Length (mm)
H - 1	4.27
H - 2	2.66
H - 3	3.79
H - 4	4.18
H - 5	4.45
H - 6	3.61
H - 7	3.46
H - 8	3.86
H - 9	2.95
H - 10	3.54

Aquatec Biological Sciences, Inc.

Reviewed by: [illegible] Date: 12/20/22

SDG: 13339

Project: 12051

100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: TOX3-001

LENGTH DATA:

43662 SD2-1012

Photo ID: 436062-A

Rep	Length (mm)
A - 1	3.17
A - 2	2.64
A - 3	2.65
A - 4	3.26
A - 5	2.75
A - 6	3.29
A - 7	3.28
A - 8	2.70
A - 9	2.37
A - 10	3.01

Photo ID: 436062-B

Rep	Length (mm)
B - 1	2.97
B - 2	3.14
B - 3	3.01
B - 4	2.69
B - 5	2.85
B - 6	3.17
B - 7	2.72
B - 8	3.05
B - 9	2.62
B - 10	3.16

Photo ID: 436062-~~B~~ C

Rep	Length (mm)
C - 1	3.37
C - 2	3.24
C - 3	3.17
C - 4	2.41
C - 5	3.27
C - 6	2.20
C - 7	2.93
C - 8	2.70
C - 9	2.99
C - 10	2.59

Photo ID: 436062-D

Rep	Length (mm)
D - 1	3.36
D - 2	3.37
D - 3	3.42
D - 4	3.52
D - 5	3.48
D - 6	3.20
D - 7	3.48
D - 8	3.24
D - 9	3.38
D - 10	3.75

Photo ID: 436062-E

Rep	Length (mm)
E - 1	3.51
E - 2	3.48
E - 3	3.15
E - 4	3.18
E - 5	3.65
E - 6	2.56
E - 7	3.55
E - 8	3.43
E - 9	3.41
E - 10	3.27

Photo ID: 436062-F

Rep	Length (mm)
F - 1	3.17
F - 2	3.22
F - 3	3.63
F - 4	2.91
F - 5	2.40
F - 6	3.66
F - 7	3.40
F - 8	2.55
F - 9	3.84
F - 10	3.02

Photo ID: 436062-G

Rep	Length (mm)
G - 1	2.69
G - 2	2.88
G - 3	3.40
G - 4	2.42
G - 5	3.19
G - 6	2.99
G - 7	2.77
G - 8	2.87
G - 9	3.06
G - 10	2.96

Photo ID: 436062-H

Rep	Length (mm)
H - 1	3.32
H - 2	3.13
H - 3	2.52
H - 4	2.87
H - 5	2.89
H - 6	3.17
H - 7	3.61
H - 8	2.87
H - 9	3.67
H - 10	3.60

Aquatec Biological Sciences, Inc.

Reviewed by: 40 Date: 12/20/12

SDG: 13339

Project: 12051

Project: Auburn Road Landfill

100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: TOX3-001

LENGTH DATA:

43663 SD4-1012

Photo ID: 43663-A

Rep	Length (mm)
A - 1	3.49
A - 2	3.71
A - 3	2.90
A - 4	2.94
A - 5	3.35
A - 6	3.36
A - 7	2.38
A - 8	2.77
A - 9	3.42
A - 10	3.44

Photo ID: 43663-B

Rep	Length (mm)
B - 1	3.74
B - 2	3.31
B - 3	2.63
B - 4	3.06
B - 5	3.44
B - 6	2.38
B - 7	3.65
B - 8	3.32
B - 9	2.95
B - 10	3.36

Photo ID: 43663-C

Rep	Length (mm)
C - 1	3.41
C - 2	3.37
C - 3	3.48
C - 4	3.02
C - 5	2.99
C - 6	3.14
C - 7	3.31
C - 8	3.03
C - 9	3.57
C - 10	3.09

Photo ID: 43663-D

Rep	Length (mm)
D - 1	2.30
D - 2	2.97
D - 3	3.55
D - 4	3.13
D - 5	2.79
D - 6	3.50
D - 7	3.02
D - 8	3.43
D - 9	2.78
D - 10	3.05

Photo ID: 43663-E

Rep	Length (mm)
E - 1	3.11
E - 2	3.00
E - 3	3.21
E - 4	3.85
E - 5	3.60
E - 6	3.33
E - 7	3.27
E - 8	3.51
E - 9	3.83
E - 10	3.18

Photo ID: 43663-F

Rep	Length (mm)
F - 1	2.97
F - 2	3.05
F - 3	3.11
F - 4	2.96
F - 5	3.10
F - 6	3.20
F - 7	3.63
F - 8	2.73
F - 9	3.02
F - 10	3.19

Photo ID: 43663-G

Rep	Length (mm)
G - 1	3.89
G - 2	3.74
G - 3	3.73
G - 4	3.38
G - 5	3.59
G - 6	4.64
G - 7	2.98
G - 8	2.32
G - 9	2.95
G - 10	4.11

Photo ID: 43663-H

Rep	Length (mm)
H - 1	3.88
H - 2	3.35
H - 3	3.61
H - 4	3.57
H - 5	3.82
H - 6	3.12
H - 7	3.66
H - 8	3.03
H - 9	—
H - 10	—

Aquatec Biological Sciences, Inc.

Reviewed by: [illegible] Date: 12/20/12

SDG: 13339

Project: 12051

Project: Auburn Road Landfill

100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: TOX3-001

LENGTH DATA:

43664 SD5-1012

Photo ID: 43664-A

Rep	Length (mm)
A - 1	3.34
A - 2	3.37
A - 3	3.86
A - 4	3.82
A - 5	3.39
A - 6	4.26
A - 7	3.40
A - 8	3.76
A - 9	3.82
A - 10	3.16

Photo ID: 43664-B

Rep	Length (mm)
B - 1	3.85
B - 2	3.84
B - 3	3.57
B - 4	3.24
B - 5	3.44
B - 6	4.88
B - 7	4.44
B - 8	3.93
B - 9	—
B - 10	—

Photo ID: 43664-C

Rep	Length (mm)
C - 1	3.87
C - 2	—
C - 3	—
C - 4	—
C - 5	—
C - 6	—
C - 7	—
C - 8	—
C - 9	—
C - 10	—

Photo ID: 43664-D

Rep	Length (mm)
D - 1	—
D - 2	—
D - 3	—
D - 4	—
D - 5	—
D - 6	—
D - 7	—
D - 8	—
D - 9	—
D - 10	—

Photo ID: 43664-E

Rep	Length (mm)
E - 1	4.31
E - 2	4.47
E - 3	4.44
E - 4	4.18
E - 5	4.22
E - 6	4.71
E - 7	4.56
E - 8	4.10
E - 9	4.44
E - 10	—

Photo ID: 43664-F

Rep	Length (mm)
F - 1	4.05
F - 2	3.54
F - 3	4.62
F - 4	4.57
F - 5	4.47
F - 6	3.69
F - 7	3.54
F - 8	3.60
F - 9	—
F - 10	—

Photo ID: 43664-G

Rep	Length (mm)
G - 1	4.13
G - 2	3.82
G - 3	4.31
G - 4	3.32
G - 5	3.45
G - 6	—
G - 7	—
G - 8	—
G - 9	—
G - 10	—

Photo ID: 43664-H

Rep	Length (mm)
H - 1	4.68
H - 2	4.25
H - 3	3.78
H - 4	3.89
H - 5	4.16
H - 6	4.43
H - 7	3.51
H - 8	3.81
H - 9	3.54
H - 10	3.79

Aquatec Biological Sciences, Inc.

Reviewed by: [illegible] Date: 12/20/12

SDG: 13339

Project: 12051

Project: Auburn Road Landfill

100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: TOX3-001

LENGTH DATA:

43665 SD9-1012

Photo ID: 43665-A

Rep	Length (mm)
A - 1	2.28
A - 2	3.14
A - 3	3.83
A - 4	2.21
A - 5	2.94
A - 6	2.65
A - 7	3.39
A - 8	3.11
A - 9	2.73
A - 10	3.09

Photo ID: 43665-B

Rep	Length (mm)
B - 1	2.92
B - 2	3.26
B - 3	2.95
B - 4	2.50
B - 5	3.14
B - 6	2.58
B - 7	2.67
B - 8	3.00
B - 9	3.07
B - 10	—

Photo ID: 43665-C

Rep	Length (mm)
C - 1	3.19
C - 2	2.94
C - 3	3.67
C - 4	3.43
C - 5	2.07
C - 6	3.52
C - 7	2.90
C - 8	2.91
C - 9	3.15
C - 10	—

Photo ID: 43665-D

Rep	Length (mm)
D - 1	2.81
D - 2	3.17
D - 3	3.08
D - 4	3.12
D - 5	2.68
D - 6	2.43
D - 7	3.23
D - 8	2.23
D - 9	3.02
D - 10	3.01

Photo ID: 43665-E

Rep	Length (mm)
E - 1	2.79
E - 2	3.15
E - 3	2.75
E - 4	3.32
E - 5	2.47
E - 6	2.01
E - 7	2.66
E - 8	2.51
E - 9	2.31
E - 10	3.04

Photo ID: 43665-F

Rep	Length (mm)
F - 1	2.46
F - 2	3.64
F - 3	1.95
F - 4	2.35
F - 5	2.57
F - 6	2.86
F - 7	3.12
F - 8	3.32
F - 9	3.24
F - 10	—

Photo ID: 43665-G

Rep	Length (mm)
G - 1	2.51
G - 2	2.87
G - 3	2.83
G - 4	3.08
G - 5	2.99
G - 6	3.30
G - 7	3.39
G - 8	3.15
G - 9	—
G - 10	—

Photo ID: 43665-H

Rep	Length (mm)
H - 1	2.73
H - 2	2.70
H - 3	2.96
H - 4	2.97
H - 5	2.65
H - 6	2.18
H - 7	3.34
H - 8	2.57
H - 9	3.00
H - 10	—

Aquatec Biological Sciences, Inc.

Reviewed by: [illegible] Date: 12/20/12

SDG: 13339

Project: 12051

Aquatic Research Organisms

DATA SHEET

I. Organism History

Species Hyalella azteca

Source: Lab reared X Hatchery reared____ Field collected____

Hatch date 10/21/12 Receipt date____

Lot number 10 21 12 H.A Strain ARO

Brood origination ~~L~~ Pus fus 140

II. Water Quality

Temperature 24 °C Salinity — ppt D.O. SAT ppm

pH 7.4 su Hardness ≈120 ppm Alkalinity ≈140 ppm

III. Culture Conditions

Rec. 11/1/12 gw
Temp. 19.5
D.O. 16.5
pH. 7.1
Conductivity 430

Freshwater x Saltwater____ Other____

Recirculating____ Flow through____ Static renewal x

DIET: Flake food x Phytoplankton____ Trout chow x

Artemia____ Rotifers____ YCT____ Other____

Condition
Normal/active

Prophylactic treatments:____

Comments:____

Added sed recon. w/
Feed YCT ✓

IV. Shipping Information

Client: Aquatec VT # of Organisms 540+

Carrier: fedex Date shipped 10/31/12

Biologist:____

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WWW.AROFISH.US

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Weston Solutions, Inc.
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Suite 100
Concord, NH 03301

Tel: (603) 656-5453
Fax: (603) 656-5401

E-Mail: s.combs@westonso

ORGANISM HOLDING AND ACCLIMATION

Species: *Hyalella azteca*

Date Received: __/__/__

Supplier: _____

Age of Organisms _____

Condition: _____

Culture ID: _____

Acclimation / Holding Procedures: Transfer to holding culture boxes, add laboratory water. Acclimate to water to be used for testing (sediment overlying water formulation). Aerate lightly. Water change at least once (50 %) every two days.

Daily Feeding: 1:1 mix of Selenastrum / YCT, 1-3 mL (Maintain hint of green algal coloration on culture box bottom). Also add a pinch of ground Tetrafin. Do not allow excess food to accumulate.

Date	Fed	Temp.	pH	D.O.	Cond.	Condition	Water Change	Initials
11/1/12	✓ YC	19.5	7.1	16.5	480	Normal/Active	✓	JW
11/2/12	/	22.2	7.8	6.9	410	Normal/Active	/	JW
__/__/__								
__/__/__								
__/__/__								

N = Normal, appear healthy. Record # dead if any observed.

Hyalella azteca Initial Dry Weight

Replicate	No. of Org. weighed	Initial Pan weight (mg)	Final Pan weight (mg)	Initial Average wt. (mg)
1	10	18.70	18.86	0.016
2	10	19.55	19.71	0.021
3	10	18.05	18.23	0.018
4	10	16.72	16.93	0.021
5	10	17.28	17.45	0.017
6	10	18.53	18.70	0.017
7	10	16.62	16.83	0.021
8	10	17.25	17.46	0.021
	Initials		SL	
	Date		11/3/12	

IN/OUT of Oven:

IN: Date/Time/Initials/Temp.
11/2/12 16:28 - 76°C ✓

OUT: Date/Time/Initials/Temp.
11/3/12 13:10 - 78°C SL

Aquatec Biological Sciences, Inc.
Reviewed by: CS Date: 12/20/12

SDG: 13339
Project: 12051

Project: Auburn Road Landfill Test ID: **65294**

100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: TOX3-001

CHEMISTRY DATA: Chemical analysis Date/Initials are noted on last page of Days 0 - 10 chemistry data sheets

Sample	Analysis	0	1	2	3	4	5	6	7	8	9	10
43661	pH	7.1									7.5	
Control	DO	6.4	6.7	7.5	7.4	7.1	7.1	7.7	6.8	6.6	6.3	6.5
	Cond.	358									396	
43662	pH	7.1									7.4	
SD2-1012	DO	7.0	6.8	7.7	7.6	7.1	7.1	7.7	6.9	6.9	6.9	6.6
	Cond.	343									383	
43663	pH	7.2									7.5	
SD4-1012	DO	7.3	7.0	7.6	7.8	7.5	7.4	7.8	7.1	7.4	6.8	6.9
	Cond.	384									389	
43664	pH	7.4									7.5	
SD5-1012	DO	7.0	6.8	7.5	7.6	7.0	7.3	7.0	6.6	6.5	6.4	6.5
	Cond.	383									393	
43665	pH	7.2									7.3	
SD9-1012	DO	6.4	6.5	7.3	7.3	6.9	6.7	7.3	6.7	6.4	6.0	6.4
	Cond.	392									405	
2012	Date	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12
	Initials	KK	SL	JR	JR	KK	JR	JR	JR	KK	J	J

↳ D.O. taken after renewal JR 12:50 11/8

Aquatec Biological Sciences, Inc.

Reviewed by: J Date: 12/20/12

SDG: 13339

Project: 12051

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SDG: 13339
Project: 12051

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ALKALINITY AND HARDNESS

Sample ID:			Analysis Date:	Alkalinity: (mg/L)	Hardness: (mg/L)
43661	Control	Ha Day 0	11/2/2012	48.0	90.0
43662	SD2-1012	Ha Day 0	11/2/2012	36.0	80.0
43663	SD4-1012	Ha Day 0	11/2/2012	48.0	90.0
43664	SD5-1012	Ha Day 0	11/2/2012	44.0	90.0
43665	SD9-1012	Ha Day 0	11/2/2012	48.0	94.0
43661	Control	Ha Day 9	11/11/2012	56.0	100.0
43662	SD2-1012	Ha Day 9	11/11/2012	48.0	92.0
43663	SD4-1012	Ha Day 9	11/11/2012	56.0	96.0
43664	SD5-1012	Ha Day 9	11/11/2012	48.0	104.0
43665	SD9-1012	Ha Day 9	11/11/2012	56.0	100.0

.INF: Interference. The color endpoint was reached immediately.

Reviewed by: [illegible] Date: 1/8/13

Aquatec Biological Sciences, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 1638 Fax: (802) 658 - 3189

SDG: 13339
Project: 12051

AMMONIA ANALYSIS REPORT

Project: Auburn Road Landfill

100.1 **Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments**

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: TOX3-001

Sample	Pore Water (mg/L) 11/1/2012	Overlying Water (mg/L) 11/2/2012	11/11/2012
43661 - **Control**	0.9	0.3	0.3
43662 - **SD2-1012**	1.0	0.3	0.5
43663 - **SD4-1012**	1.0	0.3	0.3
43664 - **SD5-1012**	1.0	0.2	0.3
43665 - **SD9-1012**	1.0	0.7	0.5

BD- Indicates a concentration value below the reporting limit (<0.1).

Reviewed by: CI Date: 1/7/13.

Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Aquatec Biological Sciences

Channel #: 8

TEMPERATURE LOG (°C)

Client: Weston Solutions, Inc.
Project: Auburn Road Landfill
Project #: 12051
SDG: 13339
Species: *Hyalella azteca*

DAY	Hour of the Day																								Daily		
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AVE	MIN	MAX
11/02/2012											22.4	22.8	22.7	22.9	23.0	23.0	22.9	22.8	22.8	22.7	23.2	23.2	23.2	23.2	22.9	22.4	23.2
11/03/2012	23.1	23.1	23.2	23.0	22.9	23.2	23.0	23.0	23.0	23.0	23.1	23.0	22.9	22.7	23.1	23.0	23.2	23.1	22.9	23.2	23.2	23.0	22.9	23.1	23.0	22.7	23.2
11/04/2012	22.8	22.7	22.9	23.0	22.8	23.1	22.8	23.0	22.8	23.1	22.9	22.8	23.1	22.3	23.0	23.1	23.1	22.9	23.2	22.7	22.7	23.0	23.0	22.8	22.9	22.3	23.2
11/05/2012	23.0	22.4	22.8	23.0	23.0	22.8	22.8	22.8	23.0	23.0	22.7	23.0	23.0	22.9	23.1	22.8	22.9	23.0	23.0	23.0	23.0	23.1	23.0	22.8	22.9	22.4	23.1
11/06/2012	23.1	23.0	23.0	22.8	23.0	23.1	22.8	23.1	23.1	22.8	23.1	22.8	22.8	22.7	23.0	22.8	23.0	23.0	22.9	22.8	23.0	23.1	23.1	22.9	23.0	22.7	23.1
11/07/2012	23.0	23.1	23.1	23.0	23.0	23.1	22.9	23.1	22.9	23.1	22.7	23.0	23.0	22.7	22.7	22.9	22.9	22.8	22.8	22.8	22.8	23.1	23.1	23.0	22.9	22.7	23.1
11/08/2012	22.9	23.0	22.8	23.1	22.9	22.9	23.0	23.0	23.1	23.1	23.0	22.8	22.8	22.9	22.8	22.8	23.1	23.1	22.9	22.8	23.0	23.1	23.0	23.0	23.0	22.8	23.1
11/09/2012	22.9	23.0	22.8	23.0	23.1	22.8	23.0	23.0	22.8	23.1	23.0	23.0	22.8	23.0	22.8	22.8	23.0	22.9	23.0	22.9	23.1	23.1	23.1	23.1	23.0	22.8	23.1
11/10/2012	23.0	23.2	22.9	22.8	22.8	22.9	23.1	23.1	23.0	23.0	23.0	22.9	23.0	22.9	23.0	23.0	22.9	22.8	23.0	23.0	23.0	23.0	22.9	22.9	23.0	22.8	23.2
11/11/2012	22.9	23.0	22.8	23.0	23.0	22.8	23.0	22.7	23.1	23.1	23.0	23.0	22.8	23.0	23.0	22.8	23.1	23.0	23.0	23.0	23.1	23.0	23.0	23.0	23.0	22.7	23.1
11/12/2012	22.8	23.0	22.8	22.8	23.0	23.2	23.1	23.0	22.7																22.9	22.7	23.2
																								Overall Test Temperature:	**22.9**	**22.3**	**23.2**

Reviewed by: J Date: 1/7/13

Aquatec Biological Sciences, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 1638 Fax: (802) 658 - 3189

Weston Solutions, Inc.
45 Constitution Avenue
Suite 100
Concord, NH 03301

Tel: (603) 656-5453
Fax: (603) 656-5401

E-Mail: s.combs@westonso

SEDIMENT CHARACTERIZATION:

Sample Number	Client Sample ID	Sediment Characteristics	Pore Water pH	Organisms Present	Initial /Date
43661	Control Sieved: (Y) / N 0.5 Mesh size	Fine sand collected from Lamoille River & Lake Arrowhead, VT	6.8	None seen	11/1/12
43662	SD2-1012 Sieved: (Y) / N 1.0 Mesh size	Soft mud & sand w/ roots/vegetative material. A couple stones.	5.5	None seen.	JW 10/31/12
43663	SD4-1012 Sieved: (Y) / N 1.0 Mesh size	Soft mud w/ roots/vegetative material.	6.1	None Seen.	JW 10/31/12
43664	SD5-1012 Sieved: (Y) / N 2.8 Mesh size	Coarse sand & gravel. Pebbles & stones	6.6	None Seen	J 10/31/12
43665	SD9-1012 Sieved: (Y) / N 1.0 Mesh size	Soft red mud with much vegetation (roots)	6.4	None Seen	J 10/31/12

Aquatec Biological Sciences, Inc.
Reviewed by: J Date: 12/20/12

SDG: 13339
Project: 12051

Project: Auburn Road Landfill **WEEK OF:** 10/28/12

100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: TOX3-001

ACTIVITY / DAY **DAILY SEDIMENT MONITORING - CHECKLIST**

AM	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Temperature(s): Probe #(s): SL2 & Channel B						22.7	23.4
Fill Reservoirs						✓	✓
Delivery tubes in place						✓	✓
Check water Supply						✓	✓
Empty Waste Buckets						✓	✓
Floater/~~Aeration~~* Check						—	✓
Chems Collected / ok?						✓	✓

NOON							
Splitter box(s) filling?						09:50 ✓	✓
Syringes filing?						✓	✓
Needles flowing?						✓	✓
Drainage to Waste - ok?						✓	✓
Feeding (Time/Init.)						17:45 SL	13:00 SL

PM							
Temperature(s): Probe #(s): See Above						22.9	22.8
Fill Reservoirs					✓	✓	✓
Delivery tubes in place					✓	✓	✓
Check water Supply					✓	✓	✓
Empty Waste Buckets					✓	✓	✓
Floater/~~Aeration~~* Check					—	✓	✓
Date:					11/1/12	11/2/12	11/3/12
Initials:					JW	KK	SL

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Corrective Actions / Comments (Initial/Time) * Aeration required if DO is below/reaching minimum DO reqirements (Note when initiated)					Sediments loaded into beakers OLW added. PW extracted for T. ammonia. JW	10:40 Test START JW	

Aquatec Biological Sciences, Inc.

Reviewed by: JW Date: 12/20/12

SDG: 13339

Project: 12051

Project: Auburn Road Landfill **WEEK OF:** 11/4/12

100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: TOX3-001

ACTIVITY / DAY **DAILY SEDIMENT MONITORING - CHECKLIST**

AM

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Temperature(s): Probe #(s):	22.7	22.8	23.8	22.9	23.1	22.8	23.0
Fill Reservoirs	✓	✓	✓	✓	✓	✓	✓
Delivery tubes in place	✓	✓	✓	✓	✓	✓	✓
Check water Supply	✓	✓	✓	✓	✓	✓	✓
Empty Waste Buckets	✓	✓	✓	✓	✓	✓	✓
Floater/~~Aeration~~* Check	✓	✓	✓	✓	✓	✓	✓
Chems Collected / ok?	✓	✓	✓	✓	✓	✓	✓

NOON

Splitter box(s) filling?	✓	✓	✓	✓	✓	✓	✓
Syringes filing?	✓	✓	✓	✓	✓	✓	✓
Needles flowing?	✓	✓	✓	✓	✓	✓	✓
Drainage to Waste - ok?	✓	✓	✓	✓	✓	✓	✓
Feeding (Time/Init.)	11:53 JR	14:40 JR	12:50 JR	15:17 JR 17:15 JR	13:05 JR	12:15 SL	12:30 SL

PM

Temperature(s): Probe #(s): See Above	23.1		22.8	22.8	23.4	22.6	23.0
Fill Reservoirs	✓	✓	✓	✓	✓	✓	✓
Delivery tubes in place	✓	✓	✓	✓	✓	✓	✓
Check water Supply	✓	✓	✓	✓	✓	✓	✓
Empty Waste Buckets	✓	✓	✓	✓	✓	✓	✓
Floater/~~Aeration~~* Check	✓		✓	✓	✓ submerged	✓	✓
Date:	11/4/12	11/5/12	11/6/12	11/7/12	11/8/12	11/9/12	11/10/12
Initials:	JR	JR	JR/KK/JW	JR	SL JR	JW	KK

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Corrective Actions / Comments (Initial/Time)							

* Aeration required if DO is below/reaching minimum DO reqirements (Note when initiated)

Aquatec Biological Sciences, Inc. **SDG:** 13339

Reviewed by: _____ Date: 12/20/12 **Project:** 12051

Project: Auburn Road Landfill **WEEK OF:** 11/11/12

100.1 Amphipod, H. azteca, 10-D Survival and Growth Test for Sediments

Species: *Hyalella azteca* Reference: EPA/600/R-99/064 SOP: TOX3-001

DAILY SEDIMENT MONITORING - CHECKLIST

ACTIVITY / DAY

AM

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Temperature(s): Probe #(s):	22.9	23.2					
Fill Reservoirs	✓						
Delivery tubes in place	✓						
Check water Supply	✓						
Empty Waste Buckets	✓						
Floater/Aeration* Check	✓	✓					
Chems Collected / ok?	✓	✓					

NOON

Splitter box(s) filling?	✓						
Syringes filing?	✓						
Needles flowing?	✓						
Drainage to Waste - ok?	✓						
Feeding (Time/Init.)	15:20 JR						

PM

Temperature(s): Probe #(s): See Above	22.9						
Fill Reservoirs	✓						
Delivery tubes in place	✓						
Check water Supply	✓						
Empty Waste Buckets	✓						
Floater/Aeration* Check	✓						
Date:	11/11/12	11/12/12					
Initials:	JR/ CW	JC					

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Corrective Actions / Comments (Initial/Time)		TEST END ~~0900~~ 06:30-09:30 J					

* Aeration required if DO is below/reaching minimum DO reqirements (Note when initiated)

100.5-28Ct - Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

CETIS Summary Report

Test Code: 65294 | 17-5144-0015

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Batch ID:	11-2602-3869	**Test Type:**	Survival	**Analyst:**	
Start Date:	06 Nov-12 16:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Reconstituted Water
Ending Date:	04 Dec-12 10:30	**Species:**	Chironomus tentans	**Brine:**	
Duration:	27d 19h	**Source:**	In-House Culture	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
43661	09-9038-3902	19 Sep-12 07:15	19 Sep-12 08:15	48d 9h	Weston Solutions, Inc.	
43662	03-8789-8795	24 Oct-12 15:50	26 Oct-12 10:00	13d 0h		
43663	09-1086-2928	24 Oct-12 16:30	26 Oct-12 10:00	12d 23h		
43664	00-7258-0456	24 Oct-12 08:15	26 Oct-12 10:00	13d 8h		
43665	11-9899-1264	24 Oct-12 09:15	26 Oct-12 10:00	13d 7h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
43661	Control Sediment	CONTROL	CONTROL		
43662	Sediment	Auburn Rd	SD2		
43663	Sediment	Auburn Rd	SD4		
43664	Sediment	Auburn Rd	SD5		
43665	Sediment	Auburn Rd	SD9		

Emergence Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
43661	8	0.538	0.455	0.62	0.2	0.9	0.0778	0.22	40.9%	0.0%
43662	8	0.313	0.258	0.367	0.1	0.5	0.0515	0.146	46.6%	41.9%
43663	8	0.5	0.437	0.563	0.3	0.8	0.0598	0.169	33.8%	6.98%
43664	8	0.513	0.439	0.586	0.2	0.7	0.0693	0.196	38.2%	4.65%
43665	8	0.462	0.406	0.519	0.2	0.7	0.0532	0.151	32.6%	14.0%

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
43661	8	0.538	0.455	0.62	0.2	0.9	0.0778	0.22	40.9%	0.0%
43662	8	0.375	0.327	0.423	0.1	0.5	0.0453	0.128	34.2%	30.2%
43663	8	0.5	0.437	0.563	0.3	0.8	0.0598	0.169	33.8%	6.98%
43664	8	0.513	0.439	0.586	0.2	0.7	0.0693	0.196	38.2%	4.65%
43665	8	0.462	0.406	0.519	0.2	0.7	0.0532	0.151	32.6%	14.0%

Emergence Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.5	0.9	0.6	0.5	0.3	0.2	0.7	0.6
43662	0.3	0.2	0.4	0.1	0.3	0.5	0.5	0.2
43663	0.5	0.3	0.5	0.8	0.4	0.4	0.7	0.4
43664	0.2	0.7	0.4	0.3	0.6	0.5	0.7	0.7
43665	0.5	0.2	0.4	0.7	0.5	0.4	0.4	0.6

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.5	0.9	0.6	0.5	0.3	0.2	0.7	0.6
43662	0.3	0.4	0.4	0.1	0.4	0.5	0.5	0.4
43663	0.5	0.3	0.5	0.8	0.4	0.4	0.7	0.4
43664	0.2	0.7	0.4	0.3	0.6	0.5	0.7	0.7
43665	0.5	0.2	0.4	0.7	0.5	0.4	0.4	0.6

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Emergence Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	5/10	9/10	6/10	5/10	3/10	2/10	7/10	6/10
43662	3/10	2/10	4/10	1/10	3/10	5/10	5/10	2/10
43663	5/10	3/10	5/10	8/10	4/10	4/10	7/10	4/10
43664	2/10	7/10	4/10	3/10	6/10	5/10	7/10	7/10
43665	5/10	2/10	4/10	7/10	5/10	4/10	4/10	6/10

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	5/10	9/10	6/10	5/10	3/10	2/10	7/10	6/10
43662	3/10	4/10	4/10	1/10	4/10	5/10	5/10	4/10
43663	5/10	3/10	5/10	8/10	4/10	4/10	7/10	4/10
43664	2/10	7/10	4/10	3/10	6/10	5/10	7/10	7/10
43665	5/10	2/10	4/10	7/10	5/10	4/10	4/10	6/10

CETIS Analytical Report

Report Date:	03 Jan-13 16:27 (p 1 of 1)
Test Code:	65294 | 17-5144-0015

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	16-8489-9541	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.4
Analyzed:	03 Jan-13 16:27	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	31.6%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43661		43662	1.76	1.76	0.177	14	0.0497	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.1252057	0.1252057	1	3.11	0.0994	Non-Significant Effect
Error	0.5628801	0.04020572	14			
Total	0.6880858		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	2.65	8.89	0.2217	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.921	0.841	0.1778	Normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.538	0.354	0.721	0.55	0.2	0.9	0.0778	40.9%	0.0%
43662	8	0.375	0.268	0.482	0.4	0.1	0.5	0.0453	34.2%	30.2%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.828	0.626	1.03	0.836	0.464	1.25	0.0854	29.2%	0.0%
43662	8	0.651	0.527	0.775	0.685	0.322	0.785	0.0525	22.8%	21.4%

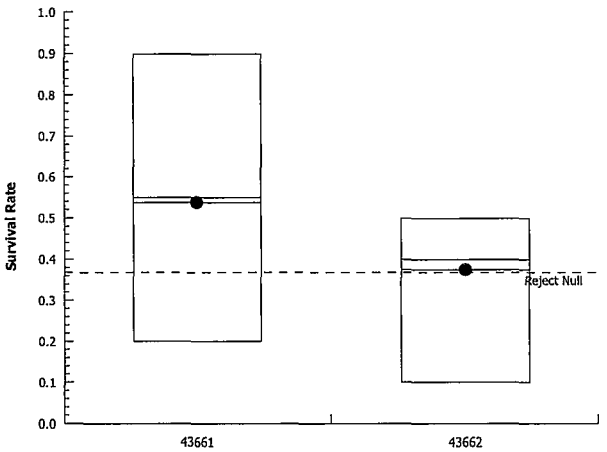
Survival Rate Detail

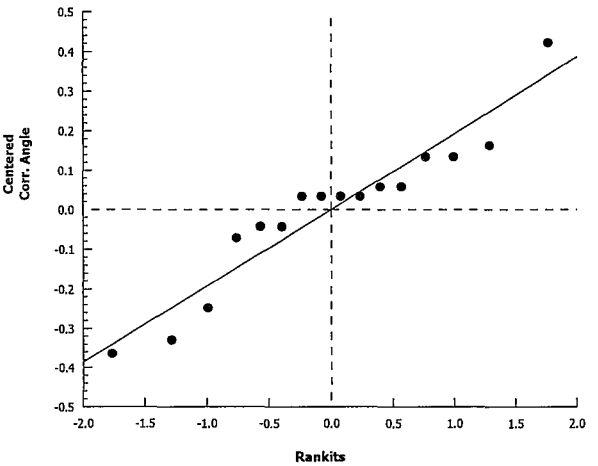
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.5	0.9	0.6	0.5	0.3	0.2	0.7	0.6
43662	0.3	0.4	0.4	0.1	0.4	0.5	0.5	0.4

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.785	1.25	0.886	0.785	0.58	0.464	0.991	0.886
43662	0.58	0.685	0.685	0.322	0.685	0.785	0.785	0.685

Graphics





CETIS Analytical Report

Report Date:	03 Jan-13 16:27 (p 1 of 1)
Test Code:	65294 | 17-5144-0015

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	08-8891-1166	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.4
Analyzed:	03 Jan-13 16:27	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	33.3%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43661		43663	0.382	1.76	0.186	14	0.3541	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.006542436	0.006542436	1	0.146	0.7081	Non-Significant Effect
Error	0.6272668	0.04480477	14			
Total	0.6338092		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.87	8.89	0.4278	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.975	0.841	0.9088	Normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.538	0.354	0.721	0.55	0.2	0.9	0.0778	40.9%	0.0%
43663	8	0.5	0.359	0.641	0.45	0.3	0.8	0.0598	33.8%	6.98%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.828	0.626	1.03	0.836	0.464	1.25	0.0854	29.2%	0.0%
43663	8	0.788	0.64	0.936	0.735	0.58	1.11	0.0625	22.4%	4.88%

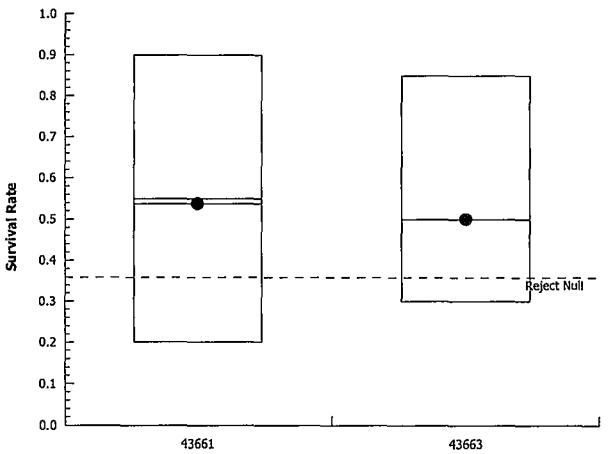
Survival Rate Detail

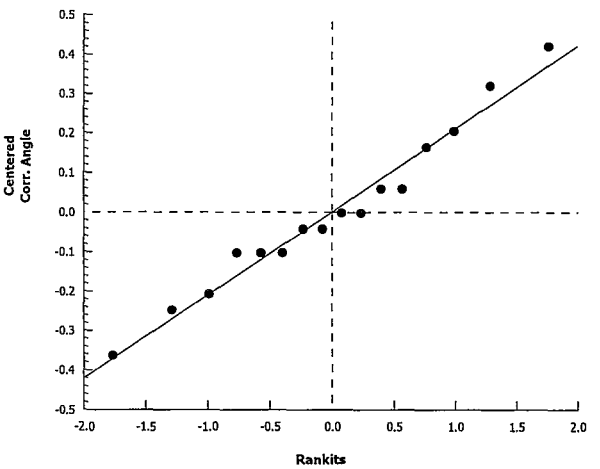
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.5	0.9	0.6	0.5	0.3	0.2	0.7	0.6
43663	0.5	0.3	0.5	0.8	0.4	0.4	0.7	0.4

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.785	1.25	0.886	0.785	0.58	0.464	0.991	0.886
43663	0.785	0.58	0.785	1.11	0.685	0.685	0.991	0.685

Graphics





CETIS Analytical Report

Report Date:	03 Jan-13 16:27 (p 1 of 1)
Test Code:	65294 | 17-5144-0015

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	12-5744-7293	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.4
Analyzed:	03 Jan-13 16:27	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	35.2%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43661		43664	0.283	1.76	0.197	14	0.3906	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.004016032	0.004016032	1	0.0802	0.7811	Non-Significant Effect
Error	0.7008449	0.05006035	14			
Total	0.7048609		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.4	8.89	0.6689	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.965	0.841	0.7598	Normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.538	0.354	0.721	0.55	0.2	0.9	0.0778	40.9%	0.0%
43664	8	0.513	0.349	0.676	0.55	0.2	0.7	0.0693	38.2%	4.65%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.828	0.626	1.03	0.836	0.464	1.25	0.0854	29.2%	0.0%
43664	8	0.797	0.626	0.967	0.836	0.464	0.991	0.0722	25.6%	3.83%

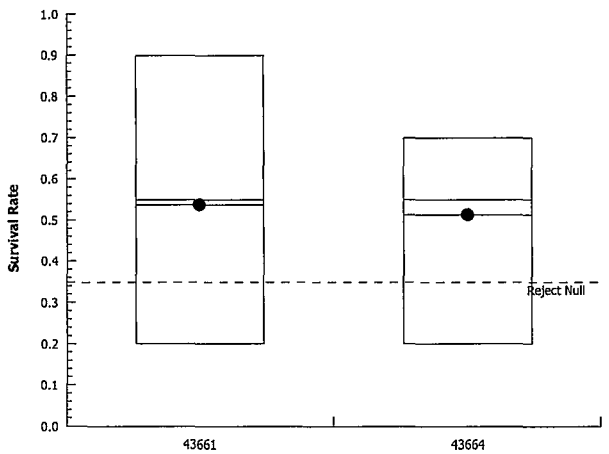
Survival Rate Detail

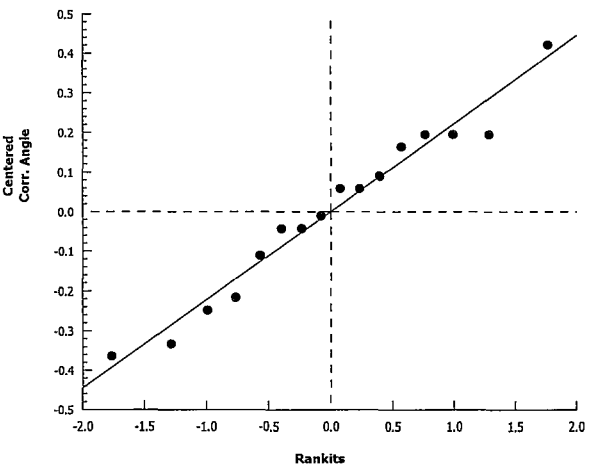
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.5	0.9	0.6	0.5	0.3	0.2	0.7	0.6
43664	0.2	0.7	0.4	0.3	0.6	0.5	0.7	0.7

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.785	1.25	0.886	0.785	0.58	0.464	0.991	0.886
43664	0.464	0.991	0.685	0.58	0.886	0.785	0.991	0.991

Graphics





CETIS Analytical Report

Report Date:	03 Jan-13 16:27 (p 1 of 1)
Test Code:	65294 | 17-5144-0015

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	21-4060-2913	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.4
Analyzed:	03 Jan-13 16:27	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	32.1%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43661		43665	0.81	1.76	0.18	14	0.2158	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.02727494	0.02727494	1	0.656	0.4317	Non-Significant Effect
Error	0.5825261	0.04160901	14			
Total	0.6098011		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	2.35	8.89	0.2819	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.963	0.841	0.7211	Normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.538	0.354	0.721	0.55	0.2	0.9	0.0778	40.9%	0.0%
43665	8	0.463	0.337	0.588	0.45	0.2	0.7	0.0532	32.6%	14.0%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.828	0.626	1.03	0.836	0.464	1.25	0.0854	29.2%	0.0%
43665	8	0.746	0.614	0.877	0.735	0.464	0.991	0.0557	21.1%	9.97%

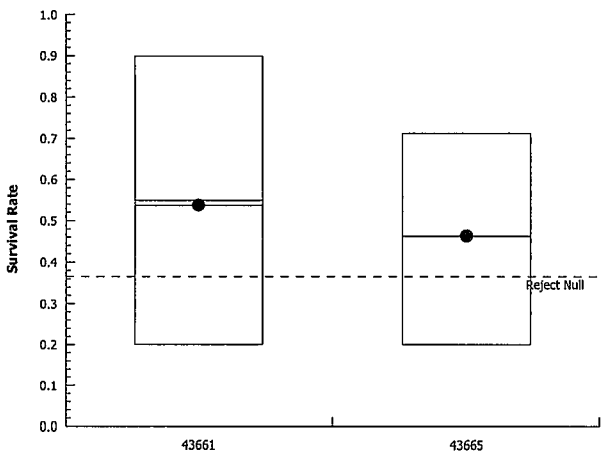
Survival Rate Detail

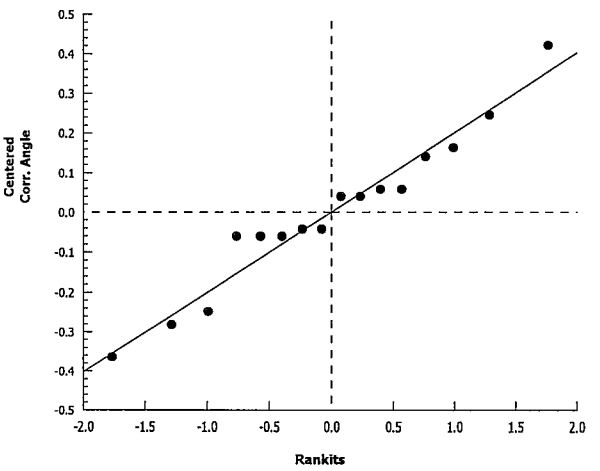
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.5	0.9	0.6	0.5	0.3	0.2	0.7	0.6
43665	0.5	0.2	0.4	0.7	0.5	0.4	0.4	0.6

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.785	1.25	0.886	0.785	0.58	0.464	0.991	0.886
43665	0.785	0.464	0.685	0.991	0.785	0.685	0.685	0.886

Graphics





CETIS Analytical Report

Report Date: 03 Jan-13 16:27 (p 1 of 1)
Test Code: 65294 | 17-5144-0015

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	06-8358-5532	**Endpoint:**	Emergence Rate	**CETIS Version:**	CETISv1.8.4
Analyzed:	03 Jan-13 16:26	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	32.5%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43661		43662	2.37	1.76	0.182	14	0.0162	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.2407373	0.2407373	1	5.64	0.0324	Significant Effect
Error	0.5977508	0.04269648	14			
Total	0.8384881		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	2.16	8.89	0.3306	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.982	0.841	0.9767	Normal Distribution

Emergence Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.538	0.354	0.721	0.55	0.2	0.9	0.0778	40.9%	0.0%
43662	8	0.313	0.191	0.434	0.3	0.1	0.5	0.0515	46.6%	41.9%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.828	0.626	1.03	0.836	0.464	1.25	0.0854	29.2%	0.0%
43662	8	0.583	0.446	0.72	0.58	0.322	0.785	0.0581	28.2%	29.6%

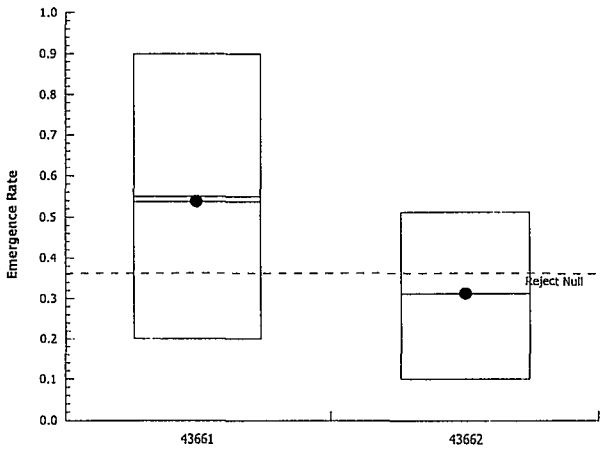
Emergence Rate Detail

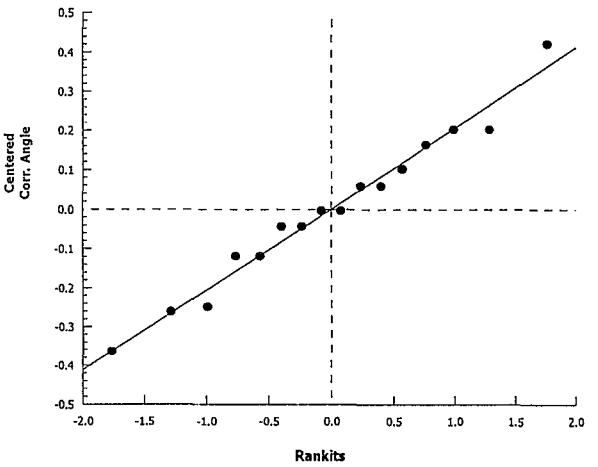
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.5	0.9	0.6	0.5	0.3	0.2	0.7	0.6
43662	0.3	0.2	0.4	0.1	0.3	0.5	0.5	0.2

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.785	1.25	0.886	0.785	0.58	0.464	0.991	0.886
43662	0.58	0.464	0.685	0.322	0.58	0.785	0.785	0.464

Graphics





CETIS Analytical Report

Report Date: 03 Jan-13 16:27 (p 1 of 1)
Test Code: 65294 | 17-5144-0015

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	20-3586-7193	**Endpoint:**	Emergence Rate	**CETIS Version:**	CETISv1.8.4
Analyzed:	03 Jan-13 16:26	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	33.3%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43661		43663	0.382	1.76	0.186	14	0.3541	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.006542436	0.006542436	1	0.146	0.7081	Non-Significant Effect
Error	0.6272668	0.04480477	14			
Total	0.6338092		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.87	8.89	0.4278	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.975	0.841	0.9088	Normal Distribution

Emergence Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.538	0.354	0.721	0.55	0.2	0.9	0.0778	40.9%	0.0%
43663	8	0.5	0.359	0.641	0.45	0.3	0.8	0.0598	33.8%	6.98%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.828	0.626	1.03	0.836	0.464	1.25	0.0854	29.2%	0.0%
43663	8	0.788	0.64	0.936	0.735	0.58	1.11	0.0625	22.4%	4.88%

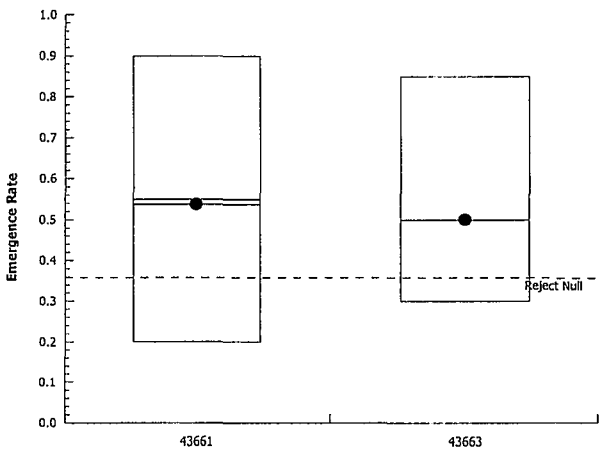
Emergence Rate Detail

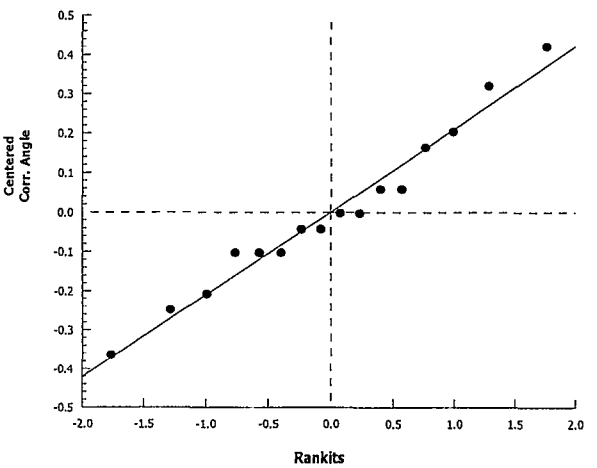
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.5	0.9	0.6	0.5	0.3	0.2	0.7	0.6
43663	0.5	0.3	0.5	0.8	0.4	0.4	0.7	0.4

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.785	1.25	0.886	0.785	0.58	0.464	0.991	0.886
43663	0.785	0.58	0.785	1.11	0.685	0.685	0.991	0.685

Graphics





CETIS Analytical Report

Report Date: 03 Jan-13 16:27 (p 1 of 1)
Test Code: 65294 | 17-5144-0015

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID: 01-3283-2209 **Endpoint:** Emergence Rate **CETIS Version:** CETISv1.8.4
Analyzed: 03 Jan-13 16:26 **Analysis:** Parametric-Two Sample **Official Results:** Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	35.2%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43661		43664	0.283	1.76	0.197	14	0.3906	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.004016032	0.004016032	1	0.0802	0.7811	Non-Significant Effect
Error	0.7008449	0.05006035	14			
Total	0.7048609		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.4	8.89	0.6689	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.965	0.841	0.7598	Normal Distribution

Emergence Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.538	0.354	0.721	0.55	0.2	0.9	0.0778	40.9%	0.0%
43664	8	0.513	0.349	0.676	0.55	0.2	0.7	0.0693	38.2%	4.65%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.828	0.626	1.03	0.836	0.464	1.25	0.0854	29.2%	0.0%
43664	8	0.797	0.626	0.967	0.836	0.464	0.991	0.0722	25.6%	3.83%

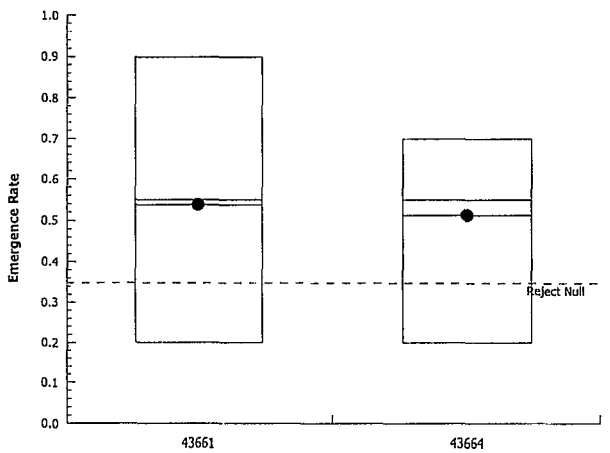
Emergence Rate Detail

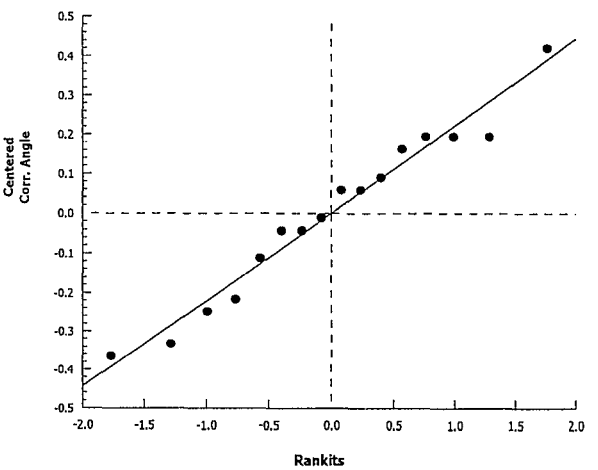
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.5	0.9	0.6	0.5	0.3	0.2	0.7	0.6
43664	0.2	0.7	0.4	0.3	0.6	0.5	0.7	0.7

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.785	1.25	0.886	0.785	0.58	0.464	0.991	0.886
43664	0.464	0.991	0.685	0.58	0.886	0.785	0.991	0.991

Graphics





Analyst: ____ QA: 1/7/13

CETIS Analytical Report

Report Date:	03 Jan-13 16:27 (p 1 of 1)
Test Code:	65294 | 17-5144-0015

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	18-4704-5635	**Endpoint:**	Emergence Rate	**CETIS Version:**	CETISv1.8.4
Analyzed:	03 Jan-13 16:26	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	32.1%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43661		43665	0.81	1.76	0.18	14	0.2158	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.02727494	0.02727494	1	0.656	0.4317	Non-Significant Effect
Error	0.5825261	0.04160901	14			
Total	0.6098011		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	2.35	8.89	0.2819	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.963	0.841	0.7211	Normal Distribution

Emergence Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.538	0.354	0.721	0.55	0.2	0.9	0.0778	40.9%	0.0%
43665	8	0.463	0.337	0.588	0.45	0.2	0.7	0.0532	32.6%	14.0%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43661	8	0.828	0.626	1.03	0.836	0.464	1.25	0.0854	29.2%	0.0%
43665	8	0.746	0.614	0.877	0.735	0.464	0.991	0.0557	21.1%	9.97%

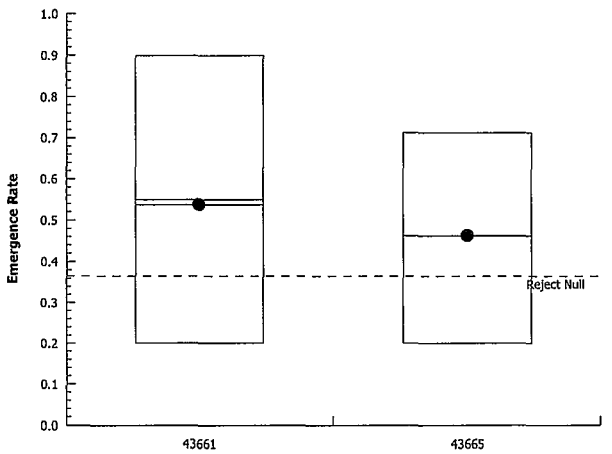
Emergence Rate Detail

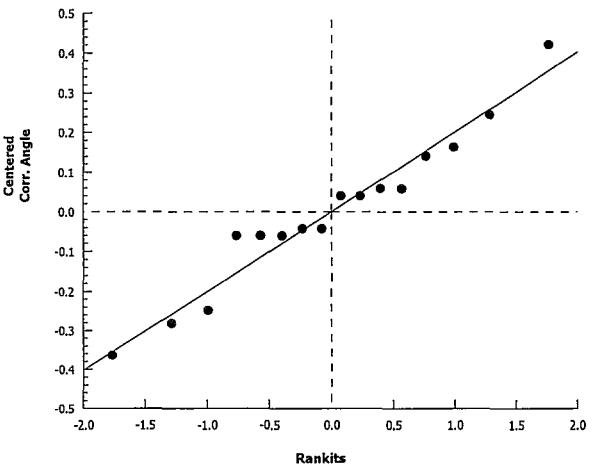
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.5	0.9	0.6	0.5	0.3	0.2	0.7	0.6
43665	0.5	0.2	0.4	0.7	0.5	0.4	0.4	0.6

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43661	0.785	1.25	0.886	0.785	0.58	0.464	0.991	0.886
43665	0.785	0.464	0.685	0.991	0.785	0.685	0.685	0.886

Graphics





CETIS Test Data Worksheet

Report Date: 03 Jan-13 16:26 (p 1 of 1)
Test Code: 17-5144-0015/65294

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Start Date: 06 Nov-12 16:00 **Species:** Chironomus tentans **Sample Code:** 43661
End Date: 04 Dec-12 10:30 **Protocol:** EPA/600/R-99/064 (2000) **Sample Source:** CONTROL
Sample Date: 19 Sep-12 07:15 **Material:** Control Sediment **Sample Station:** CONTROL

Sample Code	Rep	Pos	# Exposed	# Survived	# Emerged	Notes
43661	1	23	10	5	5	
43661	2	16	10	9	9	
43661	3	36	10	6	6	
43661	4	4	10	5	5	
43661	5	25	10	3	3	
43661	6	28	10	2	2	
43661	7	14	10	7	7	
43661	8	34	10	6	6	
43662	1	39	10	3	3	
43662	2	7	10	4	2	
43662	3	26	10	4	4	
43662	4	8	10	1	1	
43662	5	40	10	4	3	
43662	6	17	10	5	5	
43662	7	9	10	5	5	
43662	8	35	10	4	2	
43663	1	31	10	5	5	
43663	2	10	10	3	3	
43663	3	22	10	5	5	
43663	4	20	10	8	8	
43663	5	6	10	4	4	
43663	6	5	10	4	4	
43663	7	11	10	7	7	
43663	8	24	10	4	4	
43664	1	1	10	2	2	
43664	2	38	10	7	7	
43664	3	19	10	4	4	
43664	4	37	10	3	3	
43664	5	29	10	6	6	
43664	6	15	10	5	5	
43664	7	21	10	7	7	
43664	8	33	10	7	7	
43665	1	18	10	5	5	
43665	2	2	10	2	2	
43665	3	27	10	4	4	
43665	4	32	10	7	7	
43665	5	12	10	5	5	
43665	6	30	10	4	4	
43665	7	13	10	4	4	
43665	8	3	10	6	6	

STATISTICS VS. SD4

CETIS Summary Report

Report Date: 07 Jan-13 16:48 (p 1 of 1)
Test Code: 65299 Ref | 03-8109-2541

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Batch ID:	11-2602-3869	**Test Type:**	Survival	**Analyst:**	
Start Date:	06 Nov-12 16:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Reconstituted Water
Ending Date:	04 Dec-12 10:30	**Species:**	Chironomus tentans	**Brine:**	
Duration:	27d 19h	**Source:**	In-House Culture	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
43663	09-1086-2928	24 Oct-12 16:30	26 Oct-12 10:00	12d 23h	Weston Solutions, Inc.	
43662	03-8789-8795	24 Oct-12 15:50	26 Oct-12 10:00	13d 0h		
43664	00-7258-0456	24 Oct-12 08:15	26 Oct-12 10:00	13d 8h		
43665	11-9899-1264	24 Oct-12 09:15	26 Oct-12 10:00	13d 7h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
43663	Sediment	Auburn Rd	SD4		
43662	Sediment	Auburn Rd	SD2		
43664	Sediment	Auburn Rd	SD5		
43665	Sediment	Auburn Rd	SD9		

Emergence Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
43663	8	0.5	0.437	0.563	0.3	0.8	0.0598	0.169	33.8%	0.0%
43662	8	0.313	0.258	0.367	0.1	0.5	0.0515	0.146	46.6%	37.5%
43664	8	0.513	0.439	0.586	0.2	0.7	0.0693	0.196	38.2%	-2.5%
43665	8	0.462	0.406	0.519	0.2	0.7	0.0532	0.151	32.6%	7.5%

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
43663	8	0.5	0.437	0.563	0.3	0.8	0.0598	0.169	33.8%	0.0%
43662	8	0.375	0.327	0.423	0.1	0.5	0.0453	0.128	34.2%	25.0%
43664	8	0.513	0.439	0.586	0.2	0.7	0.0693	0.196	38.2%	-2.5%
43665	8	0.462	0.406	0.519	0.2	0.7	0.0532	0.151	32.6%	7.5%

Emergence Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.5	0.3	0.5	0.8	0.4	0.4	0.7	0.4
43662	0.3	0.2	0.4	0.1	0.3	0.5	0.5	0.2
43664	0.2	0.7	0.4	0.3	0.6	0.5	0.7	0.7
43665	0.5	0.2	0.4	0.7	0.5	0.4	0.4	0.6

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.5	0.3	0.5	0.8	0.4	0.4	0.7	0.4
43662	0.3	0.4	0.4	0.1	0.4	0.5	0.5	0.4
43664	0.2	0.7	0.4	0.3	0.6	0.5	0.7	0.7
43665	0.5	0.2	0.4	0.7	0.5	0.4	0.4	0.6

Emergence Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	5/10	3/10	5/10	8/10	4/10	4/10	7/10	4/10
43662	3/10	2/10	4/10	1/10	3/10	5/10	5/10	2/10
43664	2/10	7/10	4/10	3/10	6/10	5/10	7/10	7/10
43665	5/10	2/10	4/10	7/10	5/10	4/10	4/10	6/10

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	5/10	3/10	5/10	8/10	4/10	4/10	7/10	4/10
43662	3/10	4/10	4/10	1/10	4/10	5/10	5/10	4/10
43664	2/10	7/10	4/10	3/10	6/10	5/10	7/10	7/10
43665	5/10	2/10	4/10	7/10	5/10	4/10	4/10	6/10

CETIS Analytical Report

Report Date:	07 Jan-13 16:49 (p 1 of 1)
Test Code:	65299 Ref | 03-8109-2541

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	12-3186-0411	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.4
Analyzed:	07 Jan-13 16:48	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	27.9%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43663		43662	1.67	1.76	0.144	14	0.0583	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.07450655	0.07450655	1	2.8	0.1165	Non-Significant Effect
Error	0.3727266	0.02662333	14			
Total	0.4472332		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.42	8.89	0.6567	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.974	0.841	0.8951	Normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.5	0.359	0.641	0.45	0.3	0.8	0.0598	33.8%	0.0%
43662	8	0.375	0.268	0.482	0.4	0.1	0.5	0.0453	34.2%	25.0%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.788	0.64	0.936	0.735	0.58	1.11	0.0625	22.4%	0.0%
43662	8	0.651	0.527	0.775	0.685	0.322	0.785	0.0525	22.8%	17.3%

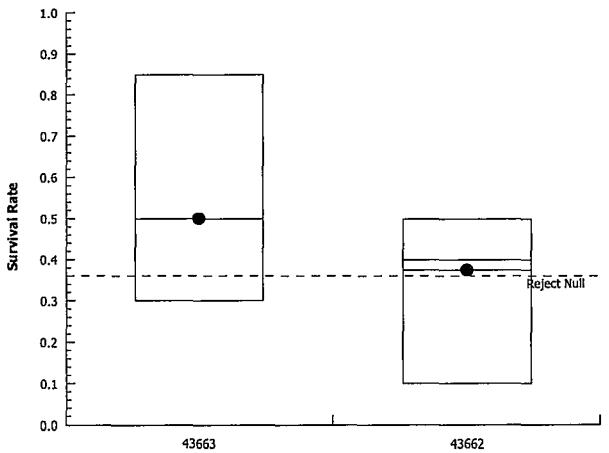
Survival Rate Detail

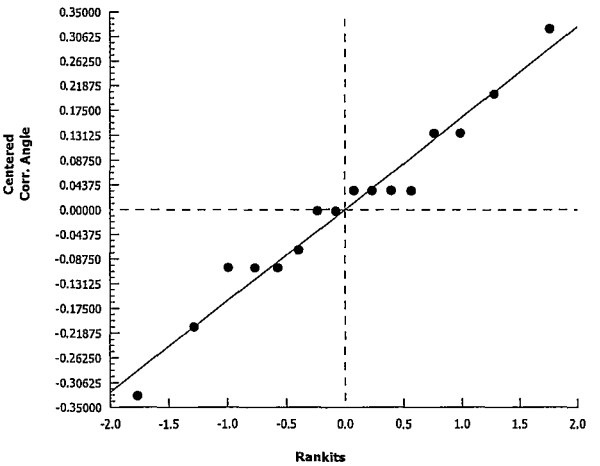
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.5	0.3	0.5	0.8	0.4	0.4	0.7	0.4
43662	0.3	0.4	0.4	0.1	0.4	0.5	0.5	0.4

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.785	0.58	0.785	1.11	0.685	0.685	0.991	0.685
43662	0.58	0.685	0.685	0.322	0.685	0.785	0.785	0.685

Graphics





CETIS Analytical Report

Report Date:	07 Jan-13 16:49 (p 1 of 1)
Test Code:	65299 Ref | 03-8109-2541

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	18-7477-5532	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.4
Analyzed:	07 Jan-13 16:48	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	32.5%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43663		43664	-0.0917	1.76	0.168	14	0.5359	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0003067106	0.0003067106	1	0.00841	0.9282	Non-Significant Effect
Error	0.5106915	0.03647796	14			
Total	0.5109982		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.34	8.89	0.7115	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.953	0.841	0.5362	Normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.5	0.359	0.641	0.45	0.3	0.8	0.0598	33.8%	0.0%
43664	8	0.513	0.349	0.676	0.55	0.2	0.7	0.0693	38.2%	-2.5%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.788	0.64	0.936	0.735	0.58	1.11	0.0625	22.4%	0.0%
43664	8	0.797	0.626	0.967	0.836	0.464	0.991	0.0722	25.6%	-1.11%

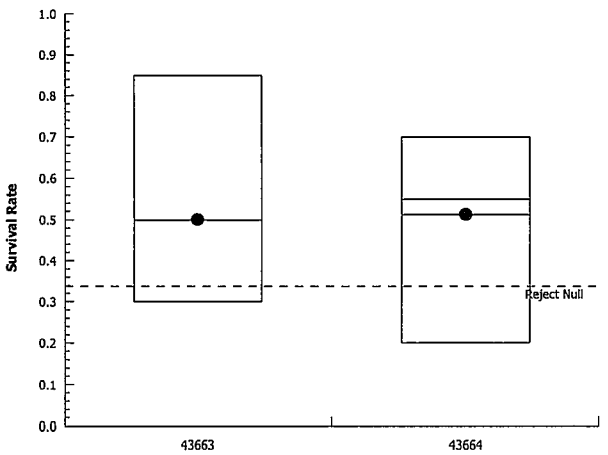
Survival Rate Detail

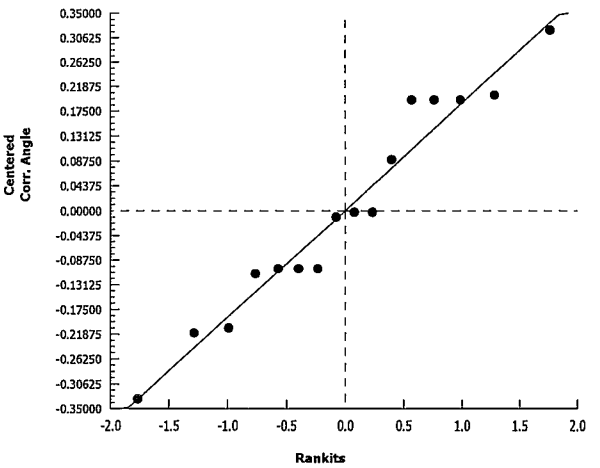
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.5	0.3	0.5	0.8	0.4	0.4	0.7	0.4
43664	0.2	0.7	0.4	0.3	0.6	0.5	0.7	0.7

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.785	0.58	0.785	1.11	0.685	0.685	0.991	0.685
43664	0.464	0.991	0.685	0.58	0.886	0.785	0.991	0.991

Graphics





CETIS Analytical Report

Report Date:	07 Jan-13 16:49 (p 1 of 1)
Test Code:	65299 Ref | 03-8109-2541

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	07-0486-3414	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.4
Analyzed:	07 Jan-13 16:48	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	28.6%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43663		43665	0.503	1.76	0.147	14	0.3113	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.007100747	0.007100747	1	0.253	0.6225	Non-Significant Effect
Error	0.3923727	0.02802662	14			
Total	0.3994735		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.26	8.89	0.7702	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.958	0.841	0.6317	Normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.5	0.359	0.641	0.45	0.3	0.8	0.0598	33.8%	0.0%
43665	8	0.463	0.337	0.588	0.45	0.2	0.7	0.0532	32.6%	7.5%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.788	0.64	0.936	0.735	0.58	1.11	0.0625	22.4%	0.0%
43665	8	0.746	0.614	0.877	0.735	0.464	0.991	0.0557	21.1%	5.35%

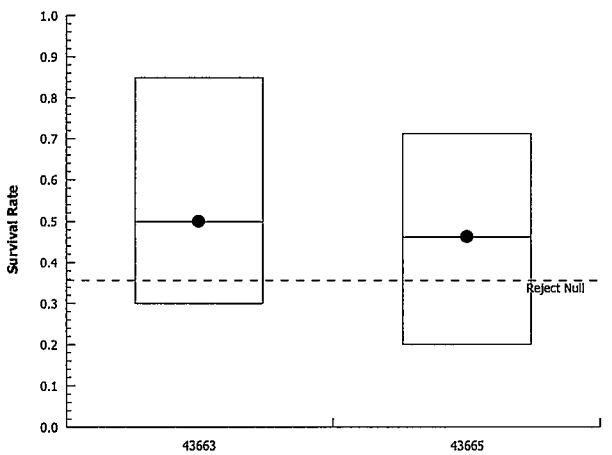
Survival Rate Detail

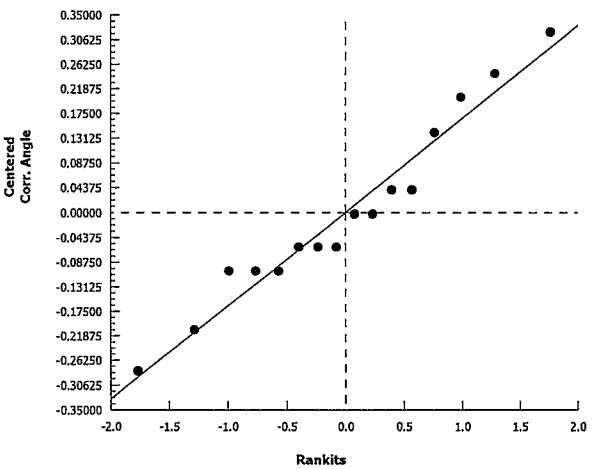
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.5	0.3	0.5	0.8	0.4	0.4	0.7	0.4
43665	0.5	0.2	0.4	0.7	0.5	0.4	0.4	0.6

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.785	0.58	0.785	1.11	0.685	0.685	0.991	0.685
43665	0.785	0.464	0.685	0.991	0.785	0.685	0.685	0.886

Graphics





CETIS Analytical Report

Report Date:	07 Jan-13 16:49 (p 1 of 1)
Test Code:	65299 Ref | 03-8109-2541

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	13-5431-7987	**Endpoint:**	Emergence Rate	**CETIS Version:**	CETISv1.8.4
Analyzed:	07 Jan-13 16:48	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	29.1%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43663		43662	2.4	1.76	0.15	14	0.0154	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.167907	0.167907	1	5.77	0.0308	Significant Effect
Error	0.4075973	0.0291141	14			
Total	0.5755043		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.16	8.89	0.8531	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.937	0.841	0.3191	Normal Distribution

Emergence Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.5	0.359	0.641	0.45	0.3	0.8	0.0598	33.8%	0.0%
43662	8	0.313	0.191	0.434	0.3	0.1	0.5	0.0515	46.6%	37.5%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.788	0.64	0.936	0.735	0.58	1.11	0.0625	22.4%	0.0%
43662	8	0.583	0.446	0.72	0.58	0.322	0.785	0.0581	28.2%	26.0%

Emergence Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.5	0.3	0.5	0.8	0.4	0.4	0.7	0.4
43662	0.3	0.2	0.4	0.1	0.3	0.5	0.5	0.2

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.785	0.58	0.785	1.11	0.685	0.685	0.991	0.685
43662	0.58	0.464	0.685	0.322	0.58	0.785	0.785	0.464

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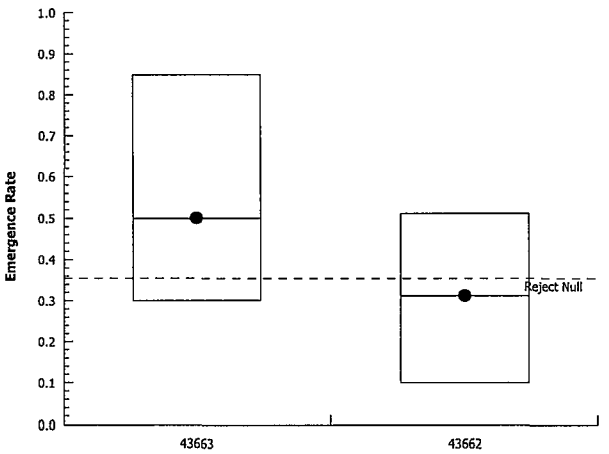

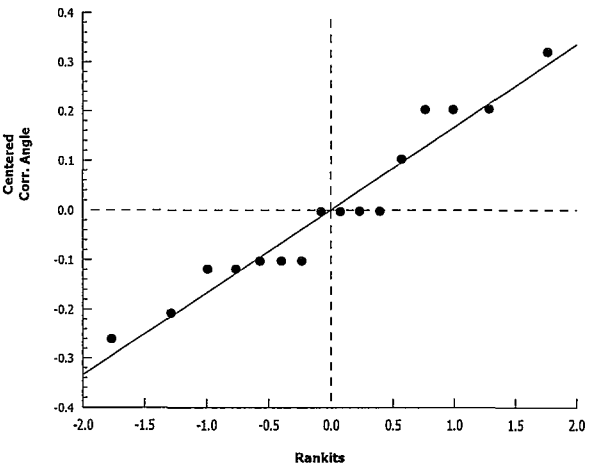

CETIS Analytical Report

Report Date:	07 Jan-13 16:49 (p 1 of 1)
Test Code:	65299 Ref | 03-8109-2541

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	07-3129-7836	**Endpoint:**	Emergence Rate	**CETIS Version:**	CETISv1.8.4
Analyzed:	07 Jan-13 16:48	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	32.5%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43663		43664	-0.0917	1.76	0.168	14	0.5359	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0003067106	0.0003067106	1	0.00841	0.9282	Non-Significant Effect
Error	0.5106915	0.03647796	14			
Total	0.5109982		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.34	8.89	0.7115	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.953	0.841	0.5362	Normal Distribution

Emergence Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.5	0.359	0.641	0.45	0.3	0.8	0.0598	33.8%	0.0%
43664	8	0.513	0.349	0.676	0.55	0.2	0.7	0.0693	38.2%	-2.5%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.788	0.64	0.936	0.735	0.58	1.11	0.0625	22.4%	0.0%
43664	8	0.797	0.626	0.967	0.836	0.464	0.991	0.0722	25.6%	-1.11%

Emergence Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.5	0.3	0.5	0.8	0.4	0.4	0.7	0.4
43664	0.2	0.7	0.4	0.3	0.6	0.5	0.7	0.7

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.785	0.58	0.785	1.11	0.685	0.685	0.991	0.685
43664	0.464	0.991	0.685	0.58	0.886	0.785	0.991	0.991

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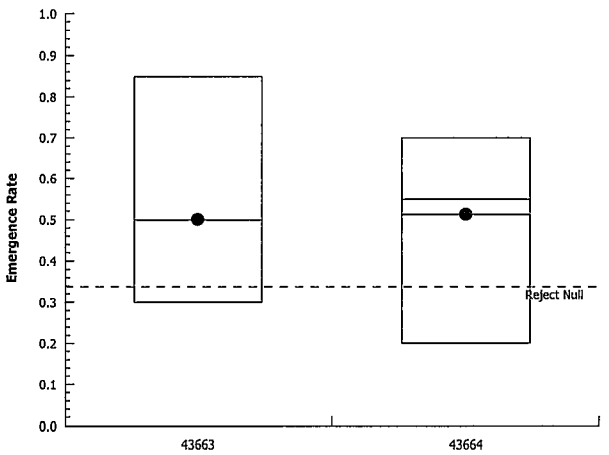
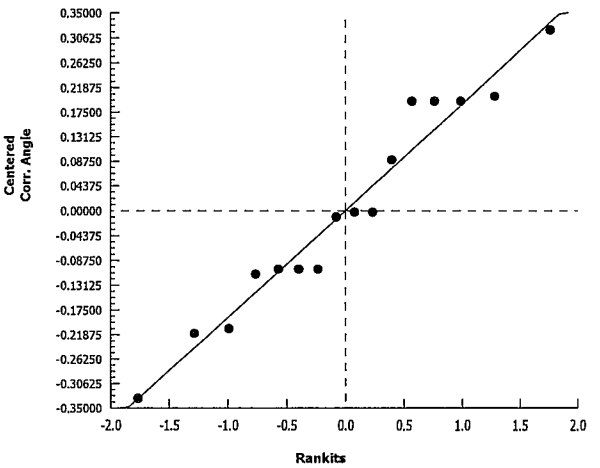




CETIS Analytical Report

Report Date:	07 Jan-13 16:49 (p 1 of 1)
Test Code:	65299 Ref | 03-8109-2541

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	14-9806-7610	**Endpoint:**	Emergence Rate	**CETIS Version:**	CETISv1.8.4
Analyzed:	07 Jan-13 16:48	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	28.6%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43663		43665	0.503	1.76	0.147	14	0.3113	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.007100747	0.007100747	1	0.253	0.6225	Non-Significant Effect
Error	0.3923727	0.02802662	14			
Total	0.3994735		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.26	8.89	0.7702	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.958	0.841	0.6317	Normal Distribution

Emergence Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.5	0.359	0.641	0.45	0.3	0.8	0.0598	33.8%	0.0%
43665	8	0.463	0.337	0.588	0.45	0.2	0.7	0.0532	32.6%	7.5%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.788	0.64	0.936	0.735	0.58	1.11	0.0625	22.4%	0.0%
43665	8	0.746	0.614	0.877	0.735	0.464	0.991	0.0557	21.1%	5.35%

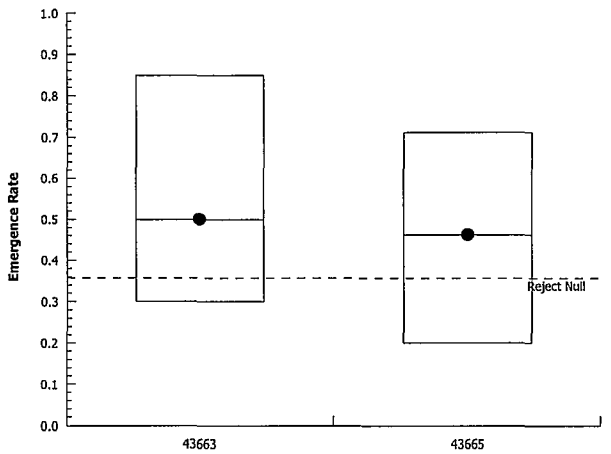
Emergence Rate Detail

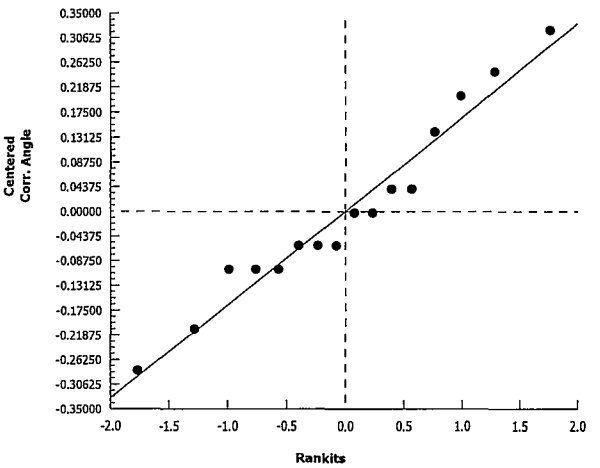
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.5	0.3	0.5	0.8	0.4	0.4	0.7	0.4
43665	0.5	0.2	0.4	0.7	0.5	0.4	0.4	0.6

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.785	0.58	0.785	1.11	0.685	0.685	0.991	0.685
43665	0.785	0.464	0.685	0.991	0.785	0.685	0.685	0.886

Graphics





CETIS Test Data Worksheet

Report Date: 07 Jan-13 16:48 (p 1 of 1)
Test Code: 03-8109-2541/65299 Ref

Chironomus 28-d Survival and Emergence Sediment Test — **Aquatec Biological Sciences, Inc**

Start Date:	06 Nov-12 16:00	**Species:**	Chironomus tentans	**Sample Code:**	43663
End Date:	04 Dec-12 10:30	**Protocol:**	EPA/600/R-99/064 (2000)	**Sample Source:**	Auburn Rd
Sample Date:	24 Oct-12 16:30	**Material:**	Sediment	**Sample Station:**	SD4

Sample Code	Rep	Pos	# Exposed	# Survived	# Emerged	Notes
43663	1	7	10	5	5	
43663	2	31	10	3	3	
43663	3	28	10	5	5	
43663	4	26	10	8	8	
43663	5	5	10	4	4	
43663	6	3	10	4	4	
43663	7	10	10	7	7	
43663	8	14	10	4	4	
43662	1	6	10	3	3	
43662	2	22	10	4	2	
43662	3	19	10	4	4	
43662	4	16	10	1	1	
43662	5	29	10	4	3	
43662	6	12	10	5	5	
43662	7	32	10	5	5	
43662	8	1	10	4	2	
43664	1	2	10	2	2	
43664	2	15	10	7	7	
43664	3	18	10	4	4	
43664	4	4	10	3	3	
43664	5	30	10	6	6	
43664	6	9	10	5	5	
43664	7	27	10	7	7	
43664	8	11	10	7	7	
43665	1	8	10	5	5	
43665	2	13	10	2	2	
43665	3	25	10	4	4	
43665	4	23	10	7	7	
43665	5	17	10	5	5	
43665	6	20	10	4	4	
43665	7	21	10	4	4	
43665	8	24	10	6	6	

STATISTICAL ANALYSIS VS. SD4

CETIS Summary Report

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Batch ID:	16-5035-1257	**Test Type:**	Survival-Growth	**Analyst:**	
Start Date:	02 Nov-12 10:40	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Reconstituted Water
Ending Date:	12 Nov-12 09:30	**Species:**	Hyalella azteca	**Brine:**	
Duration:	9d 23h	**Source:**	Aquatic Biosystems, CO	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
43663	09-1086-2928	24 Oct-12 16:30	26 Oct-12 10:00	8d 18h	Weston Solutions, Inc.	
43662	03-8789-8795	24 Oct-12 15:50	26 Oct-12 10:00	8d 19h		
43664	00-7258-0456	24 Oct-12 08:15	26 Oct-12 10:00	9d 2h		
43665	11-9899-1264	24 Oct-12 09:15	26 Oct-12 10:00	9d 1h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
43663	Sediment	Auburn Rd	SD4		
43662	Sediment	Auburn Rd	SD2		
43664	Sediment	Auburn Rd	SD5		
43665	Sediment	Auburn Rd	SD9		

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
05-2854-5286	Survival Rate	Control Resp	0.975	0.8 - NL	Yes	Passes Acceptability Criteria
07-7251-5710	Survival Rate	Control Resp	0.975	0.8 - NL	Yes	Passes Acceptability Criteria
19-4273-4545	Survival Rate	Control Resp	0.975	0.8 - NL	Yes	Passes Acceptability Criteria

Mean Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
43663	8	0.0651	0.062	0.0683	0.05	0.074	0.003	0.00849	13.0%	0.0%
43662	8	0.0594	0.0569	0.0618	0.05	0.069	0.00234	0.00661	11.1%	8.83%
43664	7	0.109	0.104	0.114	0.092	0.128	0.0053	0.014	12.8%	-67.7%
43665	8	0.0557	0.053	0.0584	0.043	0.0667	0.00253	0.00716	12.8%	14.5%

Mean Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
43663	8	3.27	3.2	3.34	3.05	3.53	0.0646	0.183	5.59%	0.0%
43662	8	3.09	3.02	3.17	2.89	3.42	0.0732	0.207	6.69%	5.46%
43664	7	3.94	3.85	4.03	3.62	4.38	0.0881	0.233	5.92%	-20.4%
43665	8	2.89	2.85	2.94	2.7	3.09	0.0442	0.125	4.32%	11.6%

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
43663	8	0.975	0.949	1	0.8	1	0.025	0.0707	7.25%	0.0%
43662	8	1	1	1	1	1	0	0	0.0%	-2.56%
43664	8	0.638	0.49	0.785	0	1	0.14	0.396	62.1%	34.6%
43665	8	0.925	0.899	0.951	0.8	1	0.025	0.0707	7.64%	5.13%

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.072	0.074	0.061	0.062	0.059	0.05	0.073	0.07
43662	0.056	0.058	0.053	0.067	0.069	0.05	0.059	0.063
43664	0.102	0.118	0.1	0.128	0.125	0.092	0.1	
43665	0.043	0.0589	0.0667	0.051	0.057	0.0556	0.0612	0.0522

Mean Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	3.18	3.18	3.24	3.05	3.39	3.1	3.53	3.51
43662	2.91	2.94	2.89	3.42	3.32	3.18	2.92	3.17
43664	3.62	3.9	3.87		4.38	4.01	3.81	3.98
43665	2.94	2.9	3.09	2.88	2.7	2.83	3.02	2.79

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	1	1	1	1	1	1	1	0.8
43662	1	1	1	1	1	1	1	1
43664	1	0.8	0.1	0	0.9	0.8	0.5	1
43665	1	0.9	0.9	1	1	0.9	0.8	0.9

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	10/10	10/10	10/10	10/10	10/10	10/10	10/10	8/10
43662	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10
43664	10/10	8/10	1/10	0/10	9/10	8/10	5/10	10/10
43665	10/10	9/10	9/10	10/10	10/10	9/10	8/10	9/10

CETIS Analytical Report

Report Date:	07 Jan-13 16:54 (p 1 of 1)
Test Code:	65294 Ref | 08-1818-7367

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	19-4273-4545	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.4
Analyzed:	07 Jan-13 16:53	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	4.42%

Wilcoxon Rank Sum Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
43663		43662	72	NA	1	14	1.0000	Exact	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.005809008	0.005809008	1	1	0.3343	Non-Significant Effect
Error	0.08132611	0.005809008	14			
Total	0.08713512		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	4.58E+13	8.89	<0.0001	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.469	0.841	<0.0001	Non-normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.975	0.916	1	1	0.8	1	0.025	7.25%	0.0%
43662	8	1	1	1	1	1	1	0	0.0%	-2.56%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	1.37	1.28	1.46	1.41	1.11	1.41	0.0381	7.85%	0.0%
43662	8	1.41	1.41	1.41	1.41	1.41	1.41	0	0.0%	-2.77%

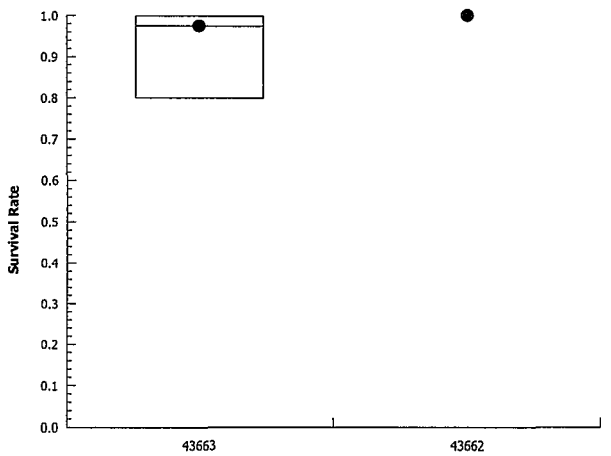
Survival Rate Detail

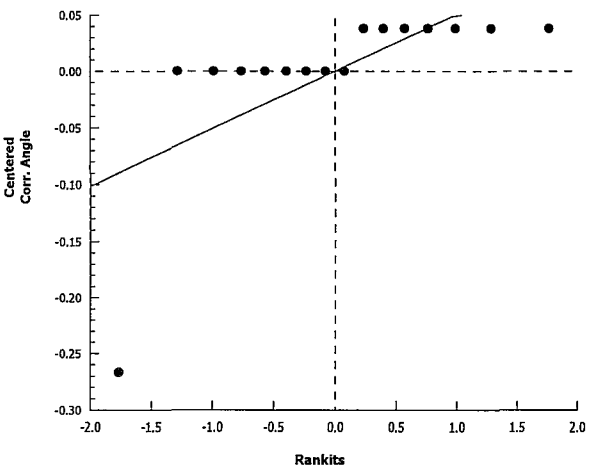
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	1	1	1	1	1	1	1	0.8
43662	1	1	1	1	1	1	1	1

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.11
43662	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41

Graphics





CETIS Analytical Report

Report Date:	07 Jan-13 16:54 (p 1 of 1)
Test Code:	65294 Ref | 08-1818-7367

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	07-7251-5710	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.4
Analyzed:	07 Jan-13 16:52	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	23.3%

Unequal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43663		43664	2.47	1.89	0.33	7	0.0214	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.7387218	0.7387218	1	6.1	0.0270	Significant Effect
Error	1.694611	0.1210436	14			
Total	2.433333		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	19.8	8.89	0.0008	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.874	0.841	0.0313	Normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.975	0.916	1	1	0.8	1	0.025	7.25%	0.0%
43664	8	0.638	0.306	0.969	0.8	0	1	0.14	62.1%	34.6%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	1.37	1.28	1.46	1.41	1.11	1.41	0.0381	7.85%	0.0%
43664	8	0.944	0.543	1.35	1.11	0.159	1.41	0.17	50.8%	31.3%

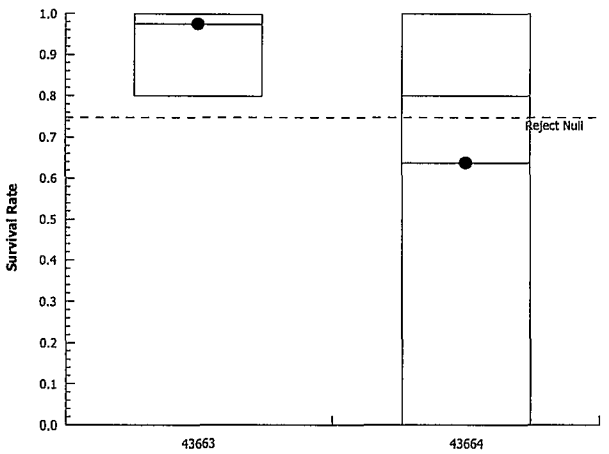
Survival Rate Detail

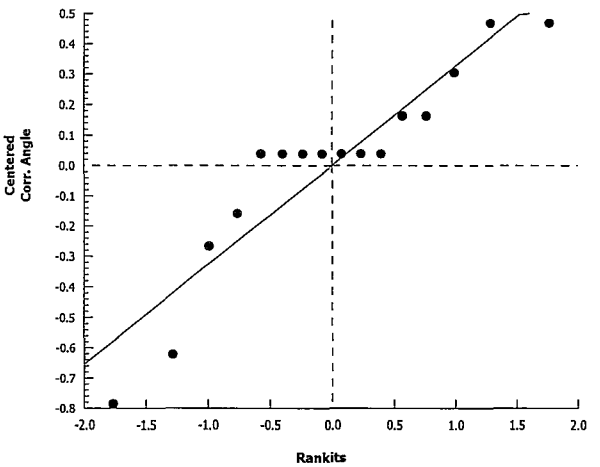
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	1	1	1	1	1	1	1	0.8
43664	1	0.8	0.1	0	0.9	0.8	0.5	1

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.11
43664	1.41	1.11	0.322	0.159	1.25	1.11	0.785	1.41

Graphics





CETIS Analytical Report

Report Date:	07 Jan-13 16:54 (p 1 of 1)
Test Code:	65294 Ref | 08-1818-7367

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	05-2854-5286	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.4
Analyzed:	07 Jan-13 16:52	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Angular (Corrected)	NA	C > T	NA	NA	5.98%

Wilcoxon Rank Sum Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
43663		43665	54	NA	2	14	0.0594	Exact	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.02655933	0.02655933	1	2.24	0.1568	Non-Significant Effect
Error	0.1660865	0.01186332	14			
Total	0.1926459		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.04	8.89	0.9579	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.836	0.841	0.0085	Non-normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.975	0.916	1	1	0.8	1	0.025	7.25%	0.0%
43665	8	0.925	0.866	0.984	0.9	0.8	1	0.025	7.64%	5.13%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	1.37	1.28	1.46	1.41	1.11	1.41	0.0381	7.85%	0.0%
43665	8	1.29	1.2	1.38	1.25	1.11	1.41	0.0389	8.51%	5.93%

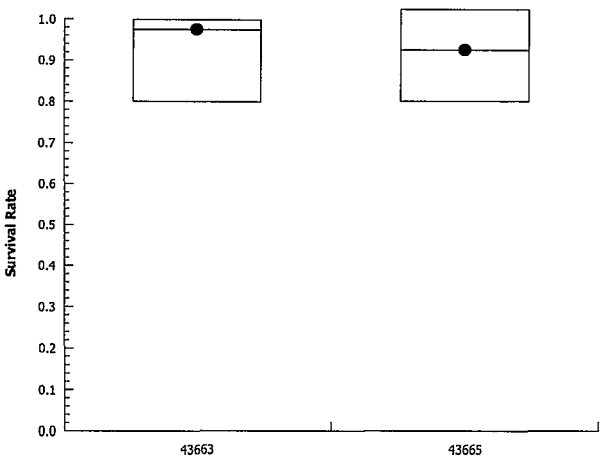
Survival Rate Detail

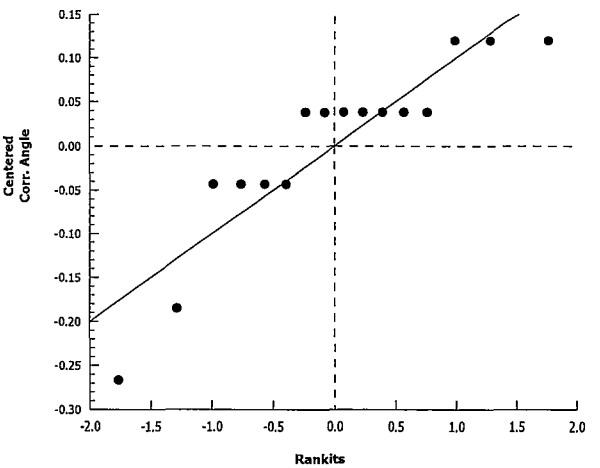
Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	1	1	1	1	1	1	1	0.8
43665	1	0.9	0.9	1	1	0.9	0.8	0.9

Angular (Corrected) Transformed Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.11
43665	1.41	1.25	1.25	1.41	1.41	1.25	1.11	1.25

Graphics





CETIS Analytical Report

Report Date:	07 Jan-13 16:53 (p 1 of 1)
Test Code:	65294 Ref | 08-1818-7367

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	16-9326-4287	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.4
Analyzed:	07 Jan-13 16:53	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Untransformed	NA	C > T	NA	NA	10.3%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43663		43662	1.51	1.76	0.007	14	0.0765	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.000132249	0.000132249	1	2.28	0.1530	Non-Significant Effect
Error	0.0008107484	5.79106E-05	14			
Total	0.0009429974		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.65	8.89	0.5244	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.941	0.841	0.3600	Normal Distribution

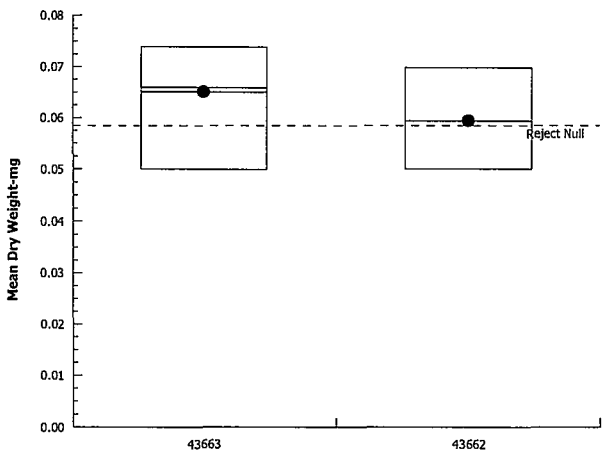
Mean Dry Weight-mg Summary

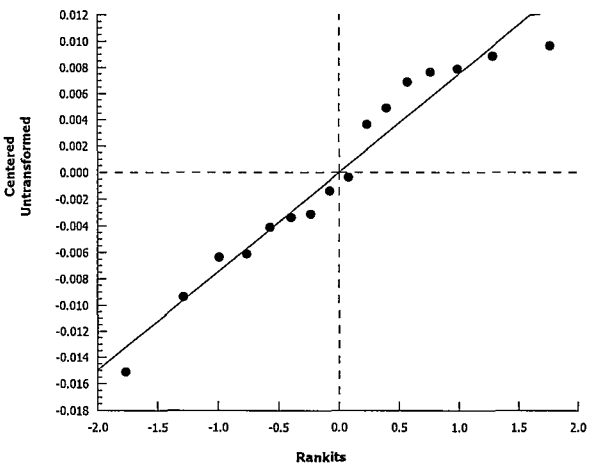
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.0651	0.058	0.0722	0.066	0.05	0.074	0.003	13.0%	0.0%
43662	8	0.0594	0.0538	0.0649	0.0585	0.05	0.069	0.00234	11.1%	8.83%

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.072	0.074	0.061	0.062	0.059	0.05	0.073	0.07
43662	0.056	0.058	0.053	0.067	0.069	0.05	0.059	0.063

Graphics





CETIS Analytical Report

Report Date:	07 Jan-13 16:53 (p 1 of 1)
Test Code:	65294 Ref | 08-1818-7367

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	11-1348-8543	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.4
Analyzed:	07 Jan-13 16:53	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Untransformed	NA	C > T	NA	NA	16.0%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43663		43664	-7.48	1.77	0.010	13	1.0000	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.007246654	0.007246654	1	55.9	<0.0001	Significant Effect
Error	0.001685494	0.0001296533	13			
Total	0.008932147		14			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	2.73	9.16	0.2152	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.95	0.833	0.5318	Normal Distribution

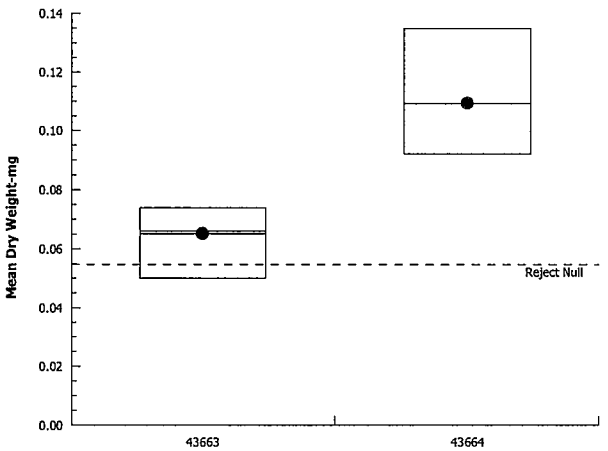
Mean Dry Weight-mg Summary

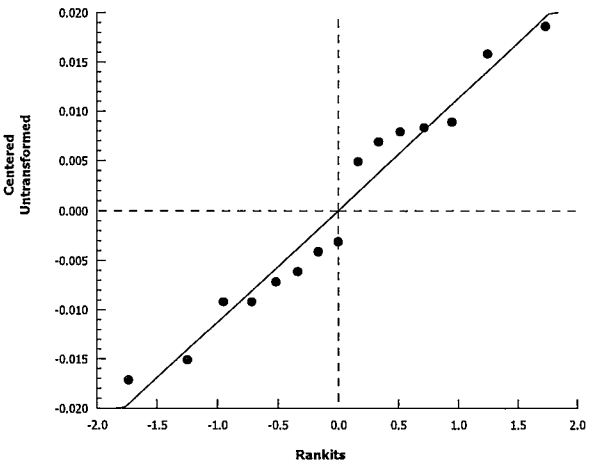
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.0651	0.058	0.0722	0.066	0.05	0.074	0.003	13.0%	0.0%
43664	7	0.109	0.0962	0.122	0.102	0.092	0.128	0.0053	12.8%	-67.7%

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.072	0.074	0.061	0.062	0.059	0.05	0.073	0.07
43664	0.102	0.118	0.1	0.128	0.125	0.092	0.1	

Graphics





CETIS Analytical Report

Report Date:	07 Jan-13 16:53 (p 1 of 1)
Test Code:	65294 Ref | 08-1818-7367

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	16-8272-2115	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.8.4
Analyzed:	07 Jan-13 16:53	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Untransformed	NA	C > T	NA	NA	10.6%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43663		43665	2.4	1.76	0.007	14	0.0154	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0003554811	0.0003554811	1	5.76	0.0308	Significant Effect
Error	0.0008632989	6.166421E-05	14			
Total	0.00121878		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.41	8.89	0.6626	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.955	0.841	0.5689	Normal Distribution

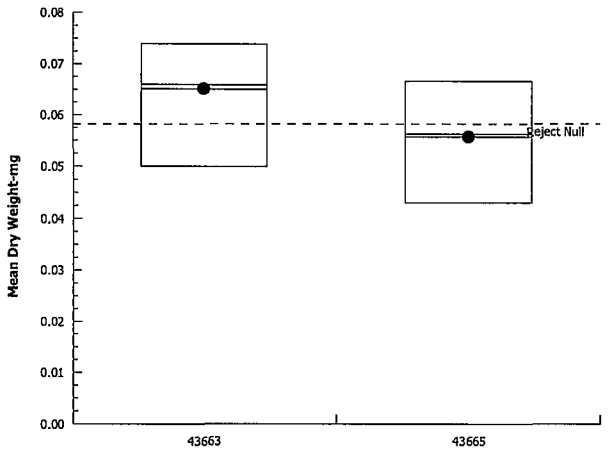
Mean Dry Weight-mg Summary

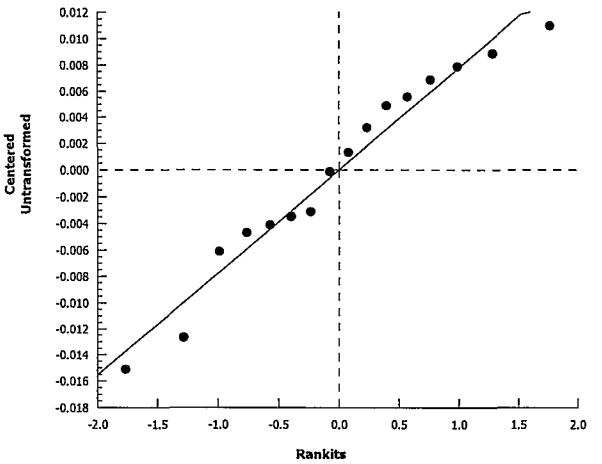
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	0.0651	0.058	0.0722	0.066	0.05	0.074	0.003	13.0%	0.0%
43665	8	0.0557	0.0497	0.0617	0.0563	0.043	0.0667	0.00253	12.8%	14.5%

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	0.072	0.074	0.061	0.062	0.059	0.05	0.073	0.07
43665	0.043	0.0589	0.0667	0.051	0.057	0.0556	0.0612	0.0522

Graphics





CETIS Analytical Report

Report Date:	07 Jan-13 16:53 (p 1 of 1)
Test Code:	65294 Ref | 08-1818-7367

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	04-4154-2753	**Endpoint:**	Mean Length-mm	**CETIS Version:**	CETISv1.8.4
Analyzed:	07 Jan-13 16:53	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Untransformed	NA	C > T	NA	NA	5.26%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43663		43662	1.83	1.76	0.172	14	0.0443	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.1278062	0.1278062	1	3.35	0.0885	Non-Significant Effect
Error	0.5339375	0.03813839	14			
Total	0.6617436		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.28	8.89	0.7512	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.892	0.841	0.0606	Normal Distribution

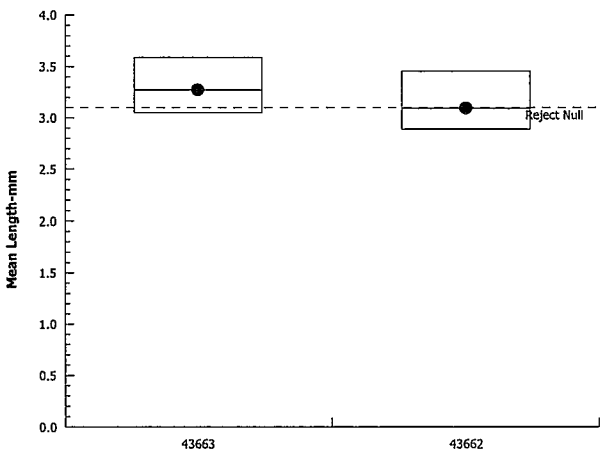
Mean Length-mm Summary

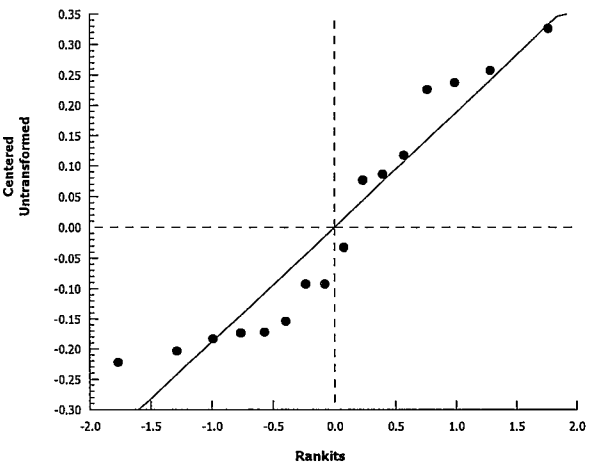
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	3.27	3.12	3.43	3.21	3.05	3.53	0.0646	5.59%	0.0%
43662	8	3.09	2.92	3.27	3.06	2.89	3.42	0.0732	6.69%	5.46%

Mean Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	3.18	3.18	3.24	3.05	3.39	3.1	3.53	3.51
43662	2.91	2.94	2.89	3.42	3.32	3.18	2.92	3.17

Graphics





CETIS Analytical Report

Report Date:	07 Jan-13 16:53 (p 1 of 1)
Test Code:	65294 Ref | 08-1818-7367

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	18-2464-8056	**Endpoint:**	Mean Length-mm	**CETIS Version:**	CETISv1.8.4
Analyzed:	07 Jan-13 16:53	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Untransformed	NA	C > T	NA	NA	5.81%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43663		43664	-6.2	1.77	0.19	13	1.0000	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.656298	1.656298	1	38.5	<0.0001	Significant Effect
Error	0.559836	0.04306431	13			
Total	2.216134		14			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.63	9.16	0.5384	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.963	0.833	0.7379	Normal Distribution

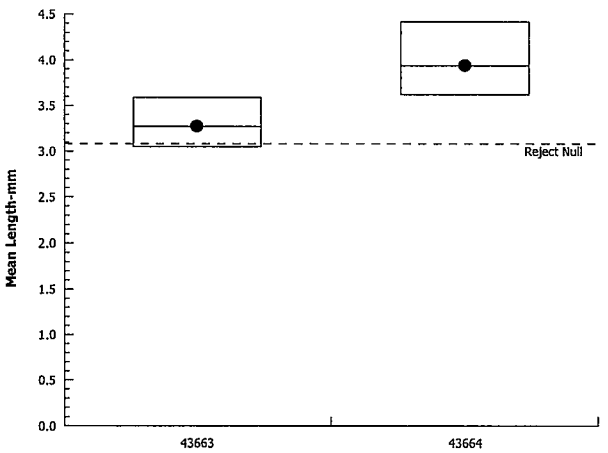
Mean Length-mm Summary

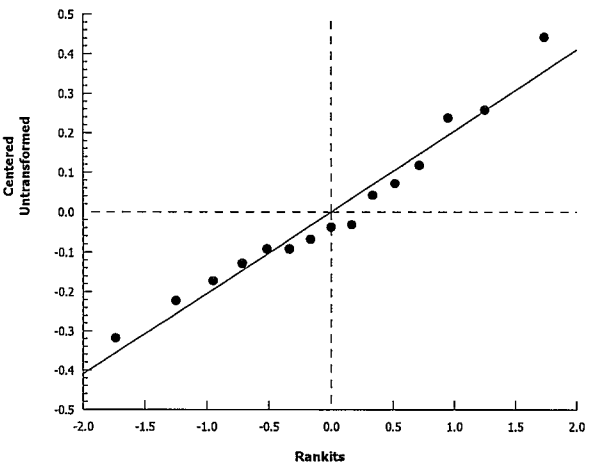
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	3.27	3.12	3.43	3.21	3.05	3.53	0.0646	5.59%	0.0%
43664	7	3.94	3.72	4.15	3.9	3.62	4.38	0.0881	5.92%	-20.4%

Mean Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	3.18	3.18	3.24	3.05	3.39	3.1	3.53	3.51
43664	3.62	3.9	3.87	4.38	4.01	3.81	3.98	

Graphics





CETIS Analytical Report

Report Date:	07 Jan-13 16:53 (p 1 of 1)
Test Code:	65294 Ref | 08-1818-7367

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Analysis ID:	09-0126-5297	**Endpoint:**	Mean Length-mm	**CETIS Version:**	CETISv1.8.4
Analyzed:	07 Jan-13 16:53	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD
Untransformed	NA	C > T	NA	NA	4.21%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
43663		43665	4.84	1.76	0.138	14	0.0001	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.5738062	0.5738062	1	23.4	0.0003	Significant Effect
Error	0.3431375	0.02450982	14			
Total	0.9169437		15			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	2.14	8.89	0.3361	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.95	0.841	0.4916	Normal Distribution

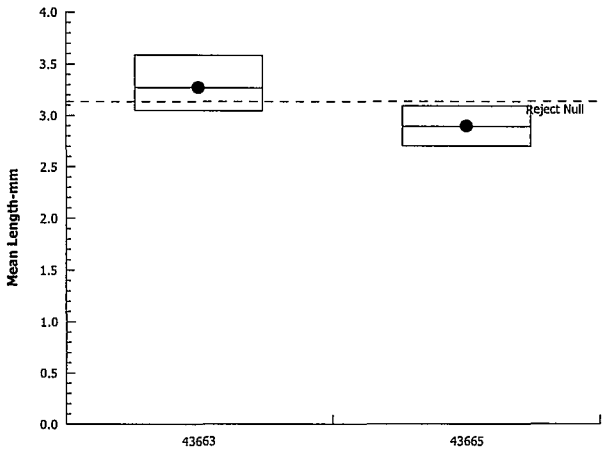
Mean Length-mm Summary

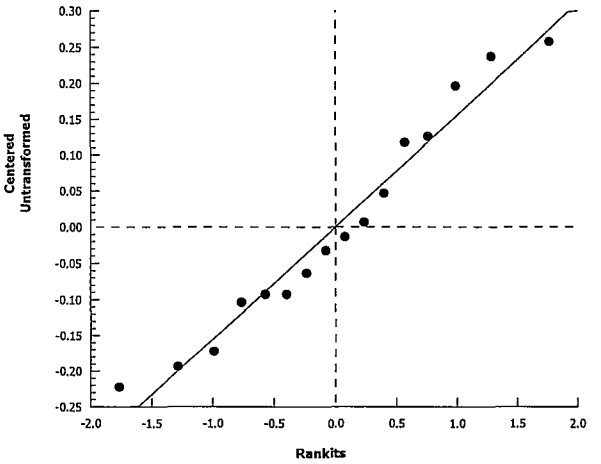
Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
43663	8	3.27	3.12	3.43	3.21	3.05	3.53	0.0646	5.59%	0.0%
43665	8	2.89	2.79	3	2.89	2.7	3.09	0.0442	4.32%	11.6%

Mean Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
43663	3.18	3.18	3.24	3.05	3.39	3.1	3.53	3.51
43665	2.94	2.9	3.09	2.88	2.7	2.83	3.02	2.79

Graphics





CETIS Test Data Worksheet

Report Date: 07 Jan-13 16:52 (p 1 of 1)
Test Code: 08-1818-7367/65294 Ref

Hyalella 10-d Survival and Growth Sediment Test — **Aquatec Biological Sciences, Inc**

Start Date: 02 Nov-12 10:40 **Species:** Hyalella azteca **Sample Code:** 43663
End Date: 12 Nov-12 09:30 **Protocol:** EPA/600/R-99/064 (2000) **Sample Source:** Auburn Rd
Sample Date: 24 Oct-12 16:30 **Material:** Sediment **Sample Station:** SD4

Sample Code	Rep	Pos	# Exposed	# Survived	Total Weight-mg	Tare Weight-mg	Pan Count	Mean Length-mm	Notes
43663	1	16	10	10	30.46	29.74	10	3.18	
43663	2	28	10	10	25.08	24.34	10	3.18	
43663	3	25	10	10	25.42	24.81	10	3.24	
43663	4	8	10	10	28.92	28.3	10	3.05	
43663	5	27	10	10	26.72	26.13	10	3.39	
43663	6	14	10	10	27.65	27.15	10	3.1	
43663	7	6	10	10	23.88	23.15	10	3.53	
43663	8	32	10	8	28.29	27.73	8	3.51	
43662	1	30	10	10	32.75	32.19	10	2.91	
43662	2	11	10	10	26.32	25.74	10	2.94	
43662	3	1	10	10	25.76	25.23	10	2.89	
43662	4	21	10	10	29.61	28.94	10	3.42	
43662	5	31	10	10	30.61	29.92	10	3.32	
43662	6	17	10	10	30.24	29.74	10	3.18	
43662	7	5	10	10	30.99	30.4	10	2.92	
43662	8	3	10	10	31.45	30.82	10	3.17	
43664	1	2	10	10	30.58	29.56	10	3.62	
43664	2	15	10	8	29.82	28.88	8	3.9	
43664	3	12	10	1	30.93	30.83	1	3.87	
43664	4	18	10	0					
43664	5	24	10	9	28	26.85	9	4.38	
43664	6	22	10	8	30.13	29.13	8	4.01	
43664	7	10	10	5	29.65	29.19	5	3.81	
43664	8	13	10	10	30.08	29.08	10	3.98	
43665	1	23	10	10	23.6	23.17	10	2.94	
43665	2	4	10	9	29.5	28.97	9	2.9	
43665	3	19	10	9	29.43	28.83	9	3.09	
43665	4	20	10	10	30.86	30.35	10	2.88	
43665	5	9	10	10	30.4	29.83	10	2.7	
43665	6	26	10	9	27.03	26.53	9	2.83	
43665	7	29	10	8	30.36	29.87	8	3.02	
43665	8	7	10	9	30.46	29.99	9	2.79	

Project: 12051

Chironomus tentans 28-day Emergence Test

SDG: 13339

Auburn Road

Sample	Rep	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15	Day 16	Day 17	Day 18	Day 19	Day 20	Day 21	Day 22	Day 23	Day 24	Day 25	Day 26	Day 27	Day 28 Emerg.	Day 28 Larvae	Day 28 Pupae	Total Emerg.	Total Surv.
43661	A	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5
43661	B	0	0	0	0	0	0	4	1	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	9	9
43661	C	0	0	0	0	0	0	1	0	0	2	0	0	2	1	0	0	0	0	0	0	0	0	0	6	6
43661	D	0	0	0	0	0	0	0	3	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5	5
43661	E	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
43661	F	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
43661	G	0	0	0	0	0	0	3	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	7	7
43661	H	0	0	0	0	1	2	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6
	Date:	14-Nov	15-Nov	16-Nov	17-Nov	18-Nov	19-Nov	20-Nov	21-Nov	22-Nov	23-Nov	24-Nov	25-Nov	26-Nov	27-Nov	28-Nov	29-Nov	30-Nov	1-Dec	2-Dec	3-Dec	4-Dec	4-Dec	4-Dec		
	Init.	JR	JR	KK	SL	JR	JR	JR	KK	J	JR	KK	JR	KK	JR	JR	SL	J	SL	JR	J	J	J	J		

Notes:

Sample	Rep	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15	Day 16	Day 17	Day 18	Day 19	Day 20	Day 21	Day 22	Day 23	Day 24	Day 25	Day 26	Day 27	Day 28 Emerg.	Day 28 Larvae	Day 28 Pupae	Total Emerg.	Total Surv.
43662	A	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	3	3
43662	B	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	2	0	2	4
43662	C	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	4	4
43662	D	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
43662	E	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	1	0	3	4
43662	F	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	1	0	0	0	0	5	5
43662	G	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	1	0	0	0	0	0	0	5	5
43662	H	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	1	2	4
	Date:	14-Nov	15-Nov	16-Nov	17-Nov	18-Nov	19-Nov	20-Nov	21-Nov	22-Nov	23-Nov	24-Nov	25-Nov	26-Nov	27-Nov	28-Nov	29-Nov	30-Nov	1-Dec	2-Dec	3-Dec	4-Dec	4-Dec	4-Dec		
	Init.	JR	JR	KK	SL	JR	JR	JR	KK	J	JR	KK	JR	KK	JR	JR	SL	J	SL	JR	J	J	J	J		

Notes: 11/30 Fly believed to be from Rep G, not H. JW

Aquatec Biological Sciences, Inc.

Reviewed by: SS Date: 1/7/13

Project: 12051

Chironomus tentans 28-day Emergence Test

SDG: 13339

Auburn Road

Sample	Rep	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15	Day 16	Day 17	Day 18	Day 19	Day 20	Day 21	Day 22	Day 23	Day 24	Day 25	Day 26	Day 27	Day 28 Emerg.	Day 28 Larvae	Day 28 Pupae	Total Emerg.	Total Surv.
43663	A	0	0	0	0	1	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	5	5
43663	B	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
43663	C	0	0	0	0	0	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	5	5
43663	D	0	0	0	0	0	1	2	1	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	8	8
43663	E	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	4	4
43663	F	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	4	4
43663	G	0	0	0	0	0	0	3	0	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	7	7
43663	H	0	0	0	0	0	0	0	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	4	4
	Date:	14-Nov	15-Nov	16-Nov	17-Nov	18-Nov	19-Nov	20-Nov	21-Nov	22-Nov	23-Nov	24-Nov	25-Nov	26-Nov	27-Nov	28-Nov	29-Nov	30-Nov	1-Dec	2-Dec	3-Dec	4-Dec	4-Dec	4-Dec		
	Init.	JR	JR	KK	SL	JR	JR	JR	KK	J	JR	KK	JR	KK	JR	JR	SL	J	SL	JR	J	J	J	J	✓	

Notes:

Sample	Rep	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15	Day 16	Day 17	Day 18	Day 19	Day 20	Day 21	Day 22	Day 23	Day 24	Day 25	Day 26	Day 27	Day 28 Emerg.	Day 28 Larvae	Day 28 Pupae	Total Emerg.	Total Surv.
43664	A	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
43664	B	0	0	0	0	1	2	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	7	7
43664	C	0	0	0	0	1	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
43664	D	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
43664	E	0	0	0	0	0	1	1	1	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	6	6
43664	F	0	0	0	0	0	2	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	5	5
43664	G	0	0	0	0	0	0	1	2	2	0	0	1	0	0	1	0	0	0	0	0	0	0	0	7	7
43664	H	0	0	0	0	1	1	1	1	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	7	7
	Date:	14-Nov	15-Nov	16-Nov	17-Nov	18-Nov	19-Nov	20-Nov	21-Nov	22-Nov	23-Nov	24-Nov	25-Nov	26-Nov	27-Nov	28-Nov	29-Nov	30-Nov	1-Dec	2-Dec	3-Dec	4-Dec	4-Dec	4-Dec		
	Init.	JR	JR	KK	SL	JR	JR	JR	KK	J	JR	KK	JR	KK	JR	JR	SL	J	SL	JR	J	J	J	J	✓	

Notes:

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Aquatec Biological Sciences, Inc.

Reviewed by: _____ Date: 1/7/13

Project: 12051

Chironomus tentans 28-day Emergence Test

Auburn Road

SDG: 13339

	Rep	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15	Day 16	Day 17	Day 18	Day 19	Day 20	Day 21	Day 22	Day 23	Day 24	Day 25	Day 26	Day 27	Day 28 Emerg.	Day 28 Larvae	Day 28 Pupae	Total Emerg.	Total Surv.
43665	A	0	0	0	0	0	1	1	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	5	5
43665	B	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
43665	C	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
43665	D	0	0	0	0	0	0	1	1	1	1	2	0	0	1	0	0	0	0	0	0	0	0	0	7	7
43665	E	0	0	0	0	0	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5
43665	F	0	0	0	0	0	0	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	4	4
43665	G	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	4	4
43665	H	0	0	0	0	0	1	2	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	6	6
	Date:	14-Nov	15-Nov	16-Nov	17-Nov	18-Nov	19-Nov	20-Nov	21-Nov	22-Nov	23-Nov	24-Nov	25-Nov	26-Nov	27-Nov	28-Nov	29-Nov	30-Nov	1-Dec	2-Dec	3-Dec	4-Dec	4-Dec	4-Dec		
	Init.	JR	JR	KK	SL	JR	JR	JR	KK	J	JR	KK	JR	KK	JR	JR	SL	J	SL	JR	J	J	J	J		

Notes:

Aquatec Biological Sciences, Inc.

Reviewed by: J Date: 1/7/13

Project: Auburn Road Landfill

100.5-28Ct Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

EMERGENCE DATA:

43661 Control

Rep	8	9	10	11	12	13	14	15	16	17	18	19	20	21
A			0	0	0	0	3	2	0	0	0	0	0	0
B			0	0	0	0	4	1	0	JR ~~1~~ 2	2	0	0	0
C			0	0	0	0	1	0	0	JR ~~1~~ 2	0	0	2	1
D			0	0	0	0	0	3	1	0	1	0	0	0
E			0	0	0	0	1	0	0	2	0	0	0	0
F			0	0	0	0	0	1	0	1	0	0	0	0
G			0	0	0	0	3	1	0	0	1	1	1	0
H			0	0	1	2	0	2	1	0	0	0	0	0
Date			11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27
Initials			KK	SL	JR	JR	JR	KK	J	JR	KK	JR	KK	JR

Rep	22	23	24	25	26	27	28
A	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0
D	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
F	0	0	0	0	0	0	0
G	0	0	0	0	0	0	0
H	0	0	0	0	0	0	0
Date	11/28	11/29	11/30	12/1	12/2	12/3	12/4
Initials	JR	SL	J	SL	JR	J	JW

Aquatec Biological Sciences, Inc.

Reviewed by: J Date: 12/21/12

SDG: 13339

Project: 12051

Project: Auburn Road Landfill

100.5-28Ct Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

EMERGENCE DATA:

43662 SD2-1012

Rep	8	9	10	11	12	13	14	15	16	17	18	19	20	21
A			0	0	0	0	0	0	1	1	0	0	0	0
B			0	0	0	0	0	0	0	1	0	0	1	0
C			0	0	0	0	0	1	0	1	0	1	0	0
D			0	0	0	0	0	0	0	1	0	0	0	0
E			0	0	0	0	0	0	1	0	1	0	0	0
F			0	0	0	0	0	0	0	0	0	1	0	1
G			0	0	0	0	0	0	1	0	1	0	0	0
H			0	0	0	0	0	0	0	1	0	0	0	1
Date			11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27
Initials			KK	SL	JR	JR	JR	KK	[illegible]	JR	KK	JR	KK	JR

Rep	22	23	24	25	26	27	28
A	1	0	0	0	0	0	0
B	0	0	0	0	0	0	0
C	0	0	1	0	0	0	0
D	0	0	0	0	0	0	0
E	0	0	1	0	0	0	0
F	0	1	1	0	1	0	0
G	1	1	~~0~~ 1 (1)	0	0	0	0
H	0	0	~~1~~ 0	0	0	0	0
Date	11/28	11/29	11/30	12/1	12/2	12/3	12/4
Initials	JR	SL	JW	SL	JR	[illegible]	JW

(1) Fly believed to be from Rep G, not 1st. JW 11/30/12

Aquatec Biological Sciences, Inc.

Reviewed by: [illegible] Date: 12/20/12

SDG: 13339

Project: 12051

Project: Auburn Road Landfill

100.5-28Ct Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

EMERGENCE DATA:

43663 SD4-1012

Rep	8	9	10	11	12	13	14	15	16	17	18	19	20	21
A			0	0	1	0	1	KK 1	0	0	0	2	0	0
B			0	0	0	0	0	0	2	1	0	0	0	0
C			0	0	0	0	SL 3	0	0	0	2	0	0	0
D			0	0	0	1	2	1	1	1	0	0	0	1
E			0	0	0	0	1	0	1	1	1	0	0	0
F			0	0	0	0	0	0	0	0	2	2	0	0
G			0	0	0	0	3	0	2	1	0	1	0	0
H			0	0	0	0	0	2	1	0	1	0	0	0
Date			11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27
Initials			KK	SL	JR	JR	JR	KK	J	JR	KK	JR	KK	JR

Rep	22	23	24	25	26	27	28
A	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0
D	0	0	0	1	0	0	0
E	0	0	0	0	0	0	0
F	0	0	0	0	0	0	0
G	0	0	0	0	0	0	0
H	0	0	0	0	0	0	0
Date	11/28	11/29	11/30	12/1	12/2	12/3	12/4
Initials	JR	SL	J	SL	JR	J	JW

Aquatec Biological Sciences, Inc.

Reviewed by: J Date: 12/21/12

SDG: 13339

Project: 12051

Project: Auburn Road Landfill

100.5-28Ct Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

EMERGENCE DATA:

43664 SD5-1012

Rep	8	9	10	11	12	13	14	15	16	17	18	19	20	21
A			0	0	0	1	0	1	0	0	0	0	0	0
B			0	0	1	2	1	1	0	1	1	0	0	0
C			0	0	1	0	1	2	0	0	0	0	0	0
D			0	0	0	0	0	3	0	0	0	0	0	0
E			0	0	0	1	1	1	2	0	0	1	0	0
F			0	0	0	2	0	1	1	0	0	1	0	0
G			0	0	0	0	1	2	2	0	0	1	0	0
H			0	0	1	1	1	1	0	1	2	0	0	0
Date			11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27
Initials			KK	SL	JR	JR	JR	KK	J	JR	KK	JR	KK	JR

Rep	22	23	24	25	26	27	28
A	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0
D	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
F	0	0	0	0	0	0	0
G	1	0	0	0	0	0	0
H	0	0	0	0	0	0	0
Date	11/28	11/29	11/30	12/1	12/2	12/3	12/4
Initials	JR	SL	J	SL	JR	J	JV

Aquatec Biological Sciences, Inc.

Reviewed by: J Date: 12/21/12

SDG: 13339

Project: 12051

Project: Auburn Road Landfill

100.5-28Ct Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

EMERGENCE DATA:

43665 SD9-1012

Rep	8	9	10	11	12	13	14	15	16	17	18	19	20	21
A			0	0	0	1	1	0	1	0	2	0	0	0
B			0	0	0	0	0	1	1	0	0	0	0	0
C			0	0	0	0	2	0	2	0	0	0	0	0
D			0	0	0	0	1	1	1	1	2	0	0	1
E			0	0	0	1	1	1	2	0	0	0	0	0
F			0	0	0	0	1	0	0	2	1	0	0	0
G			0	0	0	1	JR ~~0~~ 1	0	0	1	1	0	0	0
H			0	0	0	1	2	2	0	0	0	1	0	0
Date			11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27
Initials			KK	SL	JR	JR	JR	KK	[illegible]	JR	KK	JR	KK	JR

Rep	22	23	24	25	26	27	28
A	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0
D	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
F	0	0	0	0	0	0	0
G	0	0	0	0	0	0	0
H	0	0	0	0	0	0	0
Date	11/28	11/29	11/30	12/1	12/2	12/3	12/4
Initials	JR	SL	[illegible]	SL	JR	[illegible]	[illegible]

Aquatec Biological Sciences, Inc.

Reviewed by: [illegible] Date: 12/21/12

SDG: 13339

Project: 12051

Project: Auburn Road Landfill

100.5-28Ct Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

END OF TEST DATA:

Sample Number	Date Sample Ended		A	B	C	D	E	F	G	H	Initials
43661 Control	12/4/12 08:30	Larvae	0	0	0	0	0	0	0	0	JW
		Pupae	0	0	0	0	0	0	0	0	
43662 SD2-1012	12/4/12 09:10	Larvae	0	2	0	0	1	0	0	1	JW
		Pupae	0	0	0	0	0	0	0	1	
43663 SD4-1012	12/4/12 09:40	Larvae	0	0	0	0	0	0	0	0	JW
		Pupae	0	0	0	0	0	0	0	0	
43664 SD5-1012	12/4/12 10:00	Larvae	0	0	0	0	0	0	0	0	JW
		Pupae	0	0	0	0	0	0	0	0	
43665 SD9-1012	12/4/12 10:30	Larvae	0	0	0	0	0	0	0	0	JW
		Pupae	0	0	0	0	0	0	0	0	

NOTES:

Aquatec Biological Sciences, Inc.

Reviewed by: [illegible] Date: 12/21/12

SDG: 13339

Project: 12051

***Chironomus tentans* Head Capsule Width**
Auburn Road 28-day survival and emergence test

Culture ID: 102912 Cdilutus Age: 9 days
Target head capsule width, second/third instar: 0.33-0.45 mm
Magnification: 32X, Measured with Swiftcam system
Straightline measurement from eye to eye across head capsule.
Source of Organisms: In-house culture
Organisms from cultures used for testing on 11/6/12 (preserved until time of measurement)

Organism Number	Head Capsule Width (mm)
1	0.36
2	0.38
3	0.34
4	0.33
5	0.18
6	0.32
7	0.37
8	0.34
9	0.33
10	0.34
11	0.34
12	0.39
13	0.19
14	0.2
15	0.37
16	0.41
17	0.2
18	0.38
19	0.35
20	0.2

Average:	**0.316**	**mm**

JW 1/8/13

Aquatec Biological Sciences, Inc.

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Williston, VT 05495
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45 Constitution Avenue
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Concord, NH 03301

Tel: (603) 656-5453
Fax: (603) 656-5401

E-Mail: s.combs@westonso

ORGANISM HOLDING AND ACCLIMATION

Species: *Chironomus tentans*
Supplier: IN-house
Condition: Normal / Active

Date Received: __/__/__
Age of Organisms 8 d
Culture ID: 102912 C dilutus

Acclimation / Holding Procedures: Transfer to holding culture boxes, add laboratory water. Acclimate to water to be used for testing (sediment overlying water formulation). Aerate lightly. Water change at least once (50 %) every two days.

Daily Feeding: Tetrafin slury. Do Not allow excess food to accumulate.

Date	Fed	Temp.	pH	D.O.	Cond.	Condition	Water Change	Initials
__/__/__		See Attached data sheet						
__/__/__								
__/__/__								
__/__/__								
__/__/__								

N = Normal, appear healthy. Record # dead if any observed.

Chironomus tentans Head capsule measurements

Organism	Head Capsule Width (mm)	Organism	Head Capsule Width (mm)
1	0.36	11	0.34
2	0.38	12	0.39
3	0.34	13	0.19
4	0.33	14	0.20
5	0.18	15	0.37
6	0.32	16	0.41
7	0.37	17	0.20
8	0.34	18	0.38
9	0.33	19	0.35
10	0.34	20	0.20
Initials	KR	Initials	KR
Date	1/7/2013	Date	1/7/2013

Aquatec Biological Sciences, Inc.
Reviewed by: [illegible] Date: 1/8/13

SDG: 13339
Project: 12051

Organism Holding and Acclimation

Species: *Chironomus dilutus*	
Source: Aquatec in-house cultures	
Egg case deposit date: 10/26/12	Number of egg cases 3
Larval 1st hatch date: 10/28-10/29/12	Culture ID: 1029 12 Cdilutus

Some still hatching 10/29/12

Acclimation / Holding Procedures: Hold egg cases in sed recon water within small Carolina bowl. When hatching begins, add a few drops of Selenastrum algae. After strong hatching, transfer to culture box with thin layer of very fine sediment and sed recon water. Provide moderate aeration. Feed Selenastrum/dilute ground Tetrafin. Shift to all Tetrafin within 3-4 days post hatch.

Water change (50%-80%) once weekly by decanting and replacing overlying water.

2012 Date	Fed	Temp °C	pH	D.O.	Cond.	Water Change	Comment	Init.
10/30/12	✓ TET/sel	23.5						J
10/31	✓ Tet	23.1						J
11/1	✓ Tet	22.1						J
11/2	✓ Tet	22.8	Split into	2 boxes.		✓ Added	sediment.	J
11/3	✓	22.5						SL
11/4	tetV	22.1						JR
11/5	TetV	22.6	Added	sediment		substrat		J
11/6		23.1	7.6	6.9	399			J
11/6/12	STARTED	WS	AUBURN	RD	TEST.			JW

* N = normal, appear healthy. Record approximate # dead if any observed.

JW 1/8/13

Project: Auburn Road Landfill

100.5-28Ct Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

CHEMISTRY DATA: Chemical analysis Date/Initials are noted on last page of Days 0 - 15 chemistry data sheets

Sample	Analysis	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
43661 Control	pH	7.2	7.2	/	7.4	/	/	7.7	/	7.7	/	7.6	/	/	7.5	/	7.5
	DO	6.9	6.6	/	5.8	~~5.8~~ 5.8	/	7.4	/	7.2	/	7.6	/	/	7.6	/	7.6
	Cond.	374		/	/	/	/	/	/	396	/	/	/	/	/	/	375
43662 SD2-1012	pH	7.2	7.2	/	7.2	/	/	7.6	/	7.7	/	7.7	/	/	7.6	/	7.5
	DO	7.0	6.7	/	5.6	~~5.6~~ 5.6	/	7.3	/	7.2	/	7.8	/	/	8.0	/	7.6
	Cond.	351		/	/	/	/	/	/	379	/	/	/	/	/	/	365
43663 SD4-1012	pH	7.3	7.2	/	7.3	/	/	7.9	/	7.7	/	7.7	/	/	7.6	/	7.5
	DO	7.5	6.6	/	5.5	/	/	7.8	/	7.2	/	7.6	/	/	7.7	/	7.4
	Cond.	388		/	/	/	/	/	/	392	/	/	/	/	/	/	371
43664 SD5-1012	pH	7.5	7.5	/	7.4	/	/	7.7	/	7.7	/	7.7	/	/	7.6	/	7.6
	DO	7.5	7.2	/	5.6	/	/	7.2	/	7.1	/	7.6	/	/	7.7	/	7.5
	Cond.	396		/	/	/	/	/	/	407	/	/	/	/	/	/	380
43665 SD9-1012	pH	7.2	7.3	/	7.3	/	/	7.5	/	7.6	/	7.5	/	/	7.6	/	7.5
	DO	6.7	6.6	/	5.5	/	/	6.9	/	7.0	/	7.4	/	/	7.8	/	7.2
	Cond.	399		/	/	/	/	/	/	399	/	/	/	/	/	/	384
2012	Date	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21
	Initials	KK	JR		JW			JR		JR		KK			JR		KK

Aquatec Biological Sciences, Inc.

Reviewed by: [signature] Date: 12/21/12

SDG: 13339

Project: 12051

Project: Auburn Road Landfill

100.5-28Ct Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

CHEMISTRY DATA: Chemical analysis Date/Initials are noted on last page of Days 16 - 31 chemistry data sheets

Sample	Analysis	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
43661	pH		7.5			7.5		7.5		7.7			7.9				
Control	DO		7.8			7.6		7.3		7.2			6.7				
	Cond.		—			—		391					392				
43662	pH		7.6			7.6		7.5		7.6			7.9				
SD2-1012	DO		8.0			7.9		7.4		7.6			7.0				
	Cond.		—			—		380					385				
43663	pH		7.5			7.5		7.5		7.7			7.9				
SD4-1012	DO		7.4			7.5		7.5		7.7			7.1				
	Cond.		—			—		385					397				
43664	pH		7.5			7.6		7.5		7.6			7.8				
SD5-1012	DO		7.6			7.7		7.5		7.6			7.0				
	Cond.		—			—		391					401				
43665	pH		7.5			7.5		7.6		7.7			7.7				
SD9-1012	DO		7.7			7.5		7.6		7.7			6.4				
	Cond.		—			—		394					408				
2012	Date		11/23			11/26		11/28		11/30			12/3				
	Initials		JR			KK		JR		JL			JW				

Aquatec Biological Sciences, Inc.

Reviewed by: _____ Date: 12/21/12

SDG: 13339

Project: 12051

Project: Auburn Road Landfill **PAGE:** ___ **OF:** ___

100.5-28Ct Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

SEDIMENT D.O. MONITORING

(Rep/D.O. measurement)

Sample Number	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
43661			4.6	4.8/C	3.1/H					
43662			4.8	5.0/D	4.2/C					
43663			4.9	4.8/D	3.8/D					
43664			4.9	4.6/H	4.1/H					
43665			4.7	4.5/F	3.8/F					
Initials/Date			11/9/12	11/10/12 KP	11/11/12 JW					

Procedure: beginning on day 1, measure and record DO directly in two randomly selected replicates. Beginning on Day 4, measure and record DO directly in four randomly selected replicates (Try to check different sample #'s on each subsequent day). When a declining DO trend is seen in any replicate, begin aeration to all replicates on that day.

No aeration 11/9/12 JW

STARTED AERATION 11/11/12 JW

Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Aquatec Biological Sciences

Channel #: 7

TEMPERATURE LOG (°C)

Client: Weston Solutions, Inc.
Project: Auburn Road Landfill
Project #: 12051
SDG: 13339
Species: *Chironomus dilutus*

DAY	Hour of the Day 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Daily AVE	MIN	MAX
11/06/2012																	23.1	23.1	23.1	23.3	23.4	23.6	23.6	23.6	23.4	23.1	23.6
11/07/2012	23.5	23.3	23.3	23.4	23.5	23.4	23.5	23.4	23.6	23.3	23.4	23.4	23.2	22.9	23.1	23.2	23.2	23.1	23.2	23.3	23.3	23.6	23.6	23.6	23.3	22.9	23.6
11/08/2012	23.6	23.4	23.6	23.6	23.6	23.6	23.5	23.6	23.6	23.5	23.6	23.5	23.3	23.1	23.2	23.3	23.5	23.4	23.5	23.4	23.5	23.5	23.5	23.6	23.5	23.1	23.6
11/09/2012	23.6	23.2	23.5	23.5	23.6	23.4	23.5	23.4	23.5	23.6	23.2	23.2	23.2	23.1	23.1	23.2	23.3	23.4	23.3	23.3	23.6	23.6	23.6	23.6	23.4	23.1	23.6
11/10/2012	23.6	23.4	23.5	23.6	23.5	23.4	23.6	23.5	23.5	23.6	23.6	23.3	23.3	23.2	23.3	23.3	23.3	23.6	23.5	23.5	23.6	23.5	23.5	23.5	23.5	23.2	23.6
11/11/2012	23.5	23.3	23.4	23.4	23.5	23.5	23.3	23.5	23.5	23.4	23.5	23.2	23.3	23.2	23.3	23.2	23.4	23.5	23.5	23.5	23.5	23.6	23.6	23.6	23.4	23.2	23.6
11/12/2012	23.6	23.1	23.3	23.3	23.5	23.5	23.4	23.5	23.3	23.3	23.3	23.4	23.3	23.5	23.3	23.4	23.5	23.6	23.6	23.7	23.6	23.7	23.7	23.6	23.5	23.1	23.7
11/13/2012	23.6	23.7	23.4	23.5	23.5	23.5	23.6	23.6	23.5	23.5	23.6	23.5	23.3	23.4	23.0	23.2	23.5	23.5	23.5	23.5	23.3	23.4	23.4	23.4	23.5	23.0	23.7
11/14/2012	23.3	23.3	23.1	23.1	23.2	23.1	23.2	23.0	23.1	23.1	23.2	23.0	23.0	23.2	22.8	23.0	23.2	23.2	23.2	23.0	23.2	23.2	23.2	23.2	23.1	22.8	23.3
11/15/2012	23.2	23.2	22.9	23.1	23.1	23.2	23.1	23.2	23.1	23.1	23.1	23.0	23.0	23.0	22.7	23.2	23.0	23.1	23.2	23.3	23.5	23.5	23.4	23.4	23.1	22.7	23.5
11/16/2012	23.4	22.8	23.6	23.3	23.7	23.4	23.6	23.3	23.2	23.1	23.2	23.2	23.1	22.3	23.0	23.2	23.2	23.1	23.2	23.5	23.2	23.3	23.2	23.5	23.2	22.3	23.7
11/17/2012	23.6	23.4	23.2	23.4	23.5	23.4	23.6	23.5	23.5	23.6	23.5	23.5	23.4	23.6	23.1	23.5	23.6	23.6	23.6	23.7	23.8	23.8	23.7	23.6	23.5	23.1	23.8
11/18/2012	23.8	23.7	23.3	23.6	23.5	23.6	23.7	23.5	23.6	23.6	23.7	23.5	23.2	23.6	23.2	23.4	23.5	23.2	23.3	23.5	23.5	23.4	23.5	23.5	23.5	23.2	23.8
11/19/2012	23.5	23.3	23.3	23.3	23.3	23.3	23.5	23.2	23.5	23.3	23.3	23.3	23.1	23.0	23.0	23.0	23.3	23.2	23.2	23.3	23.3	23.2	23.4	23.5	23.3	23.0	23.5
11/20/2012	23.2	23.4	23.2	23.3	23.4	23.1	23.3	23.5	23.2	23.5	23.2	23.2	23.3	23.3	23.0	23.3	23.2	23.3	23.5	23.5	23.5	23.5	23.5	23.3	23.3	23.0	23.5
11/21/2012	23.5	23.5	23.3	23.3	23.6	23.4	23.3	23.6	23.5	23.3	23.3	23.3	23.2	23.2	23.2	23.2	23.3	23.3	23.2	23.3	23.3	23.5	23.6	23.5	23.4	23.2	23.6
11/22/2012	23.4	23.3	23.5	23.3	23.4	23.5	23.5	23.4	23.5	23.6	23.5	23.5	23.6	23.5	23.4	23.1	23.3	23.3	23.5	23.5	23.5	23.5	23.4	23.6	23.4	23.1	23.6
11/23/2012	23.5	23.1	23.3	23.4	23.3	23.4	23.4	23.3	23.5	23.3	23.3	23.6	23.2	22.8	23.1	23.5	23.4	23.3	23.4	23.3	23.4	23.3	23.6	23.5	23.3	22.8	23.6
11/24/2012	23.5	23.1	23.3	23.5	23.6	23.6	23.5	23.3	23.5	23.5	23.5	23.4	23.6	22.8	23.1	23.3	23.4	23.6	23.6	23.4	23.5	23.4	23.5	23.5	23.4	22.8	23.6
11/25/2012	23.3	23.1	23.5	23.3	23.5	23.4	23.5	23.3	23.5	23.5	23.3	23.2	23.2	22.7	23.0	23.1	23.1	23.3	23.3	23.5	23.3	23.5	23.3	23.4	23.3	22.7	23.5
11/26/2012	23.3	23.2	23.3	23.3	23.3	23.5	23.3	23.3	23.5	23.3	23.4	23.3	23.2	23.0	22.9	22.8	23.1	23.1	23.1	23.2	23.5	23.4	23.5	23.4	23.3	22.8	23.5
11/27/2012	23.6	23.4	23.2	23.5	23.2	23.5	23.3	23.3	23.4	23.5	23.5	23.3	23.2	23.1	22.9	23.4	23.2	23.2	23.2	23.2	23.3	23.6	23.5	23.5	23.3	22.9	23.6
11/28/2012	23.5	23.5	23.3	23.5	23.5	23.4	23.5	23.3	23.5	23.3	23.6	23.2	23.2	23.2	23.0	23.0	23.0	23.1	23.1	23.4	23.4	23.5	23.6	23.6	23.3	23.0	23.6
11/29/2012	23.6	23.4	23.4	23.4	23.3	23.5	23.5	23.5	23.3	23.5	23.5	23.4	23.3	23.2	23.1	23.0	23.1	23.2	23.4	23.6	23.6	23.6	23.6	23.6	23.4	23.0	23.6
11/30/2012	23.6	23.4	23.5	23.5	23.5	23.3	23.3	23.3	23.6	23.6	23.4	23.2	23.0	23.0	22.7	23.0	23.4	23.2	23.2	23.3	23.4	23.5	23.5	23.5	23.3	22.7	23.6
12/01/2012	23.4	23.4	23.4	23.5	23.5	23.5	23.5	23.3	23.5	23.5	23.4	23.5	23.4	23.5	23.0	23.3	23.5	23.6	23.5	23.5	23.6	23.5	23.5	23.7	23.5	23.0	23.7
12/02/2012	23.5	23.3	23.3	23.5	23.5	23.4	23.7	23.3	23.6	23.5	23.4	23.5	23.4	23.6	23.1	23.2	23.6	23.6	23.5	23.7	23.6	23.6	23.5	23.7	23.5	23.1	23.7
12/03/2012	23.7	23.6	23.5	23.5	23.5	23.6	23.7	23.6	23.5	23.6	23.6	23.6	23.5	23.5	22.8	23.3	23.6	23.3	23.2	23.2	23.4	23.5	23.5	23.6	23.5	22.8	23.7
12/04/2012	23.6	23.5	23.5	23.5	23.6	23.5	23.3	23.4	23.5	23.5	23.4														23.5	23.3	23.6
																								Overall Test Temperature:	**23.4**	**22.3**	**23.8**

101

Reviewed by: [illegible] Date: 1/7/13.

Aquatec Biological Sciences, Inc.
273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 1638 Fax: (802) 658 - 3189

SDG: 13339
Project: 12051

Weston Solutions, Inc.
45 Constitution Avenue
Suite 100
Concord, NH 03301

Tel: (603) 656-5453
Fax: (603) 656-5401
E-Mail: s.combs@westonso

ALKALINITY AND HARDNESS

Sample ID:			Analysis Date:	Alkalinity: (mg/L)	Hardness: (mg/L)
43661	Control	Cd Day 0	11/6/2012	68.0	92.0
43662	SD2-1012	Cd Day 0	11/6/2012	44.0	88.0
43663	SD4-1012	Cd Day 0	11/6/2012	48.0	92.0
43664	SD5-1012	Cd Day 0	11/6/2012	56.0	100.0
43665	SD9-1012	Cd Day 0	11/6/2012	56.0	100.0
43661	Control	Cd Day 27	12/3/2012	52.0	110.0
43662	SD2-1012	Cd Day 27	12/3/2012	52.0	90.0
43663	SD4-1012	Cd Day 27	12/3/2012	48.0	100.0
43664	SD5-1012	Cd Day 27	12/3/2012	56.0	102.0
43665	SD9-1012	Cd Day 27	12/3/2012	56.0	106.0

.INF: Interference. The color endpoint was reached immediately.

Reviewed by: _____ Date: 1/7/13.

Aquatec Biological Sciences, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 1638 Fax: (802) 658 - 3189

SDG: 13339
Project: 12051

AMMONIA ANALYSIS REPORT

Project: Auburn Road Landfill

100.5-28Ct **Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments**

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

Sample	Pore Water (mg/L) 11/1/2012	Overlying Water (mg/L) 11/6/2012	12/3/2012
43661 - **Control**	0.9	0.3	0.3
43662 - **SD2-1012**	1.0	0.3	0.3
43663 - **SD4-1012**	1.0	0.4	0.3
43664 - **SD5-1012**	1.0	0.3	0.3
43665 - **SD9-1012**	1.0	0.6	0.3

BD- Indicates a concentration value below the reporting limit (<0.1).

Reviewed by: _____ Date: 1/7/13.

Project: Auburn Road Landfill **WEEK OF:** 11/4/12

100.5-28Ct Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

ACTIVITY / DAY

DAILY SEDIMENT MONITORING - CHECKLIST

AM

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Temperature(s): Probe #(s): SL2 Ch. 7			23.6	23.7 JW	23.9	23.8	23.7
Fill Reservoirs			✓	✓	✓	✓	✓
Delivery tubes in place			✓	✓	✓	✓	✓
Check water Supply			✓	✓	✓	✓	✓
Empty Waste Buckets			✓	✓	✓	✓	✓
Floater/Aeration* Check			✓	✓	✓	✓	✓
Chems Collected / ok?			✓	✓	—		—

NOON

Splitter box(s) filling?			08:00 J	✓	✓	✓	✓
Syringes filing?			✓	✓	✓	✓	✓
Needles flowing?			✓	✓	✓	✓	✓
Drainage to Waste - ok?			✓	✓ JW	✓	✓ JW	✓
Feeding (Time/Init.)			08:25 JW	15:50 J	14:15 JR	12:30 SL	12:30 SL

PM

Temperature(s): Probe #(s): See Above			23.4	23.7	23.3	23.4	23.1
Fill Reservoirs		✓	✓	✓	✓	✓	✓
Delivery tubes in place		✓	✓	✓	✓	✓	✓
Check water Supply		✓	✓	✓	✓	✓	✓
Empty Waste Buckets		✓	✓	✓	✓	✓ J	✓
Floater/Aeration* Check		—	✓	✓	✓	✓	✓
Date:		11/5/12	11/6/12	11/7/12	11/8/12	11/9/12	11/10/12
Initials:		JW	KC/JW	JR	SL/JR	JW	KC

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Corrective Actions / Comments (Initial/Time)		Loaded Sediments into test beakers. Added OLW	Test start 13:00 - 16:00 JW No aeration			No aeration	

* Aeration required if DO is below/reaching minimum DO reqirements (Note when initiated)

Aquatec Biological Sciences, Inc.

Reviewed by: J Date: 12/21/12

SDG: 13339

Project: 12051

Project: Auburn Road Landfill **WEEK OF:** 11 / 11 / 12

100.5-28Ct Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

DAILY SEDIMENT MONITORING - CHECKLIST

ACTIVITY / DAY

AM

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Temperature(s): Probe #(s):	23.7	23.3	24.2	23.1	23.4	23.3	23.1
Fill Reservoirs	✓	✓	✓	✓	✓	✓	✓
Delivery tubes in place	✓	✓	✓	✓	✓	✓	✓
Check water Supply	✓	✓	✓	✓	✓	✓	✓
Empty Waste Buckets	✓	✓	✓	✓	✓	✓	✓
Floater/Aeration* Check	✓	✓	✓	✓	✓	✓	✓
Chems Collected / ok?	✓	✓	—	✓	—	✓	—

NOON

Splitter box(s) filling?	✓	✓	✓	✓	✓	✓	✓
Syringes filing?	✓	✓	✓	✓	✓	✓	✓
Needles flowing?	✓	✓	✓	✓	✓	✓	✓
Drainage to Waste - ok?	✓	✓	✓	✓	✓	✓	✓
Feeding (Time/Init.)	JR 15:10	12:10 JR	13:05 JR	13:05 JR	12:20 JR	16:00 SL	12:30 SL

PM

Temperature(s): Probe #(s): See Above	23.8	24.4	23.8	23.4	23.3	23.2	23.6
Fill Reservoirs	✓	✓	✓	✓	✓	✓	✓
Delivery tubes in place	✓	✓	✓	✓	✓	✓	✓
Check water Supply	✓	✓	✓	✓	✓	✓	✓
Empty Waste Buckets	✓	✓	✓	✓	✓	✓	✓
Floater/Aeration* Check	✓	✓	✓	✓	✓	✓	✓
Date:	11/11/12	11/12/12	11/13/12	11/14/12	11/15/12	11/16/12	11/17/12
Initials:	JR/	JR/JR	JR	JR	JR/	KK	SL

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Corrective Actions / Comments (Initial/Time)	STARTED AERATION TO ALL TEST REPLICATES		Turned heater setting down slightly 17:20		Placed emergence traps on all reps 16:30 - JR		

* Aeration required if DO is below/reaching minimum DO reqirements (Note when initiated)

Project: Auburn Road Landfill **WEEK OF:** 11 / 18 / 12

100.5-28Ct Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

DAILY SEDIMENT MONITORING - CHECKLIST

ACTIVITY / DAY

AM

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Temperature(s): Probe #(s):	23.9	23.8	23.6	23.6	23.6	23.7	23.8
Fill Reservoirs	✓	✓	✓	✓	✓	✓	✓
Delivery tubes in place	✓	✓	✓	✓	✓	✓	✓
Check water Supply	✓	✓	✓	✓	✓	✓	✓
Empty Waste Buckets	✓	✓	✓	✓	✓	✓	✓
Floater/Aeration* Check	✓	✓	✓	✓	✓	✓	✓
Chems Collected / ok?	—	✓	—	✓	/	✓	—

NOON

Splitter box(s) filling?	✓	✓	✓	✓	✓	✓	✓
Syringes filing?	✓	✓	✓	✓	✓	✓	✓
Needles flowing?	✓	✓	✓	✓	✓	✓	✓
Drainage to Waste - ok?	✓	✓	✓	✓	✓	✓	✓
Feeding (Time/Init.)	14:30 JR	12:55 JR	12:00 JR	1230 KK	14:00 J	12:15 JR	1210 KK

PM

Temperature(s): Probe #(s): See Above	23.7	23.3	23.4 J	23.4 KK	23.3	23.2	23.1
Fill Reservoirs	✓	✓	✓	✓	✓	✓	✓
Delivery tubes in place	✓	✓	✓	✓	✓	✓	✓
Check water Supply	✓	✓	✓	✓	✓	✓	✓
Empty Waste Buckets	✓	✓	✓	✓	✓	✓	✓
Floater/Aeration* Check	✓	✓	✓	✓	✓	✓	✓
Date:	11/18/12	11/19/12	11/20/12	11/21/12	11/22/12	11/23/12	11/24/12
Initials:	JR	JR	JR / J	KK	J	JR	KK

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Corrective Actions / Comments (Initial/Time)							

* Aeration required if DO is below/reaching minimum DO reqirements (Note when initiated)

Aquatec Biological Sciences, Inc.

Reviewed by: J Date: 12/21/12

SDG: 13339

Project: 12051

Project: Auburn Road Landfill **WEEK OF:** 11/29/12

100.5-28Ct Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

DAILY SEDIMENT MONITORING - CHECKLIST

ACTIVITY / DAY

AM

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Temperature(s): Probe #(s):	23.5	23.7	23.6	23.7	23.2	23.5	23.4
Fill Reservoirs	✓	✓	✓	✓	✓	✓	✓
Delivery tubes in place	✓	✓	✓	✓	✓	✓	✓
Check water Supply	✓	✓	✓	✓	✓	✓	✓
Empty Waste Buckets	✓	✓	✓	✓	✓	✓	✓
Floater/Aeration* Check	✓	✓	✓	✓		✓	✓
Chems Collected / ok?	—	✓	—	✓	✓ JR	✓ JW	✓ SL

NOON

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Splitter box(s) filling?	✓	✓	✓	✓	✓	✓	✓
Syringes filing?	✓	✓	✓	✓	✓	✓	✓
Needles flowing?	✓	✓	✓	✓	✓	✓	✓
Drainage to Waste - ok?	✓	✓	✓	✓ JW	✓ JW	✓	✓
Feeding (Time/Init.)	1500 JR	16:20 JW	14:25 JW	14:00 JR	14:20 JR	13:00 SL	12:30 SL

PM

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Temperature(s): Probe #(s): See Above	23.3	23.1	23.2	23.2	23.7	22.9	23.4
Fill Reservoirs	✓	✓	✓	✓	✓	✓	✓
Delivery tubes in place	✓	✓	✓	✓	✓	✓	✓
Check water Supply	✓	✓	✓	✓	✓	✓	✓
Empty Waste Buckets	✓	✓	✓	✓	✓	✓	✓
Floater/Aeration* Check	✓	✓	✓	✓	✓	✓	✓
Date:	11/25/12	11/26/12	11/27/12	11/28/12	11/29/12	11/30/12	12/1/12
Initials:	JR	KK	JW/JR	JR/JW	JR/JR	JW/SL	SL

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Corrective Actions / Comments (Initial/Time)							

* Aeration required if DO is below/reaching minimum DO reqirements (Note when initiated)

Aquatec Biological Sciences, Inc.

Reviewed by: JR Date: 12/21/12

SDG: 13339

Project: 12051

Project: Auburn Road Landfill **WEEK OF:** 12/02/12

100.5-28Ct Midge, C. dilutus, 28-Day Survival and Emergence Test for Sediments

Species: *Chironomus dilutus* Reference: EPA/600/R-99/064 SOP: TOX3-018

ACTIVITY / DAY

DAILY SEDIMENT MONITORING - CHECKLIST

AM

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Temperature(s): Probe #(s):	23.7	23.7	23.6				
Fill Reservoirs	✓	✓					
Delivery tubes in place	✓	✓					
Check water Supply	✓	✓					
Empty Waste Buckets	✓	✓					
Floater/Aeration* Check	✓	✓					
Chems Collected / ok?	—	✓					

NOON

Splitter box(s) filling?	✓	✓					
Syringes filing?	✓	✓					
Needles flowing?	✓	✓					
Drainage to Waste - ok?	✓	✓					
Feeding (Time/Init.)	12:30 JR	15:50 J					

PM

Temperature(s): Probe #(s): See Above	23.7	23.3					
Fill Reservoirs	✓	✓					
Delivery tubes in place	✓	✓					
Check water Supply	✓	✓					
Empty Waste Buckets	✓	✓					
Floater/Aeration* Check	✓	✓					
Date:	12/02/12	12/3/12	12/4/12				
Initials:	JR	J	JW				

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Corrective Actions / Comments (Initial/Time)			Tests ended Day 28 08:30-10:30 JW				

* Aeration required if DO is below/reaching minimum DO reqirements (Note when initiated)

Aquatec Biological Sciences, Inc.

Reviewed by: J Date: 12/21/12

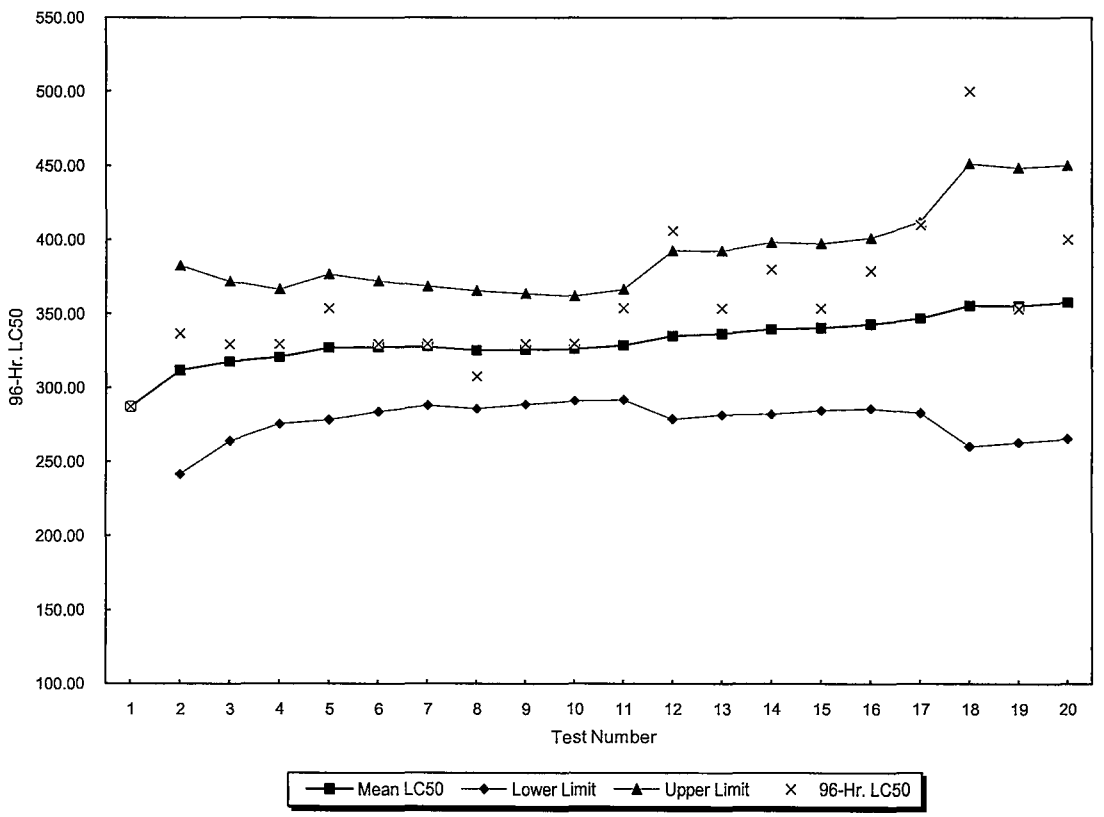
SDG: 13339

Project: 12051

Standard Reference Toxicant Control Charts

Reference Toxicant Control Chart
Hyalella azteca
in Potassium chloride (mg/L)

Test Number	Test Date	Organism Age (Days)	96-Hr. LC50	Mean LC50	Lower Limit	Upper Limit	Organism Source
1	08/31/09	9	287.175	287.18			Aquatic Research Organisms
2	09/25/09	8	337.050	312.11	241.58	382.65	Aquatic Research Organisms
3	10/30/09	12	329.880	318.04	264.11	371.96	Aquatic Research Organisms
4	02/25/10	8	329.877	321.00	275.40	366.59	Aquatic Research Organisms
5	05/06/10	8	354.000	327.60	278.29	376.90	Aquatic Research Organisms
6	05/18/10	12	330.000	328.00	283.86	372.14	Aquatic Research Organisms
7	06/08/10	7	330.000	328.28	287.96	368.61	Aquatic Research Organisms
8	11/09/10	7	308.000	325.75	285.75	365.74	Aquatic Research Organisms
9	11/19/10	12	330.000	326.22	288.70	363.74	Aquatic Research Organisms
10	04/29/11	12	330.000	326.60	291.15	362.05	Aquatic Research Organisms
11	06/09/11	8	354.000	329.09	291.62	366.56	Aquatic Research Organisms
12	06/22/11	8	406.000	335.50	278.50	392.49	Aquatic Research Organisms
13	07/22/11	8	354.000	336.92	281.40	392.45	Aquatic Research Organisms
14	07/27/11	8	380.000	340.00	281.90	398.10	Aquatic Research Organisms
15	10/20/11	8	354.000	340.93	284.48	397.39	Aquatic Research Organisms
16	11/04/11	12	379.000	343.31	285.54	401.08	Aquatic Research Organisms
17	04/27/12	12	410.000	347.23	282.62	411.85	Aquatic Research Organisms
18	09/07/12	14	499.900	355.72	260.28	451.15	Aquatic Research Organisms
19	10/05/12	9	353.600	355.60	262.85	448.36	Aquatic Research Organisms
20	11/02/12	12	400.100	357.83	265.38	450.28	Aquatic Research Organisms



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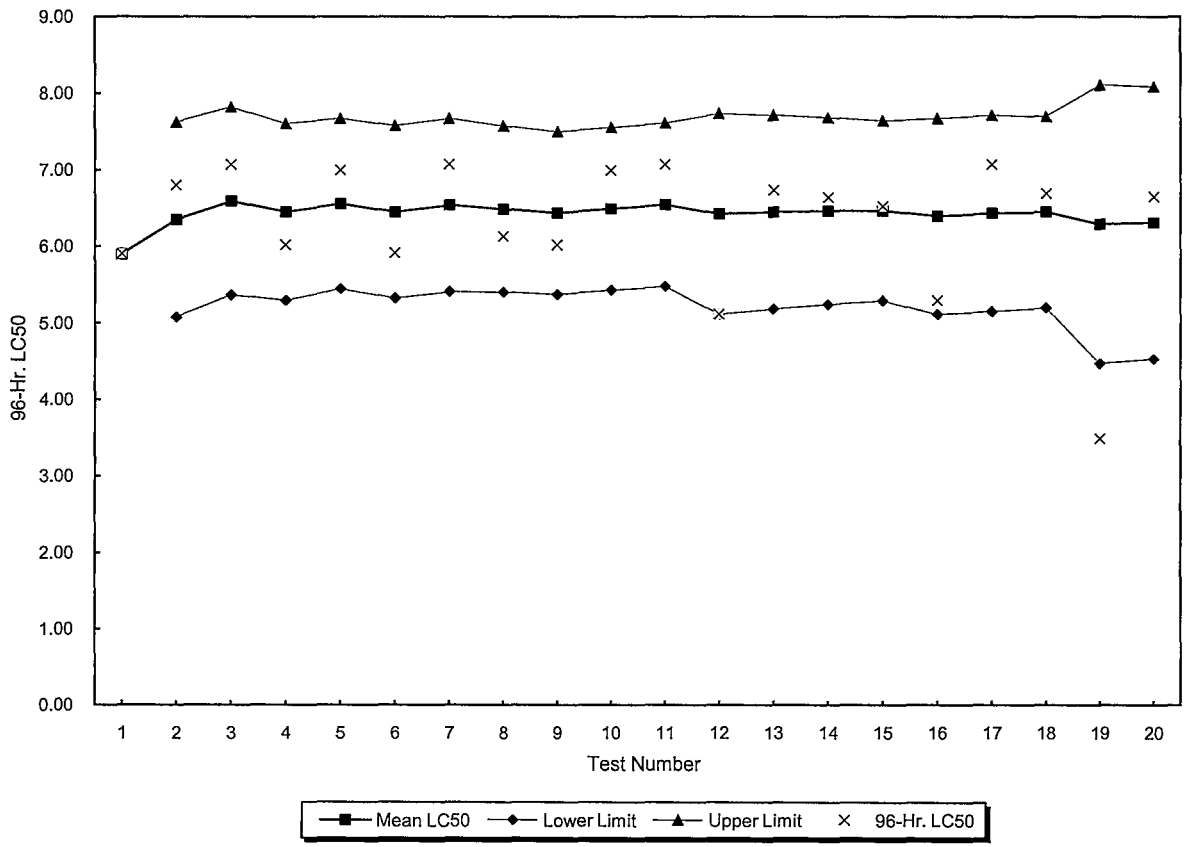
Reference Toxicant Control Chart
Chironomus dilutus (formerly Chironomus tentans)
in Potassium chloride (g/L)

Test Number	Test Date	Organism Age (Days)	96-Hr. LC50	Mean LC50	Lower Limit	Upper Limit	Organism Source
1	12/06/07	9	5.900	5.90			Aquatic BioSystems
2	05/30/08	9	6.800	6.35	5.08	7.62	Aquatic BioSystems
3	11/07/08	9	7.071	6.59	5.36	7.82	Aquatic BioSystems
4	03/25/09	9	6.020	6.45	5.30	7.60	Aquatic BioSystems
5	10/14/09	13	6.995	6.56	5.45	7.67	Aquatic BioSystems
6	11/03/09	7	5.913	6.45	5.33	7.57	Aquatic BioSystems
7	01/26/10	7	7.071	6.54	5.41	7.67	Aquatic BioSystems
8	05/18/10	10	6.130	6.49	5.40	7.57	Aquatic BioSystems
9	06/23/10	13	6.020	6.44	5.37	7.50	Aquatic BioSystems
10	11/18/10	9	6.990	6.49	5.43	7.55	Aquatic BioSystems
11	11/24/10	14	7.070	6.54	5.48	7.61	Aquatic BioSystems
12	04/29/11	9	5.120	6.43	5.12	7.73	Aquatic BioSystems
13	08/10/11	13	6.730	6.45	5.19	7.71	Aquatic BioSystems
14	08/16/11	19	6.640	6.46	5.25	7.68	Aquatic BioSystems
15	11/05/11	8	6.520	6.47	5.29	7.64	Aquatic BioSystems
16	08/21/12	11	5.300	6.39	5.12	7.67	Aquatec Biological Sciences
17	09/07/12	12	7.071	6.43	5.16	7.71	Aquatec Biological Sciences
18	10/17/12	12	6.689	6.45	5.20	7.69	Aquatic BioSystems
19	11/08/12	10	3.497	6.29	4.48	8.11	Aquatec Biological Sciences
20	12/07/12	10	6.647	6.31	4.54	8.08	Aquatec Biological Sciences



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APPENDIX H

MONITORING AND REMEDIATION OPTIMIZATION SYSTEM (MAROS) SOFTWARE UPDATED RESULTS

APPENDIX H

SUMMARY OF MONITORING AND REMEDIATION OPTIMIZATION SYSTEM SOFTWARE ANALYSIS

1. ANALYSIS OF GROUNDWATER MONITORING DATA USING MAROS

An evaluation of the groundwater Long-Term Environmental Monitoring Program (LTEMP) implemented at the Auburn Road Landfill Superfund Site (Site) was conducted using the Monitoring and Remediation Optimization System (MAROS) software, MAROS 2.2 for MS Office 2007. The MAROS evaluation consisted of both quantitative and qualitative analyses. The results of the MAROS analysis, in combination with site hydrogeologic conditions, well construction details and monitoring locations, were qualitatively reviewed to develop recommendations. These recommendations were reviewed and evaluated in light of the existing Record of Decision (ROD) and all available data for the Site.

2. MAROS METHOD

MAROS is a collection of tools in one software package that is used to statistically evaluate groundwater monitoring programs. The tools include models, statistics, heuristic rules, and empirical relationships to assist in optimizing a groundwater monitoring network system. MAROS analysis results can be used, in combination with professional judgment, to optimize a safe and economical long-term program to monitor groundwater plumes in a relatively simple hydrogeological environment. For a complete description of the tools and methodology used in the analysis and the structure of the software and further utilities, refer to the MAROS 2.2 Manual (Air Force Center for Engineering and the Environment, 2003; http://www.gsi-net.com/software/MAROS_V2_2Manual.pdf), included as Attachment B to this submittal.

In MAROS 2.2, two levels of analysis are used for optimizing long-term monitoring plans:

1. A statistical evaluation with interpretive trend analysis based on temporal trend analysis resulting in plume stability information.

2. A more detailed statistical optimization based on spatial and temporal redundancy reduction methods.

The approach used for the quantitative evaluation of the Site involved separately analyzing groundwater monitoring data available for the overburden and bedrock aquifers. Data from each aquifer were prepared for evaluation of plume stability, spatial redundancy and sufficiency; and optimal sampling frequency and data sufficiency. The results of each of these analyses are presented in Section 3. A brief summary of each of these methods is provided below.

2.1 MAROS ANALYSES

2.1.1 Plume Stability

The available site LTEMP arsenic concentration data from 2000 to 2012 were formatted for input into the MAROS program. The arsenic concentration trends were then calculated and analyzed for plume stability using the MAROS software. In general, if a plume is found to be stable, the number of locations and monitoring frequency can be reduced without loss of information. The plume stability results were assessed from the time-series concentration data with the application of two types of statistical tools:

- Individual well concentration trend analyses
- Plume-wide moment analysis

For the plume-wide analysis, MAROS applies moment analysis algorithms to estimate the total dissolved mass (zeroth moment), the location of the center of mass (first moment), and the spread of mass (second moment) for each sampling event. Temporal trends identified in the site LTEMP (2000 - 2012) data set for each of these spatial metrics were determined using the Mann-Kendall method. Results of the moment analyses provide a plume-wide metric of plume stability.

The trend in the zeroth moment is determined from comparing the total mass estimates for each sampling event (or consolidated time period) over time. The trend indicates if total mass within the network is increasing, decreasing, or stable. (The zeroth moment does not estimate the dissolved mass outside of the current network.)

The first moment estimates the X, Y coordinates of the center of the mass of the plume for each sampling event. Trend evaluation indicates if the center of mass is getting farther from the source (increasing trend) or if the center is retreating toward the identified source (decreasing trend).

The trend in first moments reflects the change in the relative amount of mass in the source area versus that in the downgradient tail region over time. For example, an increasing trend may indicate decreases in mass in the source area or increasing concentrations in downgradient wells. Decreasing trends in the first moment can indicate degradation of constituents in the tail of the plume or continued input of dissolved mass in the source area (i.e., uncontrolled source).

Trends in the second moments indicate the relative spread or distribution of mass from the center of the plume to the edges, both in the direction of groundwater flow (x-direction) and perpendicular to groundwater flow (y-direction). An increasing second moment indicates an increase in the amount of mass on the edge of the plume relative to the center, as when an extraction well removes mass from the center of the plume.

The moment analysis module is sensitive to the number and arrangement of wells in each sampling event, so data are sometimes consolidated (semi-annually or annually) to ensure that the number and identity of wells during monitoring events are comparable. For the site data set, the moments were calculated using the concentration during semi-annual monitoring events at each monitoring location.

2.1.2 Well Redundancy and Sufficiency

Sample locations are evaluated in MAROS for their importance in providing information to define concentrations within the groundwater plume. Wells identified as providing information redundant with surrounding wells are recommended for elimination from the program. Proposed elimination from the sampling program does not necessarily mean abandoning the well. Well sufficiency is evaluated in MAROS using the same spatial analysis as that for redundancy. Areas identified as having high levels of concentration uncertainty are possible sites for additional monitoring locations.

The well redundancy and sufficiency analysis uses the Delaunay method and is designed to select the minimum number of sampling locations based on the spatial analysis of the relative importance of each sampling location in the monitoring network. The importance of each sampling location is assessed by calculating a slope factor (SF) and concentration and area ratios (CR and AR, respectively). Sampling locations with a high SF provide unique information and are retained in the network. Locations with low SF are considered for removal. Areas defined by

many wells with high SF may be candidates for new wells. A SF was calculated for all wells at the Site and the results were used to determine the importance of the well in the network.

The results from the Delaunay method and the method for determining new sampling locations are derived solely from the spatial configuration of the monitoring network and the spatial pattern of the contaminant plume based on a two-dimensional assumption. No parameters such as site hydrogeologic conditions are considered in the analysis. Therefore, professional judgment and regulatory considerations must be used to make final decisions.

2.1.3 Sampling Frequency

MAROS uses a Modified Cost Effective Sampling (MCES) method to optimize sampling frequency for each location based on the magnitude, direction, and uncertainty of its concentration trends. The MCES method estimates a conservative lowest-frequency sampling schedule for a given groundwater monitoring location that still provides needed information for regulatory and remedial decision-making.

MAROS recommends a preliminary location sampling frequency (PLSF) for each monitoring location at the Site based on a combination of recent and long-term trends and the magnitude and rate of arsenic concentration change. The PLSF is reviewed qualitatively to ensure the recommended sampling frequency is consistent with monitoring objectives and regulatory requirements.

2.1.4 Data Sufficiency

The MAROS Data Sufficiency module employs simple statistical methods to evaluate whether the analytical data are adequate both in quantity and in quality for revealing changes in constituent concentrations. Statistical tests for the MAROS module were taken from the United States Environmental Protection Agency (EPA) *Methods for Evaluating the Attainment of Cleanup Standards Volume 2: Groundwater Statistical Guidance Document* (EPA, 1992).

Two types of statistical analyses are performed on analytical samples from each individual well. First, hypothesis testing using a sequential T-test is performed to determine if groundwater concentration is statistically below the screening level for a constituent (screening levels were set to EPA Maximum Contaminant Levels [MCL]). The sequential T-test indicates whether the well

has a sufficient number of samples at low enough concentrations to be categorized as "statistically below the MCL". If measured concentrations are high or there are an insufficient number of data points, then the well is recommended for further sampling.

A statistical power analysis was also performed in the Data Sufficiency module to assess the reliability of the hypothesis test and to suggest the number of additional samples that may be required to reach statistical significance. The power analysis uses the number of samples (n), the variance of the samples, the minimum detectible difference, and the significance (α) of the test to determine if the well is below the cleanup level with very high confidence. The power analysis is a more stringent test than the sequential T-test and provides a higher level of certainty that the well is not affected above risk-based levels. Locations that pass the power test are considered "statistically clean".

Locations that monitor groundwater areas "statistically below MCL" or "statistically clean" may be considered for reduced sampling frequency or elimination from the program. These locations may also be retained in the program to help define the plume, set institutional control boundaries, or function as surrogate "point of exposure" locations.

2.2 MAROS DATA INPUT AND SITE ASSUMPTIONS

The LTEMP (2000 – 2012) groundwater analytical data from the Site were formatted and inputted in the MAROS software application. The groundwater analytical data was supplemented with hydrogeological information from historic site reports and observations and results from the LTEMP sampling events. This additional information included boring log information (geological features), screen intervals and depth in the aquifer, groundwater elevation data, and groundwater flow directions.

It should be noted that the LTEMP monitoring well MW-205 was destroyed sometime in 2000, and no data was available since the fall 2000 LTEMP sampling round. Therefore, this well location was not included in the MAROS analysis.

2.2.1 Data Division

The dataset for the Site was divided into overburden and bedrock aquifers, according to the formation in which each monitoring well was screened in. The following 21 LTEMP and GMZ

monitoring locations were included in the MAROS network evaluation for the overburden aquifer: GZ-1-2R; GZ-6-2R; GZ-6-3R (well cluster with GZ-6-2R); GZ-9-4R; MW101B; MW-104B; MW-106B; MW-108B; MW-109B; MW-1B; MW-207B; MW-210B; MW-211B; MW-212B; MW-213; MW-302R; MW-303B; NUS-1-2; NUS-2-2; NUS-9-1; and PZ-218 (shallow piezometer). The following 14 LTEMP and GMZ monitoring locations were included in the MAROS network evaluation for the bedrock aquifer: C-1; GZ-1-3R; MW-101A; MW-102A; MW-106A; MW-108A; MW-109A; MW-1A; MW-204; MW-207A; MW-210A; MW-212A; MW-302A; and MW-303A.

Monitoring data from each aquifer was input for plume stability, well sufficiency, well redundancy, monitoring frequency, and data sufficiency.

2.2.2 Time Interval and Data Consolidation

Typically, raw data from groundwater monitoring networks have been measured irregularly in time or contain many non-detects, trace level results, and duplicates. Before the data can be further analyzed using MAROS, the raw data are reviewed and, if necessary, consolidated and formatted to allow for a consistent dataset meeting the minimum data requirements for statistical analysis.

The data obtained from the LTEMP monitoring events after 2000 were available in a relatively consistent semi-annual frequency (spring and fall) as established by the LTEMP. The various dates during each monitoring event are consolidated into one representative date, April 1 (representing spring and summer seasons) and October 1 (representing fall and winter seasons). Duplicate samples were averaged to develop one result for each sampling event. The consolidated data at each selected location are used for the moment analysis.

For the sampling frequency analysis, the rate of concentration change in every two adjoining monitoring events for each location has been determined for recent data and for the full set of data. The recent data was defined here as those that were obtained in the last five years, i.e., from spring 2008 to fall 2012. MAROS recommends a monitoring frequency using decision logic considering both recent and long-term rates of concentration change and trends.

2.3 CONSTITUENTS OF CONCERN

The MAROS software allows simultaneous analysis of multiple constituents of concern (COC). For this Site, arsenic was identified as the primary COC and was the only constituent evaluated in this MAROS analysis. Several volatile organic compounds (VOCs) were identified in the ROD and are monitored in the LTEMP sampling; however, the small dataset did not warrant evaluation using MAROS.

3. FACTORS CONSIDERED IN QUALITATIVE EVALUATION

Multiple factors should be considered in developing recommendations for ongoing long-term groundwater monitoring program. Qualitative evaluation for sampling frequency recommendations includes looking at factors such as trend in the recent sampling events, well location, screened depth and formation, groundwater flow velocity, and groundwater depth and seasonal variation. Additionally, consideration is given to the concentration at a particular location relative to the regulatory screening level and the location relative to potential receptors.

For this Site, results from the MAROS analyses were qualitatively reviewed to determine continuation or cessation of monitoring at each well location, addition of new well locations into the monitoring program, and sampling frequency for those locations retained in the network.

The primary consideration is to ensure that information collected efficiently supports site management decisions. Proposed changes to the LTEMP are reviewed to be consistent with and supportive of the monitoring objectives. Each well location in the site network was evaluated for its contribution to site monitoring objectives.

A recommendation to eliminate analytical monitoring at a particular location based on the data reviewed does not necessarily constitute a recommendation to physically abandon the well. A change in site conditions might warrant resumption of monitoring at some time in the future at wells that are not currently recommended for continued sampling. In general, continuation of water level measurements in all site wells is recommended. Data on hydraulic gradients and potentiometric surfaces are often relatively inexpensive to collect and can be used to support model development and support resource planning.

4. SITE ANALYSIS RESULTS

4.1 OVERBURDEN AQUIFER

The arsenic data from 21 LTEMP and GMZ monitoring wells screened in the overburden aquifer were included in the MAROS quantitative analysis. The 21 wells are:

GZ-1-2R; GZ-6-2R; GZ-6-3R (well cluster with GZ-6-2R); GZ-9-4R; MW101B; MW-104B; MW-106B; MW-108B; MW-109B; MW-1B; MW-207B; MW-210B; MW-211B; MW-212B; MW-213; MW-302R; MW-303B; NUS-1-2; NUS-2-2; NUS-9-1; and PZ-218 (shallow piezometer)

Source Zone Wells:

GZ-1-2R, MW-1B, PZ-218, MW-211B, and MW-212B;

Tail Zone Wells:

MW101B, MW-104B, MW-106B, MW-109B, MW-207B, MW-210B, MW-211B, MW-212B, MW-213, MW-302R, MW-303B, GZ-6-2R, GZ-6-3R, GZ-9-4R, NUS-1-2, and NUS-2-2.

Among these wells, MW-108B, MW-211B, MW-212B, MW-213, NUS-2-2, and NUS-9-1 were analyzed for individual well concentration trend only because of insufficient data. Well MW-1B is an upgradient background well that is not actually within the plume. Monitoring wells GZ-6-2R and GZ-6-3R are located as couplet wells; however, both are screened within the overburden aquifer while GZ-6-3R is screened in the till (deeper) layer which has a lower permeability than the layer GZ-6-2R is screened in and therefore has a smaller impact on the entire plume with regard to arsenic fate and transport. MW-211B is a replacement well for PZ-218 while PZ-218 has been sampled in the last four years when MW-211B was sampled. If data from MW-1B, GZ-6-3R, and MW-211B were included within the MAROS evaluation, the data would provide little meaningful or skewed information for plume analysis. Based on this information, these wells were excluded from plume stability analysis and further optimization analysis (i.e., well redundancy and sufficiency, sampling frequency, and data sufficiency). The overburden wells are listed in Table 2, and well locations are shown in Figure 1 of this LTEMP Report.

4.1.1 Plume Stability

Concentration Trends

The individual overburden aquifer well concentration trends for data sets 2000-2012 and 2006-2012 using the Mann-Kendall (MK) statistical method within MAROS are summarized in Table 1. The detailed MAROS MK reports for each monitoring well evaluated in the overburden aquifer are included in Report 2 and Graphs W1 through W21 in Attachment A. Snapshots of these MAROS outputs are shown as Table 2 and Figures 1 through 21, respectively.

A qualitative analysis was performed on the MAROS MK results for those locations with earlier data between 2000 and 2006 and comparing the results obtained from the LTEMP dataset (since 2000) with the more recent dataset (since 2006). The results based on the recent dataset (2006 – 2012) were given a higher weight than that with the older data in trend qualitative analysis. Spring data and fall data were evaluated separately when apparent seasonable variation of the data at the locations is present. Based on the qualitative analysis, the trend of arsenic concentrations were reassigned as shown in Table 1 and are discussed in more detail below. In this report, the “ND” trend is incorporated into the trend group “ND/S (stable)”.

Table 1

Mann-Kendall (MK) Analysis for Concentration Trends in Monitoring locations in the Overburden Aquifer

	Total wells	D/PD	ND/S	I/PI	NT
MAROS MK Analysis with recent data (2006 – 2012)	21	7	8	1	5
Well Location		GZ-6-2R GZ-9-4R MW-104B MW-109B MW-212B NUS-1-2 NUS-2-2	MW-101B (ND) MW-1B (ND) MW-207B (ND) MW-210B (ND) NUS-9-1 (ND) MW-108B (S) MW-213 (S) MW-303B (S)	GZ-6-3R	GZ-1-2R MW-106B MW-211B MW-302BR PZ-218
MAROS MK analysis with LTEMP data (2000 – 2012)	21	6	10	3	2
Well Location		GZ-9-4R MW-104B MW-108B MW-212B NUS-1-2 NUS-2-2 PZ-218	MW-101B (ND) MW-1B (ND) MW-207B (ND) MW-210B (ND) NUS-9-1 (ND) MW-109B (S) GZ-6-2R (S) GZ-6-3R (S) MW-213 (S)	GZ-1-2R MW-303B	MW-211B MW-106B MW-302BR
Final MAROS MK based on Qualitative Analysis	21	7	10	2	2
Well Location		GZ-6-2R GZ-9-4R MW-108B MW-212B NUS-1-2 NUS-2-2 PZ-218	MW-101B (ND) MW-1B (ND) MW-207B (ND) MW-210B (ND) NUS-9-1 (ND) MW-109B (S) GZ-6-3R (S) MW-104B (S) MW-106B (S) MW-213 (S)	GZ-1-2R MW-303B	MW-211B MW-302BR

Notes:

Decreasing (D)	Probably Decreasing (PD)	Stable (S)	ND (all non-detects)
Increasing (I)	Probably Increasing (PI)	No Trend (NT)	

Table 2-a

Snapshot of MAROS Report 2-a –MK Statistics Summary

With LTEMP Dataset (2000 – 2012)

Well	Source/ Tail	Number of Samples	Number of Detects	Average Conc. (mg/L)	Median Conc. (mg/L)	All Samples "ND" ?	Mann-Kendall Trend	Linear Regression Trend
ARSENIC								
GZ-1-2R	S	20	20	4.8E-02	5.0E-02	No	NT	PI
GZ-6-2R	T	26	25	1.5E-01	1.7E-01	No	D	D
GZ-6-3R	T	26	26	1.7E-01	1.7E-01	No	PI	S
GZ-9-4R	T	26	24	7.3E-02	7.8E-02	No	D	S
MW-101B	T	14	0	4.0E-03	4.0E-03	Yes	ND	ND
MW-104B	T	11	11	9.8E-02	1.1E-01	No	PD	S
MW-106B	T	14	2	4.3E-03	4.0E-03	No	NT	PI
MW-108B	T	6	2	6.7E-03	4.0E-03	No	S	PD
MW-109B	T	26	11	3.5E-02	4.0E-03	No	D	D
MW-1B	S	25	0	4.0E-03	4.0E-03	Yes	ND	ND
MW-207B	T	14	0	4.0E-03	4.0E-03	Yes	ND	ND
MW-210B	T	14	0	4.0E-03	4.0E-03	Yes	ND	ND
MW-211B	S	9	9	1.8E-01	1.6E-01	No	NT	NT
MW-212B	S	9	9	3.6E-02	3.6E-02	No	PD	D
MW-213	T	5	5	1.0E-01	9.7E-02	No	S	S
MW-302BR	T	20	8	4.9E-02	4.0E-03	No	NT	NT
MW-303B	T	26	25	3.3E-02	3.5E-02	No	S	NT
NUS-1-2	T	25	25	2.3E-01	2.4E-01	No	D	D
NUS-2-2	T	14	13	1.1E-01	1.1E-01	No	D	S
NUS-9-1	T	6	0	4.0E-03	4.0E-03	Yes	ND	ND
PZ-218	S	22	21	4.4E-01	4.3E-01	No	NT	S

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); No Detectable Concentration (NDC)

The Number of Samples and Number of Detects shown above are post-consolidation values.

Table 2-b

Snapshot of MAROS Report 2-b – MK Statistics Summary

With The Overburden Data Set After 2000

Well Name	S/T	Trend Result
PZ-218	S	D
GZ-1-2R	S	PI
NUS-1-2	T	D
MW-303B	T	I
MW-302BR	T	NT
MW-210B	T	ND
MW-207B	T	ND
MW-109B	T	S
MW-106B	T	PI
MW-104B	T	S
MW-101B	T	ND
GZ-9-4R	T	D
GZ-6-2R	T	S

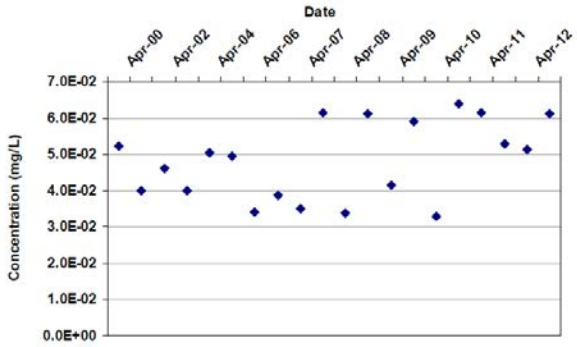
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A); Source/Tail (S/T)

Figure 1

Snapshot of MAROS Graph W1 – Mann_Kendall Statistics Summary GZ-1-2R

Well: GZ-1-2R
Well Type: S
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 37

Confidence in Trend: 87.7%

Coefficient of Variation: 0.22

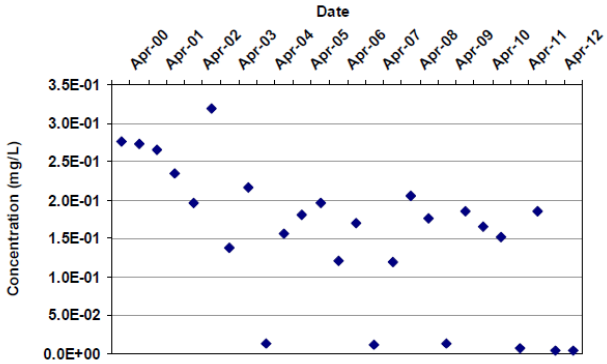
Mann Kendall Concentration Trend: (See Note) NT

Figure 2

Snapshot of MAROS Graph W2 – Mann_Kendall Statistics Summary GZ-6-2R

Well: GZ-6-2R
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -167

Confidence in Trend: 100.0%

Coefficient of Variation: 0.61

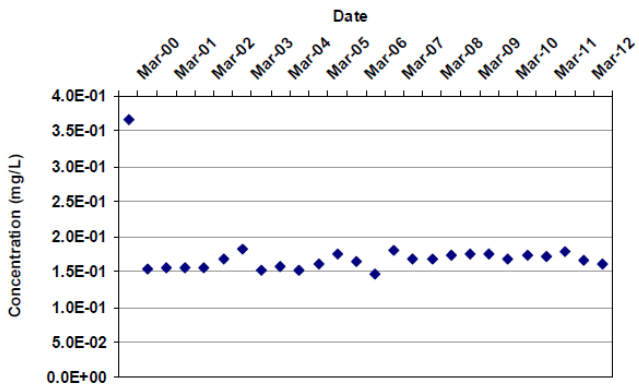
Mann Kendall Concentration Trend: (See Note) D

Figure 3

Snapshot of MAROS Graph W3 – Mann_Kendall Statistics Summary GZ-6-3R

Well: GZ-6-3R
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 68

Confidence in Trend: 93.0%

Coefficient of Variation: 0.23

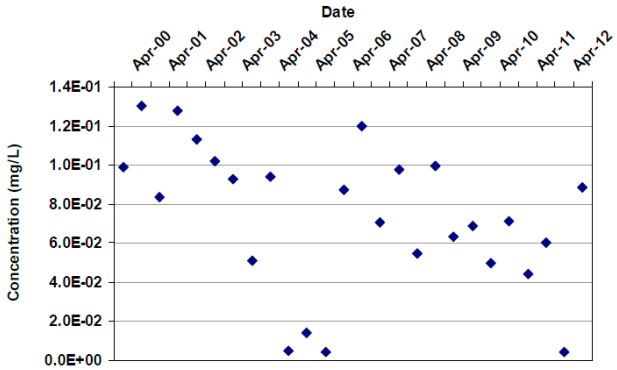
Mann Kendall Concentration Trend: (See Note) PI

Figure 4

Snapshot of MAROS Graph W4 – Mann_Kendall Statistics Summary GZ-9-4R

Well: GZ-9-4R
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -114

Confidence in Trend: 99.5%

Coefficient of Variation: 0.51

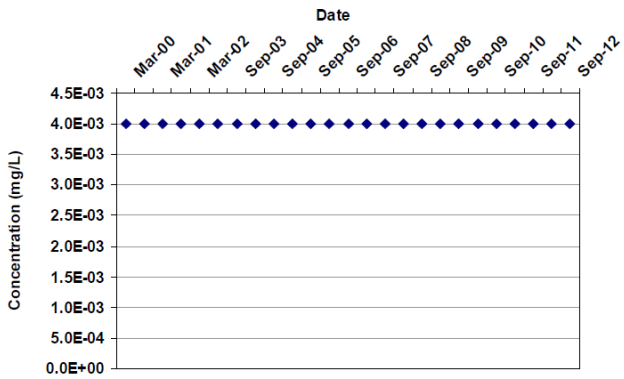
Mann Kendall Concentration Trend: (See Note) D

Figure 5

Snapshot of MAROS Graph W5 – Mann_Kendall Statistics Summary MW-1B

Well: MW-1B
Well Type: S
COC: ARSENIC

Time Period: 1/1/2000 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 0

Confidence in Trend: 49.1%

Coefficient of Variation: 0.00

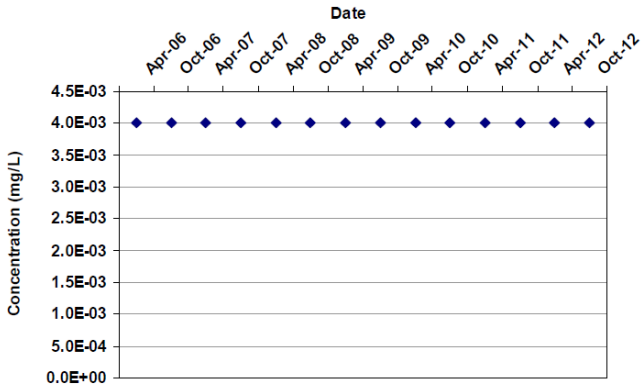
Mann Kendall Concentration Trend: (See Note) ND

Figure 6

Snapshot of MAROS Graph W6 – Mann_Kendall Statistics Summary MW-101B

Well: MW-101B
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 0

Confidence in Trend: 47.8%

Coefficient of Variation: 0.00

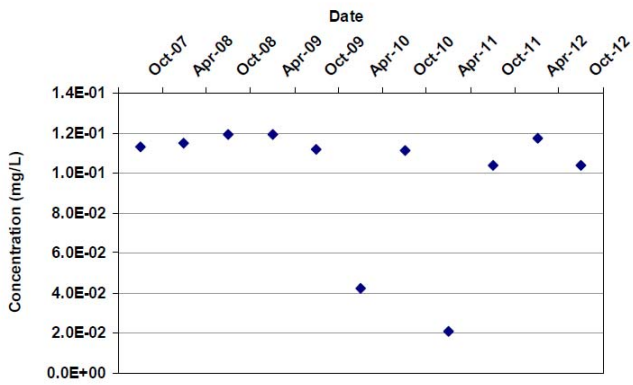
Mann Kendall Concentration Trend: (See Note) ND

Figure 7

Snapshot of MAROS Graph W7 – Mann_Kendall Statistics Summary MW-104B

Well: MW-104B
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -19

Confidence in Trend: 91.8%

Coefficient of Variation: 0.34

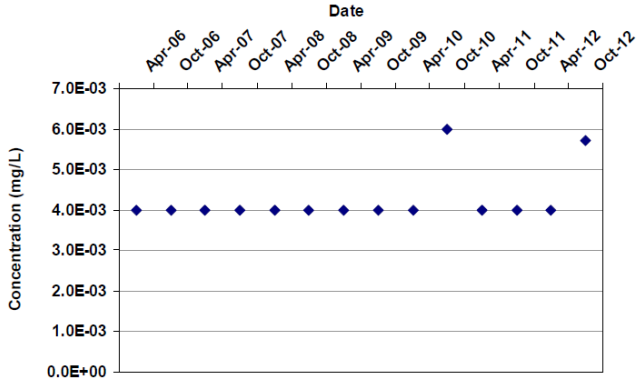
Mann Kendall Concentration Trend: (See Note) PD

Figure 8

Snapshot of MAROS Graph W8 – Mann_Kendall Statistics Summary MW-106B

Well: MW-106B
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 17

Confidence in Trend: 80.6%

Coefficient of Variation: 0.16

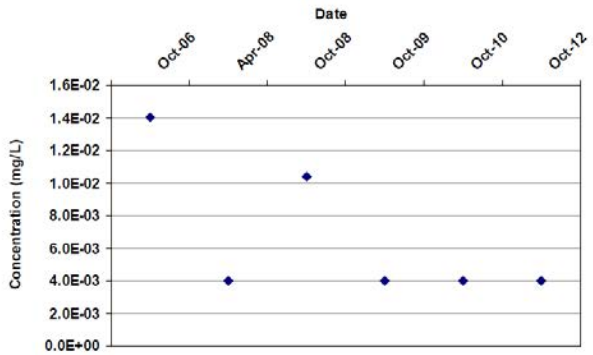
Mann Kendall Concentration Trend: (See Note) NT

Figure 9

Snapshot of MAROS Graph W9 – Mann_Kendall Statistics Summary MW-108B

Well: MW-108B
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 to 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -7

Confidence in Trend: 86.4%

Coefficient of Variation: 0.65

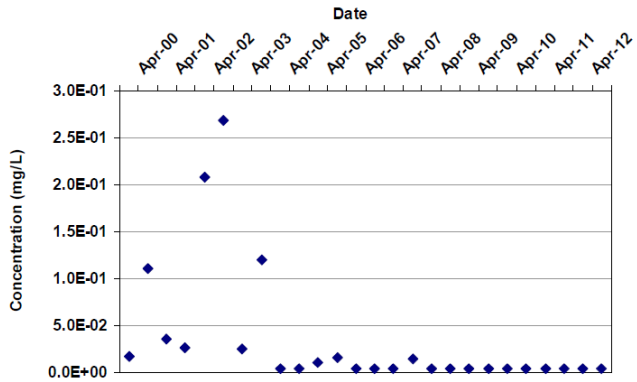
Mann Kendall Concentration Trend: (See Note) S

Figure 10

Snapshot of MAROS Graph W10 – Mann_Kendall Statistics Summary MW-109B

Well: MW-109B
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 to 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -162

Confidence in Trend: 100.0%

Coefficient of Variation: 1.92

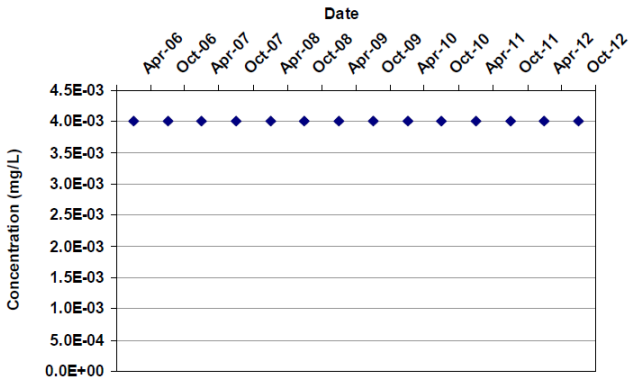
Mann Kendall Concentration Trend: (See Note) D

Figure 11

Snapshot of MAROS Graph W11 – Mann_Kendall Statistics Summary MW-207B

Well: MW-207B
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 0

Confidence in Trend: 47.8%

Coefficient of Variation: 0.00

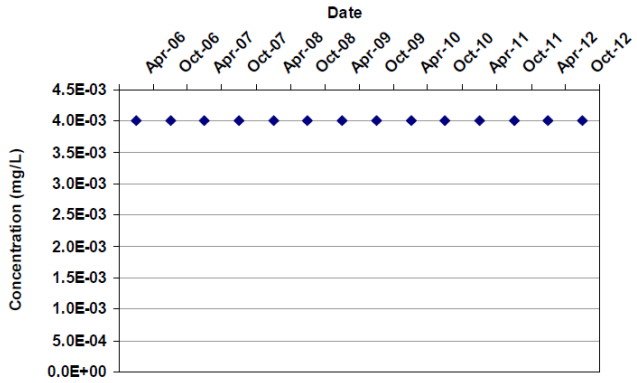
Mann Kendall Concentration Trend: (See Note) ND

Figure 12

Snapshot of MAROS Graph W12 – Mann_Kendall Statistics Summary MW-210B

Well: MW-210B
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 0

Confidence in Trend: 47.8%

Coefficient of Variation: 0.00

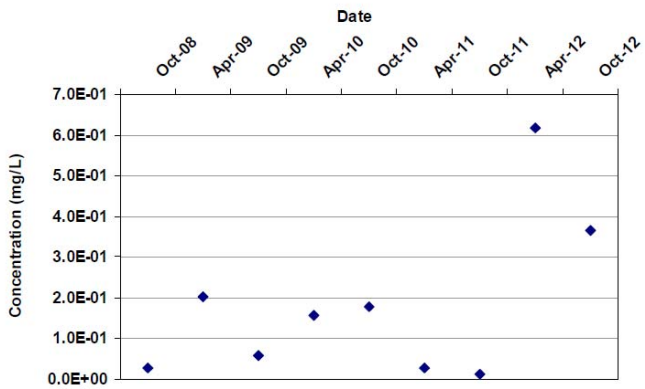
Mann Kendall Concentration Trend: (See Note) ND

Figure 13

Snapshot of MAROS Graph W13 – Mann_Kendall Statistics Summary MW-211B

Well: MW-211B
Well Type: S
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 8

Confidence in Trend: 76.2%

Coefficient of Variation: 1.09

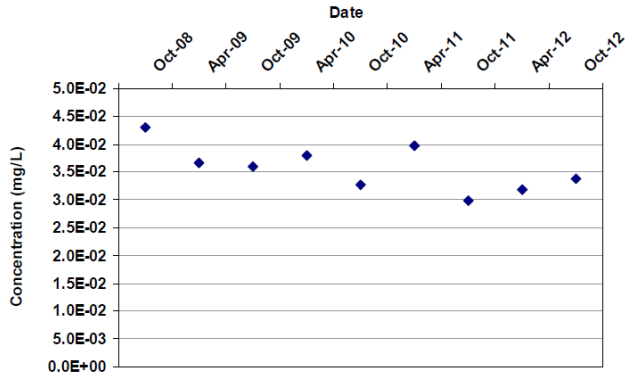
Mann Kendall Concentration Trend: (See Note) NT

Figure 14

Snapshot of MAROS Graph W14 – Mann_Kendall Statistics Summary MW-212B

Well: MW-212B
Well Type: S
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -16

Confidence in Trend: 94.0%

Coefficient of Variation: 0.12

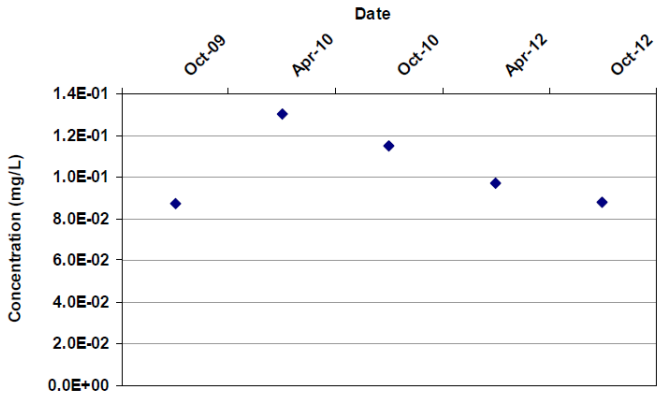
Mann Kendall Concentration Trend: (See Note) PD

Figure 15

Snapshot of MAROS Graph W15 – Mann_Kendall Statistics Summary MW-213

Well: MW-213
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -2

Confidence in Trend: 59.2%

Coefficient of Variation: 0.18

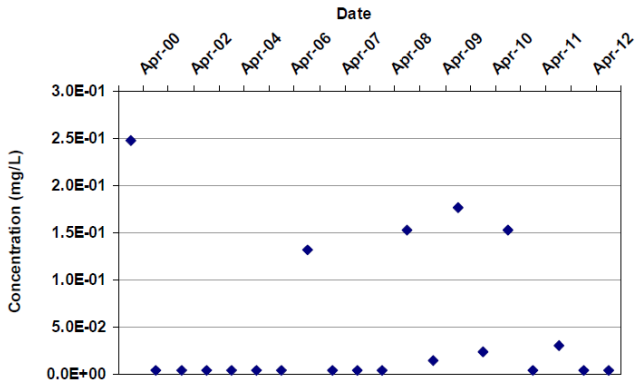
Mann Kendall Concentration Trend: (See Note) S

Figure 16

Snapshot of MAROS Graph W16 – Mann_Kendall Statistics Summary MW-302BR

Well: MW-302BR
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 18

Confidence in Trend: 70.7%

Coefficient of Variation: 1.56

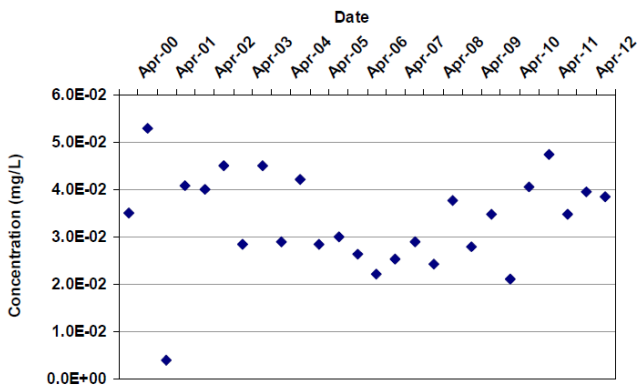
Mann Kendall Concentration Trend: (See Note) NT

Figure 17

Snapshot of MAROS Graph W17 – Mann_Kendall Statistics Summary MW-303B

Well: MW-303B
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -24

Confidence in Trend: 69.2%

Coefficient of Variation: 0.31

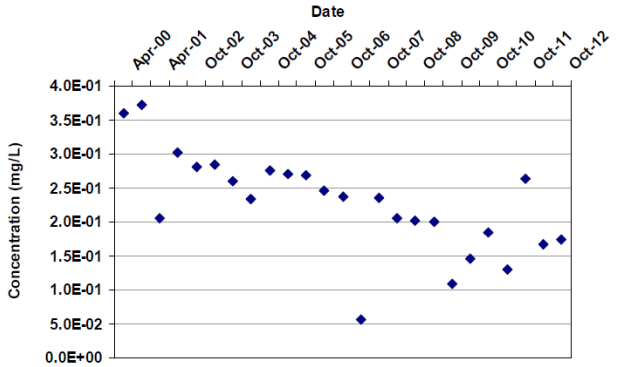
Mann Kendall Concentration Trend: (See Note) S

Figure 18

Snapshot of MAROS Graph W18 – Mann_Kendall Statistics Summary NUS-1-2

Well: NUS-1-2
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -185

Confidence in Trend: 100.0%

Coefficient of Variation: 0.32

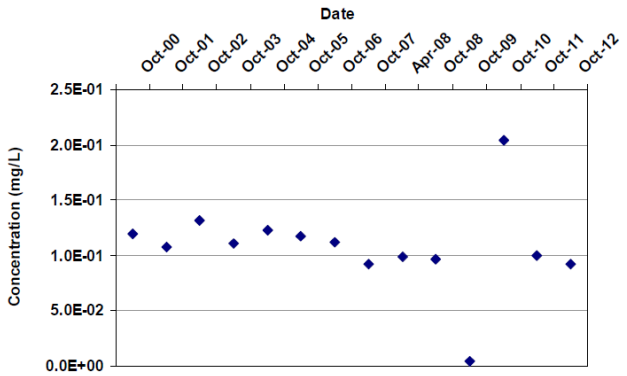
Mann Kendall Concentration Trend: (See Note) D

Figure 19

Snapshot of MAROS Graph W19 – Mann_Kendall Statistics Summary NUS-2-2

Well: NUS-2-2
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -35

Confidence in Trend: 96.9%

Coefficient of Variation: 0.38

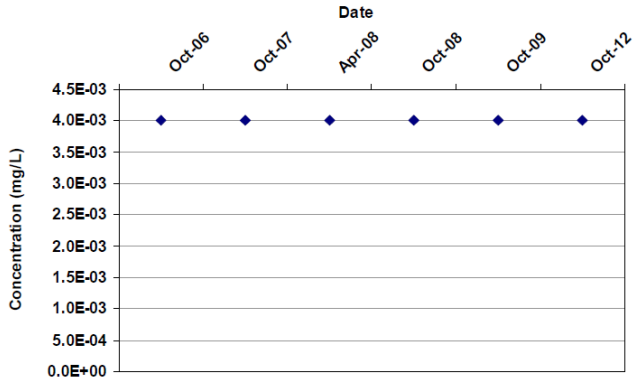
Mann Kendall Concentration Trend: (See Note) D

Figure 20

Snapshot of MAROS Graph W20 – Mann_Kendall Statistics Summary NUS-9-1

Well: NUS-9-1
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 0

Confidence in Trend: 42.3%

Coefficient of Variation: 0.00

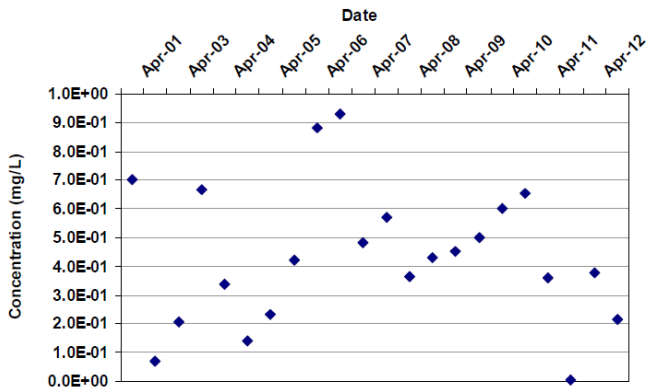
Mann Kendall Concentration Trend: (See Note) ND

Figure 21

Snapshot of MAROS Graph W21 – Mann_Kendall Statistics Summary PZ-218

Well: PZ-218
Well Type: S
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 1

Confidence in Trend: 50.0%

Coefficient of Variation: 0.56

Mann Kendall Concentration Trend: (See Note) NT

According to Table 1, 17 out of 21 monitoring locations showed consistent trends, i.e., 4 out of 21 monitoring locations showed different trends, when the LTEMP dataset (since 2000) versus more recent dataset (since 2006) was used to evaluate individual well concentration trend.

Five locations showed different trends GZ-1-2R, GZ-6-2R, MW-109B, MW-303B, and PZ-218 and were further examined. GZ-1-2R (Figure 1) has data points with an increasing trend in the period of time from 2000 to 2012, however, because of relatively low confidence in the trend, it was assigned "NT" trend. A clearer increasing trend with a higher confidence is evident in more recent data (since 2006), and "I" trend was assigned in MAROS analysis. This "I" trend is considered reliable and accepted as the final trend for this location.

GZ-6-2R (Figure 2) showed an overall decreasing trend in the period from 2000 to 2012, which shrouds the NT trend in the more recent period from 2006 to 2012 which showed higher variations in the period from 2006 to 2012. Considering that more NDs were obtained in latest monitoring events, consistent with the overall decreasing trend, a final decreasing trend is

reassigned to this location (as shown in Figure 2). Continuing monitoring is recommended to determine any potential uncertainties in the fall season.

MW-109B has a stable low level concentration or ND since 2003. Though overall it has a decreasing trend, the final trend "S" is assigned to this location to honor more recent data.

According to MAROS analysis, MW-303B has an overall "Stable" in the LTEMP period while an increasing trend in the more recent 2006 – 2012 period. With a higher weight on the more recent data, this location was assigned to have a final increasing trend.

PZ-218 is a source zone monitoring location. Significant variation in arsenic concentrations (with approximately one order of magnitude) has been observed over the years, resulting in an "NT" trend for the LTEMP period in the MAROS analysis. Seasonal difference, i.e. spring data versus fall data, is not as significant as seen at other locations at the site. In the more recent (2006 – 2012) dataset, a clear decreasing trend is apparent. As a higher weight is given to more recent data, a final trend "D" is assigned to this location.

Two other wells, MW-104B and MW-106B were also qualitatively evaluated because of limited data points and potential seasonal variation to produce a reliable trend.

MW-106B only has data available after 2006 and shows NT trends because of 2 detects scattering in 12 NDs. A final "Stable" trend was assigned to this location because the 2 detects were at very low level and below the cleanup goal at the site. Continuing monitoring at this location is recommended.

MW-104B is located downstream of and nearby the source zone and has been showing significant exceedance of the remedial goal (10 ug/L). MAROS analysis assigned a "D" at this location. However, when the two spring data points of lower concentration that likely caused the seemingly decreasing trend are excluded, the data points at this location show a relatively stable trend on a flat baseline. Therefore, a final trend "S" is assigned to this location and continuing monitoring is recommended to obtain more data for further trend evaluation.

The assigned trends of the overburden well locations are summarized in Table 1. Based on the evaluation of the data set of 21 wells, seven monitoring locations exhibit a decreasing trend

(D/PD). Ten wells were evaluated as Stable, among which five boundary wells show consistent ND during all monitoring events, and five tail locations appeared to be stable when the outliers were excluded. Two monitoring locations, MW-211B and MW-302BR, did not show a reliable or consistent trend in LTEMP period. MW-211B (in replacement of PZ-218) is located in the source zone and detected with the high concentrations in the plume. Particular attention should be given to understand significant variation in the source zone at MW-211B and PZ-218 which showed an overall decreasing trend in the last several years. Two well locations, GZ-1-2R and MW-303B, display varying but increasing trend (I), particularly since 2006. GZ-1-2R is located near the source zone, confirming the varying nature of arsenic release from the source.

Moment Analysis

The MAROS moment analysis quantified the dissolved mass (Zeroth Moment), center of mass (First Moment), and spread or distribution of mass (Second Moment) for the site overburden aquifer using more recent arsenic dataset (2006 – 2012) with a smaller set of well locations that have a more consistent dataset over the time period. A total of 13 wells were included. These wells are source zone wells GZ-1-2R and PZ-218; and tail zone wells GZ-6-2R, GZ-9-4R, MW-101B, MW-104B, MW-106B, MW-109B, MW-207B, MW-210B, MW-302B, MW-303B, and NUS-1-2.

Estimates of the moments for the overburden aquifer at the Site are provided in Attachment A (Report 6, and Graphs 1 through 3); snapshots of these MAROS outputs are shown as Table 3 and Figures 19 through 21, respectively.

Table 3

Snapshot of MAROS Report 6-a – Spatial Moment Analysis Summary

Moment Type	Constituent	Coefficient of Variation	Mann-Kendall S Statistic	Confidence in Trend	Moment Trend
Zeroth Moment: Mass					
	ARSENIC	0.31	-13	74.1%	S
1st Moment: Distance to Source					
	ARSENIC	0.07	-7	62.6%	S
2nd Moment: Sigma XX					
	ARSENIC	0.14	-5	58.5%	S
2nd Moment: Sigma YY					
	ARSENIC	0.14	-7	62.6%	S

Note: The following assumptions were applied for the calculation of the Zeroth Moment:

Porosity: 0.30 **Saturated Thickness:** Variable

Mann-Kendall Trend test performed on all sample events for each constituent. Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events).

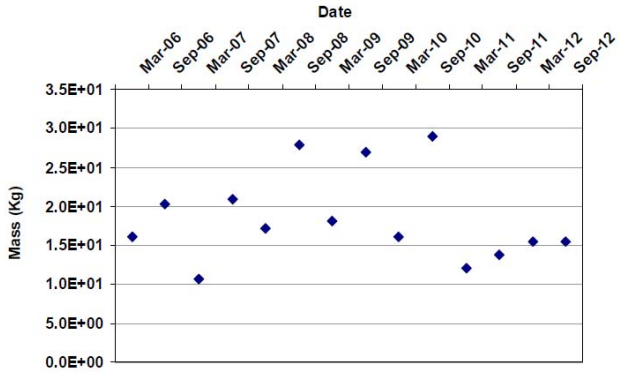
Note: The Sigma XX and Sigma YY components are estimated using the given field coordinate system and then rotated to align with the estimated groundwater flow direction. Moments are not calculated for sample events with less than 6 wells.

Figure 22

Snapshot of MAROS Graph 1 – Zeroth Moment Trend

COC: ARSENIC

Change in Dissolved Mass Over Time



Porosity: 0.30

Saturated Thickness:

Variable

Mann Kendall S Statistic:

-13

Confidence in Trend:

74.1%

Coefficient of Variation:

0.31

Zeroth Moment Trend:

S

Figure 23

Snapshot of MAROS Graph 2 – First Moment Trend

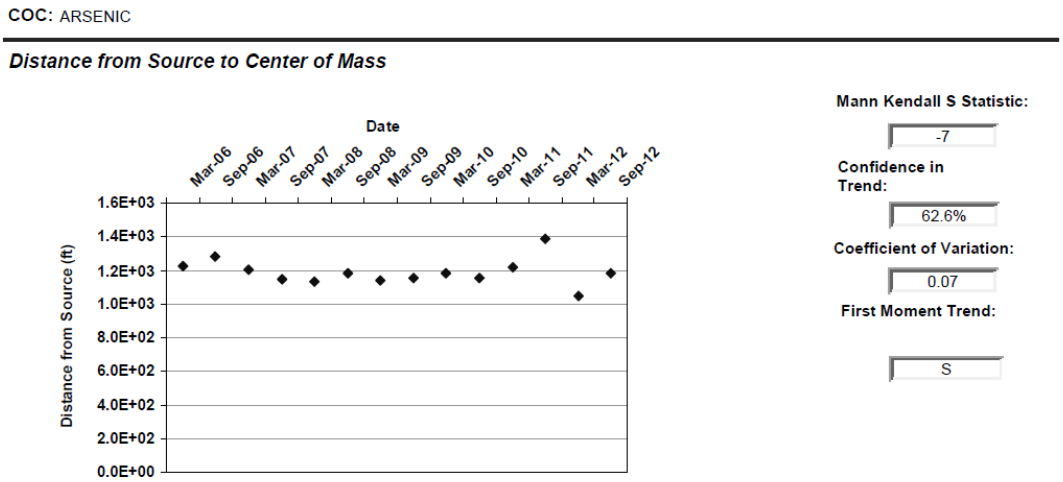


Figure 24

Snapshot of MAROS Graph 4 – Second Moment Trends

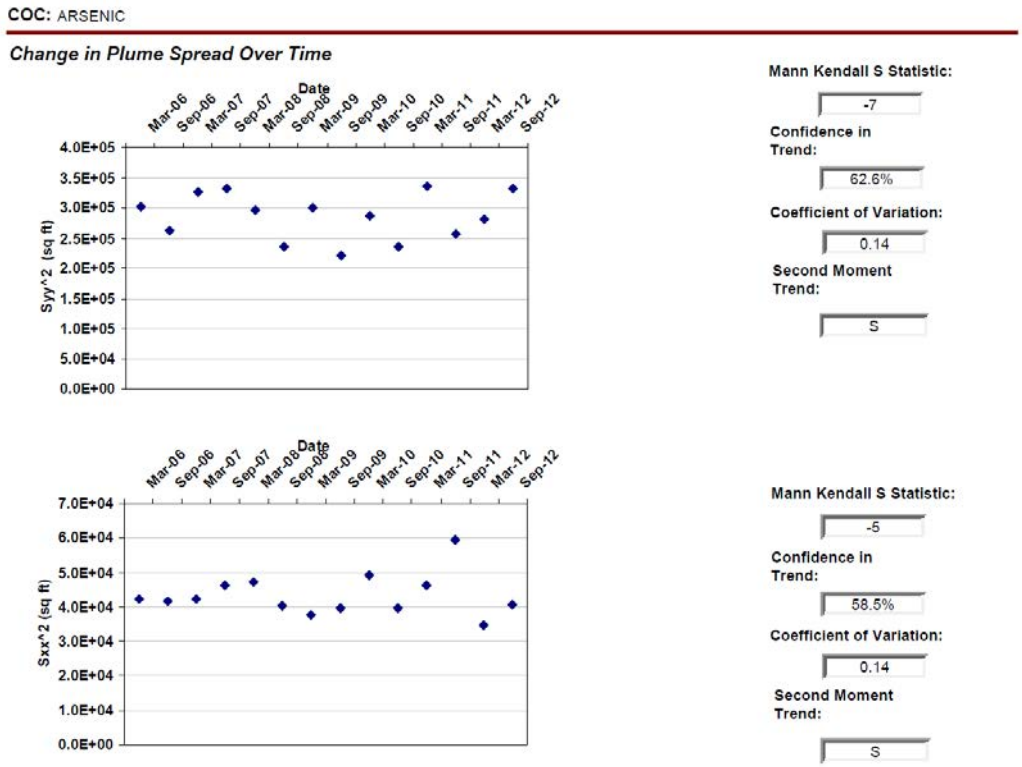


Table 4 below summarizes the MAROS moment analysis results. It should be noted that the intent is to study the trend of the mass and distribution present in the plume, and that the absolute values of total mass and distance were calculated based on simplistic assumptions that do not provide reliable estimation to the actual quantity.

Zeroth moment analysis result – total dissolved mass

Between 2006 and 2012, the total dissolved mass of arsenic in the overburden aquifer showed an overall stable trend, i.e. data points were varying around a relatively flat baseline within a limited range (Figure 19), particularly when viewer with spring and fall data points separated. The total mass appears to be more steady in the spring and experienced higher variation in the fall. The result suggests that the total dissolved mass of arsenic in the plume may have maintained at a similar level over the time, and the variation is likely attributed to the varying nature from the source mass release. The overall "S" trend, along with the individual well trends shown above, indicates that in the last 7 years the source zone continued to release arsenic mass into the downgradient plume; and mass reduction in the plume attributed to natural attenuation processes were in a similar level with the mass addition due to release from the source zone. This trend is consistent with the result of concentration trend at the individual locations that a majority of wells show a stable trend since 2006.

First moment analysis result – center of mass location

Based on first moment analysis, the distance of the center of mass to the source shows a "stable" trend, and variation was insignificant. The result indicates that the center of the contamination mass is not moving nearer or farther away from the source area or the property line.

Second moment analysis result – mass distribution in the plume

The second moment of the data showed "stable" trend in both the X (along groundwater flow) direction and Y (perpendicular to flow) direction. The result suggests that the spread of arsenic contamination in the plume has not experienced significant change over the time, even though year to year variation is present. This trend is also consistent with the result of concentration trend at the individual locations that a majority of wells show a stable trend since 2006.

Overall Plume Stability

When evaluated in combination, the results of the zeroth, first, and second moment analysis, along with individual well concentration trend, provides an overall picture of the plume development over the years.

1. There is continual arsenic mass release from the source area, maintaining the total mass in a relatively stable level.
2. The mass in the plume experiences natural attenuation.
3. More well locations in the tail area showed evident decreasing trend, while the well locations in the source zone or close to source zone did not show a clear trend, suggesting the varying nature of the source mass release.
4. The spread of the plume maintained a similar pattern over the last seven years, without an evident trend of mass distributing toward the center or any edge.

Overall, it appears that the mass release from the source area and natural attenuation are fairly balanced and the plume is in a steady condition of moderate fluctuation. Continuing monitoring is necessary, and changes to the long-term monitoring strategy may be considered.

Table 4

Summary of MAROS Moment Analysis for the Overburden Aquifer

Moment Type	Arsenic Trend in the Overburden Aquifer	Comments
Zeroth	Stable	The estimate of total dissolved mass of arsenic within the overburden aquifer has a stable trend from 2006 to 2012.
First	Stable	The distance of the plume center of mass from the source within the overburden aquifer shows a stable trend from 2006 to 2012.
Second	X direction: Stable Y direction: Stable	From 2006 to 2012, the plume spread about the center of mass was relatively stable both in the direction of groundwater flow and in the direction perpendicular to the groundwater flow.

This report used the entire dataset in the LTEMP period (i.e. 2000 – 2012) while had a focus on the last 7 years when a set of well locations were consistently monitored. With the yearly update of the monitoring data, and the expansion of the well locations included in MAROS analysis than previous analysis, the analysis results may be slightly different with the conclusions obtained previously based on the a smaller set of wells and dataset; however, this period provides more consistent data and is considered more representative of the recent plume development.

Analytical results of monitoring wells sampled to the east (MW-101A/101B and MW-301/A/301B), west (MW-304A/304B), and north end (MW-109B) of the center line of the arsenic plume since 2007 were nearly all below laboratory detection limits, indicating that the arsenic plume is within the area enclosed by these wells where all wells under this MAROS evaluation are located. Therefore, the LTEMP monitoring data from the wells input to MAROS are considered representative to general characteristics of the overburden plume.

Well Redundancy and Sufficiency

The MAROS spatial redundancy analysis was performed on the LTEMP overburden aquifer data collected between 2006 and 2012 with the well set consisting of 13 locations that were nearly consistently sampled since 2006. Summary results for the redundancy analysis are presented in Attachment A (Report 7); and the snapshot of the MAROS output is shown in Tables 5.

The parameters for redundancy analysis were set to realistic (and looser than before) values according to the newly published MAROS User Guide (October 2012). Three downgradient wells, MW-109B, MW-207B, and MW-210B were set to be non-removable because of their function as Point of Compliance (POC).

Based on the results of MAROS spatial redundancy analysis, three out of thirteen monitoring locations were identified as candidates for removal from the groundwater sampling program. These locations are GZ-9-4R, MW-104B, and MW-303B. They were identified because they only have relatively small SF (meaning that the concentrations at the locations can be represented by surrounding locations without significant uncertainty) and the loss of information is relatively small when these locations are taken out of the monitoring program. These locations are qualitatively evaluated for final recommendation on their removal from the monitoring program.

Table 5

Snapshot of MAROS Report 7 – Sample Location Optimization Results

Sampling Events Analyzed: **From** Sample Event 13 4/1/2006 **to** Sample Event 26 10/1/2012

Parameters used:

Constituent	Inside SF	Hull SF	Area Ratio	Conc. Ratio
ARSENIC	0.3	0.1	0.85	0.75

Well	X (feet)	Y (feet)	Removable?	Average Slope Factor*	Minimum Slope Factor*	Maximum Slope Factor*	Eliminated?
ARSENIC							
GZ-1-2R	1147.22	690.35	☑	0.118	0.002	0.410	☐
GZ-6-2R	1185.34	1605.99	☑	0.322	0.072	0.586	☐
GZ-9-4R	797.78	2221.24	☑	0.250	0.103	0.544	☑
MW-101B	1479.22	2080.86	☑	0.589	0.309	0.699	☐
MW-104B	1051.69	1181.13	☑	0.159	0.007	0.371	☑
MW-106B	323.79	2292.31	☑	0.582	0.501	0.622	☐
MW-109B	677.86	2923.76	☐	0.498	0.138	0.557	☐
MW-207B	81.85	2623.86	☐	0.510	0.454	0.560	☐
MW-210B	122.69	3242.91	☐	0.000	0.000	0.000	☐
MW-302BR	1009.35	1811.36	☑	0.361	0.150	0.652	☐
MW-303B	448.89	1890.43	☑	0.160	0.018	0.431	☑
NUS-1-2	727.27	2467.15	☑	0.538	0.402	0.729	☐
PZ-218	994.82	359.22	☑	0.386	0.219	0.661	☐

Note: The Slope Factor indicates the relative importance of a well in the monitoring network at a given sampling event; the larger the SF value of a well, the more important the well is and vice versa; the Average Slope Factor measures the overall well importance in the selected time period; the state coordinates system (i.e., X and Y refer to Easting and Northing respectively) or local coordinates systems may be used; wells that are NOT selected for analysis are not shown above.
* When the report is generated after running the Excel module, SF values will NOT be shown above.

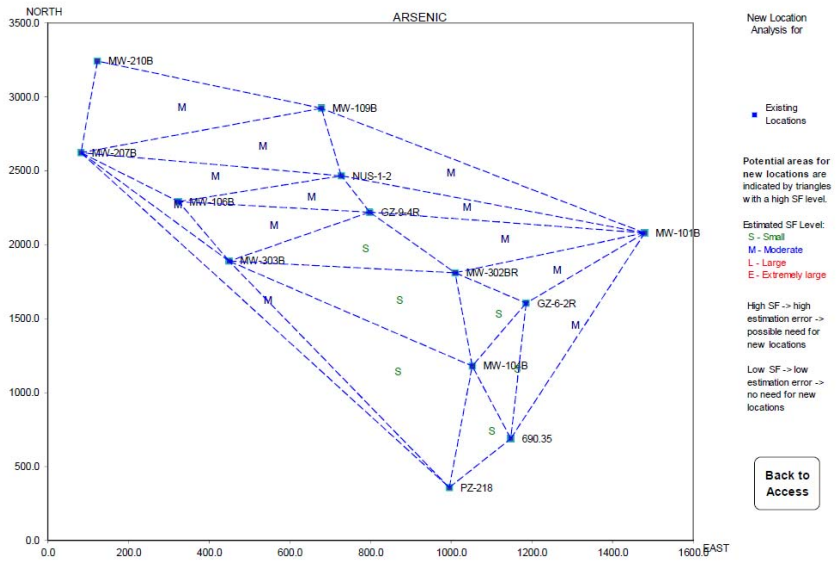
The MAROS well sufficiency analysis uses the Delaunay triangulation and SF calculations to identify areas with concentration uncertainties and indicates areas of high uncertainty with a large (L) or an extremely large (E) in the center of the triangle. The MAROS well sufficiency analysis for the overburden aquifer is illustrated in Attachment A, Graph 6 (snapshot shown below as Figure 22) and shows the polygons created by the triangulation method. The result of the MAROS analysis shows that no area of high spatial uncertainty is identified in the overburden aquifer and addition of new wells to the 13 wells evaluated in the analysis is not necessary to sufficiently characterize the plume.

Therefore, the eight wells that were not included in the analysis may also be considered for removal from the monitoring network. These eight wells are GZ-6-3R, MW-1B, MW-108B, MW-211B, MW-212B, MW-213, NUS-2-2, and NUS-9-1. Among these wells, MW-213, MW-108B, NUS-9-1, and MW-1B are delineation locations and should not be removed. GZ-6-3R and GZ-6-2R characterize the vertical variation of the plume and should also be kept.

MW-211B and MW-212B have particular function to better characterize the arsenic mass release behavior in the source zone and should not be removed. Without a particular function in the plume, NUS-2-2 may be considered for removal.

Figure 25

Snapshot of MAROS Graph 6 – New Location Analysis for Arsenic



Sampling Frequency

The MAROS sampling frequency analysis was performed using the LTEMP overburden aquifer data collected between 2006 and 2012. The recent data used to determine the recent development is the data collected in the latest 5 years from 2007 to 2012. The MAROS results of the recommended sampling frequency for each sample location in the overburden aquifer are summarized in Table 6. The MAROS sampling frequency analysis is shown in Attachment A, Report 8.

Table 6

Recommended Sampling Frequency in the Overburden Aquifer

The Overall Number of Sampling Events: 14

"Recent Period" defined by events: **From** Sample Event 17 (4/1/2008) **To** Sample Event 26 (10/1/2012)

"Rate of Change" parameters used:

Constituent	Cleanup Goal	Low Rate	Medium Rate	High Rate
ARSENIC	0.01	0.005	0.01	0.02

Units: Cleanup Goal is in mg/L; all rate parameters are in mg/L/year.

Well	Recommended Sampling Frequency	Frequency Based on Recent Data	Frequency Based on Overall Data
ARSENIC			
GZ-1-2R	Annual	Annual	Annual
GZ-6-2R	Annual	Annual	Annual
GZ-9-4R	Annual	Annual	Annual
MW-101B	Biennial	Annual	Annual
MW-104B	Annual	Annual	Annual
MW-106B	Annual	Annual	Annual
MW-109B	Biennial	Annual	Annual
MW-207B	Biennial	Annual	Annual
MW-210B	Biennial	Annual	Annual
MW-302BR	Annual	Annual	Annual
MW-303B	Annual	Annual	Annual
NUS-1-2	Annual	Annual	Annual
PZ-218	Annual	Annual	Annual

Note: Sampling frequency is determined considering both recent and overall concentration trends. Sampling Frequency is the final recommendation; Frequency Based on Recent Data is the frequency determined using recent (short) period of monitoring data; Frequency Based on Overall Data is the frequency determined using overall (long) period of monitoring data. If the "recent period" is defined using a different series of sampling events, the results could be different.

The MAROS sampling frequency analysis recommended different monitoring frequency for overburden aquifer wells. All well locations were recommended to have an annual sampling frequency, except four well locations, MW-101B, MW-109B, MW-207B, and MW-210 which are recommended to have a biennial sampling frequency. The sampling frequency determined based on both the recent data (2008 – 2012) and the LTEMP data (2000 – 2012), both recommended annual sampling frequency.

Annual monitoring frequency was recommended for piezometer PZ-218, different from the quarterly sampling frequency in last report MAROS analysis, likely attributed to the decreasing trend since 2006. It is noted that piezometer PZ-218 is very shallow and of suspect construction/condition (the location was dry during the fall 2007 LTEMP sampling round and no

sample was collected). A replacement of PZ-218, standard 2-inch-diameter polyvinyl chloride monitoring well MW-211B, was installed in 2008 and screened across the water table. Because the results from the two wells in the monitoring events in the last three years show significant difference, continuing monitoring at PZ-218 in the future few years is recommended.

Based on qualitative evaluation of the result of the recommended monitoring frequency, the locations of the monitoring wells, the plume stability, and the difference in spring and fall seasons, the following recommendation was made to on the sampling frequency.

1. Annual sampling frequency for all wells in the monitoring program based on MAROS analysis.
2. For the annual sampling frequency, sampling in the fall season is recommended because of usually higher concentrations and a less stable trend in the fall than in the spring season.

Data Sufficiency

According to MAROS individual well cleanup status – optional analysis results (Attachment A, Report 10 – a snapshot of this is shown below as Table 8), 6 out of 19 overburden aquifer LTEMP monitoring locations that were included in the analysis have attained the cleanup goal. These locations are MW-101B, MW-106B, MW-109B, MW-207B, MW-210B, and NUS-9-1, and can be considered for removal from the monitoring program or lower monitoring frequency if serving as POC wells. There are 7 out of 19 locations that have mean concentrations below the cleanup goal but not in statistically significant manner and thus need “continuing sampling” and 6 locations that have “not attained” the cleanup goal. These 13 locations are recommended for continuing sampling and evaluated with more data in the future.

The results are largely consistent with the optional power analysis on data sufficiency which identified MW-108 in addition to the six locations aforementioned that attained the cleanup goal. Because MW-108 only has six data point available for the evaluation of some variation in their values, uncertainty remains regarding whether the location has statistically significantly attained the cleanup goal and thus it is recommended to be monitored for future evaluation.

Table 7

Snapshot of MAROS Report 10 – Individual Well Cleanup Status – Optional Analysis Results

From Period: 4/1/2008 **to** 10/1/2012

Well	Sample Size	Sample Mean	Sample Stdev.	Normal Distribution Assumption Cleanup Status	Lognormal Distribution Assumption Cleanup Status	Alpha Level	Expected Power
ARSENIC			Cleanup Goal (mg/L) = 0.01		Target Level (mg/L) = 0.008		
GZ-1-2R	10	5.19E-02	1.17E-02	Cont Sampling	Not Attained	0.05	0.8
GZ-6-2R	10	1.10E-01	8.95E-02	Cont Sampling	Cont Sampling	0.05	0.8
GZ-9-4R	10	6.04E-02	2.60E-02	Cont Sampling	Cont Sampling	0.05	0.8
MW-101B	10	4.00E-03	0.00E+00	Attained	Attained	0.05	0.8
MW-104B	10	9.64E-02	3.50E-02	Cont Sampling	Not Attained	0.05	0.8
MW-106B	10	4.37E-03	7.83E-04	Attained	Attained	0.05	0.8
MW-108B	5	5.28E-03	2.86E-03	Cont Sampling	Cont Sampling	0.05	0.8
MW-109B	10	4.00E-03	0.00E+00	Attained	Attained	0.05	0.8
MW-207B	10	4.00E-03	0.00E+00	Attained	Attained	0.05	0.8
MW-210B	10	4.00E-03	0.00E+00	Attained	Attained	0.05	0.8
MW-211B	9	1.83E-01	1.99E-01	Cont Sampling	Cont Sampling	0.05	0.8
MW-212B	9	3.57E-02	4.18E-03	Not Attained	Not Attained	0.05	0.8
MW-213	5	1.03E-01	1.87E-02	Cont Sampling	Not Attained	0.05	0.8
MW-302BR	10	5.65E-02	7.25E-02	Cont Sampling	Cont Sampling	0.05	0.8
MW-303B	10	3.46E-02	8.03E-03	Not Attained	Not Attained	0.05	0.8
NUS-1-2	10	1.78E-01	4.38E-02	Cont Sampling	Not Attained	0.05	0.8
NUS-2-2	6	9.92E-02	6.34E-02	Cont Sampling	Cont Sampling	0.05	0.8
NUS-9-1	4	4.00E-03	0.00E+00	Attained	Attained	0.05	0.8
PZ-218	10	3.96E-01	1.87E-01	Cont Sampling	Cont Sampling	0.05	0.8

Note: N/C refers to "not conducted" because of insufficient data (N<4); S/E indicates the sample mean significantly exceeds the cleanup level and thus no analysis is conducted; Sample Size is the number of concentration data in a sampling location that are used in the analysis; The Target Level is the expected mean concentration in wells after cleanup attainment, it is only used in individual well celanup status evaluation. The test for evaluating attainment status is from EPA (1992). Refer to Appendix A.6 of MAROS Manual for details.

4.2 BEDROCK AQUIFER

The arsenic concentration data from fourteen monitoring wells screened in the bedrock aquifer were included in the quantitative MAROS analysis. These wells are also listed in Table 8 and are shown on Figure 1 of this LTEMP Report.

Source Area:

C-1, GZ-3-1R, MW-1A, and MW-212A;

Tail Area:

MW-101A, MW-102A, MW-106A, MW-108A, MW-109A, MW-204, MW-207A, MW-210A, MW-302A, and MW-303A;

The LTEMP monitoring data (2000 – 2012) were used for individual well trend, and to obtain sufficient consistency with adequate number of well locations for analysis, the more recent data (2007 – 2012) were used for plume related analysis provided by MAROS.

It should also be noted that MW-1A, similar to the case for MW-1B, was ND in the past monitoring events and serves as a background location for the bedrock plume. It is not an actual part of the plume and therefore was not included in the MAROS plume analysis. MW-212A is a replacement well for C-1 and located approximate to C-1. Because MW-212A has a less consistent data set than C-1 over the time period of interest, the data from MW-212A were not included in the plume analysis as MAROS recommends only one well for one location in the analysis. MW-101A, MW-106A, and MW-204 have limited available data in the recent years and were not included in the MAROS analysis beyond individual well trend.

Concentration Trends

The individual overburden aquifer well concentration trends using the Mann-Kendall (MK) statistical method within MAROS with the LTEMP data (2000 – 2012) and more recent data (2007 – 2012) are summarized in Table 9. The individual trends were qualitatively evaluated for a reassignment of a trend with a higher weight given to the more recent data. The detailed MAROS MK reports for each monitoring well evaluated in the bedrock aquifer are included in Attachment A, Report 14 and Graphs W22 through W35; and snapshots of these MAROS outputs are shown as Table 9 and Figures 26 through 39, respectively.

Table 8

Mann-Kendall Analysis for Concentration Trends in Monitoring locations in the Bedrock Aquifer

	Total wells	D	ND/S	I	NT
MAROS MK analysis with LTEMP dataset (2000 – 2012)	14	1	7	1	5
Well Location		GZ-1-3R	MW-102A (ND) MW-108A (ND) MW-109A (ND) MW-1A (ND) MW-207A (ND) MW-303A (ND) MW-302A (S)	C-1	MW-101A MW-106A MW-204 MW-210A MW-212A
MAROS MK analysis with more recent dataset (2007 – 2012)	14	1	8	0	5
Well Location		GZ-1-3R	MW-102A (ND) MW-108A (ND) MW-109A (ND) MW-1A (ND) MW-207A (ND) MW-303A (ND) MW-302A (S) C-1 (S)		MW-101A MW-106A MW-204 MW-210A MW-212A
Trend reassigned based on quantitative and qualitative evaluation	14	2	6	0	6
Well Location		GZ-1-3R	MW-102A (ND) MW-108A (ND) MW-109A (ND) MW-1A (ND) MW-207A (ND) MW-303A (ND)		C-1 MW-101A MW-106A MW-204 MW-210A MW-212A MW-302A

Notes:

Decreasing (D) Increasing (I) ND (All Non-detect)
Stable (S) No Trend (NT)

Table 9

Snapshot of MAROS Report 14 – Mann-Kendall Statistical Analysis Summary – Bedrock Wells

Time Period: 1/1/2000 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value

Well	Source/ Tail	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
ARSENIC								
C-1	S	20	19	0.53	43	91.3%	No	PI
GZ-1-3R	S	12	11	0.49	-32	98.4%	No	D
MW-101A	T	8	1	1.44	5	68.3%	No	NT
MW-102A	T	26	0	0.00	0	49.1%	Yes	ND
MW-106A	T	8	1	2.06	5	68.3%	No	NT
MW-108A	T	8	0	0.00	0	45.2%	Yes	ND
MW-109A	T	8	0	0.00	0	45.2%	Yes	ND
MW-1A	T	26	0	0.00	0	49.1%	Yes	ND
MW-204	S	8	1	1.83	3	59.4%	No	NT
MW-207A	T	12	0	0.00	0	47.3%	Yes	ND
MW-210A	T	12	2	1.10	19	88.9%	No	NT
MW-212A	S	9	9	0.48	6	69.4%	No	NT
MW-302A	T	20	19	0.51	-2	51.3%	No	S
MW-303A	T	26	0	0.00	0	49.1%	Yes	ND

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events); Source/Tail (S/T)

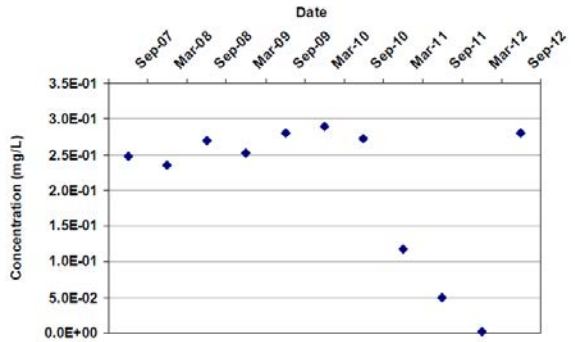
The Number of Samples and Number of Detects shown above are post-consolidation values.

Figure 26

Snapshot of MAROS Graph W22 – Mann-Kendall Statistics Summary C-1

Well: C-1
Well Type: S
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -3

Confidence in Trend: 56.0%

Coefficient of Variation: 0.49

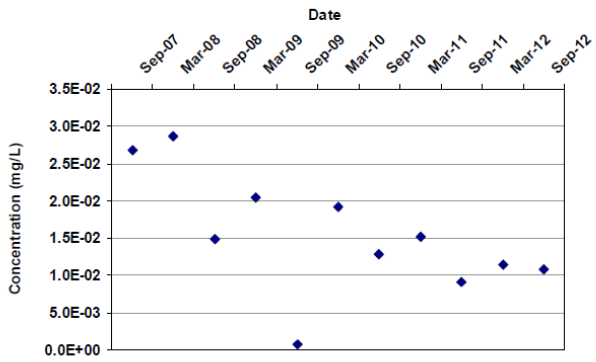
Mann Kendall Concentration Trend: (See Note) S

Figure 27

Snapshot of MAROS Graph W23 – Mann-Kendall Statistics Summary GZ-1-3R

Well: GZ-1-3R
Well Type: S
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -29

Confidence in Trend: 98.7%

Coefficient of Variation: 0.52

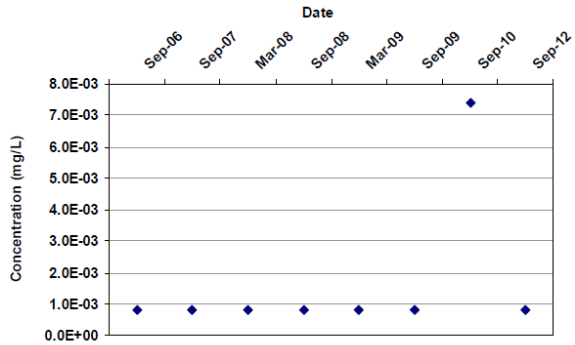
Mann Kendall Concentration Trend: (See Note) D

Figure 28

Snapshot of MAROS Graph W24 – Mann-Kendall Statistics Summary MW-101A

Well: MW-101A
Well Type: T
COC: ARSENIC

Time Period: 1/1/2000 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 5

Confidence in Trend: 68.3%

Coefficient of Variation: 1.44

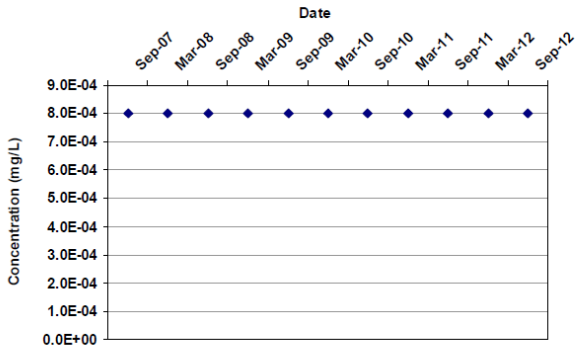
Mann Kendall Concentration Trend: (See Note) NT

Figure 29

Snapshot of MAROS Graph W25 – Mann-Kendall Statistics Summary MW-102A

Well: MW-102A
Well Type: T
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 0

Confidence in Trend: 46.9%

Coefficient of Variation: 0.00

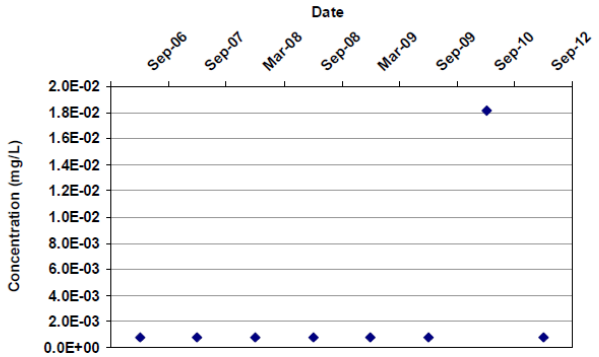
Mann Kendall Concentration Trend: (See Note) ND

Figure 30

Snapshot of MAROS Graph W26 – Mann-Kendall Statistics Summary MW-106A

Well: MW-106A
Well Type: T
COC: ARSENIC

Time Period: 1/1/2000 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 5

Confidence in Trend: 68.3%

Coefficient of Variation: 2.06

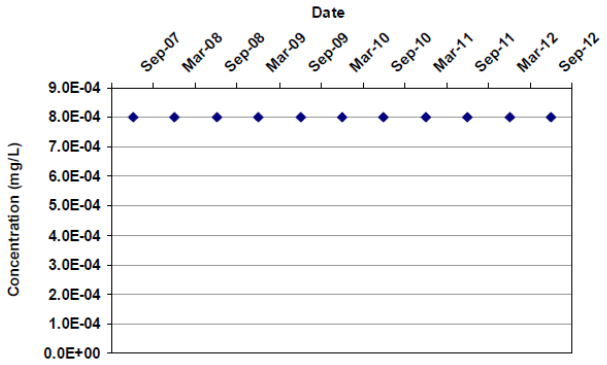
Mann Kendall Concentration Trend: (See Note) NT

Figure 31

Snapshot of MAROS Graph W27 – Mann-Kendall Statistics Summary MW-108A

Well: MW-108A
Well Type: T
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 0

Confidence in Trend: 46.9%

Coefficient of Variation: 0.00

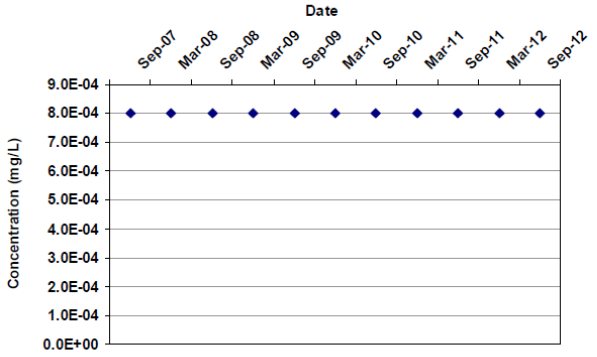
Mann Kendall Concentration Trend: (See Note) ND

Figure 32

Snapshot of MAROS Graph W28 – Mann-Kendall Statistics Summary MW-109A

Well: MW-109A
Well Type: T
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 0

Confidence in Trend: 46.9%

Coefficient of Variation: 0.00

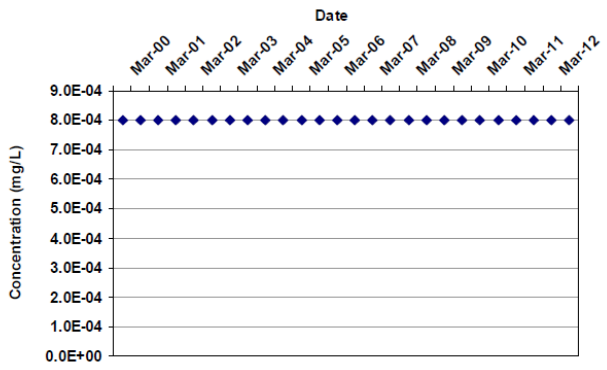
Mann Kendall Concentration Trend: (See Note) ND

Figure 33

Snapshot of MAROS Graph W29 – Mann-Kendall Statistics Summary MW-1A

Well: MW-1A
Well Type: T
COC: ARSENIC

Time Period: 1/1/2000 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 0

Confidence in Trend: 49.1%

Coefficient of Variation: 0.00

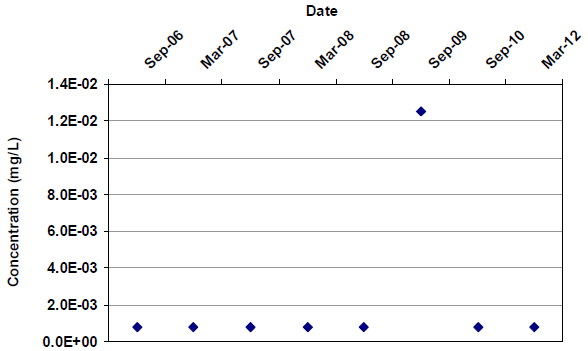
Mann Kendall Concentration Trend: (See Note) ND

Figure 34

Snapshot of MAROS Graph W30 – Mann-Kendall Statistics Summary MW-204

Well: MW-204
Well Type: S
COC: ARSENIC

Time Period: 1/1/2000 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 3

Confidence in Trend: 59.4%

Coefficient of Variation: 1.83

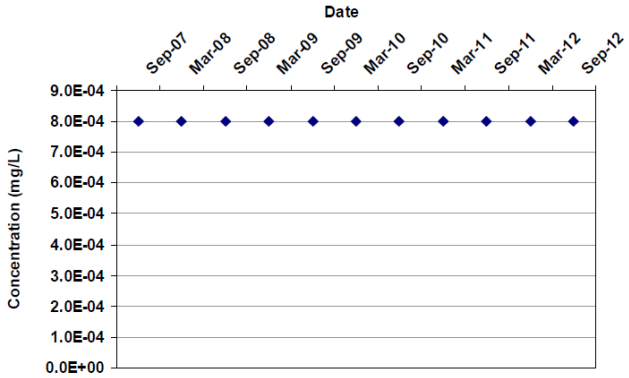
Mann Kendall Concentration Trend: (See Note) NT

Figure 35

Snapshot of MAROS Graph W31 – Mann-Kendall Statistics Summary MW-207A

Well: MW-207A
Well Type: T
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 0

Confidence in Trend: 46.9%

Coefficient of Variation: 0.00

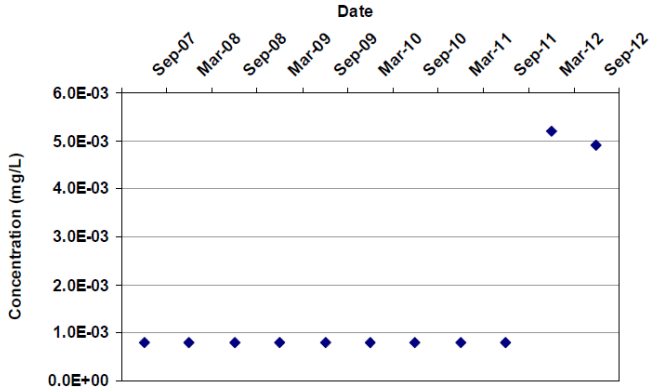
Mann Kendall Concentration Trend: (See Note) ND

Figure 36

Snapshot of MAROS Graph W32 – Mann-Kendall Statistics Summary MW-210A

Well: MW-210A
Well Type: T
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 17

Confidence in Trend: 89.1%

Coefficient of Variation: 1.09

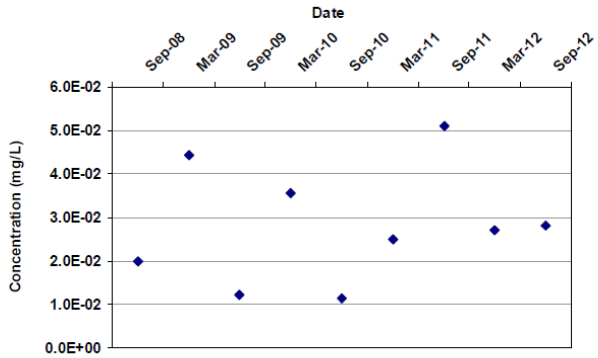
Mann Kendall Concentration Trend: (See Note) NT

Figure 37

Snapshot of MAROS Graph W33 – Mann-Kendall Statistics Summary MW-212A

Well: MW-212A
Well Type: S
COC: ARSENIC

Time Period: 1/1/2000 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 6

Confidence in Trend: 69.4%

Coefficient of Variation: 0.48

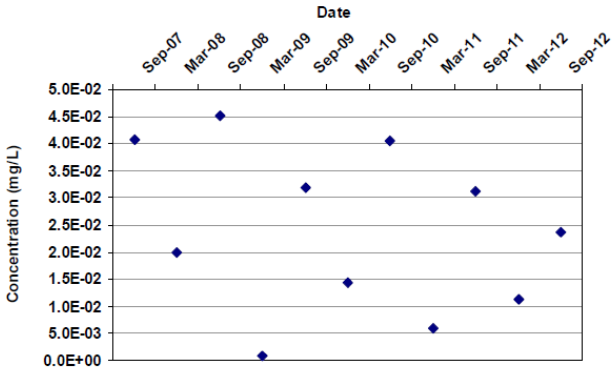
Mann Kendall Concentration Trend: (See Note) NT

Figure 38

Snapshot of MAROS Graph W34 – Mann-Kendall Statistics Summary MW-302A

Well: MW-302A
Well Type: T
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: -13

Confidence in Trend: 82.1%

Coefficient of Variation: 0.62

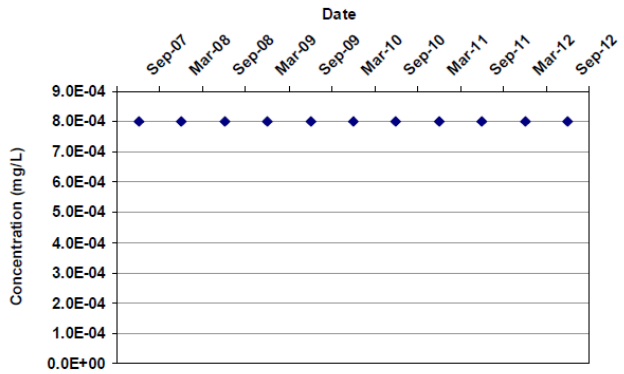
Mann Kendall Concentration Trend: (See Note) S

Figure 39

Snapshot of MAROS Graph W35 – Mann-Kendall Statistics Summary MW-303A

Well: MW-303A
Well Type: T
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 0

Confidence in Trend: 46.9%

Coefficient of Variation: 0.00

Mann Kendall Concentration Trend: (See Note) ND

The MAROS M-K analysis showed that in the LTEMP period six out of fourteen bedrock well locations were all "ND", six well locations had "NT", and two well locations had "D". No well location was identified as "I".

Two well locations, C-1 and MW-302A, were reassigned with a different concentration trend based on qualitative evaluation. With the more recent data (2007 – 2012), C-1 showed significant variation in the arsenic concentration, and no reliable trend can be concluded. Well location C-1 was reassigned as "NT". Similarly, MW-302A was also reassigned as "NT" due to its significant variation without reliable trend.

Plume Stability and Monitoring Optimization

Even though there were 14 well locations included in the MAROS analysis in this report, MW-1A and MW-212A were excluded because of their background or duplicate location. Only 9 out of the remaining 12 locations had a consistent dataset since 2007 and adequate for MAROS plume and redundancy analysis. Of these 9 wells, the majority of the wells had all or almost all "ND" concentration in the entire monitoring events. Consistent with previous

analyses, only three wells, i.e., C-1, GZ-1-3R, and MW-302A, continuously had detected concentrations in most monitoring events. These 3 locations are surrounded by locations that have ND or low arsenic concentration that do not have significant exceedance. A minimum of six locations is required for MAROS input to be evaluated for analysis on plume stability and subsequent MAROS analyses. The three well locations, in combination with the "ND" well locations, would have sufficient data points to proceed in MAROS plume stabilization and monitoring optimization analysis, however, they would not generate a meaningful and reliable result. Therefore, plume stabilization and monitoring optimization analysis for bedrock plume was not performed in this report.

Qualitatively evaluated, the bedrock plume is in a smaller scale than the overburden plume with regard to size and detected concentrations, as demonstrated in comparison between the pairs C-1/PZ-218, GZ-1-3R/GZ-1-2R, and MW-302A/MW-302BR. Because the bedrock plume is similarly steady as the overburden plume, the continuation of monitoring but with annual sampling frequency for existing LTEMP and GMZ locations is recommended.

It should be noted that the MAROS analysis for the LTEMP program at the Site has been made after plume extent was well delineated and decisions were made to decrease the number of sampling points. Therefore, though the dataset does not contain the locations to delineate the eastern side of the plume, the plume is known to be confined within the area enclosed by the eastern monitoring locations of MW-301A, MW-101A, and MW-109A and the western monitoring locations of MW-102A and MW-303A which showed consistent ND or below 10 µg/L in the last monitoring events. These wells are recommended to be monitored, at the low frequency to confirm the plume boundary.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL CONCLUSIONS

The MAROS analysis was performed for both overburden and bedrock aquifers at the Site. The goal of this MAROS analysis was to evaluate the current monitoring program and recommend an optimized monitoring strategy for the Site. MAROS analysis results indicated that both of the

overburden and the bedrock plumes are well delineated and steady, additional monitoring is recommended in the future and a lower sampling frequency should be considered.

The arsenic concentration continues to vary in range and by location in the source zone meanwhile the plume tail continues to show mass reduction. While the variation in the source zone was dampened by the long tailing area between the source and the property boundary, the uncertainty of the mass release present in the source zone shall be continuously watched and better understood to enhance predictability of the arsenic mass moving toward the compliance boundary at the plume tail area.

In general, the monitoring frequency can be lowered down to annual basis for the entire site because of the steadiness of the plume that was established in recent years. Some locations that were used for plume characterization can be considered for removal from the monitoring program.

A summary of general results for each task is presented below.

5.1.1 Evaluate Wells Data Within the Context of the Hydrogeological Regime

Results

- An adequate number of wells in the overburden aquifer network have a sufficiently large and consistent data set to perform statistical calculations.
- Wells of monitoring data with arsenic concentrations below laboratory reporting limits or cleanup goal are suitable to delineate the extent of affected groundwater in support of implementation of institutional controls on the plume, and are recommended for retention in the network in the near future.

Recommendation

- Continue monitoring under the LTEMP and GMZ programs are necessary to characterize the plumes.

5.1.2 Evaluate Overall Plume Stability in Overburden Aquifer

Results

- The estimated total mass of arsenic in the overburden plume was stable in the LTEMP period 2006 – 2012. The results suggest that overall the mass reduction of

the plume due to natural attenuation is in the similar level as the additional mass release from the source zone.

- There is a stable trend in the distance of the center of mass from the source, indicating the arsenic mass is not moving closer to the source zone or to the property boundary. This is consistent with the stable trend in many of the wells in the plume.

- The second moment analysis results showed that the plume is steady and experienced no significant change in the spread in the overburden zone.

- The results obtained from the zeroth, first, and second moment analyses in combination exhibit a steady plume in the overburden zone in the last 7 years.

- Bedrock plume has a similarly steady condition as in overburden plume, with a smaller size which is defined by an adequate number of delineation wells.

Recommendation

- With a steady plume in the last 7 years, adjustment to the monitoring strategy can be considered to cost-effectively meet the LTEMP objectives with reduced effort.

5.1.3 Sampling Location Recommendations

Result

- The MAROS spatial redundancy analysis indicated that three wells may be removed from the routine monitoring program.

- No area of high spatial uncertainty is identified in the overburden aquifer and addition of new wells (out of the 13 wells in the analysis) is not necessary to better characterize the plume. Among the list of wells that were not included, NUS-2-2 may be considered for removal from the monitoring network without a particular function.

Recommendation

- For overburden plume, all current LTEMP and GMZ monitoring wells are recommended to remain in the LTEMP, except GZ-9-4R, MW-104B, MW-303B, and NUS-2-2 that are recommended to be taken out of the LTEMP network due to estimated redundancy of information generated from monitoring in these locations. Continuous groundwater level measurement is recommended for these locations.

- For bedrock plume, no change of the monitoring locations was recommended.

5.1.4 Sampling Frequency Recommendations

Result

- The MAROS sampling frequency analysis recommended a reduced sampling frequency for the majority of wells.

Recommendations

- The current semi-annual LTEMP monitoring frequency exceeds the minimum needs for most overburden well locations. Therefore, LTEMP sampling on annual basis for both overburden and bedrock wells should be considered. Well locations that have attained the cleanup goal of a statistically significant manner may be considered for even lower monitoring frequency, e.g. biennial, when regulatory requirements are sufficiently met.

5.1.5 Statistical Data Sufficiency

Result

- Seven of the nineteen monitoring locations in the overburden aquifer and seven of the fourteen monitoring locations in the bedrock aquifer evaluated in this MAROS analysis were statistically below the cleanup goal for arsenic. These wells are located upgradient or downgradient of the plume and considered as appropriate locations for delineating the plume. All the other wells have not ‘attained’ the clean-up goal.

Recommendation

- Locations that monitor groundwater statistically below MCL can be considered for reduced monitoring effort in the future. Continuation of sampling of the monitoring network is necessary.

5.2 ADDITIONAL RECOMMENDATIONS

- Continue LTEMP monitoring and evaluating the arsenic concentration trends;
- Continue monitoring in the source zone to understand the varying nature of “source area” to reduce uncertainty of the mass release into the tail area.

6. REFERENCES

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United States Environmental Protection Agency. 1992. *Methods for Evaluating the Attainment of Cleanup Standards Volume 2: Groundwater Statistical Guidance Document*.

Attachment A – MAROS Reports and Graphs

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MAROS COC Assessment

Project: ARLF **User Name:** WESTON

Location: Londonderry **State:** New Hampshire

Toxicity:

Contaminant of Concern	Representative Concentration (mg/L)	PRG (mg/L)	Percent Above PRG
ARSENIC	8.9E-02	1.0E-02	791.6%

Note: Top COCs by toxicity were determined by examining a representative concentration for each compound over the entire site. The compound representative concentrations are then compared with the chosen PRG for that compound, with the percentage exceedance from the PRG determining the compound's toxicity. All compounds above exceed the PRG.

Prevalence:

Contaminant of Concern	Class	Total Wells	Total Exceedances	Percent Exceedances	Total detects
ARSENIC	MET	13	9	69.2%	10

Note: Top COCs by prevalence were determined by examining a representative concentration for each well location at the site. The total exceedances (values above the chosen PRGs) are compared to the total number of wells to determine the prevalence of the compound.

Mobility:

Contaminant of Concern	Kd
ARSENIC	25

Note: Top COCs by mobility were determined by examining each detected compound in the dataset and comparing their mobilities (Koc's for organics, assume foc = 0.001, and Kd's for metals).

Contaminants of Concern (COC's)

ARSENIC

MAROS Mann-Kendall Statistics Summary

Project: ARLF

User Name: WESTON

Location: Londonderry

State: New Hampshire

Time Period: 1/1/2006 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value

Well	Source/ Tail	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
ARSENIC								
GZ-1-2R	S	14	14	0.25	22	87.2%	No	NT
GZ-6-2R	T	14	13	0.74	-21	86.0%	No	S
GZ-9-4R	T	14	13	0.41	-35	96.9%	No	D
MW-101B	T	14	0	0.00	0	47.8%	Yes	ND
MW-104B	T	11	11	0.34	-19	91.8%	No	PD
MW-106B	T	14	2	0.16	17	80.6%	No	NT
MW-109B	T	14	1	0.58	-7	62.6%	No	S
MW-207B	T	14	0	0.00	0	47.8%	Yes	ND
MW-210B	T	14	0	0.00	0	47.8%	Yes	ND
MW-302BR	T	14	7	1.35	2	52.2%	No	NT
MW-303B	T	14	14	0.25	42	98.9%	No	I
NUS-1-2	T	14	14	0.32	-27	92.1%	No	PD
PZ-218	S	14	13	0.50	-39	98.2%	No	D

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)- Due to insufficient Data (< 4 sampling events); Source/Tail (S/T)

The Number of Samples and Number of Detects shown above are post-consolidation values.

MAROS Plume Analysis Summary

Project: ARLF

User Name: WESTON

Location: Londonderry

State: New Hampshire

Time Period: 1/1/2006 **to** 12/31/2012

Consolidation Period: Other

Consolidation Type: Average

Duplicate Consolidation: Average

ND Values: Specified Detection Limit

J Flag Values : Actual Value

Constituent	Well	Source/ Tail	Number of Samples	Number of Detects	Average (mg/L)	Median (mg/L)	All Samples "ND" ?	Mann-Kendall	Linear Regression	Modeling	Empirical
ARSENIC											
	GZ-1-2R	S	14	14	4.9E-02	5.2E-02	No	NT	I	N/A	N/A
	GZ-6-2R	T	14	13	1.1E-01	1.4E-01	No	S	PD	N/A	N/A
	GZ-9-4R	T	14	13	7.0E-02	7.0E-02	No	D	D	N/A	N/A
	MW-101B	T	14	0	4.0E-03	4.0E-03	Yes	ND	ND	N/A	N/A
	MW-104B	T	11	11	9.8E-02	1.1E-01	No	PD	S	N/A	N/A
	MW-106B	T	14	2	4.3E-03	4.0E-03	No	NT	PI	N/A	N/A
	MW-109B	T	14	1	4.7E-03	4.0E-03	No	S	S	N/A	N/A
	MW-207B	T	14	0	4.0E-03	4.0E-03	Yes	ND	ND	N/A	N/A
	MW-210B	T	14	0	4.0E-03	4.0E-03	Yes	ND	ND	N/A	N/A
	MW-302BR	T	14	7	5.1E-02	9.0E-03	No	NT	NT	N/A	N/A
	MW-303B	T	14	14	3.2E-02	3.2E-02	No	I	I	N/A	N/A
	NUS-1-2	T	14	14	1.8E-01	1.9E-01	No	PD	D	N/A	N/A
	PZ-218	S	14	13	4.9E-01	4.7E-01	No	D	D	N/A	N/A

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); Source/Tail (S/T)

The Number of Samples and Number of Detects shown above are post-consolidation values.

MAROS Site Results

Project: ARLF

User Name: WESTON

Location: Londonderry

State: New Hampshire

User Defined Site and Data Assumptions:

Hydrogeology and Plume Information:

Groundwater Seepage Velocity: 36 ft/yr

Current Plume Length: 2700 ft

Current Plume Width 1575 ft

Number of Tail Wells: 11

Number of Source Wells: 2

Source Information:

Source Treatment: No Current Site Treatment

NAPL is not observed at this site.

Down-gradient Information:

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 112.5 ft

Down-gradient property: 112.5 ft

Distance from Source to Nearest:

Down-gradient receptor: 2700 ft

Down-gradient property: 2700 ft

Data Consolidation Assumptions:

Time Period: 1/1/2006 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value

Plume Information Weighting Assumptions:

Consolidation Step 1. Weight Plume Information by Chemical

Summary Weighting: Weighting Applied to All Chemicals Equally

Consolidation Step 2. Weight Well Information by Chemical

Well Weighting: No Weighting of Wells was Applied.

Chemical Weighting: No Weighting of Chemicals was Applied.

Note: These assumptions were made when consolidating the historical montoring data and lumping the Wells and COCs.

1. Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling before reassessment, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

COC	Tail Stability	Source Stability	Level of Effort	Sampling Duration	Sampling Frequency	Sampling Density
ARSENIC	PD	S	L	Sample 4 more years	Annually	38

Note:

Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

Level of Monitoring Effort Indicated by Analysi Limited

2. Spatial Moment Analysis Results:

Moment Type	Constituent	Coefficient of Variation	Mann-Kendall S Statistic	Confidence in Trend	Moment Trend
Zeroth Moment: Mass					
	ARSENIC	0.31	-13	74.1%	S
1st Moment: Distance to Source					
	ARSENIC	0.07	-7	62.6%	S
2nd Moment: Sigma XX					
	ARSENIC	0.14	-5	58.5%	S
2nd Moment: Sigma YY					
	ARSENIC	0.14	-7	62.6%	S

Note: The following assumptions were applied for the calculation of the Zeroth Moment:

Porosity: 0.30 **Saturated Thickness:** Variable

Mann-Kendall Trend test performed on all sample events for each constituent. Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events).

MAROS Linear Regression Statistics Summary

Project: ARLF

User Name: WESTON

Location: Londonderry

State: New Hampshire

Time Period: 1/1/2006 **to** 12/31/2012

Consolidation Period: Other

Consolidation Type: Average

Duplicate Consolidation: Average

ND Values: Specified Detection Limit

J Flag Values : Actual Value

Well	Source/ Tail	Average Conc (mg/L)	Median Conc (mg/L)	Standard Deviation	All Samples "ND" ?	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
ARSENIC									
GZ-1-2R	S	4.9E-02	5.2E-02	1.2E-02	No	1.9E-04	0.25	98.0%	I
GZ-6-2R	T	1.1E-01	1.4E-01	8.1E-02	No	-9.3E-04	0.74	94.9%	PD
GZ-9-4R	T	7.0E-02	7.0E-02	2.9E-02	No	-5.4E-04	0.41	96.6%	D
MW-101B	T	4.0E-03	4.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
MW-104B	T	9.8E-02	1.1E-01	3.4E-02	No	-2.1E-04	0.34	74.8%	S
MW-106B	T	4.3E-03	4.0E-03	6.7E-04	No	8.0E-05	0.16	94.3%	PI
MW-109B	T	4.7E-03	4.0E-03	2.7E-03	No	-1.1E-04	0.58	79.6%	S
MW-207B	T	4.0E-03	4.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
MW-210B	T	4.0E-03	4.0E-03	0.0E+00	Yes	0.0E+00	0.00	100.0%	ND
MW-302BR	T	5.1E-02	9.0E-03	6.8E-02	No	-6.1E-05	1.35	53.9%	NT
MW-303B	T	3.2E-02	3.2E-02	8.0E-03	No	2.3E-04	0.25	99.6%	I
NUS-1-2	T	1.8E-01	1.9E-01	5.8E-02	No	-6.1E-06	0.32	100.0%	D
PZ-218	S	4.9E-01	4.7E-01	2.4E-01	No	-8.5E-04	0.50	96.1%	D

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Non-detect (ND); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); COV = Coefficient of Variation

MAROS Spatial Moment Analysis Summary

Project: ARLF

Location: Londonderry

User Name: WESTON

State: New Hampshire

	0th Moment	1st Moment (Center of Mass)			2nd Moment (Spread)		
Effective Date	Estimated Mass (Kg)	Xc (ft)	Yc (ft)	Source Distance (ft)	Sigma XX (sq ft)	Sigma YY (sq ft)	Number of Wells
ARSENIC							
3/1/2006	1.6E+01	846	1,574	1,224	42,137	302,739	12
9/1/2006	2.0E+01	868	1,635	1,282	41,764	262,952	12
3/1/2007	1.1E+01	824	1,554	1,207	42,183	327,188	12
9/1/2007	2.1E+01	863	1,501	1,150	46,110	332,907	13
3/1/2008	1.7E+01	875	1,484	1,131	47,081	296,470	13
9/1/2008	2.8E+01	888	1,536	1,181	40,323	236,291	13
3/1/2009	1.8E+01	845	1,489	1,140	37,670	300,739	13
9/1/2009	2.7E+01	894	1,507	1,152	39,595	221,488	13
3/1/2010	1.6E+01	874	1,536	1,183	49,232	287,393	13
9/1/2010	2.9E+01	881	1,505	1,151	39,466	235,469	13
3/1/2011	1.2E+01	818	1,562	1,215	46,200	336,264	13
9/1/2011	1.4E+01	900	1,742	1,386	59,299	256,879	13
3/1/2012	1.6E+01	836	1,392	1,045	34,823	281,640	13
9/1/2012	1.6E+01	828	1,532	1,184	40,580	331,865	13

Project: ARLF

Location: Londonderry

User Name: WESTON

State: New Hampshire

Moment Type	Constituent	Coefficient of Variation	Mann-Kendall S Statistic	Confidence in Trend	Moment Trend
Zeroth Moment: Mass					
	ARSENIC	0.31	-13	74.1%	S
1st Moment: Distance to Source					
	ARSENIC	0.07	-7	62.6%	S
2nd Moment: Sigma XX					
	ARSENIC	0.14	-5	58.5%	S
2nd Moment: Sigma YY					
	ARSENIC	0.14	-7	62.6%	S

Note: The following assumptions were applied for the calculation of the Zeroth Moment:

Porosity: 0.30 **Saturated Thickness:** Variable

Mann-Kendall Trend test performed on all sample events for each constituent. Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events).

Note: The Sigma XX and Sigma YY components are estimated using the given field coordinate system and then rotated to align with the estimated groundwater flow direction. Moments are not calculated for sample events with less than 6 wells.

MAROS Sampling Location Optimization Results

Project: ARLF **User Name:** WESTON

Location: Londonderry **State:** New Hampshire

Sampling Events Analyzed: **From** Sample Event 13 **to** Sample Event 26

4/1/2006 10/1/2012

Parameters used:

Constituent	Inside SF	Hull SF	Area Ratio	Conc. Ratio
ARSENIC	0.3	0.1	0.85	0.75

Well	X (feet)	Y (feet)	Removable?	Average Slope Factor*	Minimum Slope Factor*	Maximum Slope Factor*	Eliminated?
ARSENIC							
GZ-1-2R	1147.22	690.35	☑	0.118	0.002	0.410	☐
GZ-6-2R	1185.34	1605.99	☑	0.322	0.072	0.586	☐
GZ-9-4R	797.78	2221.24	☑	0.250	0.103	0.544	☑
MW-101B	1479.22	2080.86	☑	0.589	0.309	0.699	☐
MW-104B	1051.69	1181.13	☑	0.159	0.007	0.371	☑
MW-106B	323.79	2292.31	☑	0.582	0.501	0.622	☐
MW-109B	677.86	2923.76	☐	0.498	0.138	0.557	☐
MW-207B	81.85	2623.86	☐	0.510	0.454	0.560	☐
MW-210B	122.69	3242.91	☐	0.000	0.000	0.000	☐
MW-302BR	1009.35	1811.36	☑	0.361	0.150	0.652	☐
MW-303B	448.89	1890.43	☑	0.160	0.018	0.431	☑
NUS-1-2	727.27	2467.15	☑	0.538	0.402	0.729	☐
PZ-218	994.82	359.22	☑	0.386	0.219	0.661	☐

Note: The Slope Factor indicates the relative importance of a well in the monitoring network at a given sampling event; the larger the SF value of a well, the more important the well is and vice versa; the Average Slope Factor measures the overall well importance in the selected time period; the state coordinates system (i.e., X and Y refer to Easting and Northing respectively) or local coordinates systems may be used; wells that are NOT selected for analysis are not shown above.
* When the report is generated after running the Excel module, SF values will NOT be shown above.

MAROS Sampling Frequency Optimization Results

Project: ARLF

User Name: WESTON

Location: Londonderry

State: New Hampshire

The Overall Number of Sampling Events: 14

"Recent Period" defined by events: **From** Sample Event 17 4/1/2008 **To** Sample Event 26 10/1/2012

"Rate of Change" parameters used:

Constituent	Cleanup Goal	Low Rate	Medium Rate	High Rate
ARSENIC	0.01	0.005	0.01	0.02

Units: Cleanup Goal is in mg/L; all rate parameters are in mg/L/year.

Well	Recommended Sampling Frequency	Frequency Based on Recent Data	Frequency Based on Overall Data
ARSENIC			
GZ-1-2R	Annual	Annual	Annual
GZ-6-2R	Annual	Annual	Annual
GZ-9-4R	Annual	Annual	Annual
MW-101B	Biennial	Annual	Annual
MW-104B	Annual	Annual	Annual
MW-106B	Annual	Annual	Annual
MW-109B	Biennial	Annual	Annual
MW-207B	Biennial	Annual	Annual
MW-210B	Biennial	Annual	Annual
MW-302BR	Annual	Annual	Annual
MW-303B	Annual	Annual	Annual
NUS-1-2	Annual	Annual	Annual
PZ-218	Annual	Annual	Annual

Note: Sampling frequency is determined considering both recent and overall concentration trends. Sampling Frequency is the final recommendation; Frequency Based on Recent Data is the frequency determined using recent (short) period of monitoring data; Frequency Based on Overall Data is the frequency determined using overall (long) period of monitoring data. If the "recent period" is defined using a different series of sampling events, the results could be different.

MAROS Power Analysis for Individual Well Cleanup Status

Project: ARLF

User Name: WESTON

Location: Londonderry

State: New Hampshire

From Period: 4/1/2000 **to** 10/1/2012

Well	Sample Size	Sample Mean	Sample Stdev.	Normal Distribution Assumption Cleanup Status	Lognormal Distribution Assumption Cleanup Status	Alpha Level	Expected Power
ARSENIC			Cleanup Goal (mg/L) = 0.01		Target Level (mg/L) = 0.008		
GZ-1-2R	7	4.91E-02	6.84E-03	Cont Sampling	Not Attained	0.05	0.8
GZ-6-2R	7	1.09E-01	6.28E-02	Cont Sampling	Cont Sampling	0.05	0.8
GZ-9-4R	7	7.00E-02	1.99E-02	Cont Sampling	Not Attained	0.05	0.8
MW-101B	7	4.00E-03	0.00E+00	Attained	Attained	0.05	0.8
MW-104B	6	9.92E-02	2.35E-02	Cont Sampling	Not Attained	0.05	0.8
MW-106B	7	4.26E-03	4.53E-04	Attained	Attained	0.05	0.8
MW-109B	7	4.73E-03	1.93E-03	Attained	Attained	0.05	0.8
MW-207B	7	4.00E-03	0.00E+00	Attained	Attained	0.05	0.8
MW-210B	7	4.00E-03	0.00E+00	Attained	Attained	0.05	0.8
MW-302BR	7	5.06E-02	4.06E-02	Cont Sampling	Cont Sampling	0.05	0.8
MW-303B	7	3.20E-02	6.03E-03	Not Attained	Not Attained	0.05	0.8
NUS-1-2	7	1.82E-01	3.33E-02	Cont Sampling	Not Attained	0.05	0.8
PZ-218	7	4.88E-01	2.37E-01	Cont Sampling	Not Attained	0.05	0.8

Note: N/C refers to "not conducted" because of insufficient data (N<4); S/E indicates the sample mean significantly exceeds the cleanup level and thus no analysis is conducted; Sample Size is the number of concentration data in a sampling location that are used in the analysis; The Target Level is the expected mean concentration in wells after cleanup attainment, it is only used in individual well celanup status evaluation. The test for evaluating attainment status is from EPA (1992). Refer to Appendix A.6 of MAROS Manual for details.

Individual Well Cleanup Status - Optional Analysis Results

Project: ARLF

User Name: WESTON

Location: Londonderry

State: New Hampshire

From Period: 4/1/2000 **to** 10/1/2012

				Normal Distribution Assumption			Lognormal Distribution Assumption		
Well	**Sample Size**	**Sample Mean**	**Sample Stdev.**	**Significantly < Cleanup Goal?**	**Power**	**Expected Sample Size**	**Significantly < Cleanup Goal?**	**Power**	**Expected Sample Size**
ARSENIC			Cleanup Goal (mg/L) = 0.01		Alpha Level = 0.05		Expected Power = 0.8		
GZ-1-2R	7	4.91E-02	6.84E-03	NO	S/E	S/E	NO	S/E	S/E
GZ-6-2R	7	1.09E-01	6.28E-02	NO	S/E	S/E	NO	S/E	S/E
GZ-9-4R	7	7.00E-02	1.99E-02	NO	S/E	S/E	NO	S/E	S/E
MW-101B	7	4.00E-03	0.00E+00	YES	1.000	<=3	YES	1.000	<=3
MW-104B	6	9.92E-02	2.35E-02	NO	S/E	S/E	NO	S/E	S/E
MW-106B	7	4.26E-03	4.53E-04	YES	1.000	<=3	YES	1.000	<=3
MW-109B	7	4.73E-03	1.93E-03	YES	1.000	<=3	YES	1.000	<=3
MW-207B	7	4.00E-03	0.00E+00	YES	1.000	<=3	YES	1.000	<=3
MW-210B	7	4.00E-03	0.00E+00	YES	1.000	<=3	YES	1.000	<=3
MW-302BR	7	5.06E-02	4.06E-02	NO	S/E	S/E	NO	S/E	S/E
MW-303B	7	3.20E-02	6.03E-03	NO	S/E	S/E	NO	S/E	S/E
NUS-1-2	7	1.82E-01	3.33E-02	NO	S/E	S/E	NO	S/E	S/E
PZ-218	7	4.88E-01	2.37E-01	NO	S/E	S/E	NO	S/E	S/E

Note: N/C refers to "not conducted" because of insufficient data (N<4); S/E indicates the sample mean significantly exceeds the cleanup level and thus no analysis is conducted; Sample Size is the number of concentration data in a sampling location that are used in the power analysis; Expected Sample Size is the number of concentration data needed to reach the Expected Power under current sample variability; The Target Level is the expected mean concentration in wells after cleanup attainment, it is only used in individual well celanup status evaluation. The Student's t-test on mean difference is used in this analysis. Refer to Appendix A.6 of MAROS Manual for details.

Regression of Plume Centerline Concentrations

Project: ARLF **User Name:** WESTON

Location: Londonderry **State:** New Hampshire

Groundwater Flow Direction: 100 degrees **Distance to Receptor:** 112.5 feet

From Period: 4/1/2006 **to** 10/1/2012

Selected Plume Centerline Wells:

Well	Distance to Receptor (feet)
MW-109B	523.2
NUS-1-2	981.5
GZ-9-4R	1235.9
MW-302BR	1676.3
GZ-6-2R	1909.1
GZ-1-2R	2804.2
PZ-218	3103.8

The distance is measured in the Groundwater Flow Angle from the well to the compliance boundary.

Sample Event	Effective Date	Number of Centerline Wells	Regression Coefficient (1/ft)	Confidence in Coefficient
ARSENIC				
Sample Event 13	4/1/2006	7	-1.01E-03	85.6%
Sample Event 14	10/1/2006	7	-9.89E-04	89.9%
Sample Event 15	4/1/2007	7	-1.03E-03	90.8%
Sample Event 16	10/1/2007	7	-7.23E-04	81.6%
Sample Event 17	4/1/2008	7	-8.71E-04	83.9%
Sample Event 18	10/1/2008	7	-9.25E-04	91.3%
Sample Event 19	4/1/2009	7	-8.58E-04	86.8%
Sample Event 20	10/1/2009	7	-1.08E-03	95.0%
Sample Event 21	4/1/2010	7	-1.02E-03	92.1%
Sample Event 22	10/1/2010	7	-1.08E-03	94.1%
Sample Event 23	4/1/2011	7	-9.71E-04	88.1%
Sample Event 24	10/1/2011	7	2.61E-04	62.4%
Sample Event 25	4/1/2012	7	-1.12E-03	88.8%
Sample Event 26	10/1/2012	7	-7.20E-04	79.5%

Note: when the number of plume centerline wells is less than 3, no analysis is performed and all related values are set to ZERO; Confidence in Coefficient is the statistical confidence that the estimated coefficient is different from ZERO (for details, please refer to "Conference in Trend" in Linear Regression Analysis).

Risk-Based Power Analysis -- Projected Concentrations

Project: ARLF **User Name:** WESTON

Location: Londonderry **State:** New Hampshire

From Period: 4/1/2006 **to** 10/1/2012 **Distance from the most downgradient well to receptor:** 112.5 feet

Sampling Event	Effective Date	Well	Observed Concentration (mg/L)	Distance Down Centerline (ft)	Regression Coefficient (1/ft)	Projected Concentration (mg/L)	Below Detection Limit?	Used in Analysis?
ARSENIC								
Sample Event 13	4/1/2006	GZ-1-2R	3.410E-02	2804.2	-1.01E-03	1.996E-03	Yes	Yes
Sample Event 13	4/1/2006	GZ-6-2R	1.220E-01	1909.1	-1.01E-03	1.767E-02	No	Yes
Sample Event 13	4/1/2006	GZ-9-4R	8.720E-02	1235.9	-1.01E-03	2.496E-02	No	Yes
Sample Event 13	4/1/2006	MW-101B	4.000E-03	1492.5	-1.01E-03	8.832E-04	Yes	Yes
Sample Event 13	4/1/2006	MW-106B	4.000E-03	1083.6	-1.01E-03	1.336E-03	Yes	Yes
Sample Event 13	4/1/2006	MW-109B	4.000E-03	523.2	-1.01E-03	2.355E-03	Yes	Yes
Sample Event 13	4/1/2006	MW-207B	4.000E-03	715.1	-1.01E-03	1.940E-03	Yes	Yes
Sample Event 13	4/1/2006	MW-210B	4.000E-03	112.5	-1.01E-03	3.570E-03	Yes	Yes
Sample Event 13	4/1/2006	MW-302BR	4.000E-03	1676.3	-1.01E-03	7.332E-04	Yes	Yes
Sample Event 13	4/1/2006	MW-303B	2.620E-02	1501.1	-1.01E-03	5.734E-03	No	Yes
Sample Event 13	4/1/2006	NUS-1-2	2.460E-01	981.5	-1.01E-03	9.110E-02	No	Yes
Sample Event 13	4/1/2006	PZ-218	8.820E-01	3103.8	-1.01E-03	3.812E-02	No	Yes
Sample Event 14	10/1/2006	GZ-1-2R	3.860E-02	2804.2	-9.89E-04	2.408E-03	Yes	Yes
Sample Event 14	10/1/2006	GZ-6-2R	1.710E-01	1909.1	-9.89E-04	2.586E-02	No	Yes
Sample Event 14	10/1/2006	GZ-9-4R	1.200E-01	1235.9	-9.89E-04	3.533E-02	No	Yes
Sample Event 14	10/1/2006	MW-101B	4.000E-03	1492.5	-9.89E-04	9.136E-04	Yes	Yes
Sample Event 14	10/1/2006	MW-106B	4.000E-03	1083.6	-9.89E-04	1.369E-03	Yes	Yes
Sample Event 14	10/1/2006	MW-109B	4.000E-03	523.2	-9.89E-04	2.384E-03	Yes	Yes
Sample Event 14	10/1/2006	MW-207B	4.000E-03	715.1	-9.89E-04	1.972E-03	Yes	Yes
Sample Event 14	10/1/2006	MW-210B	4.000E-03	112.5	-9.89E-04	3.579E-03	Yes	Yes
Sample Event 14	10/1/2006	MW-302BR	1.320E-01	1676.3	-9.89E-04	2.514E-02	No	Yes
Sample Event 14	10/1/2006	MW-303B	2.220E-02	1501.1	-9.89E-04	5.027E-03	No	Yes
Sample Event 14	10/1/2006	NUS-1-2	2.360E-01	981.5	-9.89E-04	8.937E-02	No	Yes
Sample Event 14	10/1/2006	PZ-218	9.320E-01	3103.8	-9.89E-04	4.322E-02	No	Yes
Sample Event 15	4/1/2007	GZ-1-2R	3.510E-02	2804.2	-1.03E-03	1.948E-03	Yes	Yes
Sample Event 15	4/1/2007	GZ-6-2R	1.290E-02	1909.1	-1.03E-03	1.801E-03	Yes	Yes
Sample Event 15	4/1/2007	GZ-9-4R	7.040E-02	1235.9	-1.03E-03	1.968E-02	No	Yes
Sample Event 15	4/1/2007	MW-101B	4.000E-03	1492.5	-1.03E-03	8.584E-04	Yes	Yes
Sample Event 15	4/1/2007	MW-106B	4.000E-03	1083.6	-1.03E-03	1.309E-03	Yes	Yes
Sample Event 15	4/1/2007	MW-109B	4.000E-03	523.2	-1.03E-03	2.332E-03	Yes	Yes
Sample Event 15	4/1/2007	MW-207B	4.000E-03	715.1	-1.03E-03	1.914E-03	Yes	Yes
Sample Event 15	4/1/2007	MW-210B	4.000E-03	112.5	-1.03E-03	3.562E-03	Yes	Yes

Project: ARLF **User Name:** WESTON

Location: Londonderry **State:** New Hampshire

Sampling Event	Effective Date	Well	Observed Concentration (mg/L)	Distance Down Centerline (ft)	Regression Coefficient (1/ft)	Projected Concentration (mg/L)	Below Detection Limit?	Used in Analysis?
ARSENIC								
Sample Event 15	4/1/2007	MW-302BR	4.000E-03	1676.3	-1.03E-03	7.102E-04	Yes	Yes
Sample Event 15	4/1/2007	MW-303B	2.520E-02	1501.1	-1.03E-03	5.360E-03	No	Yes
Sample Event 15	4/1/2007	NUS-1-2	5.530E-02	981.5	-1.03E-03	2.010E-02	No	Yes
Sample Event 15	4/1/2007	PZ-218	4.820E-01	3103.8	-1.03E-03	1.963E-02	No	Yes
Sample Event 16	10/1/2007	GZ-1-2R	6.150E-02	2804.2	-7.23E-04	8.104E-03	No	Yes
Sample Event 16	10/1/2007	GZ-6-2R	1.190E-01	1909.1	-7.23E-04	2.994E-02	No	Yes
Sample Event 16	10/1/2007	GZ-9-4R	9.790E-02	1235.9	-7.23E-04	4.007E-02	No	Yes
Sample Event 16	10/1/2007	MW-101B	4.000E-03	1492.5	-7.23E-04	1.360E-03	Yes	Yes
Sample Event 16	10/1/2007	MW-104B	1.130E-01	2304.3	-7.23E-04	2.137E-02	No	Yes
Sample Event 16	10/1/2007	MW-106B	4.000E-03	1083.6	-7.23E-04	1.828E-03	Yes	Yes
Sample Event 16	10/1/2007	MW-109B	1.420E-02	523.2	-7.23E-04	9.729E-03	No	Yes
Sample Event 16	10/1/2007	MW-207B	4.000E-03	715.1	-7.23E-04	2.386E-03	Yes	Yes
Sample Event 16	10/1/2007	MW-210B	4.000E-03	112.5	-7.23E-04	3.688E-03	Yes	Yes
Sample Event 16	10/1/2007	MW-302BR	4.000E-03	1676.3	-7.23E-04	1.191E-03	Yes	Yes
Sample Event 16	10/1/2007	MW-303B	2.890E-02	1501.1	-7.23E-04	9.766E-03	No	Yes
Sample Event 16	10/1/2007	NUS-1-2	2.350E-01	981.5	-7.23E-04	1.156E-01	No	Yes
Sample Event 16	10/1/2007	PZ-218	5.720E-01	3103.8	-7.23E-04	6.070E-02	No	Yes
Sample Event 17	4/1/2008	GZ-1-2R	3.390E-02	2804.2	-8.71E-04	2.944E-03	Yes	Yes
Sample Event 17	4/1/2008	GZ-6-2R	2.050E-01	1909.1	-8.71E-04	3.884E-02	No	Yes
Sample Event 17	4/1/2008	GZ-9-4R	5.460E-02	1235.9	-8.71E-04	1.860E-02	No	Yes
Sample Event 17	4/1/2008	MW-101B	4.000E-03	1492.5	-8.71E-04	1.090E-03	Yes	Yes
Sample Event 17	4/1/2008	MW-104B	1.150E-01	2304.3	-8.71E-04	1.544E-02	No	Yes
Sample Event 17	4/1/2008	MW-106B	4.000E-03	1083.6	-8.71E-04	1.556E-03	Yes	Yes
Sample Event 17	4/1/2008	MW-109B	4.000E-03	523.2	-8.71E-04	2.535E-03	Yes	Yes
Sample Event 17	4/1/2008	MW-207B	4.000E-03	715.1	-8.71E-04	2.145E-03	Yes	Yes
Sample Event 17	4/1/2008	MW-210B	4.000E-03	112.5	-8.71E-04	3.626E-03	Yes	Yes
Sample Event 17	4/1/2008	MW-302BR	4.000E-03	1676.3	-8.71E-04	9.283E-04	Yes	Yes
Sample Event 17	4/1/2008	MW-303B	2.410E-02	1501.1	-8.71E-04	6.516E-03	No	Yes
Sample Event 17	4/1/2008	NUS-1-2	2.060E-01	981.5	-8.71E-04	8.759E-02	No	Yes
Sample Event 17	4/1/2008	PZ-218	3.630E-01	3103.8	-8.71E-04	2.428E-02	No	Yes
Sample Event 18	10/1/2008	GZ-1-2R	6.110E-02	2804.2	-9.25E-04	4.567E-03	No	Yes
Sample Event 18	10/1/2008	GZ-6-2R	1.770E-01	1909.1	-9.25E-04	3.028E-02	No	Yes
Sample Event 18	10/1/2008	GZ-9-4R	9.960E-02	1235.9	-9.25E-04	3.176E-02	No	Yes
Sample Event 18	10/1/2008	MW-101B	4.000E-03	1492.5	-9.25E-04	1.006E-03	Yes	Yes
Sample Event 18	10/1/2008	MW-104B	1.190E-01	2304.3	-9.25E-04	1.412E-02	No	Yes
Sample Event 18	10/1/2008	MW-106B	4.000E-03	1083.6	-9.25E-04	1.468E-03	Yes	Yes

Project: ARLF **User Name:** WESTON

Location: Londonderry **State:** New Hampshire

Sampling Event	Effective Date	Well	Observed Concentration (mg/L)	Distance Down Centerline (ft)	Regression Coefficient (1/ft)	Projected Concentration (mg/L)	Below Detection Limit?	Used in Analysis?
ARSENIC								
Sample Event 18	10/1/2008	MW-109B	4.000E-03	523.2	-9.25E-04	2.465E-03	Yes	Yes
Sample Event 18	10/1/2008	MW-207B	4.000E-03	715.1	-9.25E-04	2.065E-03	Yes	Yes
Sample Event 18	10/1/2008	MW-210B	4.000E-03	112.5	-9.25E-04	3.605E-03	Yes	Yes
Sample Event 18	10/1/2008	MW-302BR	1.530E-01	1676.3	-9.25E-04	3.246E-02	No	Yes
Sample Event 18	10/1/2008	MW-303B	3.750E-02	1501.1	-9.25E-04	9.356E-03	No	Yes
Sample Event 18	10/1/2008	NUS-1-2	2.010E-01	981.5	-9.25E-04	8.109E-02	No	Yes
Sample Event 18	10/1/2008	PZ-218	4.320E-01	3103.8	-9.25E-04	2.448E-02	No	Yes
Sample Event 19	4/1/2009	GZ-1-2R	4.140E-02	2804.2	-8.58E-04	3.736E-03	Yes	Yes
Sample Event 19	4/1/2009	GZ-6-2R	1.310E-02	1909.1	-8.58E-04	2.547E-03	Yes	Yes
Sample Event 19	4/1/2009	GZ-9-4R	6.310E-02	1235.9	-8.58E-04	2.186E-02	No	Yes
Sample Event 19	4/1/2009	MW-101B	4.000E-03	1492.5	-8.58E-04	1.112E-03	Yes	Yes
Sample Event 19	4/1/2009	MW-104B	1.190E-01	2304.3	-8.58E-04	1.649E-02	No	Yes
Sample Event 19	4/1/2009	MW-106B	4.000E-03	1083.6	-8.58E-04	1.579E-03	Yes	Yes
Sample Event 19	4/1/2009	MW-109B	4.000E-03	523.2	-8.58E-04	2.554E-03	Yes	Yes
Sample Event 19	4/1/2009	MW-207B	4.000E-03	715.1	-8.58E-04	2.166E-03	Yes	Yes
Sample Event 19	4/1/2009	MW-210B	4.000E-03	112.5	-8.58E-04	3.632E-03	Yes	Yes
Sample Event 19	4/1/2009	MW-302BR	1.390E-02	1676.3	-8.58E-04	3.300E-03	Yes	Yes
Sample Event 19	4/1/2009	MW-303B	2.780E-02	1501.1	-8.58E-04	7.671E-03	No	Yes
Sample Event 19	4/1/2009	NUS-1-2	2.000E-01	981.5	-8.58E-04	8.618E-02	No	Yes
Sample Event 19	4/1/2009	PZ-218	4.530E-01	3103.8	-8.58E-04	3.161E-02	No	Yes
Sample Event 20	10/1/2009	GZ-1-2R	5.880E-02	2804.2	-1.08E-03	2.857E-03	Yes	Yes
Sample Event 20	10/1/2009	GZ-6-2R	1.860E-01	1909.1	-1.08E-03	2.373E-02	No	Yes
Sample Event 20	10/1/2009	GZ-9-4R	6.880E-02	1235.9	-1.08E-03	1.814E-02	No	Yes
Sample Event 20	10/1/2009	MW-101B	4.000E-03	1492.5	-1.08E-03	7.999E-04	Yes	Yes
Sample Event 20	10/1/2009	MW-104B	1.120E-01	2304.3	-1.08E-03	9.331E-03	No	Yes
Sample Event 20	10/1/2009	MW-106B	4.000E-03	1083.6	-1.08E-03	1.243E-03	Yes	Yes
Sample Event 20	10/1/2009	MW-109B	4.000E-03	523.2	-1.08E-03	2.275E-03	Yes	Yes
Sample Event 20	10/1/2009	MW-207B	4.000E-03	715.1	-1.08E-03	1.850E-03	Yes	Yes
Sample Event 20	10/1/2009	MW-210B	4.000E-03	112.5	-1.08E-03	3.543E-03	Yes	Yes
Sample Event 20	10/1/2009	MW-302BR	1.760E-01	1676.3	-1.08E-03	2.887E-02	No	Yes
Sample Event 20	10/1/2009	MW-303B	3.470E-02	1501.1	-1.08E-03	6.875E-03	No	Yes
Sample Event 20	10/1/2009	NUS-1-2	1.090E-01	981.5	-1.08E-03	3.782E-02	No	Yes
Sample Event 20	10/1/2009	PZ-218	5.020E-01	3103.8	-1.08E-03	1.766E-02	No	Yes
Sample Event 21	4/1/2010	GZ-1-2R	3.300E-02	2804.2	-1.02E-03	1.876E-03	Yes	Yes
Sample Event 21	4/1/2010	GZ-6-2R	1.660E-01	1909.1	-1.02E-03	2.356E-02	No	Yes
Sample Event 21	4/1/2010	GZ-9-4R	4.960E-02	1235.9	-1.02E-03	1.402E-02	No	Yes

Project: ARLF **User Name:** WESTON

Location: Londonderry **State:** New Hampshire

Sampling Event	Effective Date	Well	Observed Concentration (mg/L)	Distance Down Centerline (ft)	Regression Coefficient (1/ft)	Projected Concentration (mg/L)	Below Detection Limit?	Used in Analysis?
ARSENIC								
Sample Event 21	4/1/2010	MW-101B	4.000E-03	1492.5	-1.02E-03	8.694E-04	Yes	Yes
Sample Event 21	4/1/2010	MW-104B	4.240E-02	2304.3	-1.02E-03	4.018E-03	No	Yes
Sample Event 21	4/1/2010	MW-106B	4.000E-03	1083.6	-1.02E-03	1.321E-03	Yes	Yes
Sample Event 21	4/1/2010	MW-109B	4.000E-03	523.2	-1.02E-03	2.343E-03	Yes	Yes
Sample Event 21	4/1/2010	MW-207B	4.000E-03	715.1	-1.02E-03	1.925E-03	Yes	Yes
Sample Event 21	4/1/2010	MW-210B	4.000E-03	112.5	-1.02E-03	3.565E-03	Yes	Yes
Sample Event 21	4/1/2010	MW-302BR	2.380E-02	1676.3	-1.02E-03	4.287E-03	No	Yes
Sample Event 21	4/1/2010	MW-303B	2.110E-02	1501.1	-1.02E-03	4.546E-03	No	Yes
Sample Event 21	4/1/2010	NUS-1-2	1.460E-01	981.5	-1.02E-03	5.351E-02	No	Yes
Sample Event 21	4/1/2010	PZ-218	6.010E-01	3103.8	-1.02E-03	2.514E-02	No	Yes
Sample Event 22	10/1/2010	GZ-1-2R	6.380E-02	2804.2	-1.08E-03	3.099E-03	Yes	Yes
Sample Event 22	10/1/2010	GZ-6-2R	1.520E-01	1909.1	-1.08E-03	1.939E-02	No	Yes
Sample Event 22	10/1/2010	GZ-9-4R	7.140E-02	1235.9	-1.08E-03	1.883E-02	No	Yes
Sample Event 22	10/1/2010	MW-101B	4.000E-03	1492.5	-1.08E-03	7.997E-04	Yes	Yes
Sample Event 22	10/1/2010	MW-104B	1.110E-01	2304.3	-1.08E-03	9.246E-03	No	Yes
Sample Event 22	10/1/2010	MW-106B	6.000E-03	1083.6	-1.08E-03	1.865E-03	Yes	Yes
Sample Event 22	10/1/2010	MW-109B	4.000E-03	523.2	-1.08E-03	2.275E-03	Yes	Yes
Sample Event 22	10/1/2010	MW-207B	4.000E-03	715.1	-1.08E-03	1.850E-03	Yes	Yes
Sample Event 22	10/1/2010	MW-210B	4.000E-03	112.5	-1.08E-03	3.543E-03	Yes	Yes
Sample Event 22	10/1/2010	MW-302BR	1.520E-01	1676.3	-1.08E-03	2.492E-02	No	Yes
Sample Event 22	10/1/2010	MW-303B	4.040E-02	1501.1	-1.08E-03	8.003E-03	No	Yes
Sample Event 22	10/1/2010	NUS-1-2	1.850E-01	981.5	-1.08E-03	6.418E-02	No	Yes
Sample Event 22	10/1/2010	PZ-218	6.550E-01	3103.8	-1.08E-03	2.303E-02	No	Yes
Sample Event 23	4/1/2011	GZ-1-2R	6.130E-02	2804.2	-9.71E-04	4.030E-03	No	Yes
Sample Event 23	4/1/2011	GZ-6-2R	7.300E-03	1909.1	-9.71E-04	1.144E-03	Yes	Yes
Sample Event 23	4/1/2011	GZ-9-4R	4.450E-02	1235.9	-9.71E-04	1.341E-02	No	Yes
Sample Event 23	4/1/2011	MW-101B	4.000E-03	1492.5	-9.71E-04	9.394E-04	Yes	Yes
Sample Event 23	4/1/2011	MW-104B	2.070E-02	2304.3	-9.71E-04	2.211E-03	Yes	Yes
Sample Event 23	4/1/2011	MW-106B	4.000E-03	1083.6	-9.71E-04	1.397E-03	Yes	Yes
Sample Event 23	4/1/2011	MW-109B	4.000E-03	523.2	-9.71E-04	2.407E-03	Yes	Yes
Sample Event 23	4/1/2011	MW-207B	4.000E-03	715.1	-9.71E-04	1.998E-03	Yes	Yes
Sample Event 23	4/1/2011	MW-210B	4.000E-03	112.5	-9.71E-04	3.586E-03	Yes	Yes
Sample Event 23	4/1/2011	MW-302BR	4.000E-03	1676.3	-9.71E-04	7.859E-04	Yes	Yes
Sample Event 23	4/1/2011	MW-303B	4.730E-02	1501.1	-9.71E-04	1.102E-02	No	Yes
Sample Event 23	4/1/2011	NUS-1-2	1.300E-01	981.5	-9.71E-04	5.014E-02	No	Yes
Sample Event 23	4/1/2011	PZ-218	3.590E-01	3103.8	-9.71E-04	1.764E-02	No	Yes

Project: ARLF **User Name:** WESTON

Location: Londonderry **State:** New Hampshire

Sampling Event	Effective Date	Well	Observed Concentration (mg/L)	Distance Down Centerline (ft)	Regression Coefficient (1/ft)	Projected Concentration (mg/L)	Below Detection Limit?	Used in Analysis?
ARSENIC								
Sample Event 24	10/1/2011	GZ-1-2R	5.290E-02	2804.2	2.61E-04	1.100E-01	No	Yes
Sample Event 24	10/1/2011	GZ-6-2R	1.850E-01	1909.1	2.61E-04	3.046E-01	No	Yes
Sample Event 24	10/1/2011	GZ-9-4R	6.030E-02	1235.9	2.61E-04	8.327E-02	No	Yes
Sample Event 24	10/1/2011	MW-101B	4.000E-03	1492.5	2.61E-04	5.907E-03	No	Yes
Sample Event 24	10/1/2011	MW-104B	1.040E-01	2304.3	2.61E-04	1.899E-01	No	Yes
Sample Event 24	10/1/2011	MW-106B	4.000E-03	1083.6	2.61E-04	5.309E-03	No	Yes
Sample Event 24	10/1/2011	MW-109B	4.000E-03	523.2	2.61E-04	4.586E-03	No	Yes
Sample Event 24	10/1/2011	MW-207B	4.000E-03	715.1	2.61E-04	4.821E-03	No	Yes
Sample Event 24	10/1/2011	MW-210B	4.000E-03	112.5	2.61E-04	4.119E-03	No	Yes
Sample Event 24	10/1/2011	MW-302BR	3.010E-02	1676.3	2.61E-04	4.664E-02	No	Yes
Sample Event 24	10/1/2011	MW-303B	3.470E-02	1501.1	2.61E-04	5.136E-02	No	Yes
Sample Event 24	10/1/2011	NUS-1-2	2.630E-01	981.5	2.61E-04	3.399E-01	No	Yes
Sample Event 24	10/1/2011	PZ-218	4.000E-03	3103.8	2.61E-04	8.998E-03	No	Yes
Sample Event 25	4/1/2012	GZ-1-2R	5.120E-02	2804.2	-1.12E-03	2.191E-03	Yes	Yes
Sample Event 25	4/1/2012	GZ-6-2R	4.000E-03	1909.1	-1.12E-03	4.681E-04	Yes	Yes
Sample Event 25	4/1/2012	GZ-9-4R	4.000E-03	1235.9	-1.12E-03	9.974E-04	Yes	Yes
Sample Event 25	4/1/2012	MW-101B	4.000E-03	1492.5	-1.12E-03	7.476E-04	Yes	Yes
Sample Event 25	4/1/2012	MW-104B	1.170E-01	2304.3	-1.12E-03	8.781E-03	No	Yes
Sample Event 25	4/1/2012	MW-106B	4.000E-03	1083.6	-1.12E-03	1.184E-03	Yes	Yes
Sample Event 25	4/1/2012	MW-109B	4.000E-03	523.2	-1.12E-03	2.222E-03	Yes	Yes
Sample Event 25	4/1/2012	MW-207B	4.000E-03	715.1	-1.12E-03	1.791E-03	Yes	Yes
Sample Event 25	4/1/2012	MW-210B	4.000E-03	112.5	-1.12E-03	3.525E-03	Yes	Yes
Sample Event 25	4/1/2012	MW-302BR	4.000E-03	1676.3	-1.12E-03	6.080E-04	Yes	Yes
Sample Event 25	4/1/2012	MW-303B	3.940E-02	1501.1	-1.12E-03	7.293E-03	No	Yes
Sample Event 25	4/1/2012	NUS-1-2	1.670E-01	981.5	-1.12E-03	5.542E-02	No	Yes
Sample Event 25	4/1/2012	PZ-218	3.760E-01	3103.8	-1.12E-03	1.149E-02	No	Yes
Sample Event 26	10/1/2012	GZ-1-2R	6.110E-02	2804.2	-7.20E-04	8.122E-03	No	Yes
Sample Event 26	10/1/2012	GZ-6-2R	5.000E-03	1909.1	-7.20E-04	1.266E-03	Yes	Yes
Sample Event 26	10/1/2012	GZ-9-4R	8.820E-02	1235.9	-7.20E-04	3.624E-02	No	Yes
Sample Event 26	10/1/2012	MW-101B	4.000E-03	1492.5	-7.20E-04	1.367E-03	Yes	Yes
Sample Event 26	10/1/2012	MW-104B	1.040E-01	2304.3	-7.20E-04	1.981E-02	No	Yes
Sample Event 26	10/1/2012	MW-106B	5.700E-03	1083.6	-7.20E-04	2.614E-03	Yes	Yes
Sample Event 26	10/1/2012	MW-109B	4.000E-03	523.2	-7.20E-04	2.745E-03	Yes	Yes
Sample Event 26	10/1/2012	MW-207B	4.000E-03	715.1	-7.20E-04	2.391E-03	Yes	Yes
Sample Event 26	10/1/2012	MW-210B	4.000E-03	112.5	-7.20E-04	3.689E-03	Yes	Yes
Sample Event 26	10/1/2012	MW-302BR	4.000E-03	1676.3	-7.20E-04	1.197E-03	Yes	Yes

Project: ARLF **User Name:** WESTON

Location: Londonderry **State:** New Hampshire

Sampling Event	Effective Date	Well	Observed Concentration (mg/L)	Distance Down Centerline (ft)	Regression Coefficient (1/ft)	Projected Concentration (mg/L)	Below Detection Limit?	Used in Analysis?
ARSENIC								
Sample Event 26	10/1/2012	MW-303B	3.850E-02	1501.1	-7.20E-04	1.307E-02	No	Yes
Sample Event 26	10/1/2012	NUS-1-2	1.740E-01	981.5	-7.20E-04	8.586E-02	No	Yes
Sample Event 26	10/1/2012	PZ-218	2.140E-01	3103.8	-7.20E-04	2.293E-02	No	Yes

Note: Projected Concentrations that are below the user-specified detection limit are indicated by a check mark to its right; for sampling events with less than 3 selected plume centerline wells, NO projected concentrations are calculated because no regression coefficient is available.

MAROS Risk-Based Power Analysis for Site Cleanup

Project: ARLF

User Name: WESTON

Location: Londonderry

State: New Hampshire

Parameters:

Groundwater Flow Direction: 100 degrees **Distance to Receptor:** 112.5 feet

From Period: Sample Event 13 **to** Sample Event 26

4/1/2006 10/1/2012

Selected Plume Centerline Wells:

Well	Distance to Receptor (feet)
MW-109B	523.2
NUS-1-2	981.5
GZ-9-4R	1235.9
MW-302BR	1676.3
GZ-6-2R	1909.1
GZ-1-2R	2804.2
PZ-218	3103.8

The distance is measured in the Groundwater Flow Angle from the well to the compliance boundary.

				Normal Distribution Assumption			Lognormal Distribution Assumption				
Sample Event	**Sample Size**	**Sample Mean**	**Sample Stdev.**	**Cleanup Status**	**Power**	**Expected Sample Size**	**Celanup Status**	**Power**	**Expected Sample Size**	**Alpha Level**	**Expected Power**
ARSENIC				Cleanup Goal = 0.01							
Sample Event 13	12	1.59E-02	2.65E-02	Not Attained	S/E	S/E	Not Attained	S/E	S/E	0.05	0.8
Sample Event 14	12	1.97E-02	2.66E-02	Not Attained	S/E	S/E	Not Attained	S/E	S/E	0.05	0.8
Sample Event 15	12	6.60E-03	8.06E-03	Not Attained	0.409	36	Not Attained	0.273	65	0.05	0.8
Sample Event 16	13	2.35E-02	3.30E-02	Not Attained	S/E	S/E	Not Attained	S/E	S/E	0.05	0.8
Sample Event 17	13	1.59E-02	2.44E-02	Not Attained	S/E	S/E	Not Attained	S/E	S/E	0.05	0.8
Sample Event 18	13	1.84E-02	2.26E-02	Not Attained	S/E	S/E	Not Attained	S/E	S/E	0.05	0.8
Sample Event 19	13	1.42E-02	2.36E-02	Not Attained	S/E	S/E	Not Attained	S/E	S/E	0.05	0.8
Sample Event 20	13	1.19E-02	1.22E-02	Not Attained	S/E	S/E	Not Attained	S/E	S/E	0.05	0.8
Sample Event 21	13	1.08E-02	1.53E-02	Not Attained	S/E	S/E	Not Attained	S/E	S/E	0.05	0.8
Sample Event 22	13	1.39E-02	1.75E-02	Not Attained	S/E	S/E	Not Attained	S/E	S/E	0.05	0.8
Sample Event 23	13	8.52E-03	1.36E-02	Not Attained	0.103	>100	Not Attained	0.127	>100	0.05	0.8
Sample Event 24	13	8.92E-02	1.17E-01	Not Attained	S/E	S/E	Not Attained	S/E	S/E	0.05	0.8
Sample Event 25	13	7.44E-03	1.48E-02	Not Attained	0.149	>100	Not Attained	0.258	78	0.05	0.8
Sample Event 26	13	1.55E-02	2.37E-02	Not Attained	S/E	S/E	Not Attained	S/E	S/E	0.05	0.8

Note: #N/C means "not conducted" due to a small sample size (N<4) or that the mean concentration is much greater than the cleanup level; Sample Size is the number of sampling locations used in the power analysis; Expected Sample Size is the number of concentration data needed to reach the Expected Power under current sample variability.

MAROS Zeroth Moment Analysis

Project: ARLF

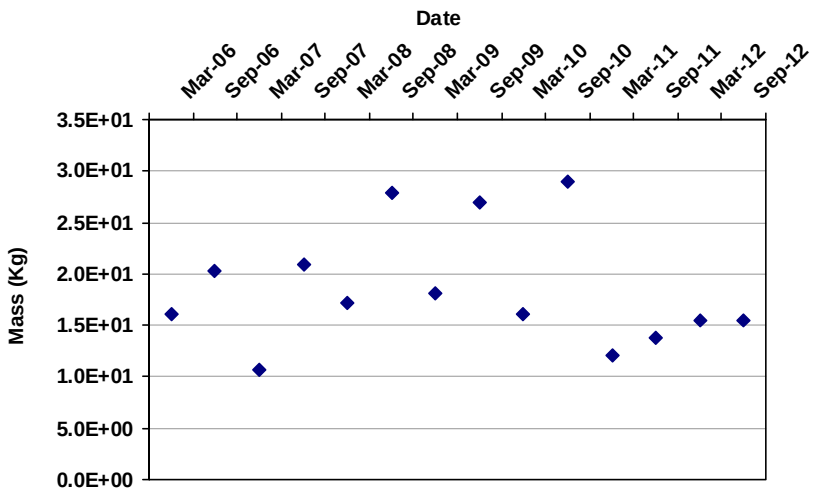
User Name: WESTON

Location: Londonderry

State: New Hampshire

COC: ARSENIC

Change in Dissolved Mass Over Time



Porosity: 0.30

Saturated Thickness:

Variable

Mann Kendall S Statistic:

-13

Confidence in Trend:

74.1%

Coefficient of Variation:

0.31

Zeroth Moment Trend:

S

Data Table:

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
3/1/2006	ARSENIC	1.6E+01	12
9/1/2006	ARSENIC	2.0E+01	12
3/1/2007	ARSENIC	1.1E+01	12
9/1/2007	ARSENIC	2.1E+01	13
3/1/2008	ARSENIC	1.7E+01	13
9/1/2008	ARSENIC	2.8E+01	13
3/1/2009	ARSENIC	1.8E+01	13
9/1/2009	ARSENIC	2.7E+01	13
3/1/2010	ARSENIC	1.6E+01	13
9/1/2010	ARSENIC	2.9E+01	13
3/1/2011	ARSENIC	1.2E+01	13
9/1/2011	ARSENIC	1.4E+01	13
3/1/2012	ARSENIC	1.6E+01	13
9/1/2012	ARSENIC	1.6E+01	13

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect. Moments are not calculated for sample events with less than 6 wells.

MAROS First Moment Analysis

Project: ARLF

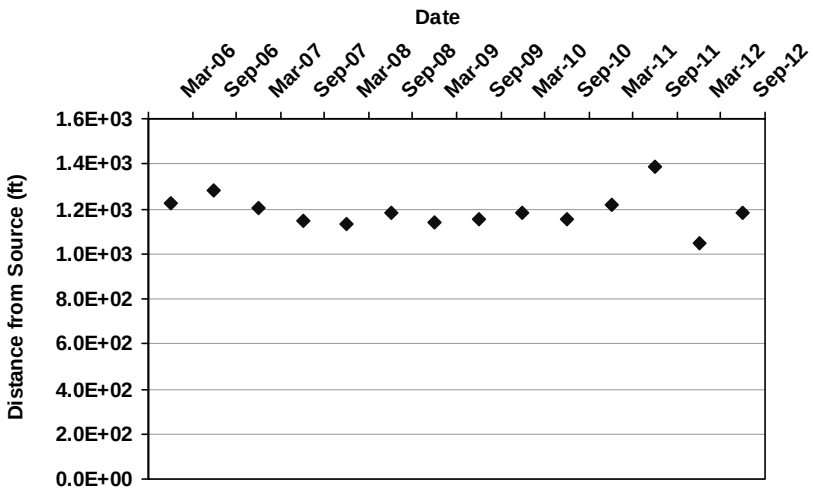
User Name: WESTON

Location: Londonderry

State: New Hampshire

COC: ARSENIC

Distance from Source to Center of Mass



Mann Kendall S Statistic:

-7

Confidence in Trend:

62.6%

Coefficient of Variation:

0.07

First Moment Trend:

S

Data Table:

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source (ft)	Number of Wells
3/1/2006	ARSENIC	846	1,574	1,224	12
9/1/2006	ARSENIC	868	1,635	1,282	12
3/1/2007	ARSENIC	824	1,554	1,207	12
9/1/2007	ARSENIC	863	1,501	1,150	13
3/1/2008	ARSENIC	875	1,484	1,131	13
9/1/2008	ARSENIC	888	1,536	1,181	13
3/1/2009	ARSENIC	845	1,489	1,140	13
9/1/2009	ARSENIC	894	1,507	1,152	13
3/1/2010	ARSENIC	874	1,536	1,183	13
9/1/2010	ARSENIC	881	1,505	1,151	13
3/1/2011	ARSENIC	818	1,562	1,215	13
9/1/2011	ARSENIC	900	1,742	1,386	13
3/1/2012	ARSENIC	836	1,392	1,045	13
9/1/2012	ARSENIC	828	1,532	1,184	13

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events). Moments are not calculated for sample events with less than 6 wells.

MAROS First Moment Analysis

Project: ARLF

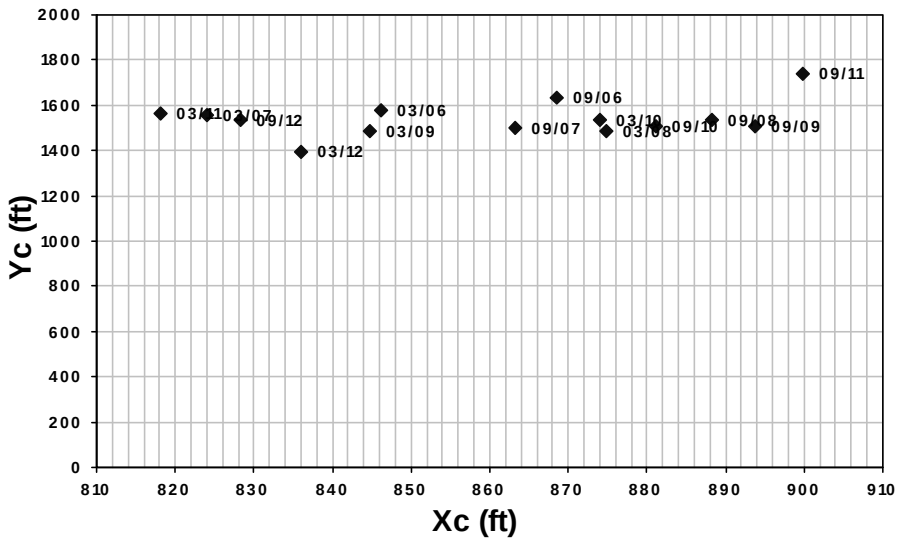
User Name: WESTON

Location: Londonderry

State: New Hampshire

COC: ARSENIC

Change in Location of Center of Mass Over Time



Groundwater Flow Direction:

Source Coordinate:

X: 1,000

Y: 360

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source (ft)	Number of Wells
3/1/2006	ARSENIC	846	1,574	1,224	12
9/1/2006	ARSENIC	868	1,635	1,282	12
3/1/2007	ARSENIC	824	1,554	1,207	12
9/1/2007	ARSENIC	863	1,501	1,150	13
3/1/2008	ARSENIC	875	1,484	1,131	13
9/1/2008	ARSENIC	888	1,536	1,181	13
3/1/2009	ARSENIC	845	1,489	1,140	13
9/1/2009	ARSENIC	894	1,507	1,152	13
3/1/2010	ARSENIC	874	1,536	1,183	13
9/1/2010	ARSENIC	881	1,505	1,151	13
3/1/2011	ARSENIC	818	1,562	1,215	13
9/1/2011	ARSENIC	900	1,742	1,386	13
3/1/2012	ARSENIC	836	1,392	1,045	13
9/1/2012	ARSENIC	828	1,532	1,184	13

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events). Moments are not calculated for sample events with less than 6 wells.

MAROS Second Moment Analysis

Project: ARLF

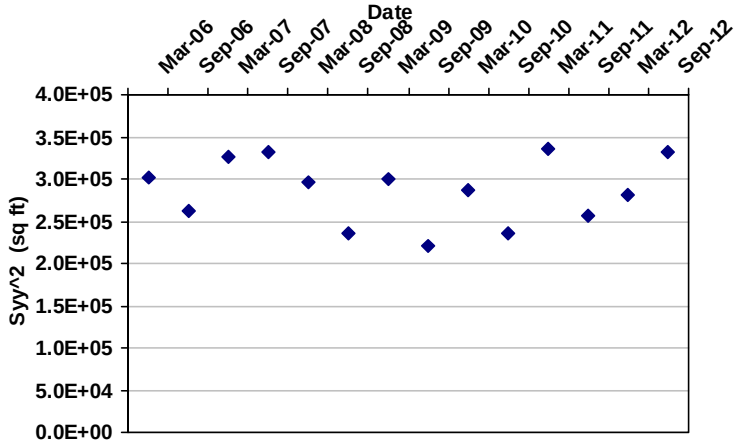
User Name: WESTON

Location: Londonderry

State: New Hampshire

COC: ARSENIC

Change in Plume Spread Over Time



Mann Kendall S Statistic:

-7

Confidence in Trend:

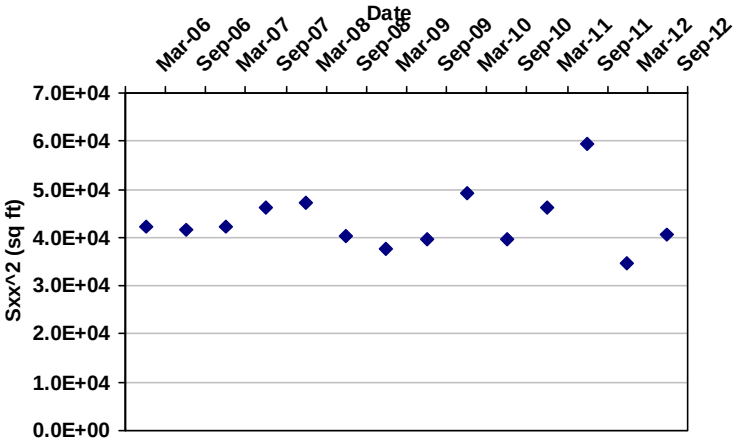
62.6%

Coefficient of Variation:

0.14

Second Moment Trend:

S



Mann Kendall S Statistic:

-5

Confidence in Trend:

58.5%

Coefficient of Variation:

0.14

Second Moment Trend:

S

Data Table:

Effective Date	Constituent	Sigma XX (sq ft)	Sigma YY (sq ft)	Number of Wells
3/1/2006	ARSENIC	42,137	302,739	12
9/1/2006	ARSENIC	41,764	262,952	12
3/1/2007	ARSENIC	42,183	327,188	12
9/1/2007	ARSENIC	46,110	332,907	13
3/1/2008	ARSENIC	47,081	296,470	13
9/1/2008	ARSENIC	40,323	236,291	13
3/1/2009	ARSENIC	37,670	300,739	13
9/1/2009	ARSENIC	39,595	221,488	13
3/1/2010	ARSENIC	49,232	287,393	13
9/1/2010	ARSENIC	39,466	235,469	13
3/1/2011	ARSENIC	46,200	336,264	13

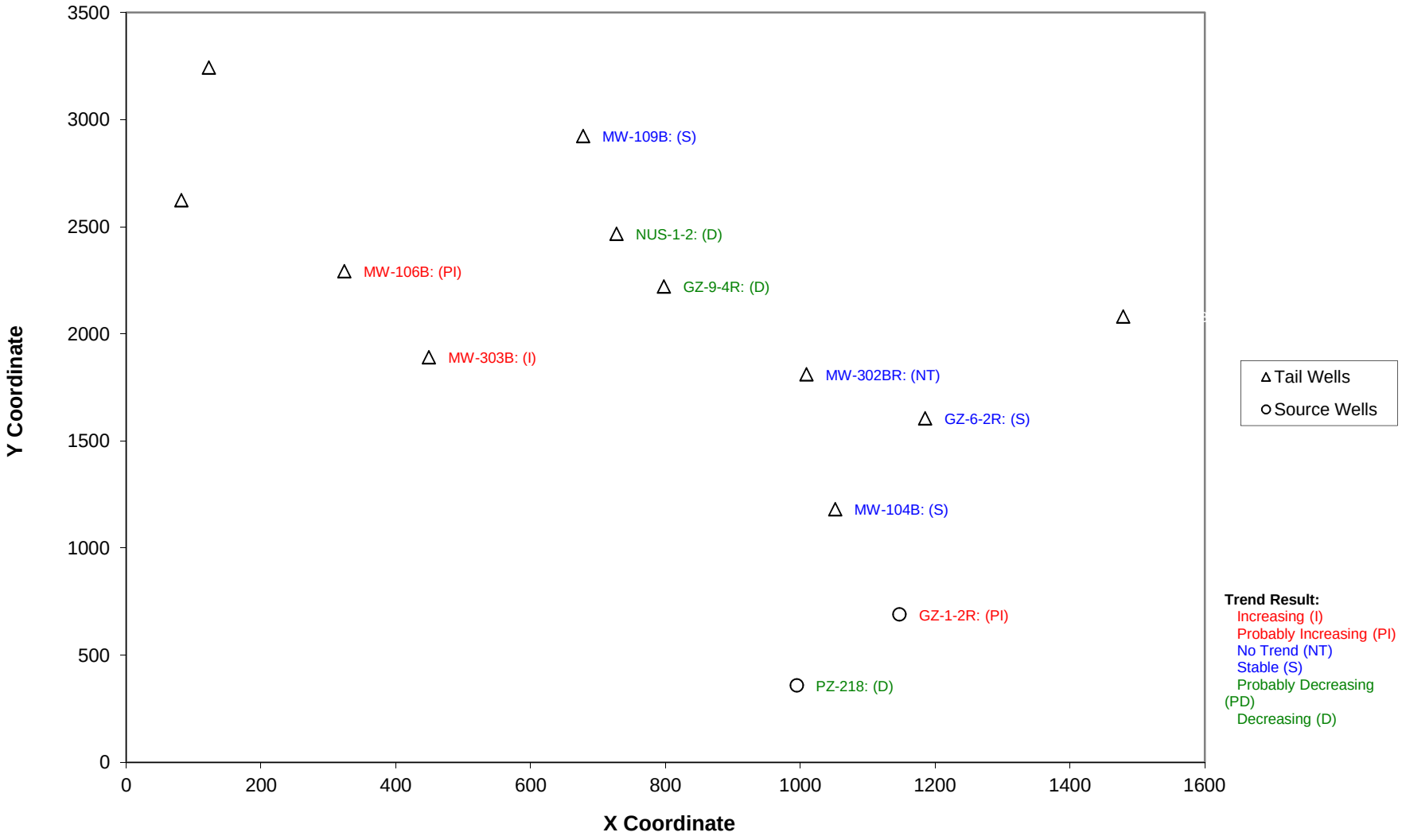
MAROS Second Moment Analysis

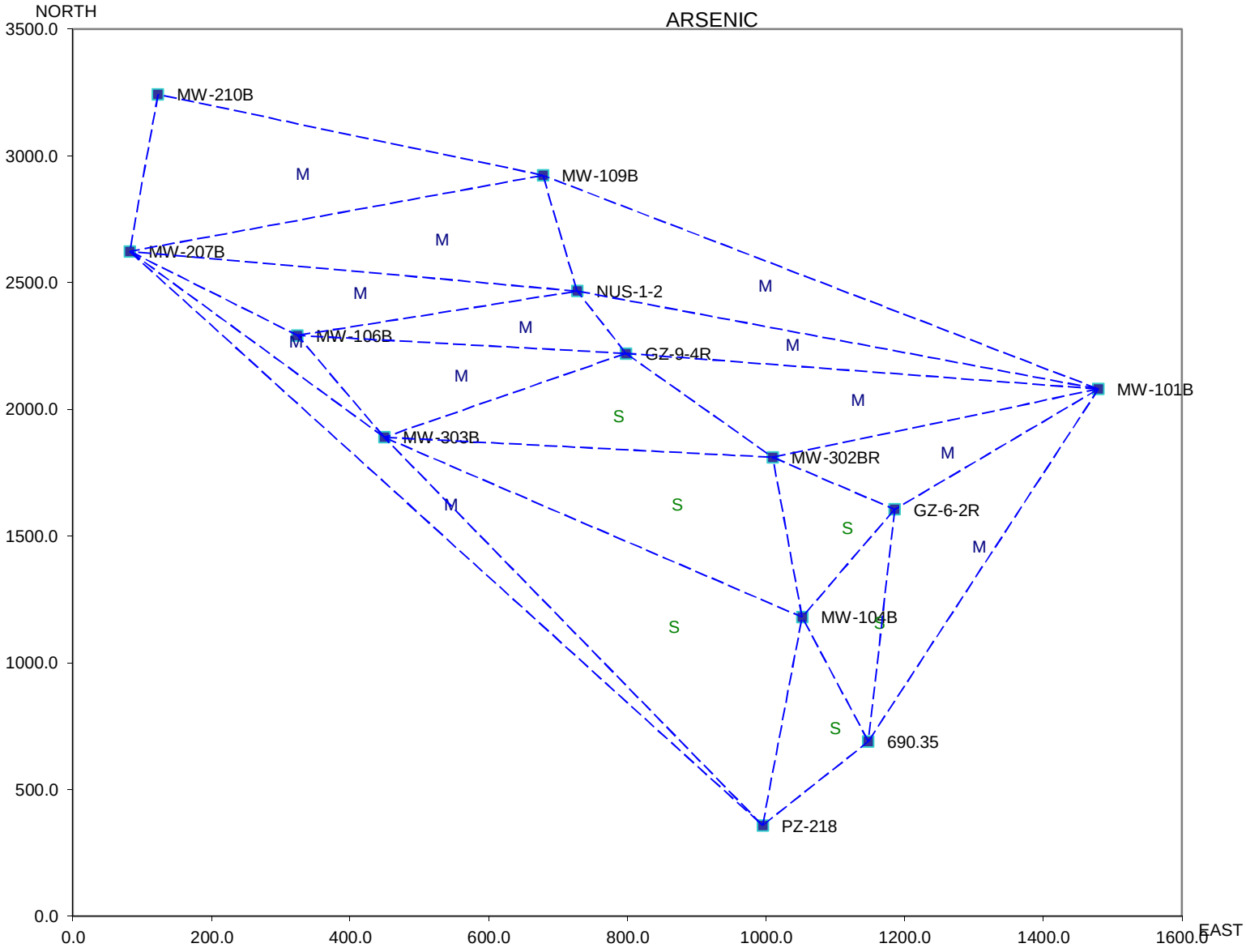
Effective Date	Constituent	Sigma XX (sq ft)	Sigma YY (sq ft)	Number of Wells
9/1/2011	ARSENIC	59,299	256,879	13
3/1/2012	ARSENIC	34,823	281,640	13
9/1/2012	ARSENIC	40,580	331,865	13

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events)

The Sigma XX and Sigma YY components are estimated using the given field coordinate system and then rotated to align with the estimated groundwater flow direction. Moments are not calculated for sample events with less than 6 wells.

Trend Results for ARSENIC





New Location Analysis for

Existing Locations

Potential areas for new locations are indicated by triangles with a high SF level.

Estimated SF Level:
S - Small
M - Moderate
L - Large
E - Extremely large

High SF -> high estimation error -> possible need for new locations

Low SF -> low estimation error -> no need for new locations

Back to Access

Individual Well Cleanup Status Visualization

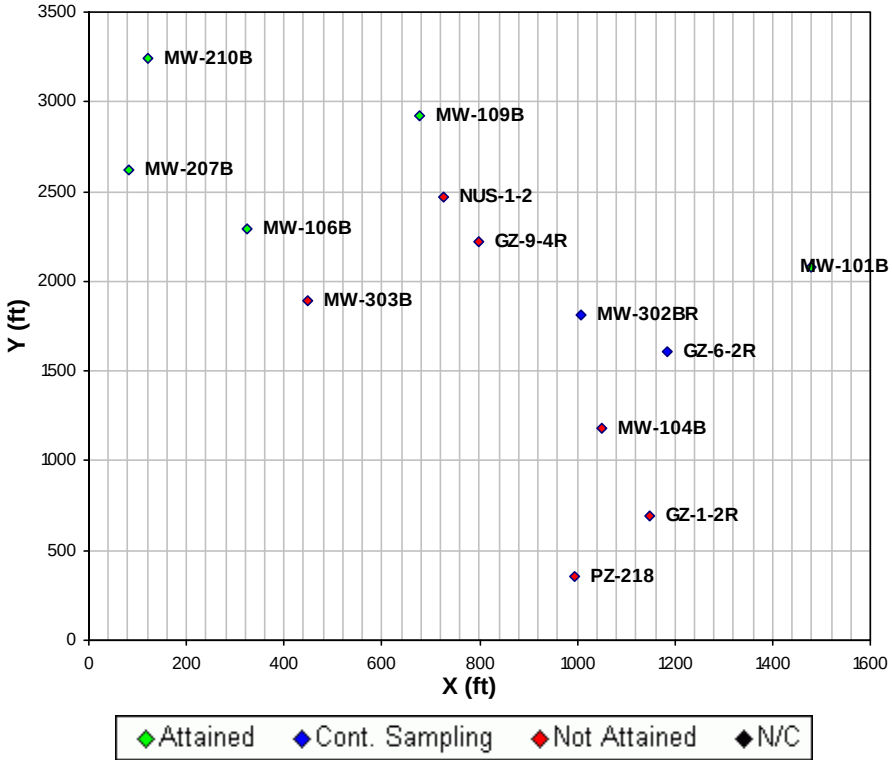
ARSENIC

Distribution Assumption

Lognormal

Normal

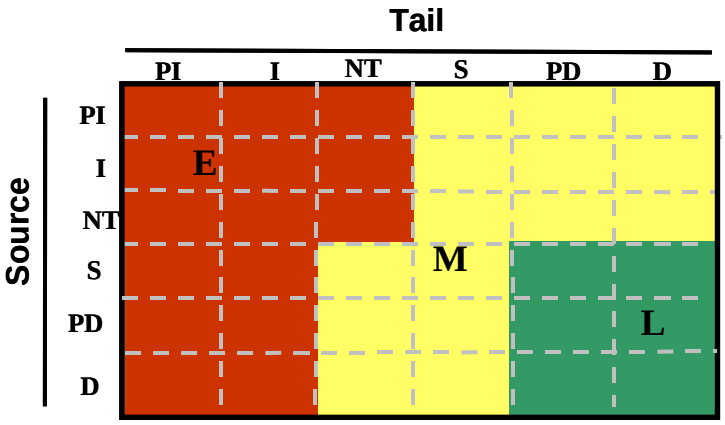
Lognormal



Groundwater
Flow Direction:

TREND ANALYSIS

Monitoring System Category



Graph Key:

Monitoring System Categories

E: Extensive

M: Moderate

L: Limited

Plume Status

(I) Increasing (PI) Probably Increasing
(S) Stable (PD) Probably Decreasing
(D) Decreasing

(NT) NoTrend

COC	Tail Stability	Source Stability	Category Result
ARSENIC	PD	S	L

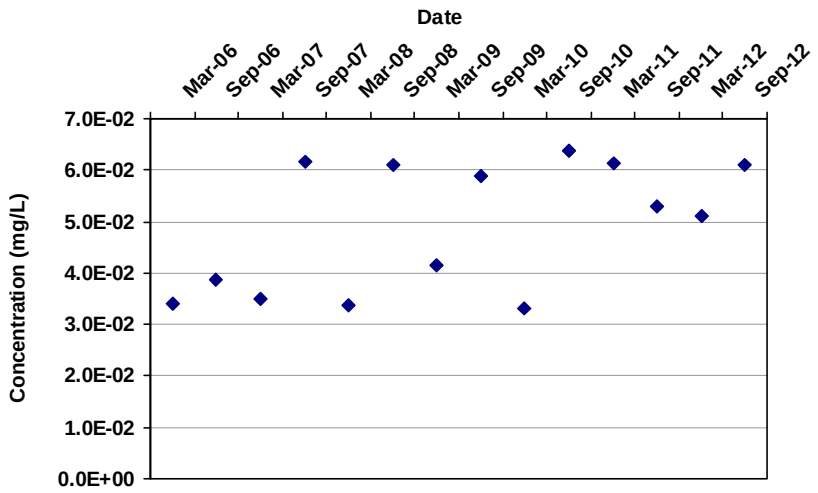
Worst Case: L

<< Back **Next >>** **View Report** **Help**

MAROS Mann-Kendall Statistics Summary

Well: GZ-1-2R
Well Type: S
COC: ARSENIC

Time Period: 1/1/2006 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 22

Confidence in Trend: 87.2%

Coefficient of Variation: 0.25

Mann Kendall Concentration Trend: (See Note) NT

Data Table:

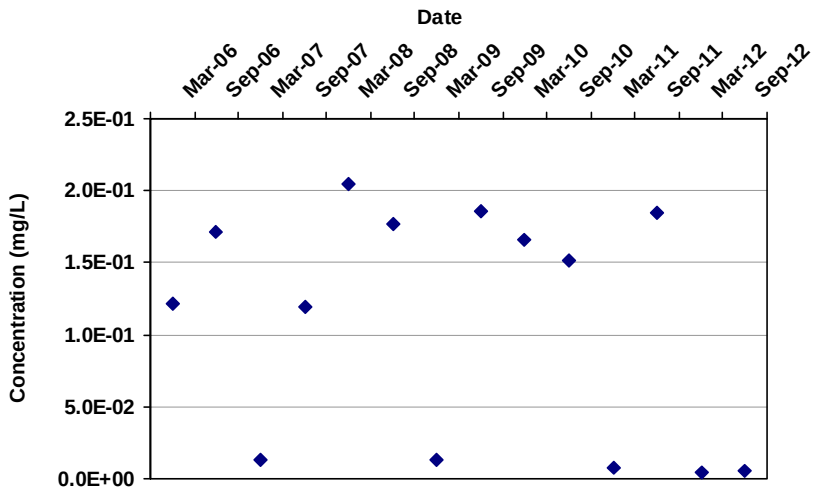
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
GZ-1-2R	S	3/1/2006	ARSENIC	3.4E-02		1	1
GZ-1-2R	S	9/1/2006	ARSENIC	3.9E-02		1	1
GZ-1-2R	S	3/1/2007	ARSENIC	3.5E-02		1	1
GZ-1-2R	S	9/1/2007	ARSENIC	6.2E-02		1	1
GZ-1-2R	S	3/1/2008	ARSENIC	3.4E-02		1	1
GZ-1-2R	S	9/1/2008	ARSENIC	6.1E-02		1	1
GZ-1-2R	S	3/1/2009	ARSENIC	4.1E-02		1	1
GZ-1-2R	S	9/1/2009	ARSENIC	5.9E-02		1	1
GZ-1-2R	S	3/1/2010	ARSENIC	3.3E-02		1	1
GZ-1-2R	S	9/1/2010	ARSENIC	6.4E-02		1	1
GZ-1-2R	S	3/1/2011	ARSENIC	6.1E-02		1	1
GZ-1-2R	S	9/1/2011	ARSENIC	5.3E-02		1	1
GZ-1-2R	S	3/1/2012	ARSENIC	5.1E-02		1	1
GZ-1-2R	S	9/1/2012	ARSENIC	6.1E-02		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: GZ-6-2R
Well Type: T
COC: ARSENIC

Time Period: 1/1/2006 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:
-21

Confidence in Trend:
86.0%

Coefficient of Variation:
0.74

Mann Kendall Concentration Trend: (See Note)
S

Data Table:

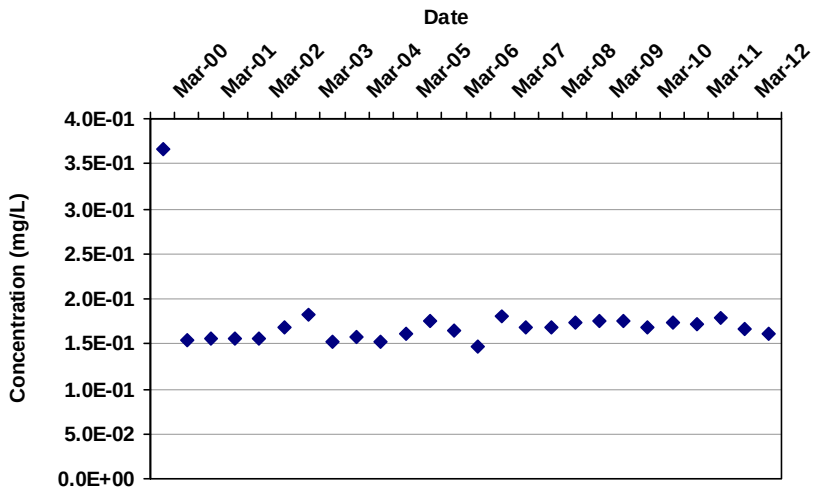
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
GZ-6-2R	T	3/1/2006	ARSENIC	1.2E-01		1	1
GZ-6-2R	T	9/1/2006	ARSENIC	1.7E-01		1	1
GZ-6-2R	T	3/1/2007	ARSENIC	1.3E-02		1	1
GZ-6-2R	T	9/1/2007	ARSENIC	1.2E-01		1	1
GZ-6-2R	T	3/1/2008	ARSENIC	2.1E-01		1	1
GZ-6-2R	T	9/1/2008	ARSENIC	1.8E-01		1	1
GZ-6-2R	T	3/1/2009	ARSENIC	1.3E-02		1	1
GZ-6-2R	T	9/1/2009	ARSENIC	1.9E-01		1	1
GZ-6-2R	T	3/1/2010	ARSENIC	1.7E-01		1	1
GZ-6-2R	T	9/1/2010	ARSENIC	1.5E-01		1	1
GZ-6-2R	T	3/1/2011	ARSENIC	7.3E-03		1	1
GZ-6-2R	T	9/1/2011	ARSENIC	1.9E-01		1	1
GZ-6-2R	T	3/1/2012	ARSENIC	4.0E-03	ND	1	0
GZ-6-2R	T	9/1/2012	ARSENIC	5.0E-03		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: GZ-6-3R
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

68

Confidence in Trend:

93.0%

Coefficient of Variation:

0.23

Mann Kendall Concentration Trend: (See Note)

PI

Data Table:

Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
GZ-6-3R	T	3/1/2000	ARSENIC	3.7E-01		1	1
GZ-6-3R	T	9/1/2000	ARSENIC	1.5E-01		1	1
GZ-6-3R	T	3/1/2001	ARSENIC	1.6E-01		1	1
GZ-6-3R	T	9/1/2001	ARSENIC	1.6E-01		1	1
GZ-6-3R	T	3/1/2002	ARSENIC	1.6E-01		1	1
GZ-6-3R	T	9/1/2002	ARSENIC	1.7E-01		1	1
GZ-6-3R	T	3/1/2003	ARSENIC	1.8E-01		1	1
GZ-6-3R	T	9/1/2003	ARSENIC	1.5E-01		1	1
GZ-6-3R	T	3/1/2004	ARSENIC	1.6E-01		1	1
GZ-6-3R	T	9/1/2004	ARSENIC	1.5E-01		1	1
GZ-6-3R	T	3/1/2005	ARSENIC	1.6E-01		1	1
GZ-6-3R	T	9/1/2005	ARSENIC	1.8E-01		1	1
GZ-6-3R	T	3/1/2006	ARSENIC	1.6E-01		1	1
GZ-6-3R	T	9/1/2006	ARSENIC	1.5E-01		1	1
GZ-6-3R	T	3/1/2007	ARSENIC	1.8E-01		1	1
GZ-6-3R	T	9/1/2007	ARSENIC	1.7E-01		1	1
GZ-6-3R	T	3/1/2008	ARSENIC	1.7E-01		1	1
GZ-6-3R	T	9/1/2008	ARSENIC	1.7E-01		1	1
GZ-6-3R	T	3/1/2009	ARSENIC	1.8E-01		1	1
GZ-6-3R	T	9/1/2009	ARSENIC	1.8E-01		1	1
GZ-6-3R	T	3/1/2010	ARSENIC	1.7E-01		1	1
GZ-6-3R	T	9/1/2010	ARSENIC	1.7E-01		1	1

MAROS Mann-Kendall Statistics Summary

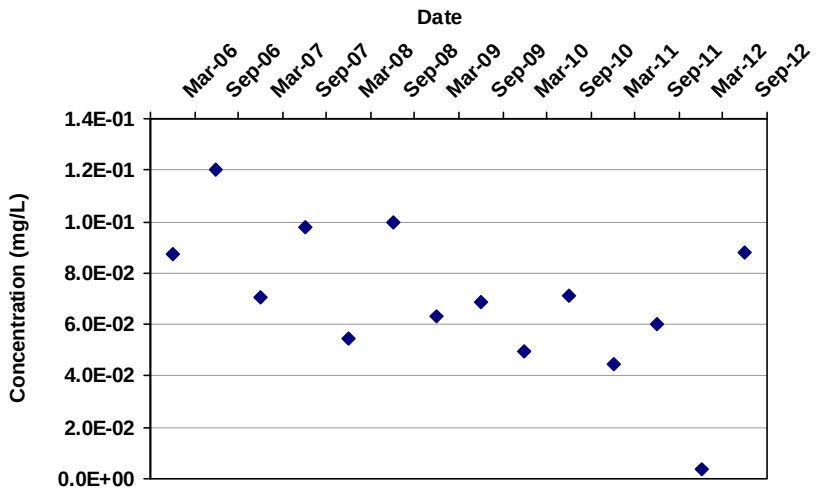
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
GZ-6-3R	T	3/1/2011	ARSENIC	1.7E-01		1	1
GZ-6-3R	T	9/1/2011	ARSENIC	1.8E-01		1	1
GZ-6-3R	T	3/1/2012	ARSENIC	1.7E-01		1	1
GZ-6-3R	T	9/1/2012	ARSENIC	1.6E-01		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: GZ-9-4R
Well Type: T
COC: ARSENIC

Time Period: 1/1/2006 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

-35

Confidence in Trend:

96.9%

Coefficient of Variation:

0.41

Mann Kendall Concentration Trend: (See Note)

D

Data Table:

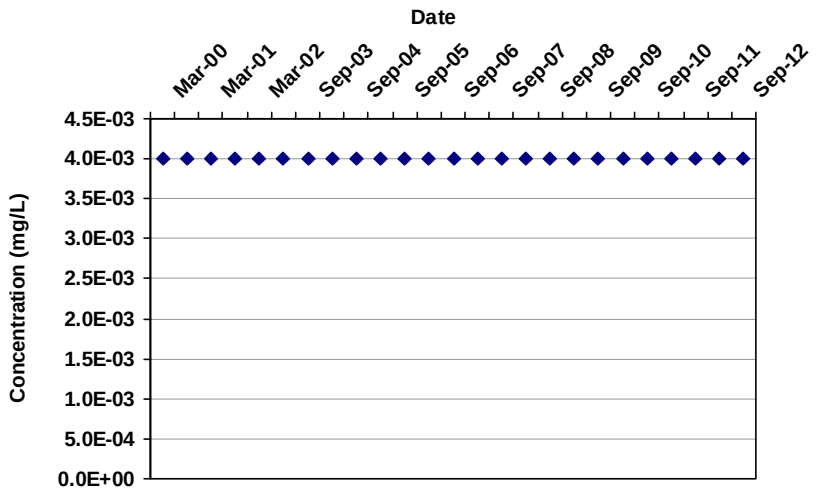
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
GZ-9-4R	T	3/1/2006	ARSENIC	8.7E-02		1	1
GZ-9-4R	T	9/1/2006	ARSENIC	1.2E-01		1	1
GZ-9-4R	T	3/1/2007	ARSENIC	7.0E-02		1	1
GZ-9-4R	T	9/1/2007	ARSENIC	9.8E-02		1	1
GZ-9-4R	T	3/1/2008	ARSENIC	5.5E-02		1	1
GZ-9-4R	T	9/1/2008	ARSENIC	1.0E-01		1	1
GZ-9-4R	T	3/1/2009	ARSENIC	6.3E-02		1	1
GZ-9-4R	T	9/1/2009	ARSENIC	6.9E-02		1	1
GZ-9-4R	T	3/1/2010	ARSENIC	5.0E-02		1	1
GZ-9-4R	T	9/1/2010	ARSENIC	7.1E-02		1	1
GZ-9-4R	T	3/1/2011	ARSENIC	4.5E-02		1	1
GZ-9-4R	T	9/1/2011	ARSENIC	6.0E-02		1	1
GZ-9-4R	T	3/1/2012	ARSENIC	4.0E-03	ND	1	0
GZ-9-4R	T	9/1/2012	ARSENIC	8.8E-02		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-1B
Well Type: S
COC: ARSENIC

Time Period: 1/1/2000 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 0

Confidence in Trend: 49.1%

Coefficient of Variation: 0.00

Mann Kendall Concentration Trend: (See Note) ND

Data Table:

Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-1B	S	3/1/2000	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	9/1/2000	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	3/1/2001	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	9/1/2001	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	3/1/2002	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	9/1/2002	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	9/1/2003	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	3/1/2004	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	9/1/2004	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	3/1/2005	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	9/1/2005	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	3/1/2006	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	9/1/2006	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	3/1/2007	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	9/1/2007	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	3/1/2008	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	9/1/2008	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	3/1/2009	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	9/1/2009	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	3/1/2010	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	9/1/2010	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	3/1/2011	ARSENIC	4.0E-03	ND	1	0

MAROS Mann-Kendall Statistics Summary

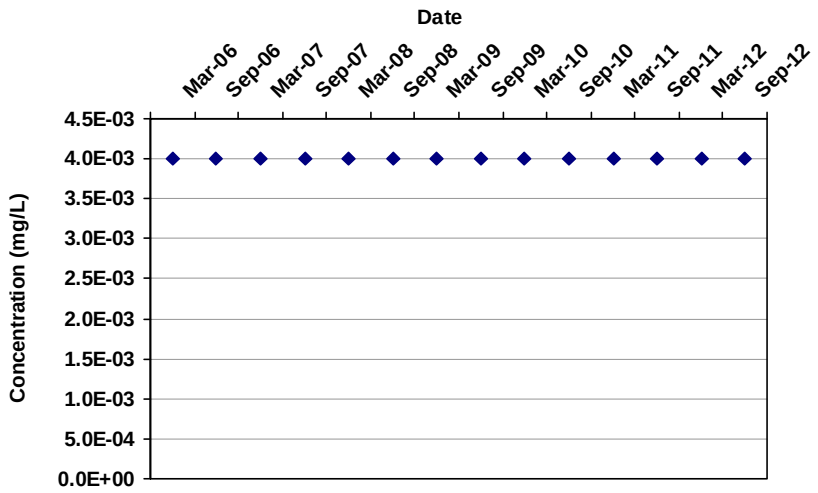
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-1B	S	9/1/2011	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	3/1/2012	ARSENIC	4.0E-03	ND	1	0
MW-1B	S	9/1/2012	ARSENIC	4.0E-03	ND	1	0

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-101B
Well Type: T
COC: ARSENIC

Time Period: 1/1/2006 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:
0

Confidence in Trend:
47.8%

Coefficient of Variation:
0.00

Mann Kendall Concentration Trend: (See Note)
ND

Data Table:

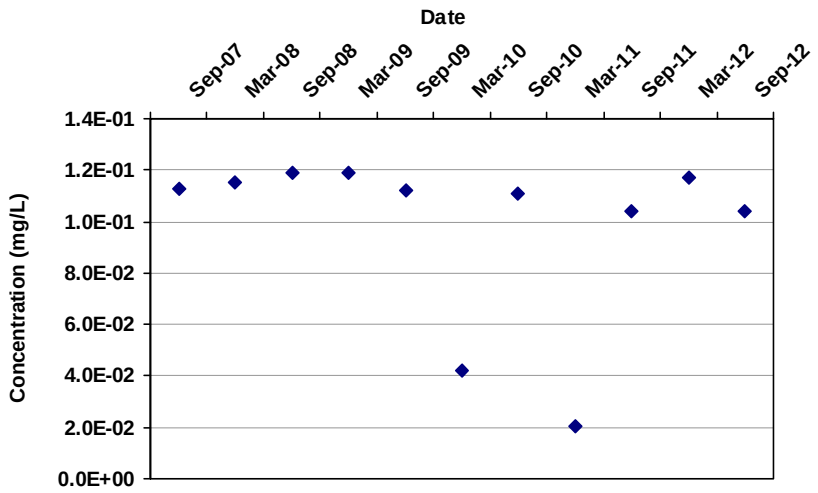
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-101B	T	3/1/2006	ARSENIC	4.0E-03	ND	1	0
MW-101B	T	9/1/2006	ARSENIC	4.0E-03	ND	1	0
MW-101B	T	3/1/2007	ARSENIC	4.0E-03	ND	1	0
MW-101B	T	9/1/2007	ARSENIC	4.0E-03	ND	1	0
MW-101B	T	3/1/2008	ARSENIC	4.0E-03	ND	1	0
MW-101B	T	9/1/2008	ARSENIC	4.0E-03	ND	1	0
MW-101B	T	3/1/2009	ARSENIC	4.0E-03	ND	1	0
MW-101B	T	9/1/2009	ARSENIC	4.0E-03	ND	1	0
MW-101B	T	3/1/2010	ARSENIC	4.0E-03	ND	1	0
MW-101B	T	9/1/2010	ARSENIC	4.0E-03	ND	1	0
MW-101B	T	3/1/2011	ARSENIC	4.0E-03	ND	1	0
MW-101B	T	9/1/2011	ARSENIC	4.0E-03	ND	1	0
MW-101B	T	3/1/2012	ARSENIC	4.0E-03	ND	1	0
MW-101B	T	9/1/2012	ARSENIC	4.0E-03	ND	1	0

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-104B
Well Type: T
COC: ARSENIC

Time Period: 1/1/2006 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

-19

Confidence in Trend:

91.8%

Coefficient of Variation:

0.34

Mann Kendall Concentration Trend: (See Note)

PD

Data Table:

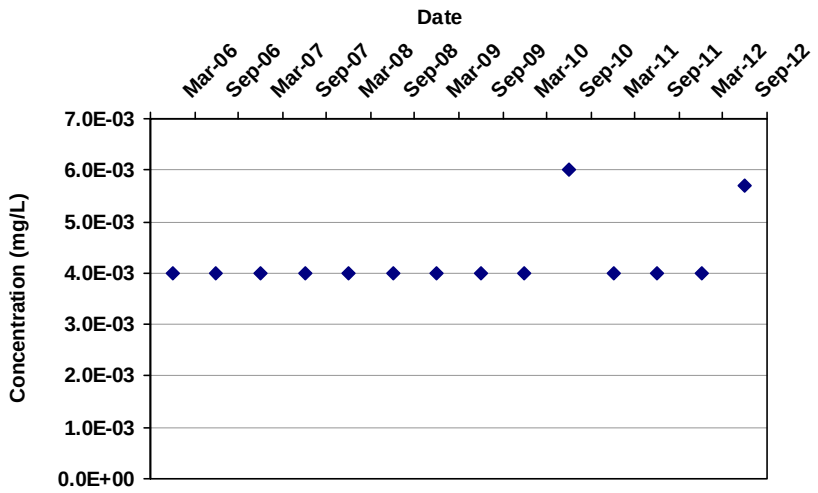
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-104B	T	9/1/2007	ARSENIC	1.1E-01		1	1
MW-104B	T	3/1/2008	ARSENIC	1.2E-01		1	1
MW-104B	T	9/1/2008	ARSENIC	1.2E-01		1	1
MW-104B	T	3/1/2009	ARSENIC	1.2E-01		1	1
MW-104B	T	9/1/2009	ARSENIC	1.1E-01		1	1
MW-104B	T	3/1/2010	ARSENIC	4.2E-02		1	1
MW-104B	T	9/1/2010	ARSENIC	1.1E-01		1	1
MW-104B	T	3/1/2011	ARSENIC	2.1E-02		1	1
MW-104B	T	9/1/2011	ARSENIC	1.0E-01		1	1
MW-104B	T	3/1/2012	ARSENIC	1.2E-01		1	1
MW-104B	T	9/1/2012	ARSENIC	1.0E-01		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-106B
Well Type: T
COC: ARSENIC

Time Period: 1/1/2006 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 17

Confidence in Trend: 80.6%

Coefficient of Variation: 0.16

Mann Kendall Concentration Trend: (See Note) NT

Data Table:

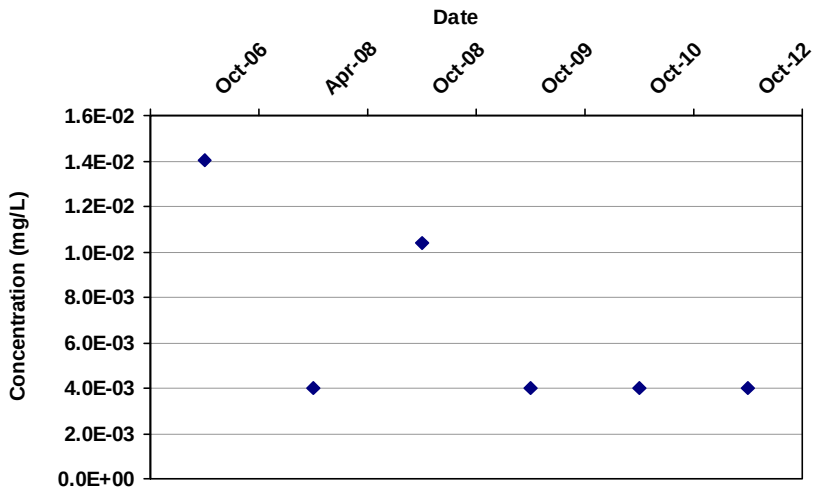
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-106B	T	3/1/2006	ARSENIC	4.0E-03	ND	1	0
MW-106B	T	9/1/2006	ARSENIC	4.0E-03	ND	1	0
MW-106B	T	3/1/2007	ARSENIC	4.0E-03	ND	1	0
MW-106B	T	9/1/2007	ARSENIC	4.0E-03	ND	1	0
MW-106B	T	3/1/2008	ARSENIC	4.0E-03	ND	1	0
MW-106B	T	9/1/2008	ARSENIC	4.0E-03	ND	1	0
MW-106B	T	3/1/2009	ARSENIC	4.0E-03	ND	1	0
MW-106B	T	9/1/2009	ARSENIC	4.0E-03	ND	1	0
MW-106B	T	3/1/2010	ARSENIC	4.0E-03	ND	1	0
MW-106B	T	9/1/2010	ARSENIC	6.0E-03		1	1
MW-106B	T	3/1/2011	ARSENIC	4.0E-03	ND	1	0
MW-106B	T	9/1/2011	ARSENIC	4.0E-03	ND	1	0
MW-106B	T	3/1/2012	ARSENIC	4.0E-03	ND	1	0
MW-106B	T	9/1/2012	ARSENIC	5.7E-03		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-108B
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

-7

Confidence in Trend:

86.4%

Coefficient of Variation:

0.65

Mann Kendall Concentration Trend: (See Note)

S

Data Table:

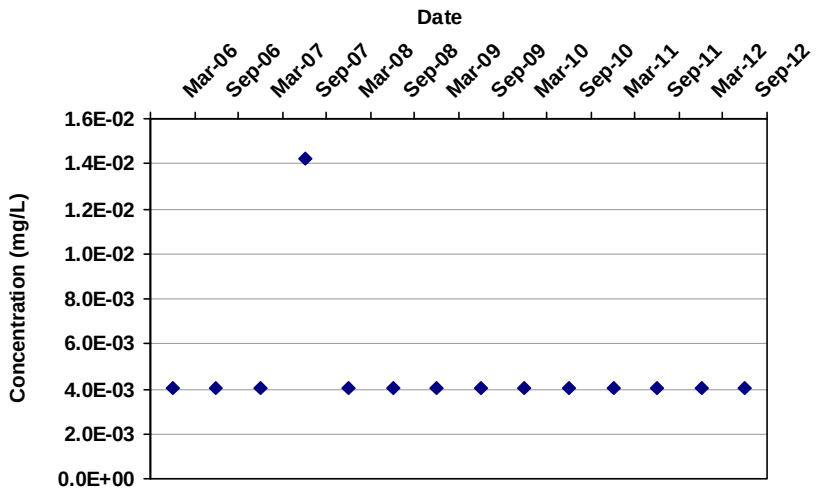
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-108B	T	10/1/2006	ARSENIC	1.4E-02		1	1
MW-108B	T	4/1/2008	ARSENIC	4.0E-03	ND	1	0
MW-108B	T	10/1/2008	ARSENIC	1.0E-02		1	1
MW-108B	T	10/1/2009	ARSENIC	4.0E-03	ND	1	0
MW-108B	T	10/1/2010	ARSENIC	4.0E-03	ND	1	0
MW-108B	T	10/1/2012	ARSENIC	4.0E-03	ND	1	0

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-109B
Well Type: T
COC: ARSENIC

Time Period: 1/1/2006 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

-7

Confidence in Trend:

62.6%

Coefficient of Variation:

0.58

Mann Kendall Concentration Trend: (See Note)

S

Data Table:

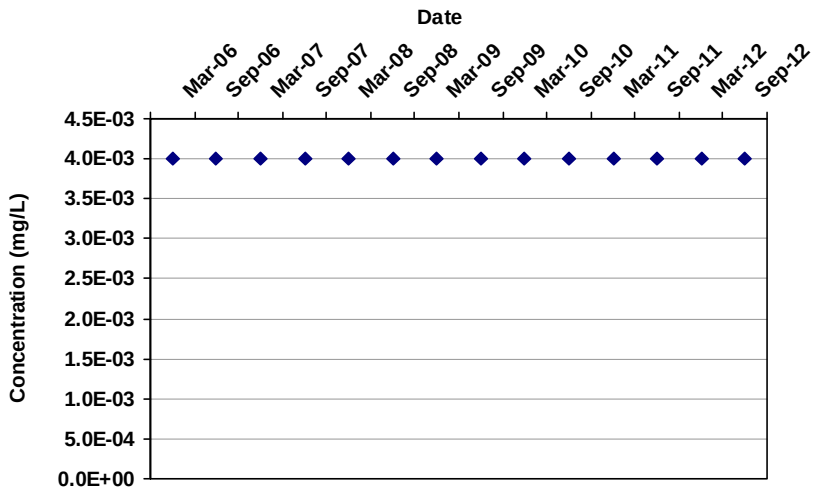
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-109B	T	3/1/2006	ARSENIC	4.0E-03	ND	1	0
MW-109B	T	9/1/2006	ARSENIC	4.0E-03	ND	1	0
MW-109B	T	3/1/2007	ARSENIC	4.0E-03	ND	1	0
MW-109B	T	9/1/2007	ARSENIC	1.4E-02		1	1
MW-109B	T	3/1/2008	ARSENIC	4.0E-03	ND	1	0
MW-109B	T	9/1/2008	ARSENIC	4.0E-03	ND	1	0
MW-109B	T	3/1/2009	ARSENIC	4.0E-03	ND	1	0
MW-109B	T	9/1/2009	ARSENIC	4.0E-03	ND	1	0
MW-109B	T	3/1/2010	ARSENIC	4.0E-03	ND	1	0
MW-109B	T	9/1/2010	ARSENIC	4.0E-03	ND	1	0
MW-109B	T	3/1/2011	ARSENIC	4.0E-03	ND	1	0
MW-109B	T	9/1/2011	ARSENIC	4.0E-03	ND	1	0
MW-109B	T	3/1/2012	ARSENIC	4.0E-03	ND	1	0
MW-109B	T	9/1/2012	ARSENIC	4.0E-03	ND	1	0

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-207B
Well Type: T
COC: ARSENIC

Time Period: 1/1/2006 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:
0

Confidence in Trend:
47.8%

Coefficient of Variation:
0.00

Mann Kendall Concentration Trend: (See Note)
ND

Data Table:

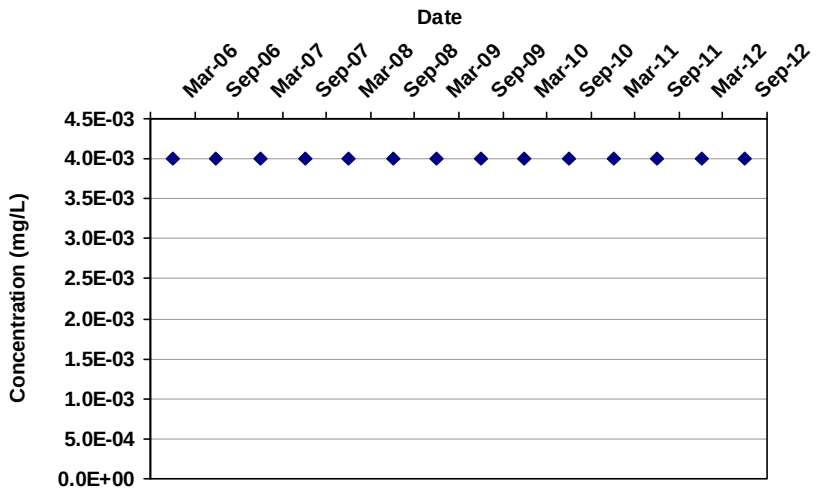
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-207B	T	3/1/2006	ARSENIC	4.0E-03	ND	1	0
MW-207B	T	9/1/2006	ARSENIC	4.0E-03	ND	1	0
MW-207B	T	3/1/2007	ARSENIC	4.0E-03	ND	1	0
MW-207B	T	9/1/2007	ARSENIC	4.0E-03	ND	1	0
MW-207B	T	3/1/2008	ARSENIC	4.0E-03	ND	1	0
MW-207B	T	9/1/2008	ARSENIC	4.0E-03	ND	1	0
MW-207B	T	3/1/2009	ARSENIC	4.0E-03	ND	1	0
MW-207B	T	9/1/2009	ARSENIC	4.0E-03	ND	1	0
MW-207B	T	3/1/2010	ARSENIC	4.0E-03	ND	1	0
MW-207B	T	9/1/2010	ARSENIC	4.0E-03	ND	1	0
MW-207B	T	3/1/2011	ARSENIC	4.0E-03	ND	1	0
MW-207B	T	9/1/2011	ARSENIC	4.0E-03	ND	1	0
MW-207B	T	3/1/2012	ARSENIC	4.0E-03	ND	1	0
MW-207B	T	9/1/2012	ARSENIC	4.0E-03	ND	1	0

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-210B
Well Type: T
COC: ARSENIC

Time Period: 1/1/2006 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:
0

Confidence in Trend:
47.8%

Coefficient of Variation:
0.00

Mann Kendall Concentration Trend: (See Note)
ND

Data Table:

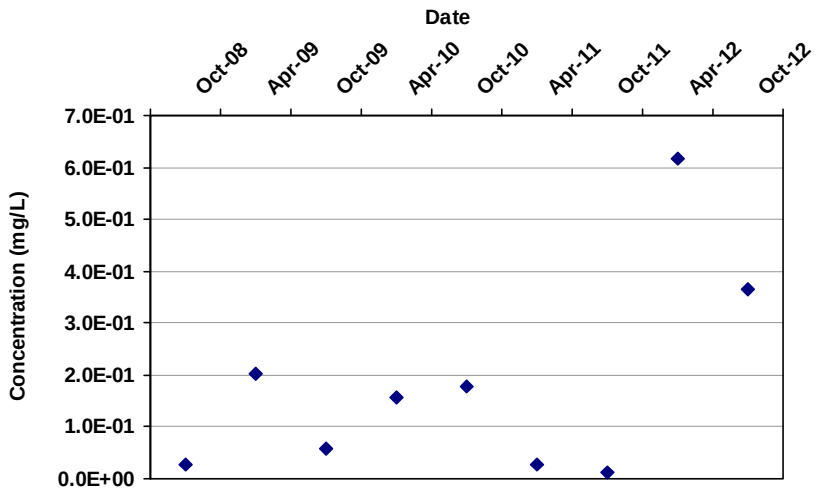
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-210B	T	3/1/2006	ARSENIC	4.0E-03	ND	1	0
MW-210B	T	9/1/2006	ARSENIC	4.0E-03	ND	1	0
MW-210B	T	3/1/2007	ARSENIC	4.0E-03	ND	1	0
MW-210B	T	9/1/2007	ARSENIC	4.0E-03	ND	1	0
MW-210B	T	3/1/2008	ARSENIC	4.0E-03	ND	1	0
MW-210B	T	9/1/2008	ARSENIC	4.0E-03	ND	1	0
MW-210B	T	3/1/2009	ARSENIC	4.0E-03	ND	1	0
MW-210B	T	9/1/2009	ARSENIC	4.0E-03	ND	1	0
MW-210B	T	3/1/2010	ARSENIC	4.0E-03	ND	1	0
MW-210B	T	9/1/2010	ARSENIC	4.0E-03	ND	1	0
MW-210B	T	3/1/2011	ARSENIC	4.0E-03	ND	1	0
MW-210B	T	9/1/2011	ARSENIC	4.0E-03	ND	1	0
MW-210B	T	3/1/2012	ARSENIC	4.0E-03	ND	1	0
MW-210B	T	9/1/2012	ARSENIC	4.0E-03	ND	1	0

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-211B
Well Type: S
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:
8

Confidence in Trend:
76.2%

Coefficient of Variation:
1.09

Mann Kendall Concentration Trend: (See Note)
NT

Data Table:

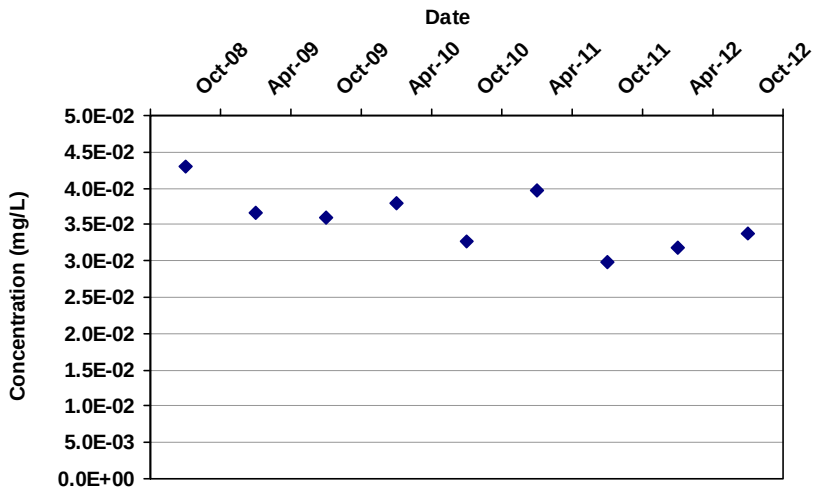
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-211B	S	10/1/2008	ARSENIC	2.6E-02		1	1
MW-211B	S	4/1/2009	ARSENIC	2.0E-01		1	1
MW-211B	S	10/1/2009	ARSENIC	5.7E-02		1	1
MW-211B	S	4/1/2010	ARSENIC	1.6E-01		1	1
MW-211B	S	10/1/2010	ARSENIC	1.8E-01		1	1
MW-211B	S	4/1/2011	ARSENIC	2.7E-02		1	1
MW-211B	S	10/1/2011	ARSENIC	1.4E-02		1	1
MW-211B	S	4/1/2012	ARSENIC	6.2E-01		1	1
MW-211B	S	10/1/2012	ARSENIC	3.7E-01		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-212B
Well Type: S
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

-16

Confidence in Trend:

94.0%

Coefficient of Variation:

0.12

Mann Kendall Concentration Trend: (See Note)

PD

Data Table:

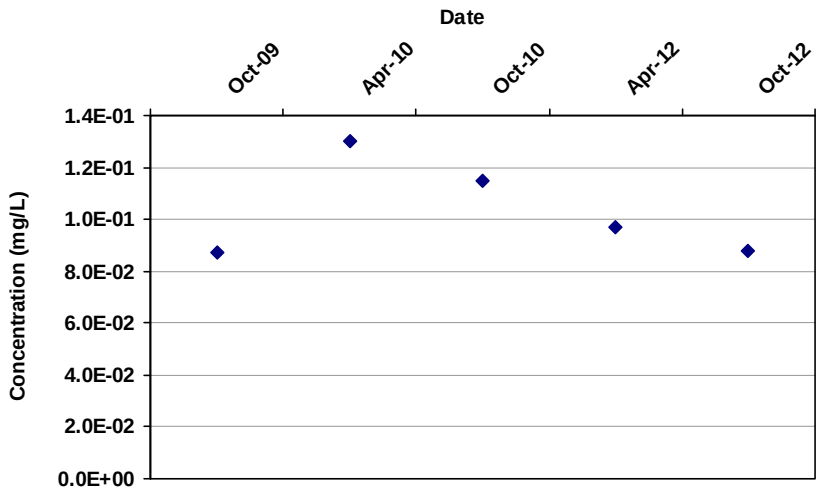
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-212B	S	10/1/2008	ARSENIC	4.3E-02		1	1
MW-212B	S	4/1/2009	ARSENIC	3.7E-02		1	1
MW-212B	S	10/1/2009	ARSENIC	3.6E-02		1	1
MW-212B	S	4/1/2010	ARSENIC	3.8E-02		1	1
MW-212B	S	10/1/2010	ARSENIC	3.3E-02		1	1
MW-212B	S	4/1/2011	ARSENIC	4.0E-02		1	1
MW-212B	S	10/1/2011	ARSENIC	3.0E-02		1	1
MW-212B	S	4/1/2012	ARSENIC	3.2E-02		1	1
MW-212B	S	10/1/2012	ARSENIC	3.4E-02		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-213
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

-2

Confidence in Trend:

59.2%

Coefficient of Variation:

0.18

Mann Kendall Concentration Trend: (See Note)

S

Data Table:

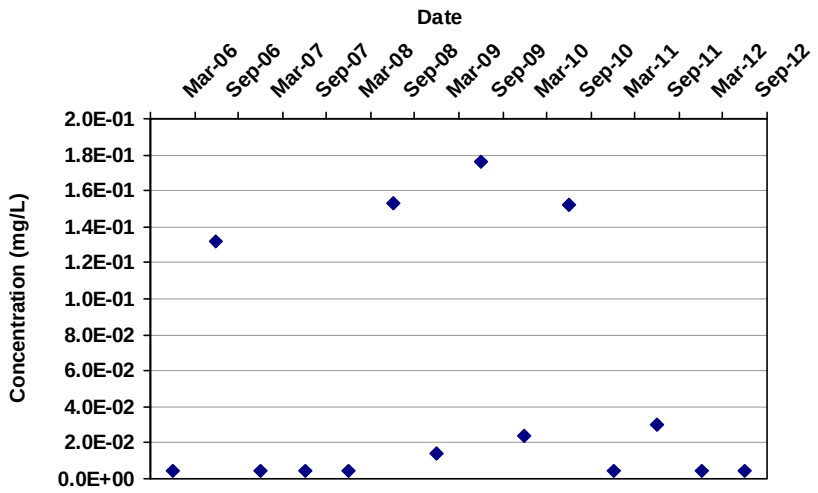
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-213	T	10/1/2009	ARSENIC	8.7E-02		1	1
MW-213	T	4/1/2010	ARSENIC	1.3E-01		1	1
MW-213	T	10/1/2010	ARSENIC	1.2E-01		1	1
MW-213	T	4/1/2012	ARSENIC	9.7E-02		1	1
MW-213	T	10/1/2012	ARSENIC	8.8E-02		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-302BR
Well Type: T
COC: ARSENIC

Time Period: 1/1/2006 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:
2

Confidence in Trend:
52.2%

Coefficient of Variation:
1.35

Mann Kendall Concentration Trend: (See Note)
NT

Data Table:

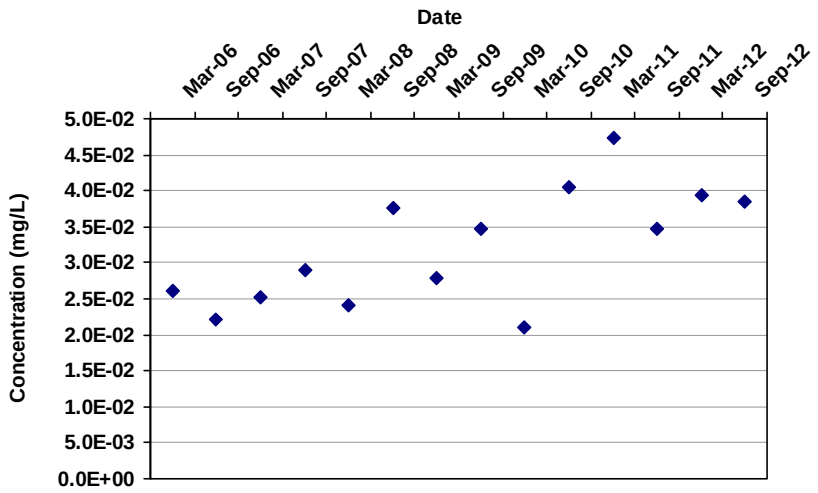
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-302BR	T	3/1/2006	ARSENIC	4.0E-03	ND	1	0
MW-302BR	T	9/1/2006	ARSENIC	1.3E-01		1	1
MW-302BR	T	3/1/2007	ARSENIC	4.0E-03	ND	1	0
MW-302BR	T	9/1/2007	ARSENIC	4.0E-03	ND	1	0
MW-302BR	T	3/1/2008	ARSENIC	4.0E-03	ND	1	0
MW-302BR	T	9/1/2008	ARSENIC	1.5E-01		1	1
MW-302BR	T	3/1/2009	ARSENIC	1.4E-02		1	1
MW-302BR	T	9/1/2009	ARSENIC	1.8E-01		1	1
MW-302BR	T	3/1/2010	ARSENIC	2.4E-02		1	1
MW-302BR	T	9/1/2010	ARSENIC	1.5E-01		1	1
MW-302BR	T	3/1/2011	ARSENIC	4.0E-03	ND	1	0
MW-302BR	T	9/1/2011	ARSENIC	3.0E-02		1	1
MW-302BR	T	3/1/2012	ARSENIC	4.0E-03	ND	1	0
MW-302BR	T	9/1/2012	ARSENIC	4.0E-03	ND	1	0

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-303B
Well Type: T
COC: ARSENIC

Time Period: 1/1/2006 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 42

Confidence in Trend: 98.9%

Coefficient of Variation: 0.25

Mann Kendall Concentration Trend: (See Note) I

Data Table:

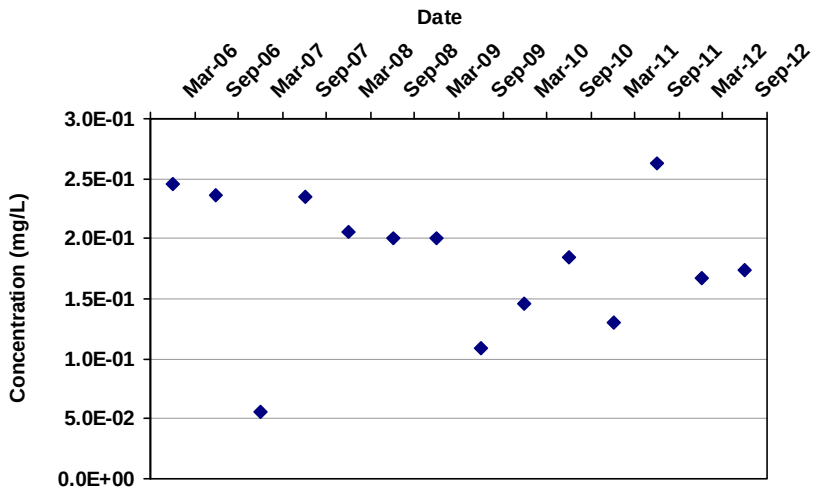
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-303B	T	3/1/2006	ARSENIC	2.6E-02		1	1
MW-303B	T	9/1/2006	ARSENIC	2.2E-02		1	1
MW-303B	T	3/1/2007	ARSENIC	2.5E-02		1	1
MW-303B	T	9/1/2007	ARSENIC	2.9E-02		1	1
MW-303B	T	3/1/2008	ARSENIC	2.4E-02		1	1
MW-303B	T	9/1/2008	ARSENIC	3.8E-02		1	1
MW-303B	T	3/1/2009	ARSENIC	2.8E-02		1	1
MW-303B	T	9/1/2009	ARSENIC	3.5E-02		1	1
MW-303B	T	3/1/2010	ARSENIC	2.1E-02		1	1
MW-303B	T	9/1/2010	ARSENIC	4.0E-02		1	1
MW-303B	T	3/1/2011	ARSENIC	4.7E-02		1	1
MW-303B	T	9/1/2011	ARSENIC	3.5E-02		1	1
MW-303B	T	3/1/2012	ARSENIC	3.9E-02		1	1
MW-303B	T	9/1/2012	ARSENIC	3.9E-02		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: NUS-1-2
Well Type: T
COC: ARSENIC

Time Period: 1/1/2006 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

-27

Confidence in Trend:

92.1%

Coefficient of Variation:

0.32

Mann Kendall Concentration Trend: (See Note)

PD

Data Table:

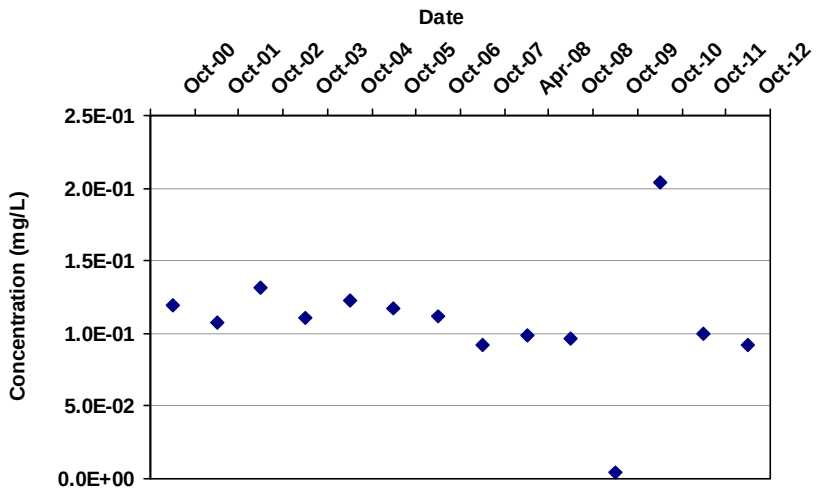
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
NUS-1-2	T	3/1/2006	ARSENIC	2.5E-01		1	1
NUS-1-2	T	9/1/2006	ARSENIC	2.4E-01		1	1
NUS-1-2	T	3/1/2007	ARSENIC	5.5E-02		1	1
NUS-1-2	T	9/1/2007	ARSENIC	2.4E-01		1	1
NUS-1-2	T	3/1/2008	ARSENIC	2.1E-01		1	1
NUS-1-2	T	9/1/2008	ARSENIC	2.0E-01		1	1
NUS-1-2	T	3/1/2009	ARSENIC	2.0E-01		1	1
NUS-1-2	T	9/1/2009	ARSENIC	1.1E-01		1	1
NUS-1-2	T	3/1/2010	ARSENIC	1.5E-01		1	1
NUS-1-2	T	9/1/2010	ARSENIC	1.9E-01		1	1
NUS-1-2	T	3/1/2011	ARSENIC	1.3E-01		1	1
NUS-1-2	T	9/1/2011	ARSENIC	2.6E-01		1	1
NUS-1-2	T	3/1/2012	ARSENIC	1.7E-01		1	1
NUS-1-2	T	9/1/2012	ARSENIC	1.7E-01		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: NUS-2-2
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

-35

Confidence in Trend:

96.9%

Coefficient of Variation:

0.38

Mann Kendall Concentration Trend: (See Note)

D

Data Table:

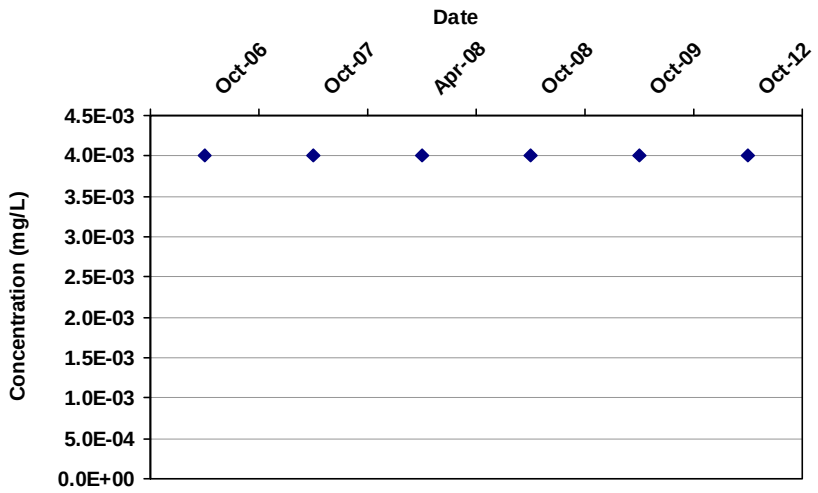
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
NUS-2-2	T	10/1/2000	ARSENIC	1.2E-01		1	1
NUS-2-2	T	10/1/2001	ARSENIC	1.1E-01		1	1
NUS-2-2	T	10/1/2002	ARSENIC	1.3E-01		1	1
NUS-2-2	T	10/1/2003	ARSENIC	1.1E-01		1	1
NUS-2-2	T	10/1/2004	ARSENIC	1.2E-01		1	1
NUS-2-2	T	10/1/2005	ARSENIC	1.2E-01		1	1
NUS-2-2	T	10/1/2006	ARSENIC	1.1E-01		1	1
NUS-2-2	T	10/1/2007	ARSENIC	9.3E-02		1	1
NUS-2-2	T	4/1/2008	ARSENIC	9.9E-02		1	1
NUS-2-2	T	10/1/2008	ARSENIC	9.7E-02		1	1
NUS-2-2	T	10/1/2009	ARSENIC	4.0E-03	ND	1	0
NUS-2-2	T	10/1/2010	ARSENIC	2.0E-01		1	1
NUS-2-2	T	10/1/2011	ARSENIC	1.0E-01		1	1
NUS-2-2	T	10/1/2012	ARSENIC	9.2E-02		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: NUS-9-1
Well Type: T
COC: ARSENIC

Time Period: 4/1/2000 **to** 10/1/2012
Consolidation Period: No Time Consolidation
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:
0

Confidence in Trend:
42.3%

Coefficient of Variation:
0.00

Mann Kendall Concentration Trend: (See Note)
ND

Data Table:

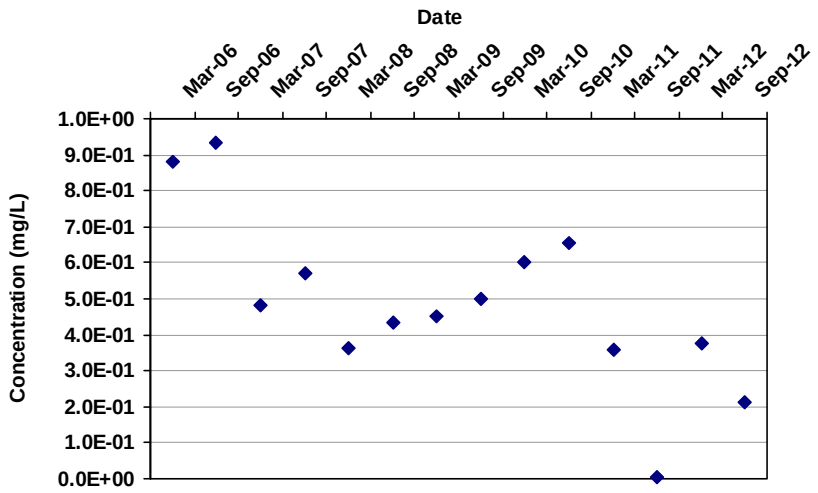
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
NUS-9-1	T	10/1/2006	ARSENIC	4.0E-03	ND	1	0
NUS-9-1	T	10/1/2007	ARSENIC	4.0E-03	ND	1	0
NUS-9-1	T	4/1/2008	ARSENIC	4.0E-03	ND	1	0
NUS-9-1	T	10/1/2008	ARSENIC	4.0E-03	ND	1	0
NUS-9-1	T	10/1/2009	ARSENIC	4.0E-03	ND	1	0
NUS-9-1	T	10/1/2012	ARSENIC	4.0E-03	ND	1	0

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: PZ-218
Well Type: S
COC: ARSENIC

Time Period: 1/1/2006 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

-39

Confidence in Trend:

98.2%

Coefficient of Variation:

0.50

Mann Kendall Concentration Trend: (See Note)

D

Data Table:

Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
PZ-218	S	3/1/2006	ARSENIC	8.8E-01		1	1
PZ-218	S	9/1/2006	ARSENIC	9.3E-01		1	1
PZ-218	S	3/1/2007	ARSENIC	4.8E-01		1	1
PZ-218	S	9/1/2007	ARSENIC	5.7E-01		1	1
PZ-218	S	3/1/2008	ARSENIC	3.6E-01		1	1
PZ-218	S	9/1/2008	ARSENIC	4.3E-01		1	1
PZ-218	S	3/1/2009	ARSENIC	4.5E-01		1	1
PZ-218	S	9/1/2009	ARSENIC	5.0E-01		1	1
PZ-218	S	3/1/2010	ARSENIC	6.0E-01		1	1
PZ-218	S	9/1/2010	ARSENIC	6.6E-01		1	1
PZ-218	S	3/1/2011	ARSENIC	3.6E-01		1	1
PZ-218	S	9/1/2011	ARSENIC	4.0E-03	ND	1	0
PZ-218	S	3/1/2012	ARSENIC	3.8E-01		1	1
PZ-218	S	9/1/2012	ARSENIC	2.1E-01		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Project: DOBBINS
User Name: WESTON
Location: LONDONDERRY
State: New Hampshire

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value

Well	Source/ Tail	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
ARSENIC								
C-1	S	11	10	0.49	-3	56.0%	No	S
GZ-1-3R	S	11	10	0.52	-29	98.7%	No	D
MW-102A	T	11	0	0.00	0	46.9%	Yes	ND
MW-108A	T	11	0	0.00	0	46.9%	Yes	ND
MW-109A	T	11	0	0.00	0	46.9%	Yes	ND
MW-207A	T	11	0	0.00	0	46.9%	Yes	ND
MW-210A	T	11	2	1.09	17	89.1%	No	NT
MW-302A	T	11	10	0.62	-13	82.1%	No	S
MW-303A	T	11	0	0.00	0	46.9%	Yes	ND

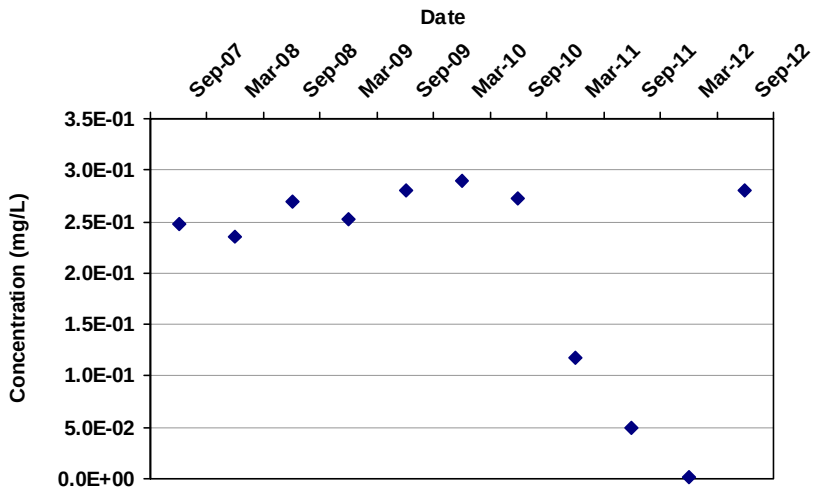
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)- Due to insufficient Data (< 4 sampling events); Source/Tail (S/T)

The Number of Samples and Number of Detects shown above are post-consolidation values.

MAROS Mann-Kendall Statistics Summary

Well: C-1
Well Type: S
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

-3

Confidence in Trend:

56.0%

Coefficient of Variation:

0.49

Mann Kendall Concentration Trend: (See Note)

S

Data Table:

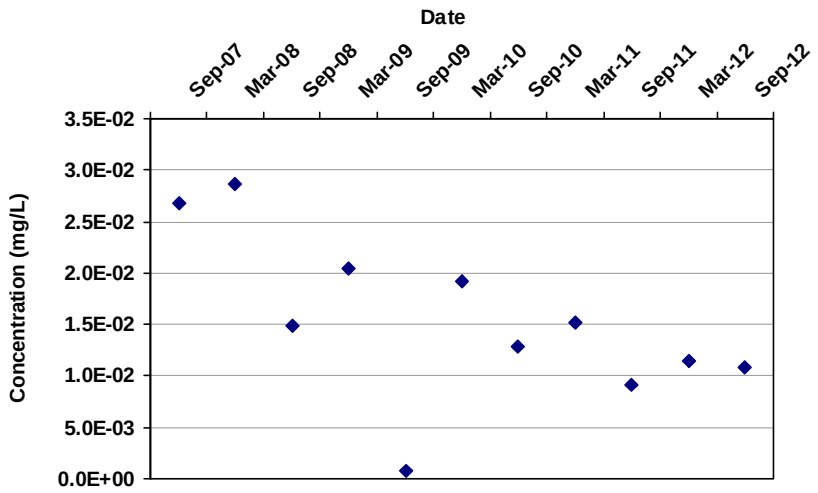
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
C-1	S	9/1/2007	ARSENIC	2.5E-01		1	1
C-1	S	3/1/2008	ARSENIC	2.4E-01		1	1
C-1	S	9/1/2008	ARSENIC	2.7E-01		1	1
C-1	S	3/1/2009	ARSENIC	2.5E-01		1	1
C-1	S	9/1/2009	ARSENIC	2.8E-01		1	1
C-1	S	3/1/2010	ARSENIC	2.9E-01		1	1
C-1	S	9/1/2010	ARSENIC	2.7E-01		1	1
C-1	S	3/1/2011	ARSENIC	1.2E-01		1	1
C-1	S	9/1/2011	ARSENIC	5.0E-02		1	1
C-1	S	3/1/2012	ARSENIC	8.0E-04	ND	1	0
C-1	S	9/1/2012	ARSENIC	2.8E-01		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: GZ-1-3R
Well Type: S
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

-29

Confidence in Trend:

98.7%

Coefficient of Variation:

0.52

Mann Kendall Concentration Trend: (See Note)

D

Data Table:

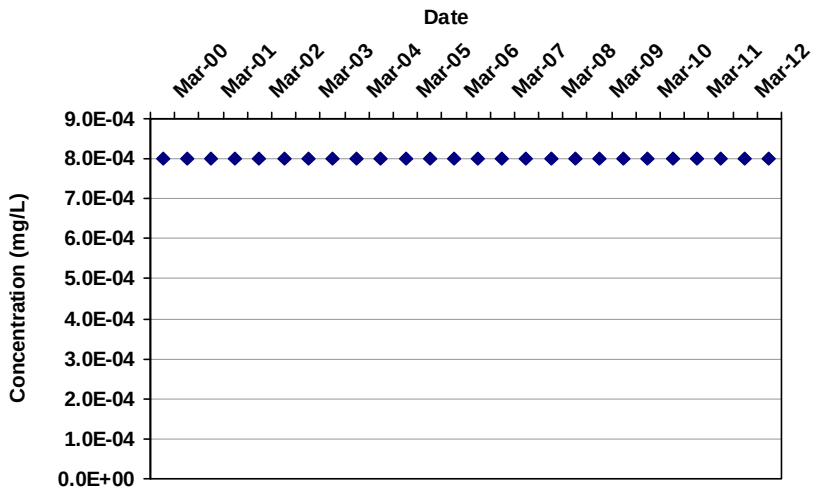
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
GZ-1-3R	S	9/1/2007	ARSENIC	2.7E-02		1	1
GZ-1-3R	S	3/1/2008	ARSENIC	2.9E-02		1	1
GZ-1-3R	S	9/1/2008	ARSENIC	1.5E-02		1	1
GZ-1-3R	S	3/1/2009	ARSENIC	2.0E-02		1	1
GZ-1-3R	S	9/1/2009	ARSENIC	8.0E-04	ND	1	0
GZ-1-3R	S	3/1/2010	ARSENIC	1.9E-02		1	1
GZ-1-3R	S	9/1/2010	ARSENIC	1.3E-02		1	1
GZ-1-3R	S	3/1/2011	ARSENIC	1.5E-02		1	1
GZ-1-3R	S	9/1/2011	ARSENIC	9.2E-03		1	1
GZ-1-3R	S	3/1/2012	ARSENIC	1.2E-02		1	1
GZ-1-3R	S	9/1/2012	ARSENIC	1.1E-02		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-1A
Well Type: T
COC: ARSENIC

Time Period: 1/1/2000 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

0

Confidence in Trend:

49.1%

Coefficient of Variation:

0.00

Mann Kendall Concentration Trend: (See Note)

ND

Data Table:

Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-1A	T	3/1/2000	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	9/1/2000	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	3/1/2001	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	9/1/2001	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	3/1/2002	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	9/1/2002	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	3/1/2003	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	9/1/2003	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	3/1/2004	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	9/1/2004	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	3/1/2005	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	9/1/2005	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	3/1/2006	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	9/1/2006	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	3/1/2007	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	9/1/2007	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	3/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	9/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	3/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	9/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	3/1/2010	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	9/1/2010	ARSENIC	8.0E-04	ND	1	0

MAROS Mann-Kendall Statistics Summary

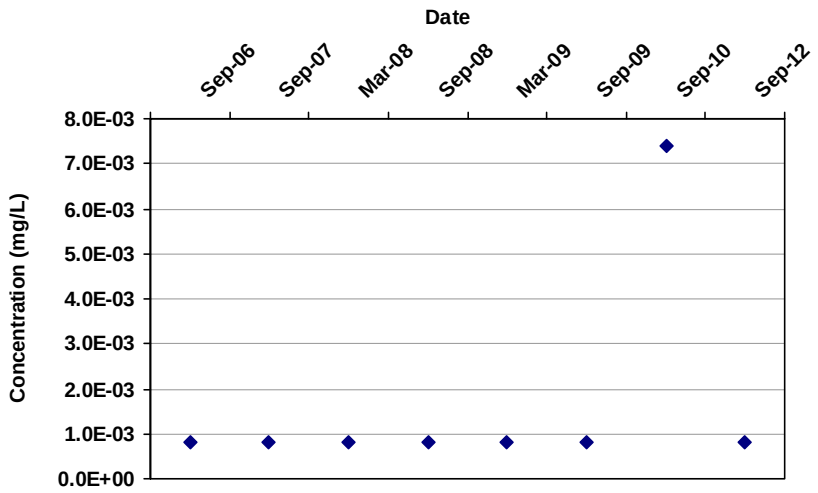
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-1A	T	3/1/2011	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	9/1/2011	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	3/1/2012	ARSENIC	8.0E-04	ND	1	0
MW-1A	T	9/1/2012	ARSENIC	8.0E-04	ND	1	0

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-101A
Well Type: T
COC: ARSENIC

Time Period: 1/1/2000 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:
5

Confidence in Trend:
68.3%

Coefficient of Variation:
1.44

Mann Kendall Concentration Trend: (See Note)
NT

Data Table:

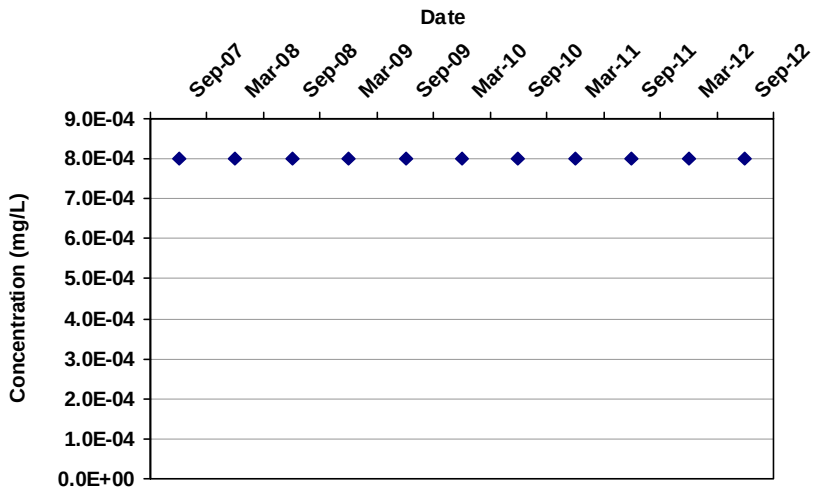
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-101A	T	9/1/2006	ARSENIC	8.0E-04	ND	1	0
MW-101A	T	9/1/2007	ARSENIC	8.0E-04	ND	1	0
MW-101A	T	3/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-101A	T	9/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-101A	T	3/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-101A	T	9/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-101A	T	9/1/2010	ARSENIC	7.4E-03		1	1
MW-101A	T	9/1/2012	ARSENIC	8.0E-04	ND	1	0

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-102A
Well Type: T
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 0

Confidence in Trend: 46.9%

Coefficient of Variation: 0.00

Mann Kendall Concentration Trend: (See Note) ND

Data Table:

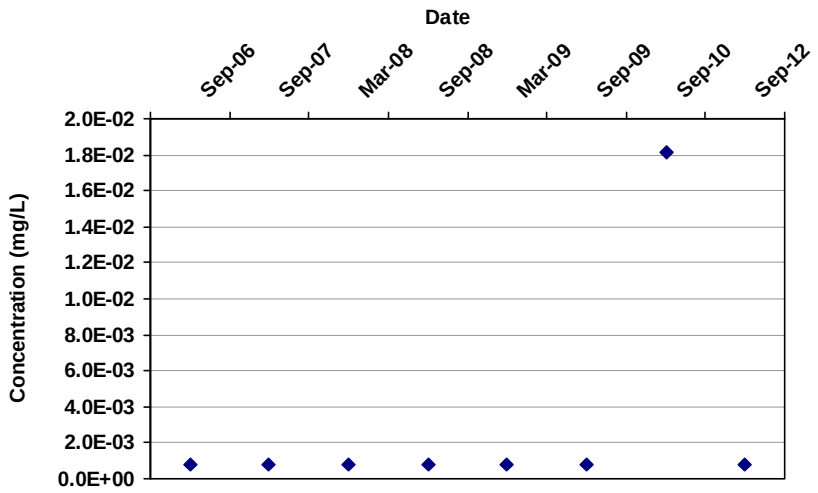
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-102A	T	9/1/2007	ARSENIC	8.0E-04	ND	1	0
MW-102A	T	3/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-102A	T	9/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-102A	T	3/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-102A	T	9/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-102A	T	3/1/2010	ARSENIC	8.0E-04	ND	1	0
MW-102A	T	9/1/2010	ARSENIC	8.0E-04	ND	1	0
MW-102A	T	3/1/2011	ARSENIC	8.0E-04	ND	1	0
MW-102A	T	9/1/2011	ARSENIC	8.0E-04	ND	1	0
MW-102A	T	3/1/2012	ARSENIC	8.0E-04	ND	1	0
MW-102A	T	9/1/2012	ARSENIC	8.0E-04	ND	1	0

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-106A
Well Type: T
COC: ARSENIC

Time Period: 1/1/2000 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:
5

Confidence in Trend:
68.3%

Coefficient of Variation:
2.06

Mann Kendall Concentration Trend: (See Note)
NT

Data Table:

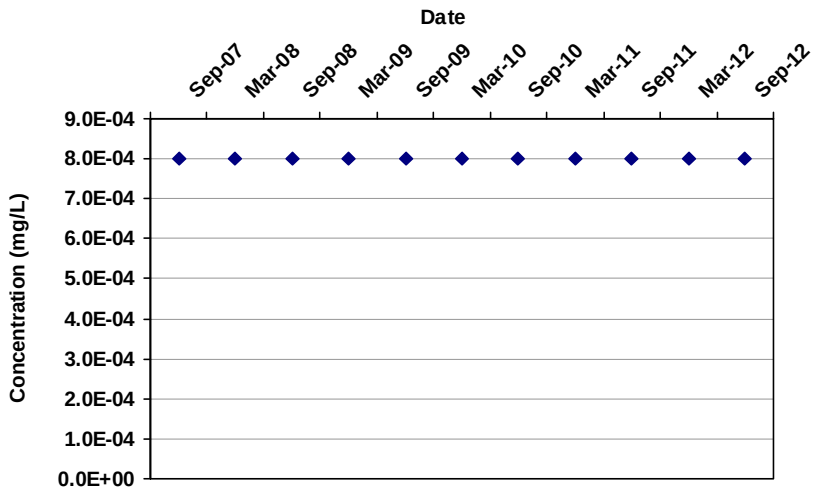
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-106A	T	9/1/2006	ARSENIC	8.0E-04	ND	1	0
MW-106A	T	9/1/2007	ARSENIC	8.0E-04	ND	1	0
MW-106A	T	3/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-106A	T	9/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-106A	T	3/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-106A	T	9/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-106A	T	9/1/2010	ARSENIC	1.8E-02		1	1
MW-106A	T	9/1/2012	ARSENIC	8.0E-04	ND	1	0

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-108A
Well Type: T
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 0

Confidence in Trend: 46.9%

Coefficient of Variation: 0.00

Mann Kendall Concentration Trend: (See Note) ND

Data Table:

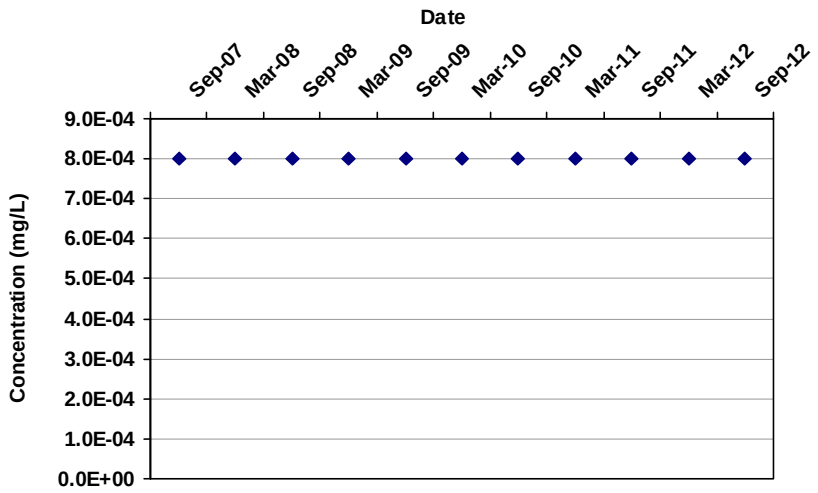
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-108A	T	9/1/2007	ARSENIC	8.0E-04	ND	1	0
MW-108A	T	3/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-108A	T	9/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-108A	T	3/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-108A	T	9/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-108A	T	3/1/2010	ARSENIC	8.0E-04	ND	1	0
MW-108A	T	9/1/2010	ARSENIC	8.0E-04	ND	1	0
MW-108A	T	3/1/2011	ARSENIC	8.0E-04	ND	1	0
MW-108A	T	9/1/2011	ARSENIC	8.0E-04	ND	1	0
MW-108A	T	3/1/2012	ARSENIC	8.0E-04	ND	1	0
MW-108A	T	9/1/2012	ARSENIC	8.0E-04	ND	1	0

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-109A
Well Type: T
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:
0

Confidence in Trend:
46.9%

Coefficient of Variation:
0.00

Mann Kendall Concentration Trend: (See Note)
ND

Data Table:

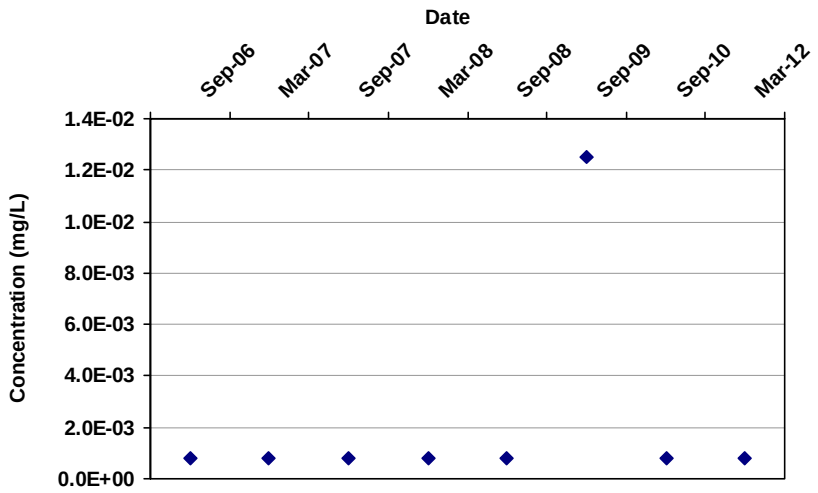
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-109A	T	9/1/2007	ARSENIC	8.0E-04	ND	1	0
MW-109A	T	3/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-109A	T	9/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-109A	T	3/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-109A	T	9/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-109A	T	3/1/2010	ARSENIC	8.0E-04	ND	1	0
MW-109A	T	9/1/2010	ARSENIC	8.0E-04	ND	1	0
MW-109A	T	3/1/2011	ARSENIC	8.0E-04	ND	1	0
MW-109A	T	9/1/2011	ARSENIC	8.0E-04	ND	1	0
MW-109A	T	3/1/2012	ARSENIC	8.0E-04	ND	1	0
MW-109A	T	9/1/2012	ARSENIC	8.0E-04	ND	1	0

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-204
Well Type: S
COC: ARSENIC

Time Period: 1/1/2000 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 3

Confidence in Trend: 59.4%

Coefficient of Variation: 1.83

Mann Kendall Concentration Trend: (See Note) NT

Data Table:

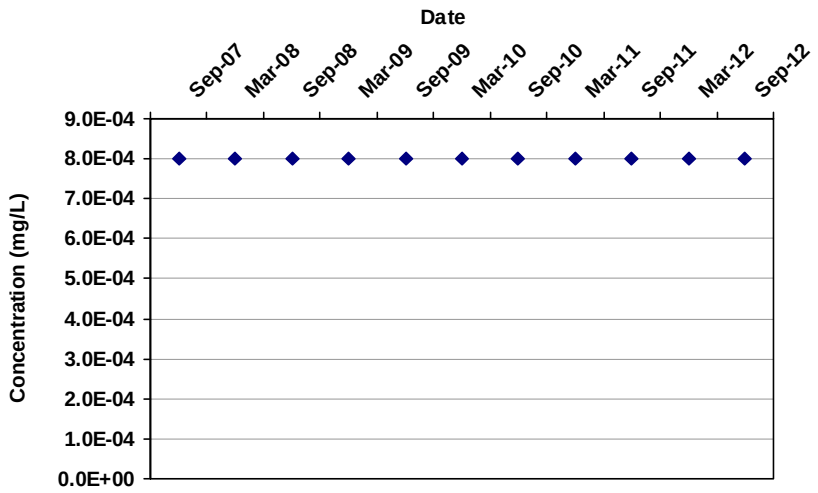
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-204	S	9/1/2006	ARSENIC	8.0E-04	ND	1	0
MW-204	S	3/1/2007	ARSENIC	8.0E-04	ND	1	0
MW-204	S	9/1/2007	ARSENIC	8.0E-04	ND	1	0
MW-204	S	3/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-204	S	9/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-204	S	9/1/2009	ARSENIC	1.3E-02		1	1
MW-204	S	9/1/2010	ARSENIC	8.0E-04	ND	1	0
MW-204	S	3/1/2012	ARSENIC	8.0E-04	ND	1	0

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-207A
Well Type: T
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 0

Confidence in Trend: 46.9%

Coefficient of Variation: 0.00

Mann Kendall Concentration Trend: (See Note) ND

Data Table:

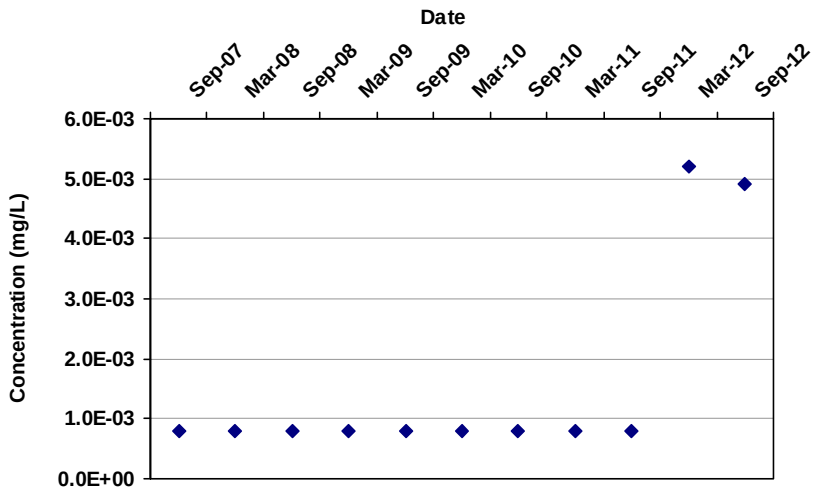
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-207A	T	9/1/2007	ARSENIC	8.0E-04	ND	1	0
MW-207A	T	3/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-207A	T	9/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-207A	T	3/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-207A	T	9/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-207A	T	3/1/2010	ARSENIC	8.0E-04	ND	1	0
MW-207A	T	9/1/2010	ARSENIC	8.0E-04	ND	1	0
MW-207A	T	3/1/2011	ARSENIC	8.0E-04	ND	1	0
MW-207A	T	9/1/2011	ARSENIC	8.0E-04	ND	1	0
MW-207A	T	3/1/2012	ARSENIC	8.0E-04	ND	1	0
MW-207A	T	9/1/2012	ARSENIC	8.0E-04	ND	1	0

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-210A
Well Type: T
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:
17

Confidence in Trend:
89.1%

Coefficient of Variation:
1.09

Mann Kendall Concentration Trend: (See Note)
NT

Data Table:

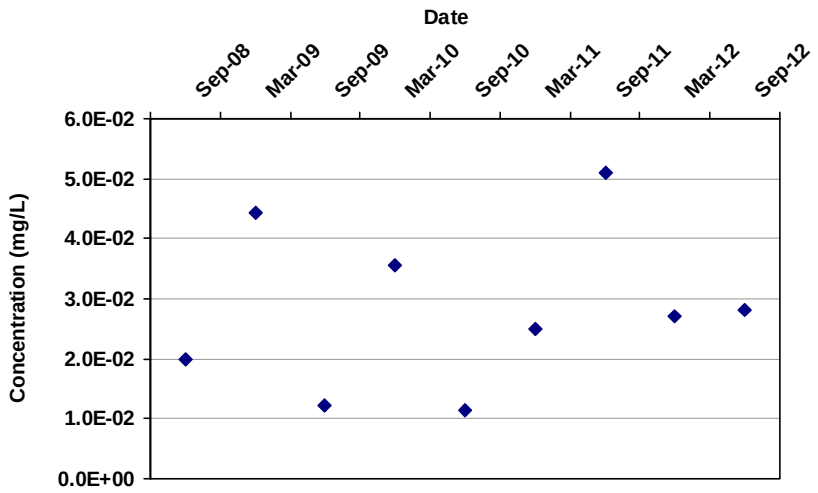
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-210A	T	9/1/2007	ARSENIC	8.0E-04	ND	1	0
MW-210A	T	3/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-210A	T	9/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-210A	T	3/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-210A	T	9/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-210A	T	3/1/2010	ARSENIC	8.0E-04	ND	1	0
MW-210A	T	9/1/2010	ARSENIC	8.0E-04	ND	1	0
MW-210A	T	3/1/2011	ARSENIC	8.0E-04	ND	1	0
MW-210A	T	9/1/2011	ARSENIC	8.0E-04	ND	1	0
MW-210A	T	3/1/2012	ARSENIC	5.2E-03		1	1
MW-210A	T	9/1/2012	ARSENIC	4.9E-03		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-212A
Well Type: S
COC: ARSENIC

Time Period: 1/1/2000 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:
6

Confidence in Trend:
69.4%

Coefficient of Variation:
0.48

Mann Kendall Concentration Trend: (See Note)
NT

Data Table:

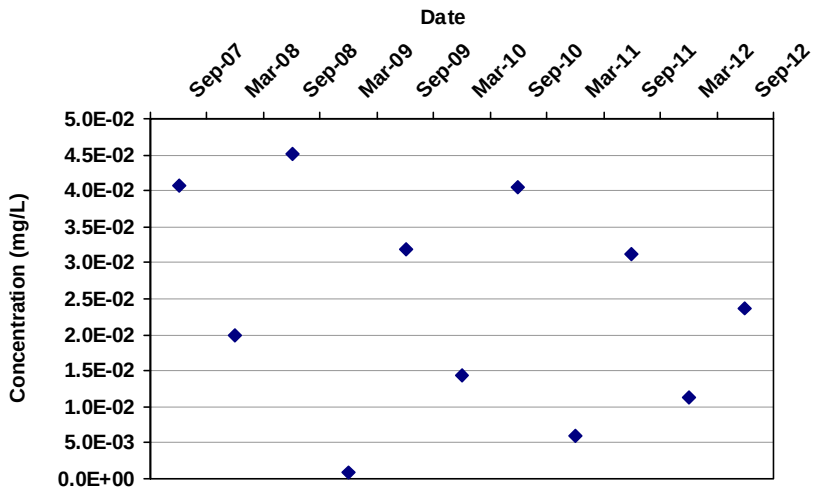
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-212A	S	9/1/2008	ARSENIC	2.0E-02		1	1
MW-212A	S	3/1/2009	ARSENIC	4.4E-02		1	1
MW-212A	S	9/1/2009	ARSENIC	1.2E-02		1	1
MW-212A	S	3/1/2010	ARSENIC	3.6E-02		1	1
MW-212A	S	9/1/2010	ARSENIC	1.1E-02		1	1
MW-212A	S	3/1/2011	ARSENIC	2.5E-02		1	1
MW-212A	S	9/1/2011	ARSENIC	5.1E-02		1	1
MW-212A	S	3/1/2012	ARSENIC	2.7E-02		1	1
MW-212A	S	9/1/2012	ARSENIC	2.8E-02		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-302A
Well Type: T
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic:

-13

Confidence in Trend:

82.1%

Coefficient of Variation:

0.62

Mann Kendall Concentration Trend: (See Note)

S

Data Table:

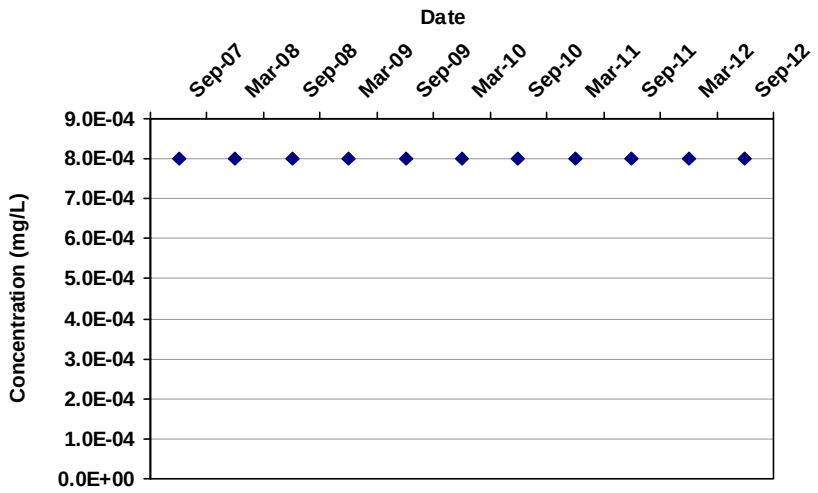
Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-302A	T	9/1/2007	ARSENIC	4.1E-02		1	1
MW-302A	T	3/1/2008	ARSENIC	2.0E-02		1	1
MW-302A	T	9/1/2008	ARSENIC	4.5E-02		1	1
MW-302A	T	3/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-302A	T	9/1/2009	ARSENIC	3.2E-02		1	1
MW-302A	T	3/1/2010	ARSENIC	1.4E-02		1	1
MW-302A	T	9/1/2010	ARSENIC	4.1E-02		1	1
MW-302A	T	3/1/2011	ARSENIC	5.9E-03		1	1
MW-302A	T	9/1/2011	ARSENIC	3.1E-02		1	1
MW-302A	T	3/1/2012	ARSENIC	1.1E-02		1	1
MW-302A	T	9/1/2012	ARSENIC	2.4E-02		1	1

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

MAROS Mann-Kendall Statistics Summary

Well: MW-303A
Well Type: T
COC: ARSENIC

Time Period: 6/1/2007 **to** 12/31/2012
Consolidation Period: Other
Consolidation Type: Average
Duplicate Consolidation: Average
ND Values: Specified Detection Limit
J Flag Values : Actual Value



Mann Kendall S Statistic: 0

Confidence in Trend: 46.9%

Coefficient of Variation: 0.00

Mann Kendall Concentration Trend: (See Note) ND

Data Table:

Well	Well Type	Effective Date	Constituent	Result (mg/L)	Flag	Number of Samples	Number of Detects
MW-303A	T	9/1/2007	ARSENIC	8.0E-04	ND	1	0
MW-303A	T	3/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-303A	T	9/1/2008	ARSENIC	8.0E-04	ND	1	0
MW-303A	T	3/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-303A	T	9/1/2009	ARSENIC	8.0E-04	ND	1	0
MW-303A	T	3/1/2010	ARSENIC	8.0E-04	ND	1	0
MW-303A	T	9/1/2010	ARSENIC	8.0E-04	ND	1	0
MW-303A	T	3/1/2011	ARSENIC	8.0E-04	ND	1	0
MW-303A	T	9/1/2011	ARSENIC	8.0E-04	ND	1	0
MW-303A	T	3/1/2012	ARSENIC	8.0E-04	ND	1	0
MW-303A	T	9/1/2012	ARSENIC	8.0E-04	ND	1	0

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect

ATTACHMENT B

MAROS 2.2 METHODOLOGY
(FROM USERS MANUAL)

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MAROS METHODOLOGY

MAROS is a collection of tools in one software package that is used in an explanatory, non-linear but linked fashion. The tool includes models, statistics, heuristic rules, and empirical relationships to assist the user in optimizing a groundwater monitoring network system. The final optimized network maintains adequate delineation while providing information on plume dynamics over time. Results generated from the software tool can be used to develop lines of evidence, which, in combination with expert opinion, can be used to inform regulatory decisions for safe and economical long-term monitoring of groundwater plumes. For a detailed description of the structure of the software and further utilities, refer to the MAROS 2.2 Manual (AFCEE, 2003; http://www.gsi-net.com/software/MAROS_V2_1Manual.pdf) and Aziz et al., 2003.

1.0 MAROS Conceptual Model

In MAROS 2.2, two levels of analysis are used for optimizing long-term monitoring plans: 1) an overview statistical evaluation with interpretive trend analysis based on temporal trend analysis and plume stability information; and 2) a more detailed statistical optimization based on spatial and temporal redundancy reduction methods (see Figures A.1 and A.2 for further details). In general, the MAROS method applies to 2-D aquifers that have relatively simple site hydrogeology. However, for a multi-aquifer (3-D) system, the user has the option to apply the statistical analysis layer-by-layer. The overview statistics or interpretive trend analysis assesses the general monitoring system category by considering individual well concentration trends, overall plume stability, hydrogeologic factors (e.g., seepage velocity, and current plume length), and the location of potential receptors (e.g., property boundaries or drinking water wells). The method relies on temporal trend analysis to assess plume stability, which is then used to determine the general monitoring system category. Since the monitoring system category is evaluated for both source and tail regions of the plume, the site wells are divided into two different zones: the source zone and the tail zone. Source zone monitoring wells could include areas with non-aqueous phase liquids (NAPLs), contaminated vadose zone soils, and areas where aqueous-phase releases have been introduced into groundwater. The source zone generally contains locations with historical high groundwater

concentrations of the COCs. The tail zone is usually the area downgradient of the contaminant source zone. Although this classification is a simplification of the plume conceptual model, this broadness makes the user aware on an individual well basis that the concentration trend results can have a different interpretation depending on the well location in and around the plume. The location and type of the individual wells allows further interpretation of the trend results, depending on what type of well is being analyzed (e.g., remediation well, leading plume edge well, or monitoring well). General recommendations for the monitoring network frequency and density are suggested based on heuristic rules applied to the source and tail trend results. The detailed statistics level of analysis or sampling optimization consists of well redundancy and well sufficiency analyses using the Delaunay method, a sampling frequency analysis using the Modified Cost Effective Sampling (MCES) method and a analysis is designed to minimize monitoring locations and the Modified CES method is designed to minimize the frequency of sampling. The data sufficiency analysis uses simple statistical methods to assess the sampling record to determine if groundwater concentrations are statistically below target levels and if the current monitoring network and record is sufficient in terms of evaluating concentrations at downgradient locations.

2.0 Data Management

In MAROS, groundwater monitoring data can be imported from simple database-format Microsoft® Excel spreadsheets, Microsoft Access tables, previously created MAROS database archive files, or entered manually. Monitoring data interpretation in MAROS is based on historical analytical data from a consistent set of wells over a series of sampling events. The analytical data is composed of the well name, coordinate location, constituent, result, detection limit and associated data qualifiers. Statistical validity of the concentration trend analysis requires constraints on the minimum data input of at least four wells (ASTM 1998) in which COCs have been detected. Individual sampling locations need to include data from at least six most-recent sampling events. To ensure a meaningful comparison of COC concentrations over time and space, both data quality and data quantity need to be considered. Prior to statistical analysis, the user can consolidate irregularly sampled data or smooth data that might result from seasonal

fluctuations or a change in site conditions. Because MAROS is a terminal analytical tool designed for long-term planning, impacts of seasonal variation in the water unit are treated on a broad scale, as they relate to multi-year trends. Imported groundwater monitoring data and the site-specific information entered in Site Details can be archived and exported as MAROS archive files. These archive files can be appended as new monitoring data becomes available, resulting in a dynamic long-term monitoring database that reflects the changing conditions at the site (i.e., biodegradation, compliance attainment, completion of remediation phase, etc.). For wells with a limited monitoring history, addition of information as it becomes available can change the frequency or identity of wells in the network.

3.0 Site Details

Information needed for the MAROS analysis includes site-specific parameters such as seepage velocity and current plume length and width. Information on the location of potential receptors relative to the source and tail regions of the plume is entered at this point. Part of the trend analysis methodology applied in MAROS focuses on where the monitoring well is located, therefore the user needs to divide site wells into two different zones: the source zone or the tail zone. Although this classification is a simplification of the well function, this broadness makes the user aware on an individual well basis that the concentration trend results can have a different interpretation depending on the well location in and around the plume. It is up to the user to make further interpretation of the trend results, depending on what type of well is being analyzed (e.g., remediation well, leading plume edge well, or monitoring well). The Site Details section of MAROS contains a preliminary map of well locations to confirm well coordinates.

4.0 Constituent Selection

A database with multiple COCs can be entered into the MAROS software. MAROS allows the analysis of up to 5 COCs concurrently and users can pick COCs from a list of compounds existing in the monitoring data. MAROS runs separate optimizations for each compound. For sites with a single source, the suggested strategy is to choose one to three priority COCs for the optimization. If, for example, the site contains multiple chlorinated

volatile organic compounds (VOCs), the standard sample chemical analysis will evaluate all VOCs, so the sample locations and frequency should based on the concentration trends of the most prevalent, toxic or mobile compounds. If different chemical classes are present, such as metals and chlorinated VOCs, choose and evaluate the priority constituent in each chemical class. MAROS includes a short module that provides recommendations on prioritizing COCs based on toxicity, prevalence, and mobility of the compound. The toxicity ranking is determined by examining a representative concentration for each compound for the entire site. The representative concentration is then compared to the screening level (PRG or MCL) for that compound and the COCs are ranked according to the representative concentrations percent exceedence of the screening level. The evaluation of prevalence is performed by determining a representative concentration for each well location and evaluating the total exceedences (values above screening levels) compared to the total number of wells. Compounds found over screening levels are ranked for mobility based on Kd (sorption partition coefficient). The MAROS COC assessment provides the relative ranking of each COC, but the user must choose which COCs are included in the analysis.

5.0 Data Consolidation

Typically, raw data from long-term monitoring have been measured irregularly in time or contain many non-detects, trace level results, and duplicates. Therefore, before the data can be further analyzed, raw data are filtered, consolidated, transformed, and possibly smoothed to allow for a consistent dataset meeting the minimum data requirements for statistical analysis mentioned previously. MAROS allows users to specify the period of interest in which data will be consolidated (i.e., monthly, bi-monthly, quarterly, semi-annual, yearly, or a biennial basis). In computing the representative value when consolidating, one of four statistics can be used: median, geometric mean, mean, and maximum. Non-detects can be transformed to one half the reporting or method detection limit (DL), the DL, or a fraction of the DL. Trace level results can be represented by their actual values, one half of the DL, the DL, or a fraction of their actual values. Duplicates are reduced in MAROS by one of three ways: assigning the average, maximum, or first

value. The reduced data for each COC and each well can be viewed as a time series in a graphical form on a linear or semi-log plot generated by the software.

6.0 Overview Statistics: Plume Trend Analysis

Within the MAROS software there are historical data analyses that support a conclusion about plume stability (e.g., increasing plume, etc.) through statistical trend analysis of historical monitoring data. Plume stability results are assessed from time-series analysis, linear regression trend analysis and moment analysis. The two trend methods are used to estimate the concentration trend for each well and each COC based on a statistical trend analysis of concentrations versus time at each well. These trend analyses are then consolidated to give the user a general plume stability estimate and general monitoring frequency and density recommendations (see Figures A.1 through A.3 for further step-by-step details). Both qualitative and quantitative plume information can be gained by these evaluations of monitoring network historical data trends both spatially and temporally. The MAROS Overview Statistics are the foundation the user needs to make informed optimization decisions at the site. The Overview Statistics are designed to allow site personnel to develop a better understanding of the plume behavior over time and understand how the individual well concentration trends are spatially distributed within the plume. This step allows the user to gain information that will support a more informed decision to be made in the next level or detailed statistics optimization analysis.

6.1 Mann-Kendall Analysis

The Mann-Kendall test is a statistical procedure that is well suited for analyzing trends in data over time. The Mann-Kendall test can be viewed as a non-parametric test for zero slope of the first-order regression of time-ordered concentration data versus time. One advantage of the Mann-Kendall test is that it does not require any assumptions as to the statistical distribution of the data (e.g. normal, lognormal, etc.) and can be used with data sets which include irregular sampling intervals and missing data. The Mann-Kendall test is designed for analyzing a single groundwater constituent, multiple constituents are analyzed separately. The Mann-Kendall S statistic measures the trend in the data: positive values indicate an increase in concentrations over time and negative values indicate a

decrease in concentrations over time. The strength of the trend is proportional to the magnitude of the Mann-Kendall statistic (i.e., a large value indicates a strong trend). The confidence in the trend is determined by consulting the S statistic and the sample size, n, in a Kendall probability table such as the one reported in Hollander and Wolfe (1973). The concentration trend is determined for each well and each COC based on results of the S statistic, the confidence in the trend, and the Coefficient of Variation (COV). The decision matrix for this evaluation is shown in Table 3. A Mann-Kendall statistic that is greater than 0 combined with a confidence of greater than 95% is categorized as an Increasing trend while a Mann-Kendall statistic of less than 0 with a confidence between 90% and 95% is defined as a probably Increasing trend, and so on. Depending on statistical indicators, the concentration trend is classified into six categories:

- Decreasing (D)
- Probably Decreasing (PD)
- Stable (S)
- No Trend (NT)
- Probably Increasing (PI)
- Increasing (I)

These trend estimates are then analyzed to identify the source and tail region overall stability category (see Figure 2 for further details).

6.2 Linear Regression Analysis

Linear Regression is a parametric statistical procedure that is typically used for analyzing trends in data over time. Using this type of analysis, a higher degree of scatter simply corresponds to a wider confidence interval about the average log-slope. Assuming the sign (i.e., positive or negative) of the estimated log-slope is correct, a level of confidence that the slope is not zero can be easily determined. Thus, despite a poor goodness of fit, the overall trend in the data may still be ascertained, where low levels of confidence correspond to “Stable” or “No Trend” conditions (depending on the degree of scatter) and higher levels of confidence indicate the stronger likelihood of a trend. The linear regression analysis is based on the first-order linear regression of the log-transformed concentration data versus time. The slope obtained from this log-transformed regression,

the confidence level for this log-slope, and the COV of the untransformed data are used to determine the concentration trend. The decision matrix for this evaluation is shown in Table 4. To estimate the confidence in the log-slope, the standard error of the log-slope is calculated. The coefficient of variation, defined as the standard deviation divided by the average, is used as a secondary measure of scatter to distinguish between "Stable" or "No Trend" conditions for negative slopes. The Linear Regression Analysis is designed for analyzing a single groundwater constituent; multiple constituents are analyzed separately, (up to five COCs simultaneously). For this evaluation, a decision matrix developed by Groundwater Services, Inc. is also used to determine the "Concentration Trend" category (plume stability) for each well. Depending on statistical indicators, the concentration trend is classified into six categories:

- Decreasing (D)
- Probably Decreasing (PD)
- Stable (S)
- No Trend (NT)
- Probably Increasing (PI)
- Increasing (I)

The resulting confidence in the trend, together with the log-slope and the COV of the untransformed data, are used in the linear regression analysis decision matrix to determine the concentration trend. For example, a positive log-slope with a confidence of less than 90% is categorized as having No Trend whereas a negative log-slope is considered Stable if the COV is less than 1 and categorized as No Trend if the COV is greater than 1.

6.3 Overall Plume Analysis

General recommendations for the monitoring network frequency and density are suggested based on heuristic rules applied to the source and tail trend results.

Individual well trend results are consolidated and weighted by the MAROS according to user input, and the direction and strength of contaminant concentration trends in the source zone and tail zone for each COC are determined. Based on **i)** the consolidated trend analysis, **ii)** hydrogeologic factors (e.g., seepage velocity), and **iii)** location of

potential receptors (e.g., wells, discharge points, or property boundaries), the software suggests a general optimization plan for the current monitoring system in order to efficiently but effectively monitor groundwater in the future. A flow chart utilizing the trend analysis results and other site-specific parameters to form a general sampling frequency and well density recommendation is outlined in Figure 2. For example, a generic plan for a shrinking petroleum hydrocarbon plume (BTEX) in a slow hydrogeologic environment (silt) with no nearby receptors would entail minimal, low frequency sampling of just a few indicators. On the other hand, the generic plan for a chlorinated solvent plume in a fast hydrogeologic environment that is expanding but has very erratic concentrations over time would entail more extensive, higher frequency sampling. The generic plan is based on a heuristically derived algorithm for assessing future sampling duration, location and density that takes into consideration plume stability. For a detailed description of the heuristic rules used in the MAROS software, refer to the MAROS 2.2Manual (AFCEE, 2003).

6.4 Moment Analysis

An analysis of moments can help resolve plume trends, where the Zeroth Moment shows change in dissolved mass vs. time, the First Moment shows the center of mass location vs. time, and the Second Moment shows the spread of the plume vs. time. Moment calculations can predict how the plume will change in the future if further statistical analysis is applied to the moments to identify a trend (in this case, Mann Kendall Trend Analysis is applied). The trend analysis of moments can be summarized as:

- Zeroth Moment: An estimate of the total mass of the constituent for each sample event.
- First Moment: An estimate of the center of mass for each sample event.
- Second Moment: An estimate of the spread of the plume around the center of mass.

The role of moment analysis in MAROS is to provide a relative estimate of plume stability and condition within the context of results from other MAROS modules. The

Moment analysis algorithms in MAROS are simple approximations of complex calculations and are meant to estimate changes in total mass, center of mass and spread of mass for complex well networks. The Moment Analysis module is sensitive to the number and arrangement of wells in each sampling event, so, changes in the number and identity of wells during monitoring events, and the parameters chosen for data consolidation can cause changes in the estimated moments. Plume stability may vary by constituent, therefore the MAROS Moment analysis can be used to evaluate multiple COCs simultaneously which can be used to provide a quick way of comparing individual plume parameters to determine the size and movement of constituents relative to one another. Moment analysis in the MAROS software can also be used to assist the user in evaluating the impact on plume delineation in future sampling events by removing identified "redundant" wells from a long-term monitoring program (this analysis was not performed as part of this study, for more details on this application of moment analysis refer to the MAROS Users Manual (AFCEE, 2003)).

The **Zeroth Moment** is the sum of concentrations for all monitoring wells and is a mass estimate. The Zeroth Moment calculation can show high variability over time, largely due to the fluctuating concentrations at the most contaminated wells as well as varying monitoring well network. Plume analysis and delineation based exclusively on concentration can exhibit fluctuating temporal and spatial values. The mass estimate is also sensitive to the extent of the site monitoring well network over time. The Zeroth Moment trend over time is determined by using the Mann-Kendall Trend Methodology. The Zeroth Moment trend test allows the user to understand how the plume mass has changed over time. Results for the trend include: Increasing, probably Increasing, no trend, stable, probably decreasing, decreasing or not applicable (N/A) (Insufficient Data). When considering the results of the Zeroth Moment trend, the following factors should be considered which could effect the calculation and interpretation of the plume mass over time: 1) Change in the spatial distribution of the wells sampled historically 2) Different wells sampled within the well network over time (addition and subtraction of well within the network). 3) Adequate versus inadequate delineation of the plume over time.

The **First Moment** estimates the center of mass, coordinates (Xc and Yc) for each sample event and COC. The changing center of mass locations indicate the movement of the center of mass over time. Whereas, the distance from the original source location to the center of mass locations indicate the movement of the center of mass over time relative to the original source. Calculation of the First Moment normalizes the spread by the concentration indicating the center of mass. The First Moment trend of the distance to the center of mass over time shows movement of the plume in relation to the original source location over time. Analysis of the movement of mass should be viewed as it relates to 1) the original source location of contamination 2) the direction of groundwater flow and/or 3) source removal or remediation. Spatial and temporal trends in the center of mass can indicate spreading or shrinking or transient movement based on season variation in rainfall or other hydraulic considerations. No appreciable movement or a neutral trend in the center of mass would indicate plume stability. However, changes in the First Moment over time do not necessarily completely characterize the changes in the concentration distribution (and the mass) over time. Therefore, in order to fully characterize the plume the First Moment trend should be compared to the Zeroth Moment trend (mass change over time).

The **Second Moment** indicates the spread of the contaminant about the center of mass (Sxx and Syy), or the distance of contamination from the center of mass for a particular COC and sample event. The Second Moment represents the spread of the plume over time in both the x and y directions. The Second Moment trend indicates the spread of the plume about the center of mass. Analysis of the spread of the plume should be viewed as it relates to the direction of groundwater flow. An Increasing trend in the Second Moment indicates an expanding plume, whereas a declining trend in the Second Moment indicates a shrinking plume. No appreciable movement or a neutral trend in the center of mass would indicate plume stability. The Second Moment provides a measure of the spread of the concentration distribution about the plume's center of mass.

However, changes in the Second Moment over time do not necessarily completely characterize the changes in the concentration distribution (and the mass) over time.

Therefore, in order to fully characterize the plume the Second Moment trend should be compared to the Zeroth Moment trend (mass change over time).

7.0 Detailed Statistics: Optimization Analysis

Although the overall plume analysis shows a general recommendation regarding sampling frequency reduction and a general sampling density, a more detailed analysis is also available with the MAROS 2.2 software in order to allow for further reductions on a well-by-well basis for frequency, well redundancy, well sufficiency and sampling sufficiency. The MAROS Detailed Statistics allows for a quantitative analysis for spatial and temporal optimization of the well network on a well-by-well basis. The results from the Overview Statistics should be considered along with the MAROS optimization recommendations gained from the Detailed Statistical Analysis described previously. The MAROS Detailed Statistics results should be reassessed in view of site knowledge and regulatory requirements as well as in consideration of the Overview Statistics (Figure 2). The Detailed Statistics or Sampling Optimization MAROS modules can be used to determine the minimal number of sampling locations and the lowest frequency of sampling that can still meet the requirements of sampling spatially and temporally for an existing monitoring program. It also provides an analysis of the sufficiency of data for the monitoring program. Sampling optimization in MAROS consists of four parts:

- Well redundancy analysis using the Delaunay method
- Well sufficiency analysis using the Delaunay method
- Sampling frequency determination using the Modified CES method
- Data sufficiency analysis using statistical power analysis

The well redundancy analysis using the Delaunay method identifies and eliminates redundant locations from the monitoring network. The well sufficiency analysis can determine the areas where new sampling locations might be needed. The Modified CES method determines the optimal sampling frequency for a sampling location based on the direction, magnitude, and uncertainty in its concentration trend. The data sufficiency analysis examines the risk-based site cleanup status and power and expected sample size associated with the cleanup status evaluation.

7.1 Well Redundancy Analysis – Delaunay Method

The well redundancy analysis using the Delaunay method is designed to select the minimum number of sampling locations based on the spatial analysis of the relative importance of each sampling location in the monitoring network. The approach allows elimination of sampling locations that have little impact on the historical characterization of a contaminant plume. An extended method or wells sufficiency analysis, based on the Delaunay method, can also be used for recommending new sampling locations.

Details about the Delaunay method can be found in Appendix A.2 of the MAROS Manual (AFCEE, 2003). Sampling Location determination uses the Delaunay triangulation method to determine the significance of the current sampling locations relative to the overall monitoring network. The Delaunay method calculates the network Area and Average concentration of the plume using data from multiple monitoring wells. A slope factor (SF) is calculated for each well to indicate the significance of this well in the system (i.e. how removing a well changes the average concentration.) The Sampling Location optimization process is performed in a stepwise fashion. Step one involves assessing the significance of the well in the system, if a well has a small SF (little significance to the network), the well may be removed from the monitoring network. Step two involves evaluating the information loss of removing a well from the network. If one well has a small SF, it may or may not be eliminated depending on whether the information loss is significant. If the information loss is not significant, the well can be eliminated from the monitoring network and the process of optimization continues with fewer wells. However if the well information loss is significant then the optimization terminates. This sampling optimization process allows the user to assess "redundant" wells that will not incur significant information loss on a constituent-by-constituent basis for individual sampling events.

7.2 Well Sufficiency Analysis – Delaunay Method

The well sufficiency analysis, using the Delaunay method, is designed to recommend new sampling locations in areas *within* the existing monitoring network where there is a high level of uncertainty in contaminant concentration. Details about the well sufficiency

analysis can be found in Appendix A.2 of the MAROS Manual (AFCEE, 2003). In many cases, new sampling locations need to be added to the existing network to enhance the spatial plume characterization. If the MAROS algorithm calculates a high level of uncertainty in predicting the constituent concentration for a particular area, a new sampling location is recommended. The Slope Factor (SF) values obtained from the redundancy evaluation described above are used to calculate the concentration estimation error for each triangle area formed in the Delaunay triangulation. The estimated SF value for each area is then classified into four levels: Small, Moderate, Large, or Extremely large (S, M, L, E) because the larger the estimated SF value, the higher the estimation error at this area. Therefore, the triangular areas with the estimated SF value at the Extremely large or Large level can be candidate regions for new sampling locations. The results from the Delaunay method and the method for determining new sampling locations are derived solely from the spatial configuration of the monitoring network and the spatial pattern of the contaminant plume. No parameters such as the hydrogeologic conditions are considered in the analysis. Therefore, professional judgment and regulatory considerations must be used to make final decisions.

7.3 Sampling Frequency Determination - Modified CES Method

The Modified CES method optimizes sampling frequency for each sampling location based on the magnitude, direction, and uncertainty of its concentration trend derived from its recent and historical monitoring records. The Modified Cost Effective Sampling (MCES) estimates a conservative lowest-frequency sampling schedule for a given groundwater monitoring location that still provides needed information for regulatory and remedial decision-making. The MCES method was developed on the basis of the Cost Effective Sampling (CES) method developed by Ridley et al (1995). Details about the MCES method can be found in Appendix A.9 of the MAROS Manual (AFCEE, 2003). In order to estimate the least frequent sampling schedule for a monitoring location that still provides enough information for regulatory and remedial decision-making, MCES employs three steps to determine the sampling frequency. The first step involves analyzing frequency based on recent trends. A preliminary location sampling frequency (PLSF) is developed based on the rate of change of well

concentrations calculated by linear regression along with the Mann-Kendall trend analysis of the most recent monitoring data (see Figure 3). The variability within the sequential sampling data is accounted for by the Mann-Kendall analysis. The rate of change vs. trend result matrix categorizes wells as requiring annual, semi-annual or quarterly sampling. The PLSF is then reevaluated and adjusted based on overall trends. If the long-term history of change is significantly greater than the recent trend, the frequency may be reduced by one level. The final step in the analysis involves reducing frequency based on risk, site-specific conditions, regulatory requirements or other external issues. Since not all compounds in the target being assessed are equally harmful, frequency is reduced by one level if recent maximum concentration for a compound of high risk is less than 1/2 of the Maximum Concentration Limit (MCL). The result of applying this method is a suggested sampling frequency based on recent sampling data trends and overall sampling data trends and expert judgment. The final sampling frequency determined from the MCES method can be Quarterly, Semiannual, Annual, or Biennial. Users can further reduce the sampling frequency to, for example, once every three years, if the trend estimated from Biennial data (i.e., data drawn once every two years from the original data) is the same as that estimated from the original data.

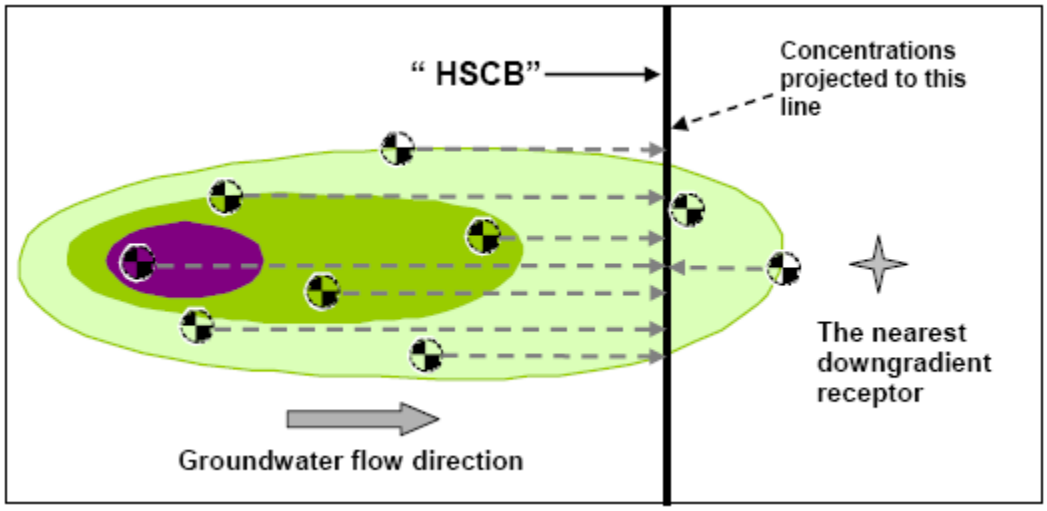
7.4 Data Sufficiency Analysis – Power Analysis

The MAROS Data Sufficiency module employs simple statistical methods to evaluate whether the collected data are adequate both in quantity and in quality for revealing changes in constituent concentrations. The first section of the module evaluates individual well concentrations to determine if they are statistically below a target screening level. The second section includes a simple calculation for estimating projected groundwater concentrations at a specified point downgradient of the plume. A statistical Power analysis is then applied to the projected concentrations to determine if the downgradient concentrations are statistically below the cleanup standard. If the number of projected concentrations is below the level to provide statistical significance, then the number of sample events required to statistically confirm concentrations below standards is estimated from the Power analysis.

Before testing the cleanup status for individual wells, the stability or trend of the contaminant plume should be evaluated. Only after the plume has reached stability or is reliably diminishing can we conduct a test to examine the cleanup status of wells. Applying the analysis to wells in an expanding plume may cause incorrect conclusions and is less meaningful. Statistical power analysis is a technique for interpreting the results of statistical tests. The Power of a statistical test is a measure of the ability of the test to detect an effect given that the effect actually exists. The method provides additional information about a statistical test: 1) the power of the statistical test, i.e., the probability of finding a difference in the variable of interest when a difference truly exists; and 2) the expected sample size of a future sampling plan given the minimum detectable difference it is supposed to detect. For example, if the mean concentration is lower than the cleanup goal but a statistical test cannot prove this, the power and expected sample size can tell the reason and how many more samples are needed to result in a significant test. The additional samples can be obtained by a longer period of sampling or an increased sampling frequency. Details about the data sufficiency analysis can be found in Appendix A.6 of the MAROS Manual (AFCEE, 2003). When applying the MAROS power analysis method, a hypothetical statistical compliance boundary (HSCB) is assigned to be a line perpendicular to the groundwater flow direction (see figure below). Monitoring well concentrations are projected onto the HSCB using the distance from each well to the compliance boundary along with a decay coefficient. The projected concentrations from each well and each sampling event are then used in the risk-based power analysis. Since there may be more than one sampling event selected by the user, the risk-based power analysis results are given on an event-by-event basis. This power analysis can then indicate if target are statistically achieved at the HSCB. For instance, at a site where the historical monitoring record is short with few wells, the HSCB would be distant; whereas, at a site with longer duration of sampling with many wells, the HSCB would be close. Ultimately, at a site the goal would be to have the HSCB coincide with or be within the actual compliance boundary (typically the site property line).

In order to perform a risk-based cleanup status evaluation for the whole site, a strategy was developed as follows:

- Estimate concentration versus distance decay coefficient from plume centerline wells.
- Extrapolate concentration versus distance for each well using this decay coefficient.
- Comparing the extrapolated concentrations with the compliance concentration using power analysis.



Results from this analysis can be *Attained* or *Not Attained*, providing a statistical interpretation of whether the cleanup goal has been met on the site-scale from the risk-based point of view. The results as a function of time can be used to evaluate if the monitoring system has enough power at each step in the sampling record to indicate certainty of compliance by the plume location and condition relative to the compliance boundary. For example, if results are *Not Attained* at early sampling events but are *Attained* in recent sampling events, it indicates that the recent sampling record provides a powerful enough result to indicate compliance of the plume relative to the location of the receptor or compliance boundary.

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TABLE 1
Mann-Kendall Analysis Decision Matrix (Aziz, et. al., 2003)

Mann-Kendall Statistic	Confidence in the Trend	Concentration Trend
S > 0	> 95%	Increasing
S > 0	90 - 95%	Probably Increasing
S > 0	< 90%	No Trend
S ≤ 0	< 90% and COV ≥ 1	No Trend
S ≤ 0	< 90% and COV < 1	Stable
S < 0	90 - 95%	Probably Decreasing
S < 0	> 95%	Decreasing

TABLE 2
Linear Regression Analysis Decision Matrix (Aziz, et. al., 2003)

Confidence in the Trend	Log-slope	
	Positive	Negative
< 90%	No Trend	COV < 1 Stable COV > 1 No Trend
90 - 95%	Probably Increasing	Probably Decreasing
> 95%	Increasing	Decreasing

MAROS: Decision Support Tool

MAROS is a collection of tools in one software package that is used in an explanatory, non-linear fashion. The tool includes models, geostatistics, heuristic rules, and empirical relationships to assist the user in optimizing a groundwater monitoring network system while maintaining adequate delineation of the plume as well as knowledge of the plume state over time. Different users utilize the tool in different ways and interpret the results from a different viewpoint.

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Overview Statistics

What it is: Simple, qualitative and quantitative plume information can be gained through evaluation of monitoring network historical data trends both spatially and temporally. The MAROS Overview Statistics are the foundation the user needs to make informed optimization decisions at the site.

What it does: The Overview Statistics are designed to allow site personnel to develop a better understanding of the plume behavior over time and understand how the individual well concentration trends are spatially distributed within the plume. This step allows the user to gain information that will support a more informed decision to be made in the next level of optimization analysis.

What are the tools: Overview Statistics includes two analytical tools:

1) **Trend Analysis:** includes Mann-Kendall and Linear Regression statistics for individual wells and results in general heuristically-derived monitoring categories with a suggested sampling density and monitoring frequency.

2) **Moment Analysis:** includes dissolved mass estimation (0th Moment), center of mass (1st Moment), and plume spread (2nd Moment) over time. Trends of these moments show the user another piece of information about the plume stability over time.

What is the product: A first-cut blueprint for a future long-term monitoring program that is intended to be a foundation for more detailed statistical analysis.

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Detailed Statistics

What it is: The MAROS Detailed Statistics allows for a quantitative analysis for spatial and temporal optimization of the well network on a well-by-well basis.

What it does: The results from the Overview Statistics should be considered along side the MAROS optimization recommendations gained from the Detailed Statistical Analysis. The MAROS Detailed Statistics results should be reassessed in view of site knowledge and regulatory requirements as well as the Overview Statistics.

What are the tools: Detailed Statistics includes four analytical tools:

1) **Sampling Frequency Optimization:** uses the Modified CES method to establish a recommended future sampling frequency.

2) **Well Redundancy Analysis:** uses the Delaunay Method to evaluate if any wells within the monitoring network are redundant and can be eliminated without any significant loss of plume information.

3) **Well Sufficiency Analysis:** uses the Delaunay Method to evaluate areas where new wells are recommended within the monitoring network due to high levels of concentration uncertainty.

4) **Data Sufficiency Analysis:** uses Power Analysis to assess if the historical monitoring data record has sufficient power to accurately reflect the location of the plume relative to the nearest receptor or compliance point.

What is the product: List of wells to remove from the monitoring program, locations where monitoring wells may need to be added, recommended frequency of sampling for each well, analysis if the overall system is statistically powerful to monitor the plume.

Figure 1. MAROS Decision Support Tool Flow Chart

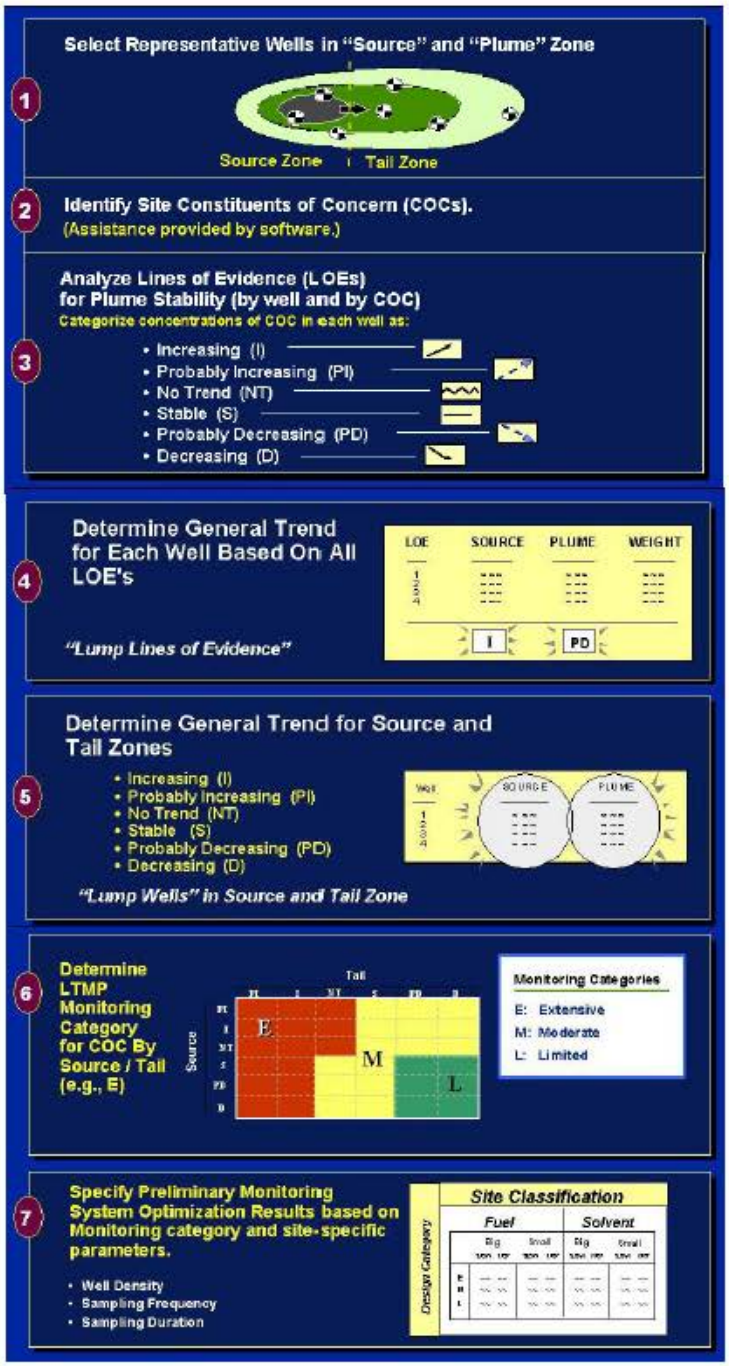

Figure 2:
MAROS Overview Statistics Trend Analysis Methodology

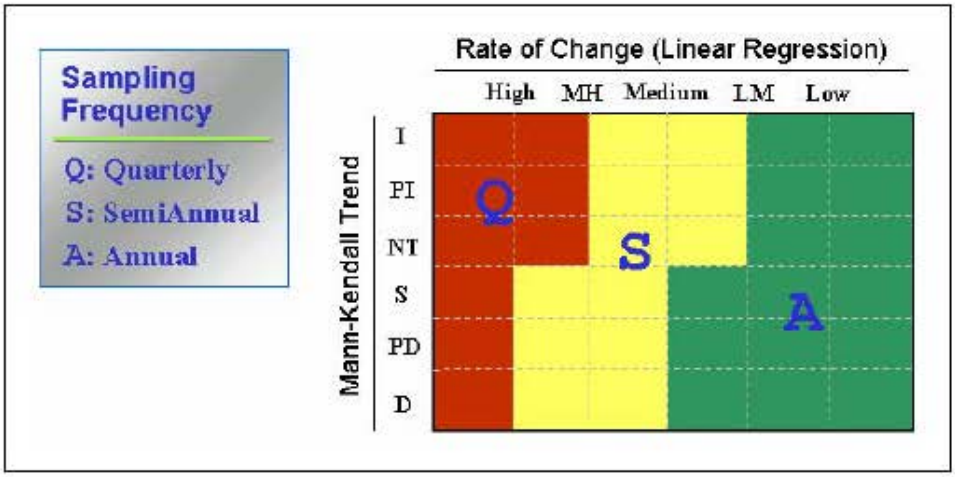

Figure 3. Decision Matrix for Determining Provisional Frequency (*Figure A.3.1 of the MAROS Manual (AFCEE 2003*)